Constructing a Financial condition index: The case of Vietnam

Tran Thi Thu Huong*, Tran Thi Xuan Anh, Nguyen Thanh Phương, Pham Tien Manh

Department of Finance, Banking Academy, Vietnam

**Corresponding author: PhD Tran Thi Thu Huong*

Abstract

The article contructs a Financial condition index (FCI) for Vietnam in the period 2000-2020. This index provides a measure of financial condition by combining several financial variables that affect economic activities. Variables in the FCI are grouped into three categories: interest rates, asset prices, and external variables. Weights of components are calculated using the VAR method. The results show that the fluctuations of FCI are similar to the financial conditions in tightening or loosening periods in Viet Nam. The Granger causality test also evaluates that the FCI is significant in predicting real growth and inflation changes. It confirms the role of the FCI as a policy tool.

Keywords: financial conditions index, VAR, short-term forecasting

1. Introduction

The financial condition index is a comprehensive index designed to measure financial conditions in a country by combining several financial variables that affect economic activities. These financial variables are transmission channels through which monetary policy is communicated to the real economy and inflation. These indicators are increasingly used for both financial monitoring and forecasting.

The important of different transmission channels depends on the structure of the financial system. In Vietnam, banking system plays more important roles in conducting capital to the economy than other capital channels such as the stock market. According to the authors' study, the banking system and credit institutions in Vietnam account for a large proportion of the total financial system's assets in the period 2011-2020. From 2013, this figure is about 60% to 70%. The stock market is ranked 2nd, higher than the bond market, while the insurance market accounts for a small percentage of the total assets in the financial system. However, the proportion of components in the financial system has changed significantly in recent years. There are gradual increases in the capitalization of the securities and insurance market. The market capitalization value (including stock and bond markets) compared to GDP has increased nearly 4 times in 10 years, from 2011 to 2020. At the same time, the insurance market continuously expands in size. Insurance service quality has been improved, supporting businesses and reinvesting in the economy.

Despite of improvement in recent years, the structure of Vietnam's financial market still has an imbalance between the capital market and the money market, leading to systemic risks. Vietnam's loan-to-GDP ratio in 2020 is up to 140%. This high ratio will put pressure on commercial banks when short-term deposit is used for medium and long-term loans. The rate of medium and long-term loans in commercial banks has remained high for a long time, leading to a weak and vulnerable banking system that affected by fluctuations and crises.

In the money market, some commercial banks are still weak in capacity. Some banks are subject to restructuring and special control. Banks with negative equity could be acquired by the State bank of Vietnam for 0 dong. Moreover, the current bad debt ratio in the banking system still

contains potential risks. The capital from the credit institution system flows into the securities market instead of production and business sectors. It could be a reason of asset bubbles, posing a threat to the entire financial system (State Bank of Vietnam, 2021).

In the capital market, firms' ability to access capital is still limited. Although the size of the stock market has improved significantly, the issuance of shares to the public in order to support the business is still limited. In the bond market, the total outstanding debt is low. Many businesses face difficulties when issuing bonds because they are not qualified to issue bonds to the public or do not have investors. Since 2018, although the corporate bond market has started to grow rapidly, it has mainly been privately issued, accounting for 93.4% of the total issuance volume (FiinGroup, 2021). The quality of issuers is also a problem when the firms have no credit rating, no collateral and no payment guarantee. There are differences in financial situations among issuers. Some firms have weak credit capacity. The debt to equity ratio is large (FiinGroup, 2021). They continue to mobilize debt capital through splitting into many issuances and increasing interest rates to attract retail investors. Moreover, when firms issue bond via private placement, investors are mainly commercial banks and securities companies (Nguyen, 2021). Other long-term institutional investors such as pension funds, investment funds, insurance companies...participating in the market are still limited.

Although Vietnam's insurance market has experienced strong growth, the ratio of premium to GDP is only 3.07%, lower than the average of 3.35% in ASEAN, 5.37% in Asia, and 6.3% in the world. Furthermore, the per capita insurance premium in Vietnam is only 72 USD/person/year, less than half of the average level in emerging countries (Ngo, 2021).

This paper constructs the FCI index to assess financial conditions in Vietnam. There are 3 groups of variables including interest rates, asset prices and external variables. The weights are calculated using the VAR model. Research results show that FCI accurately reflects the fluctuation in the financial sector. FCI movements are quite similar to the periods of financial conditions tightening or loosening in Vietnam. Specifically, in the late 2007 and early 2008 period, financial conditions tightened due to a worsening economic outlook. At the end of 2008, inflation was controlled. Monetary policy was expanded more cautiously and interest rates decreased. Financial conditions had improved while the FCI increased. At the end of 2010, high inflation forced the State Bank to tighten monetary policy. Tightening financial conditions in 2011 was reflected in the sharp decrease of FCI. In the period 2013-2015, financial conditions were stable and the FCI has gradually improved. The proposed FCIs are most correlated to GDP growth and inflation, suggesting short-term prediction ability.

