THE EFFECT OF FINANCIAL INCLUSION AND FINANCIAL TECHNOLOGY ON MONETARY POLICY EFFECTIVENESS: THE CASE OF VIETNAM

ẢNH HƯỞNG CỦA TÀI CHÍNH TOÀN DIỆN VÀ CÔNG NGHỆ TÀI CHÍNH ĐẾN HIỆU QUẢ CỦA CHÍNH SÁCH TIỀN TỆ: TRƯỜNG HỢP TẠI VIỆT NAM

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ABSTRACT

This paper aims to investigate the influence of financial inclusion on monetary policy effectiveness in Vietnam with a more comprehensive measurement of financial inclusion. Using the Fully Modified Least Squares (FMOLS) method with the observation period from 2009Q1 to 2019Q4, the results reveal that an improve of accessibility to financial products such as loans or deposits reduce the inflation rate, which helps to stabilize the price level in Vietnam. Additionally, this study is different from previous research by considering the role of (financial technology) FinTech in the relationship between financial inclusion and monetary policy in Vietnam as FinTech is considered an irreversible trend as it brings a lot of benefits for the economic development. However, we find a negligible impact of financial innovations on the monetary policy. Based on these empirical resutls, we also provide suggestions of developing financial inclusion and enhancing the role of technological innovations for Vietnam financial market in the future.

Keywords: Financial inclusion; Fintech; Monetary policy effectiveness.

TÓM TẮT

Mục tiêu của nghiên cứu này là nhằm phân tích ảnh hưởng của tài chính toàn diện đến hiệu quả của chính sách tiền tệ tại Việt Nam với cách thức đo lường yếu tố tài chính toàn diện bao quát hơn với. Sử dụng phương pháp Fully Modified Least Squares (FMOLS) với thời gian quan sát từ 2009Q1 đến 2019Q4, kết quả nghiên cứu chỉ ra rằng việc nâng cao khả năng tiếp cận các sản phẩm tài chính như cho vay hay tiền gửi giúp làm giảm tỷ lệ lạm phát và ổn định giá cả ở Việt Nam. Ngoài ra, nghiên cứu này khác với các nghiên cứu trước đây ở việc xem xét thêm vai trò của công nghệ tài chính trong mối quan hệ giữa tài chính toàn diện và hiệu quả của chính sách tiền tệ tại Việt Nam bởi vì công nghệ tài chính được xem là xu hướng tất yếu trong quá trình phát triển của nền kinh tế. Tuy nhiên, kết quả nghiên cứu chỉ ra tác động không đáng kể của việc đổi mới công nghệ tài chính với chính sách tiền tệ tại Việt Nam. Dựa trên những kết quả nghiên cứu thực nghiệm này, chúng tôi cũng đưa ra một số đề xuất về việc phát triển tài chính toàn diện và nâng cao vai trò của việc đổi mới công nghệ tài chính tại thị trường Việt Nam trong thời gian tới.

Từ khóa: Tài chính toàn diện; Công nghệ tài chính; Hiệu quả của chính sách tiền tệ.

1. Introduction

In recent years, financial inclusion (FI) has become a global concern with the goal of developing a financial system that serves all members of society, and provides suitable and convenient services with a reasonable cost for all individuals and businesses. This might be explained that a wider population involving in the formal financial system would contribute to alleviate poverty and promote economic development. For developing and emerging economies, many studies indicated that FI can reduce extreme poverty by increasing abilities to access finance, contributing to creating livelihood

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opportunities, rotating investment capital flows and saving in society, thereby promoting economic growth (Rangarajan, 2008; Birgitta D. Saraswati et al., 2020; Duc Hong Vo et al., 2020; Joseph et al., 2021). Also, based on a report of the United Nations (2016), enhancing financial inclusion is one out of four supporting pillars of human development.