The rest of the paper is organised as in the following. Section 2 is literature review, section 3 briefly explains the methodology and data, while section 4 presents the results and discusses the relationship of financial condition indicators and economic activity. The summary and concluding remarks are provided in the final section.

2. Literature review

A financial condition index has been built in many countries or regions such as the United Kingdom, the United State, EU, Japan, Finland, South Africa, Asia or indexes of the IMF and OECD. Different methods have been used to create the financial condition index such as VAR, factor analysis method with many different model versions. The financial condition indexes are cleaned to remove the cyclical effects of macroeconomic variables, reflecting only short-term fluctuations in the financial environment and shocks in policy.

Debuque-Gonzales et al. (2013) suggested 2 basic approaches to construct FCI. First, it is the weighted sum method, which determines weights of each financial variable based on assessment of their impact on real GDP. These weights are generated either through simulations of larger-scale macroeconomic models or the estimation of reduced- formed demand equations or vector autogression (VAR) models.

The formula to determine FCI is:

$$FCI_t = \sum_i w_i(q_{it} - \overline{q_{it}})$$

where q_{it} is indicator i's value at time t, $\overline{q_{it}}$ is indicator i's long-term trends or equilibrium values at time t, w_i is indicator i's weight.

The second approach has identified principal components from a range of financial variables through principal component analysis or related methods. It is assumed that the key factors that produce the largest change in the set of the financial variables could be considered as representative of the fundamental factors affecting the financial system and used to calculate the FCI.

The FCI's form by principal component analysis method is:

$$FCI_t = \sum_i w_i F_{it}$$

Where F_{it} is principal component i's value at time t, w_i is principal component i's weight.

There are different ways to determine the weights of financial variables. Large-scale macroeconomic models often have good results but it is difficult to run. Reduced- form models include an aggregate demand equation related to output differential or output growth for the FCI components. These models are easy to estimate.

VAR model

The VAR framework, which does not assess the transmission mechanism, is also widely used because of its ability to assess the effects among variables. Unlike the reduced aggregate demand equation model, all variables are endogenously. Besides estimating the link between the financial market and the real economy, VAR analysis also show the response mechanisms among financial components, especially the impact of financial shocks (Swiston, 2008). The limitation of this method is only a limited number of indicators included in the index.

According to this method, first, it is necessary to establish a VAR model, which demonstrates the impact of money supply, interest rates, exchange rates and asset prices on aggregate demand. In VAR modeling, the value of a variable is represented as a linear function of the lagged values of that variable and all other variables in the model.

Sims (1980) pointed out the p-order VAR model:

$$y_t = \alpha + \beta_1 y_{t-1} + \cdots + \beta_p y_{t-p} + \varepsilon_t, t = 1, \ldots T$$

Where $y_t = (y_{1t}, \ldots, y_{nt})'$, $\beta_i = (\beta_1, \ldots, \beta_p)$, α and ε_t being respectively a p- column vector of the dependent variables, a n- by- n matrix of the VAR coefficients, the intercepts and a p-column vector of the errors terms which are independent to the lagged values of y_t such that $\varepsilon_t \sim N(0, \Sigma)$ where Σ represents the error covariance matrix and is a positive definite matrix.

The traditional approach proposed by Sims (1980) uses the variance decomposition according to the Cholesky method to orthogonalize the shocks in order to see the impact of the macro shocks on the variance of the error. The Impulse respone function (IRF) detects the responses of the dependent variable in the VAR system to shocks of the error terms. The weight of each variable is calculated based on the degree of impact. The employment of IRF allows to determine weight of each sub-index through estimating the impact of shocks on both response variable and other regressors. However, at the beginning, it is necessary to choose the criteria for ordering the variables in the model.

In VAR, unless the correlation coefficient matrix (variance- covariance matrix of residuals, A) is simultaneously the unit matrix (basic VAR model), the residuals could be correlated. When the residuals are correlated, it skews the results of the IRF analysis. Therefore, in order to have reliable and efficient IRF analysis results, it is necessary to know the elements of

matrix A. Recently, researchers have used alternative methods that take into account the simultaneous correlation between error components. This approach is called SVAR. SVAR is a multivariable linear representation of an observation vector over its own lag and possibly other variables as a constant. SVAR is versatile method because it could accommodate many relationships between macroeconomic variables based on economic theory and allow the identification of orthogonal monetary shocks. SVAR often requires the order that the independent variables in the regression affect other variables based on their intrinsic relationship and the mutual influence. However, the order of variables could affect the Cholesky decomposition of the covariance matrix and IRF calculation, resulting in the mistake in weight determination. In the case of an FCI consisting of many financial variables, all of which respond instantaneously to shocks in the economy, there is no rule and assumption to arrange variables.

Many previous studies have different opinions on this issue. Goodhart and Hofmann (2001) calculated the FCI for G7 countries to assess the impact of asset price information on aggregate demand and monetary policy implementation. Beginning with an aggregate demand function that consists of Philips curve and IS demand curve in the past estimated using OLS, the weights of FCI variables are determined from the coefficients. In VAR method, the order of variables according to the rule of decreasing lag in response was chosen for Cholesky decomposition. Therefore, the responses to shocks of variables determine the position of these variables, moving from exogenous macroeconomic variables to financial variables. Comparing the results from OLS and VAR, the weights are similar. Shinkai and Kohsaka (2010) construct the FCI for Japan and arrange the variables in order of decreasing exogenous degree. As a result, oil prices are placed first, followed by financial variables, and all real economic variables are placed at the end as they are considered most endogenous.

Charleroy and Stemmer (2014) used seasonally adjusted data with monthly frequencies and ranked the variables from most exogenous to least exogeneous. External variables are included with 3 lags to account for their delayed respone. Many external and domestic financial variables are considered to choose. Firstly, VAR is run with the financial variables and estimates the response of GDP growth to the financial variables. Next, the important variables that have appropriate relationship with GDP are kept. It is estimated from a VAR model that includes all financial variables and changes of quarterly GDP. The weight of each variable is determined from the IRF based on the response of GDP to a unit of shock. Charleroy and Stemmer (2014) calculate the response of GDP to a simulated shock on each financial variable over a period of time p. The FCI for a given country at time t with m retained financial variables is:

$$FCI_t = \sum_{j=1}^{m} \left(\frac{\sum_{i=0}^{j} w_i^j \; v_{t-1}^j}{p} \right)$$

Where, FCI for ech period t is the average of the IRF over the period p to a simulated shock per financial variable j

w_i^j is the weight, which is the ith month lag response of domestic GDP to shocks of the variables.

v_{t-1}^j is the structural shock of the variable at each time, determined by the deviation of the financial variables from the mean.

The study of Charleroy and Stemmer (2014) selected the period p as 8 months after calculating the mean value of the response over 8 months. The weights mesure the importance of each financial variable in terms of its effect on growth. The structural shocks is determined by the Cholesky decomposition.

To remove the sensitivity of VAR results on the ordering of variables and also given the difficulty in identifying the relative sluggishness in the responses of financial variables that would determine the ordering of varibales in the VAR, according to Pesaran and Shin (1998), Gauthier et al (2004), Guichard et al (2008), Osorio et al (2014), the generalized impulse

response function is used to determine FCI of United State and Asia. The average lag is in the range of 4 to 6 quarters when accounting for the lag impact of monetary policy. The orthogonalized impulse is not fixed when reordering the variables in VAR but it is in the generalized impulse response function. The generalized impulse response function is the only one that takes into account historical correlations between shocks. Then, FCI could be constructed using weights of variables that are its average impact on output over the next 18-24 months. It is the period that monetary policy is expected to have enough effect on output and inflation.

Many previous studies have used VAR to analyze financial conditions and construct some indexes such as Guichard and Turner (2008), Swiston (2008), Shinkai and Kohsaka (2010). VAR consider the homogeneity among variables, so it could capture the response of the component variables, response of its lagged and apply time-varying weights. The main advantage of VAR-based FCI is its ability to compute relationship among financial variables (Ho et al, 2013). For example, the impact of tightening monetary policy includes both the direct impact of an interest rate increase on economic activity and the indirect effect through the impact of an interest rate increase on other financial market variables.

3. Methodology

3.1. Research variables

The selection of financial variables included in the FCI depends on the nature of the monetary transmission mechanism in the economy. Based on previous studies when constructing FCI in different countries and regions, the current situation of monetary policy, and the channels of monetary policy transmission in Vietnam, some variables are choosen to build FCI in Vietnam.

Interest rate is one of the main transmission channels of monetary policy, which has been confirmed in many previous studies. The Central Bank could change the money supply and/or the policy rate to affect real interest rates. As the real interest rate reflects the opportunity cost of present versus future expenditure, changes in the interest rate alter the incentives to defer current consumption and investment spending to a later date. A higher interest rate raises the cost of capital that directly reduces the profitability of current investment projects. Furthermore, a rise in the interest rates encourages households to reduce current consumption expenditure because of an increase in the return on savings and the cost of borrowing to finance consumption. Bernanke and Blinder (1990) argue that short-term interest rates have an impact on output, inflation and are predictable because short-term interest rates have an impact on long-term interest rates. In previous studies, the policy interest rate is used but in Vietnam it is quite rigid, so the interbank rate is exploited. Previous studies such as the study of Ho Chi Minh City University of Economics, the study of Osorio et al (2011) used the overnight interbank interest rate to calculate FCI. The overnight interbank interest rate is one of the monetary policy tools and could closely reflect financial conditions.

Overnight and 3 month interbank interest rate spread and 3- year and 10- year government bond interest rate spread (mmspread and govratespread): these variables was used in the ECB's study to construct FCI index for some countries in Europe (2013). In Goldman Sachs and Morgan Stanley's research , interest rate spread by term are used to calculate FCI. The short, medium and long-term spreads capture the term structure and the shape of the yield curve. Large interest rate spread in the interbank market can also be a sign of capital stress in financial institutions. The capital shortfall in the interbank market is typically represented by an increase in the spread between overnight and longer term lending. In addition, long-term interest rate spreads also reflect the stress in the bond market. Larger interest rate spreads indicate tighter financial conditions.