On the other hand, FI can also become a double-edged sword for the stability of the financial system if there are no appropriate implications and development environments, especially in developing and emerging economies (Bożena Frączek, 2019; Duc Hong Vo et al., 2020). Khan (2011) argued that the more banks try to expand the pool of borrowers, the more they could suffer the reduction in lending standards; thereby resulting in an inevitable financial crisis like the United States subprime mortgage crisis in 2008. In addition, there is an increase in financial system risks if microfinance institutions are not properly regulated and the reputation of banks tends to be impacted negatively from lending low-income segments of the population because of their poor credit history. Demand for loans from people and businesses is increasing, but many customer segments cannot fully access banking services. According to the latest report by World Bank in 2017, over 65 percent of adults (people aged 15 and above) have access to banking and mobile bank accounts, while approximately 1.7 billion adults are still unbanked and women take into account more than half of the unbanked group. This report by World Bank also indicates that cost and distance are two main factors making it difficulty access to banks for those interviewers. Furthermore, Douglas (2020) argues that financial infrastructure or financial technology could improve or impede the advantages of financial inclusion. Also, previous studies have reached a consensus on the role of technological development in reducing asymmetric information related to lending activities (Allen & Santomero, 1997; Hannig & Jansen, 2010). Hannig and Jansen (2010) argue that technological adoption helps improve financial services delivery by reducing fixed transactions costs. Therefore, any country desiring to increase economic growth and reduce poverty must strike a balance between financial inclusion and financial stability.

Lately, in Vietnam, several national strategies such as the socio-economic development strategies, the Vietnam Sustainable Development Strategy for 2011-2020, the National Action Plan for the implementation of the 2030 sustainable development agenda, and so on have built to improve income and living standards for the people, and to make equal opportunities for people in accessing development resources as well as receiving financial services. The Government has also developed and implemented many specific policies to achieve financial inclusion. Notably, on January 22nd in 2020, the Prime Minister signed Decision No. 149/QD-TTg approving the National Financial Inclusion Strategy until 2025, vision to 2030. This is an important milestone to the Vietnamese banking industry and its influence on the country's socio-economic development. Speaking at a conference, Anh K. Nguyen, who is the Deputy Governor in State Bank of Vietnam, emphasized the role of FI in the current economic context of Vietnam. She said that the Covid-19 pandemic was an unprecedented challenge to the whole world, in which, although Vietnam has made successes in epidemic prevention and control, economic impacts are only gradually revealed and will continue to be complicated

in the coming time[1]. Also, it is essential to recognize the impacts of the epidemic on the Vietnamese banking system from many potential risks, especially bad debt may increase. Therefore, in order to successfully implement the Government's sustainable development goals, the tasks and solutions of the National Financial Inclusion Strategy must be understood and thoroughly addressed.

Similar to other developing and emerging economies, financial technology (FinTech) in Vietnam must be concerned since the National Financial Inclusion Strategy is enacted. Recently, on June 3rd, 2020, the Prime Minister has just issued Decision No. 749 / QD-TTg approving the national digital transformation program until 2025, with the vision to 2030, intending to reach the top 50 countries in e-government. In particular, the primary goal by 2025 is to develop a digital government with 80% of online public services accessible on a variety of resources, including mobile devices; to set up a working environment over the network (90% at ministerial and provincial level, 80% at district level and 60% at commune level). Moreover, Vietnamese government also reach to build 100% of national databases that create an e-government development platform including national databases on population, land, business registration, finance, insurance and so on; thereby, providing timely public services. The government's orientation is to strive for Vietnam to be in the group of 70 leading e-government countries and in the top 50 countries in e-government by 2030. However, the financial infrastructure and technology development in Vietnam is still young, especially the potential to access financial services in rural areas is still limited (Truong & Phan, 2019).

Cai (2018) also points out that emerging countries in Asia and Africa have been highlighted by the increasing dependence on technological advancement. Additionally, based on a recent research named "Fintech Financial Inclusion Scorecard" by Tellimer[2], among emerging market, Vietnam is evaluated as the country in which technology could have the strongest influence on financial inclusion (Shah & Kumar, 2021).

Thus, does the current FinTech development environment enable to correspond towards the impact of financial inclusion on monetary policy effectiveness? Finding the answer of this question is needed in the contemporary context, but there have been no studies investigating whether FinTech could amplify the influence of financial inclusion on monetary policy for Vietnam.

Research objectives

Hence, the main objective of this study is to examine the relation between monetary policy and financial inclusion in Vietnam and whether or not FinTech improves this connection.

The rest of the paper is grouped into literature reviews, hypotheses and methodology, analysis, and conclusion as well as policy implications.

[1]https://nhandan.com.vn/nhan-dinh/trien-khai-thuc-hien-chien-luoc-tai-chinh-toan-dien-quoc-gia-616271/

[2] This is a global data provider on technology, information, which has started over 20 years and focused on emerging financial markets.

2. Literature Review

2.1. Theoretical review

With regard to the definition of financial inclusion, this term is defined variously in the literature. Sarma (2008) defines financial inclusion as a process built on three dimensions including the ease of access, availability, and usage of formal financial service for all members of an economy. In the same spirit, Amidžić et al. (2014) stated that financial inclusion is an economic condition in which individual and firms are able to use saving and borrowing instruments via formal financial institutions. Additionally, Saksonova and Kuzmina-Merlino (2017) consider financial inclusion as the wide application of financial technologies in financial services. Thus, most definitions consider financial inclusion based on three dimensions which are the *availability, the accessibility and the usage* of the financial system.

Although there is an agreement in defining financial inclusion, there is still no consensus on measuring financial inclusion (Park & Mercado, 2015). Several studies simply measure financial inclusion by the proportion of population who are able to use formal financial services (i.e. owning formal bank accounts). However, this approach experiences a biggest disadvantage that data is only available for a limited number of countries. It is noted that such primary surveys would exaggerate discrepancies in survey dates, survey units, and methodologies. Thus, most scholars employ the World Bank's Global Findex Database in their studies (i.e. Demirguc-Kunt & Klapper, 2012; Demirguc-Kunt et al, 2015; Mehrotra & Nadhanael, 2016). Sarma (2016) argues that this method is able to remove the inconsistencies stemming from the countrywide primary surveys. Other studies develop financial inclusion index or composite financial access indicator. For instance, Honohan (2008) constructed a composite indicator which reveals the proportion of adults or households using formal financial services in a given economy out of 160 countries. Nevertheless, this method only delivers a one-time measure of financial inclusion, which failed to capture the changes over time and across economies (Park & Mercado, 2015; Sarma 2016). In this respect, Amidžić, Massara, and Mialou (2014) proxy financial inclusion index by developing a composite indicator characterised by outreach, usage, and quality dimensions. However, this measurement appears to be biased when treating the dimensions unequally.

In examining the nexus of financial structure and monetary policy through transmission mechanisms, this topic has attracted much scholarly attention. Specifically, various studies investigate how the balance-sheet positions of banks, governments, household, and enterprises change in the response to monetary policy stance. Nevertheless, little attention has been paid on the dynamic and causal linkage between monetary policy and the access to formal financial services such as credit, saving, and remittance which are defined as financial inclusion (Hariharan & Marktanner, 2012). In other words, financial inclusion is conceived as one of the leading indicators of monetary policy effectiveness and thus, financial stability. This part will highlight the monetary policy transmission channels that are affected by involving financial inclusion in the financial system.

Normally, monetary policy is transmitted through two main mechanisms which are the interest rate channel and the money supply (Bondt, 1999). As an alternative, monetary

instruments can be gauged either by price-based or quantity-based.

A strand of this literature focuses on the ***interest rate channel*** to examine the nexus between financial development and monetary policy. It has been conceded that the variation in interest rates would result in capital cost changes, driving customers to spend or save and thus changing the macroeconomic situation. According to Keynesian economic theory, changes in interest rates are likely to drive investment and consumption which are major components of aggregate demand. In other words, this elucidation denotes that given a low level of financial inclusion, the interest rate would not act as an effective tool of monetary policy.

Concerning the ***direct monetary channel or the money supply channel***, monetary policies can be expansionary or contractionary. Given recession threatens, central bank would increase the money supply by increasing the number of loans, leaving aggregate demand shifted downward. On the other hand, contractionary monetary policy aims at curbing inflation by which loan quantity decreases and aggregate demand shifts upward. Comparing different monetary policy mechanisms, Yetman (2018) points out that the quantity mechanism seems to be less effective than the former regarding the influence of financial inclusion on monetary policy choices.