Spread between money market interest rates and 10-year government bond rate of Singapore (singspread): Singapore is considered as benchmark of the regional market in terms of integration and development. When calculating FCI in the context of integration, it is necessary

to add the external factors. When some studies on calculating FCI in other countries and regions choose the United State as the benchmark market, the spread between money market interest rate and 10-year government bond rate of Singapore is used to construct FCI for Vietnam because it represents the regional interest rate structure and could reflect market conditions and growth expectations.

MSCI representing the region stock market index (msci): Vietnam's FCI is built in the context of financial integration. A regional or world stock index is used to measure regional or global exposure to risk (Charleroy et al, 2014). According to research of Tran Thi Xuan Anh et al (2018) the MSCI stock index is used to represent the region when measuring the integration level of Vietnam financial market. The results showed that Vietnam stock market has integrated well with the region. Therefore MSCI is chosen in calculating FCI of Vietnam.

World oil price (oil): Research by Gomez et al (2011) uses oil price as a component of FCI because oil price is a key asset price that have impact on financial stability and the transmission of monetary policy. It also contains future information about the economy, inflation and general macroeconomic condition expectations. In Vietnam, oil price fluctuations change the production costs and spending of consumers, thereby affect investment and consumption. It has impact on inflation and economic conditions. Changes in oil price also affect state budget revenues, oil extraction and refining activities.

Real exchange rate (reer): the exchange rate fluctuations lead to changes in the relative prices of domestic and foreign goods and services. Such relative price fluctuations in turn can affect the pattern and level of spending in the domestic economy. An exchange rate appreciation lowers the domestic prices of imports and reduces the competitiveness of domestic goods and services. It encourages spending on foreign products. In addition, an appreciation of the local currency raises the foreign price of domestic exports, thereby reducing the competitiveness of exporters. A decrease in exports causes a further deficit in the trade balance, affects inflation and economic growth. Gauthier et al (2004) argued that exchange rate plays important role in small and open economies. The exchange rate is an important channel of monetary policy in Vietnam. It also transmits external shocks to the economy. The real exchange rate is selected in this study (REER).

Vietnam deposit and lending rate spread (decespread): financial expansion or tightening periods are often accompanied by significant fluctuations in interest rates. Therefore, many interest rate spreads are used to calculate FCI (Angelopoulou et al, 2013). Large spread between deposit and lending rates indicates tighter conditions for private sector credit. Credit conditions play an important role, especially in underdeveloped financial markets and corporate bond markets like Vietnam. In the context of expansionary monetary policy, banks could provide more credit to those who need capital such as businesses and households, affecting aggregate demand and output of the economy.

Money supply M2 (m2): money supply is one of the transmission channels of monetary policy. Many studies included money supply in constructing FCI. Money supply affects inflation and national financial conditions.

Reserve (reserve): Foreign exchange reserves are considered as a good indicator for countries trying to stabilize exchange rates or fix its volatility. Reserves facilitate the State Bank in operating monetary policy, flexibly managing and stabilizing exchange rates, attracting foreign investors and stimulating domestic investment. Moreover, reserves increases the resilience ability of the economy in crisis. It also reduce the impact of monetary easing on financial conditions (Arslan et al, 2019).

Corporate bond issuance volume (corbond): corporate bond issuance volume reflects the state of corporates capital raising in the financial market. It affects investment and saving and is also a signal of loosening financial conditions. Moreover, according to Thornton (1994), financial liberalization can weaken the bank credit channel. Therefore, the development of the bond market is important.

Government bond issuance volume (govbond): Government bonds are used to conduct monetary policy, as well as to invest in the market. Financial institutions often hold a certain propotion of government bonds in their portfolios. The supply of government bonds with different maturities can affect interest rates, according to the term structure expectation theory. Avouyi-Dovi and Idier (2010) study the correlation between government debt market conditions and monetary policy through collateral for open market operations and financial intermediaries. The results indicated that monetary policy effectiveness may depend on whether the bond market is segmented. At the same time, government debt is also related to financial stability.

Stock prices (VNIndex-VNI): Both consumption spending and investment could be affected by changes in asset prices according to the wealth effect. The fall in stock prices reduces a household's finanical wealth or increases financial difficulties, leading to a decrease in consumer spending. Furthermore, it is more difficult to borrow money if the assets are used as collateral for loan. At the same time, changes in asset prices affect the confidence level of consumers and business in the economy. Asset prices need to be monitored regularly as inflation pressures may appear first on asset prices in a low inflation environment (Borio, 2011).

3.2. Data description

The variables used to calculate the FCI are taken on a monthly basis, from January 2000 to November 2020. However, due to the availability of data, some variables only have data from 2005 such as interbank interes rates, government bond interest rates, regional stock price index MSCI.

In addition, due to data limitations, GDP of Vietnam is only available by year and by quarter, so an alternative variable which is the industrial production index (IPI) by month is used in this paper. Industrial production index is an indicator to assess the growth rate of industry production. IPI is the percentage of industrial production generated in the current period to the volume of industrial production in the base period. IPI data is only available from January 2008.

The data is from reliable sources such as World Bank, IMF, Asianbondsonline, Investing.com and Ceicdata.com

3.3. Constructing FCI for Vietnam by weighted sum method using VAR

In the weight sum method, the weight of each financial indicator is determined by many methods. VAR is the most commonly used method. According to VAR, the weight of each financial indicator is determined by estimating the effect on economic growth or inflation. VAR method clarifies the reason of variable selection to explain the mechanism by which finanical variables affect growth and inflation.

The data is processed before constructing FCI. Except for interest rates, all variables are converted to natural logarithms. The variables are first checked for stationary and differentiated if nonstationary. Furthermore, all variables are standardized by subtracting its mean and dividing by the standard deviation to eliminate unit effects and avoid over-weighting any series. It aims to exclude endogenous reflections of past economic activity in financial variables. So FCI reflects pure financial shocks (Hatzius et al, 2010).

Similar to the study of Goodhart and Hofmann (2002), VAR model is regressed with the financial variables presented in the section 3.1, IPI and CPI. FCI is measured on the basis of the variables' contribution to growth or inflation which means that both the magnitude and direction of the effect are significant for economic activity. The estimated response of IPI or CPI to each financial variable could be combined with the shock of each variable to calculate the total growth momentum in a certain period. Thus, FCI measures the total contribution to IPI or CPI growth in a given period from shocks of financial variables in the previous period.

FCI is equal to the weighted sum of the shocks of financial variables and the weights are calculated using the formula:

$$\mathrm{FCI}_t = \sum_{i=1} w_i (s_{it} - s_{it}^*)$$

$$w_i = \frac{\theta_i}{\sum|\theta_i|}$$

Where, s_{it} is the value of variable i at time t, s_{it}^* is the long-term average value of variable i. $(s_{it} - s_{it}^*)$ is the variation of variable i relative to the mean or shock. It has been calculated when processing data at the beginning. w_i is the weight of each variable. θi is the impulse response of growth or inflation to the shock of a variable i. θi is the sum of the lagged values of the general impulse response to shocks of one variable. And w_i is determined by the ratio of the response to the shock of 1 variable to the total response of growth or inflation to the shock of variables. The FCI construction principle is to integrate the effects of deviations to effectively reflect changes in financial conditions.

In this paper, FCI includes the impact on growth (IPI) (called FCI-IPI) or inflation (CPI) (called FCI-CPI) of financial variables shocks from the previous 12 periods because most IRFs are unchange after 12 month intervals. It is also a number that are used by many studies.

4. Results

Testing the suitable lag based on AIC principle, lagged 2 is optimal for VAR model. According to the AR root graph, all points are inside the unit circle, indicating that the VAR model is stable and could be used for impulse response analysis. Eview software was used to determine IRF (based on generalized response function). The results of the general impulse response function are detailed in Appendix 1, showing the impact of changes in each component on inflation and growth.

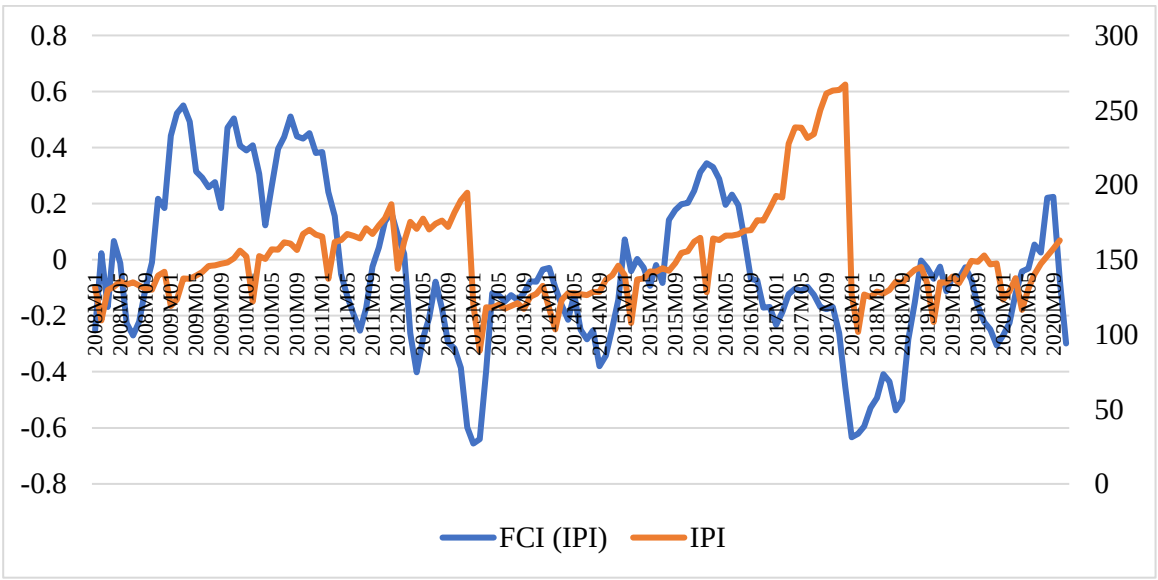
FCI results

Due to data limitations, some data are only available from August 2007 and January 2008, so the FCI series is calculated from these time points.

FCI according to the reponse of IPI growth to the shock of the finanical variables.

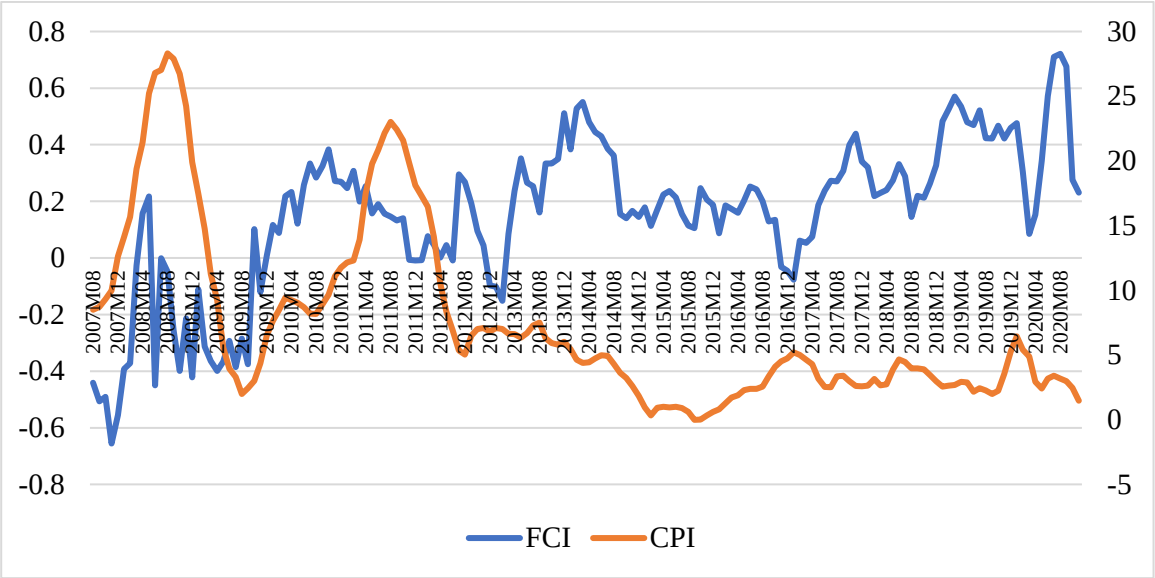
Figure 1 shows that FCI fluctuates in the same direction as IPI and it has ability to predict growth. Periods of tightening financial conditions are often accompanied by a decline in output growth and vice versa.

Figure 1. FCI results according to the response of IPI growth to the shock of the financial variables



Source: Calculations of the authors

Figure 2. FCI results according to the response of inflation CPI to the shock of the financial variables



Source: Calculations of the authors

Figure 2 shows the opposite movements of FCI and CPI and FCI could be used to predict inflation.

Interpretation of the VAR based- FCI volatility

According to the VAR method, FCI is built by summing the impulse responses of growth or inflation to the shock of financial variables. Thus, the index explains fluctuations in output or inflation. The above zero line FCI value in the figures reflects the loosening financial conditions, while the below zero line FCI value shows tight financial conditions (Charleroy et al, 2014). In addition, Hatzius et al (2010) suggested that if the FCI fluctuate significantly, the monetary policy transmission channel could be limted.

Comparing the FCI results with the steps in monetary policy management and the actual financial conditions in Vietnam, it can be seen that the FCI has quite accurately reflected the situation of the financial sector. The FCI volatility is quite similar to the tightening or loosening periods in Vietnam's financial conditions. Specifically, during late 2007 and early 2008, financial conditions are tightened due to a worsening economic outlook. State bank of Vietnam began to implement strong tightening monetary policies, increase interest rates because of high inflation pressure as a result of the previous monetary easing. It can be seen that FCI fell. In the first two quarters of 2008, along with the instability in the world financial market, the domestic economic situation was also very complicated. Prices increased. Crisis destabilize financial conditions. FCI is low. In the second half of 2008, the risk of high inflation temporarily subsided, but economic growth slowed down. The State Bank implemented easing policies. At the end of 2008, inflation was controlled and monetary policy was loosened more cautiously, leading to the decrease in the interest rate. Financial conditions improved, the FCI increased. In 2009, due to the impact of the world economic crisis departing from the United State, monetary policy continued to be loosened in order to stabilize and restore the economy. The economy had signs of improvement. The FCI is less volatile. Until the end 2009 when inflation increased again, monetary policy began to tighten, interest rate increased, financial conditions were unstable. The FCI fell. At the end of 2010, high inflation forced the State Bank to tighten monetary policy, which lasted until 2011. The tightening finanical conditions in 2011 were reflected by the sharp decrease of FCI. In 2012, inflation tended to decrease, the State Bank began to gradually loosen monetary policy to support economic growth. Fianncial conditions become easier to "breathe". FCI increased. In the period 2013-2015, the financial conditions and FCI were stable. Specifically, in 2013, the financial conditions were better, inflation was only 6.04%, the lowest rate in the past 10 years. The operation of credit institutions gradually stabilized and system liquidity was improved. Economic growth had a positive effect. The FCI rose sharply. In 2015, Vietnam's economic growth was

high, inflation was low and FCI was at a high level. In 2017, financial conditions were stable, the State Bank was successful in operating monetary policy. Monetary policy achieved the goal of satisfying liquidity for credit institutions, effectively providing credit to the economy, reducing lending interest rates, stabilizing exchange rates and foreign currency market, and controlling inflation. The FCI in 2017 increased. At the beginning of 2018, in the context of the world economic recovery, inflation and basic commodity prices tend to increase, the State Bank implemented the cautious monetary policy, gradually removed monetary stimulus measures which are previously applied. Domestic inflation was influenced by the increasing trend of world commodity prices. The FCI fell. In 2019-2020, the FCI has been at a high level. The Covid-19 epidemic has adversely affected the entire economy, causing the decrease in FCI in the first half of 2020. However, in 2020, many expansionary financial and monetary condition policies are implemented, leading to the better financial conditions. FCI has increased.

Evaluation of the predictive ability of FCI on inflation and economic growth using Granger' causality test.

The Granger causality test between the FCI and growth/ inflation were performed to exam whether the FCI could explain growth/ inflation. The test results at lags 2, 7, 8, 10 show one-way causality from FCI to growth at 10% significance level, at lags 6 and 9 at 5% significance level (Table 1). In addition, there is no inverse relationship from IPI to FCI. The past FCI could be used to predict the volatility of real IPI growth in next 10 months. It implies the role of the FCI as a policy instrument.

Table 1. Results of Granger causality test between FCI and growth

Null hypothesis: FCI does not Granger Cause IPI			Null hypothesis: IPI does not Granger Cause FCI		
Lag order	**F-value**	**p-value**	**Lag- order**	**F-value**	**p-value**
1	2.60383	0.1087	1	0.0000045	0.9983
2	2.78816	0.0648	2	0.19072	0.8266
3	2.03376	0.1118	3	0.3201	0.8108
4	1.83732	0.125	4	0.38007	0.8226
5	1.4914	0.1966	5	0.33649	0.8901
6	2.16991	0.0497	6	0.28454	0.9434
7	2.03232	0.0556	7	0.39566	0.9035
8	1.8968	0.0659	8	0.32128	0.9567
9	1.9905	0.0456	9	0.8636	0.5596
10	1.82987	0.0621	10	0.88963	0.545
11	1.61907	0.1018	11	0.84364	0.5971
12	1.46056	0.1492	12	0.7616	0.6883

Source: Results from Eview 10

Table 2. Results of Granger causality test between FCI and inflation

Null hypothesis: FCI does not Granger Cause CPI			Null hypothesis: CPI does not Granger Cause FCI		
Lag order	**F-value**	**p-value**	**Lag- order**	**F-value**	**p-value**
1	1.87284	0.1731	1	6.05146	0.015
2	2.6818	0.0717	2	3.14991	0.0456
3	3.21707	0.0246	3	2.35808	0.074
4	3.43348	0.0103	4	2.11096	0.0823
5	2.6292	0.0263	5	2.08032	0.0712
6	2.44675	0.0279	6	1.76467	0.1106
7	1.8153	0.0889	7	2.10048	0.0474
8	1.23791	0.2818	8	2.11025	0.0389
9	1.13227	0.3446	9	2.14342	0.0301
10	0.85484	0.5772	10	2.37099	0.0131
11	1.05611	0.4021	11	2.24139	0.016
12	1.47909	0.1408	12	2.23692	0.0137

Source: Results from Eview 10

The results of the Granger test between FCI and CPI show that at the lag 2, FCI and CPI have a Granger causal relationship. At lags 3, 4, 5, 6, FCI is one-way Granger cause of inflation with 95% confidence level (5% significance level). The FCI in the past is significant (at 5% significance level) in predicting inflation fluctuations in the next 6 months.

In conclusion, it can be seen that the VAR based- FCI could be used to forecast growth and inflation at a certain level of significance. However, VAR method also has a limitation that the fixed weight of financial variables are not really reasonable if applied for a long time because it is difficult to capture the exact changes in the financial condition structure.

5. Conclusion

The VAR based- FCI is constructed based on the response of growth or inflation to the shock of the component financial variables. As a result, this index has excluded the main macroeconomic developments such as growth and inflation and has only focused on measuring financial shocks like exogenous effects on the economy. When analyzing the VAR-based FCI, the FCI's fluctuations are quite consistent with the changes in Vietnam's financial conditions in the period 2008-2020. At the same time, the Granger causality tests also suggest that the FCI in the past is significant in predicting real growth and inflation changes. It confirms the role of the FCI as a policy tool.

However, the VAR-based FCI assumes that the contribution of each financial variable to real growth is stable overtime. In fact, the recent financial crises not only emphasize the relationship between financial markets and the real economy, but also suggest that this relationship is diverse and subject to change. Meanwhile, emerging economies often experience significant developments in their financial systems, changes in the monetary policy framework, regime and financial shocks. Therefore, fixed weights are not appropriate for long time. The fact shows that unstable relationship between financial sectors and real economy is one of the most important issue to be solved in assessing future financial conditions (Hatzius et al, 2010).

In addition, the VAR model with constant weight is also limited because the impact of financial variables on the real economy or the response of financial variables to monetary policy could change. Some previous studies overcome this problem by using the data rolling method to compute time-varying weights. However, the rolling data creates a problem that the post-crisis FCI could be calculated from the variables selected after observing the crisis period and the VAR model is regressed with the data for crisis period. Although this approach determines the weights of financial variables that change over time, it is difficult to construct exact post-crisis FCI. Therefore, it is necessary to study method to calculate the proportion of financial variables in FCI to overcome this problem. It also will be the future research of authors.

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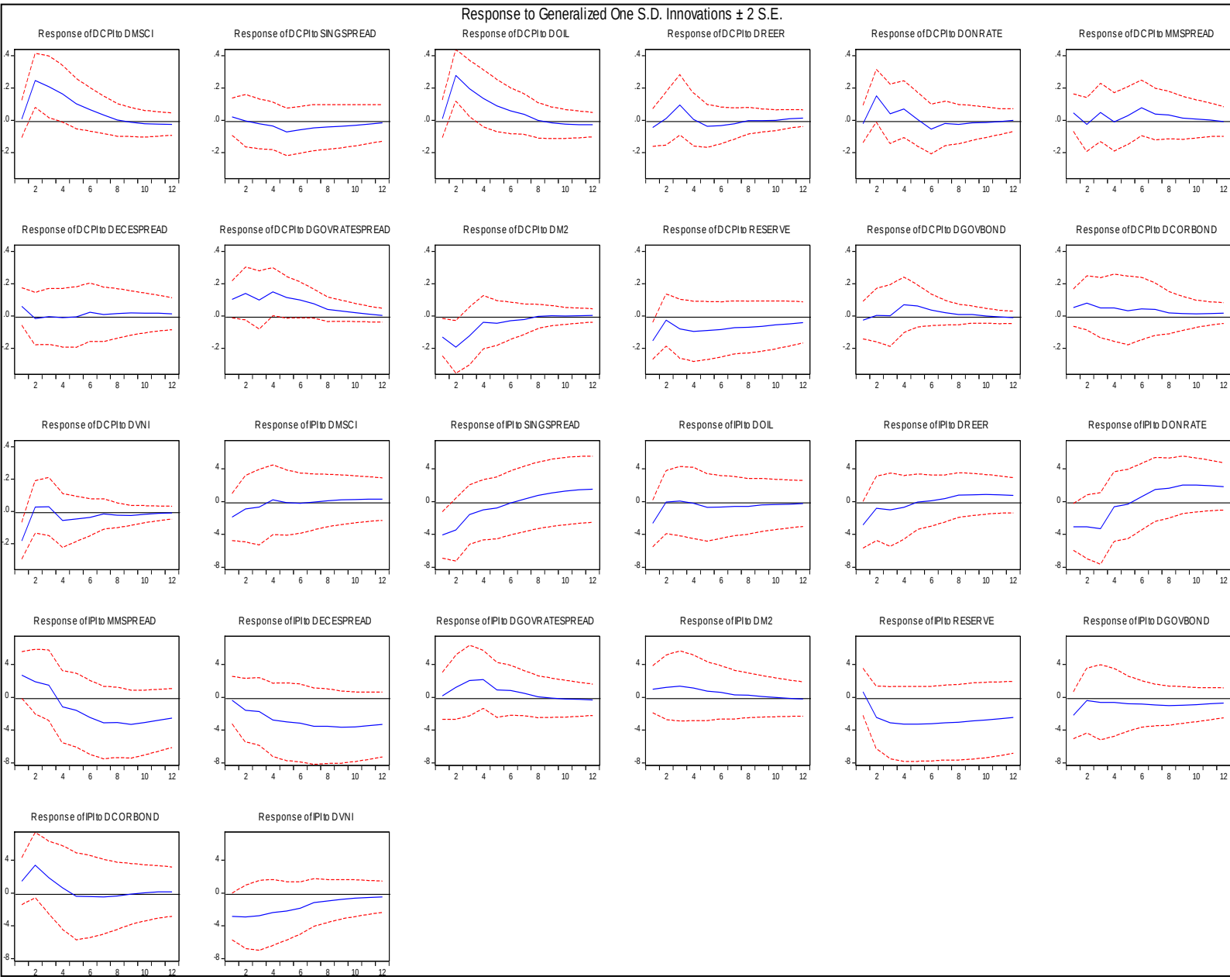
Appendix 1. Impulse response of CPI and IPI to shocks of variables



Source: Results from Eview10