Beyond these traditional channels, ***credit channel*** is conceived as the influence of monetary policy in terms of the informational asymmetry between the creditor and the debtor (Mishkin, 1996). In this respect, monetary policy has been transmitted through two channels, which are bank lending and balance sheet of economic agents (Bernanke & Gertler, 1995). Bernanke and Gertler (1995) also emphasize that the magnitude of monetary policy shocks would increase in an imperfect financial market. Simatele (2004) argues that the bank lending channel is supposed to completely tackle information failure by depository institutions, while balance sheet transmission signifies the impact of monetary policy on the net value of firms and their collaterals. Loutskina and Strahan (2009) evidence that the bank-lending channel is less effective on condition that mortgages are securitized. It is also noticeable that the increasing arrival of non-bank lenders also negatively influence the bank lending channel (Misati et al., 2010).

Related to the balance-sheet transmission, this channel signifies the changes in borrowers' balance sheets and income statements under the impact of monetary policy. Once expansionary monetary policy pushes interest rates down to a low level which then facilitates the access to loans of bank borrowers, stimulating spending and investment. In this regard, the development of financial inclusion will enhance the effectiveness of monetary policy transmissions, consequently boosting economic activity. Ashcraft and Campello (2007) have proven that the impact of the balance sheet channel is strengthened given the availability of financial securitization.

2.2. Empirical research

2.2.1. The nexus between financial inclusion and monetary policy effectiveness

Existing literature mainly focused on the relationship between financial inclusion and macroeconomic stability which is proxied by GDP growth, poverty alleviation, and income inequality (i.e. Ashraf et al., 2006; Chibba, 2009; Dupas & Robinson, 2013; Sarma, 2016). Park and Mercado (2015) claim that financial inclusion makes meaningful

contribution to poverty eradication and lower-income disparities, hence forcing economic development. Nonetheless, there has been less attention paid to the relationship between financial inclusion and the effectiveness of monetary policy like Mehotra and Yetman (2014), Lenka and Bairwa (2016). In this study, we would focus on the relationship between financial inclusion and monetary policy. Furthermore, we also examine which econometric method had been applied and what conclusion had been drawn in previous studies.

There is no consensus on the impact of financial inclusion on monetary policy effectiveness in previous studies. Mehrotra and Yetman (2014) examine the impact of financial inclusion on monetary policy using a sample of 130 different countries. By employing the Vector Autoregression method, Mehrotra and Yetman (2014) indicate that a greater financial inclusion would help to stabilize the inflation rate and output volatility. Furthermore, the result shows that the level of financial inclusion determines the sensitivity of optimal monetary policy in these countries.

Employing data spanning the period from 2004 to 2013 in the South Asian Association for Regional Cooperation (SAARC) countries, Lenka and Bairwa (2016) propose a Financial Inclusion Index by performing the principal component analysis (PCA) method. They conclude that increases in financial inclusion curb inflation rates in SAARC countries. Nevertheless, according to Anarfo et al. (2019), previous studies have proxied financial inclusion and monetary policy inadequately. The authors signify two dimensions in measuring financial inclusion instead of using single-variable proxies, which are demand-side indicators and supply-side factors. In our study, we would follow the assertion of Anarfo et al. (2019) to proxy financial inclusion which should be gauged by the usage and the ability to access financial systems.

On the other hand, several studies indicate a negative or negligible influence of financial inclusion on monetary policy effectiveness (Khan, 2011, Ascari et al., 2011, Lapukeni, 2015). Khan (2011) suggests that the involvement of financial inclusion is combined with risks to financial stability, hence increasing the complexity of monetary policy transmissions. Similar to Ascari et al. (2011), Lapukeni (2015) could not find evidence that financial inclusion in Malawi influence the effectiveness of the monetary policy. A recent study by Nguyen (2018) indicates a negative influence of financial inclusion on monetary policy in Vietnam from 2004 to 2015. The author also uses PCA technique to generate the Financial Inclusion Index based on the number of automated teller machines (ATMs) per 100,000 adults, outstanding deposit and credit from commercial banks. To produce reliable estimates, Ordinary Least Squares and Generalized Least Squares models are employed in this study.

Regarding the context of Asian region in general and Vietnam in particular, not so many studies on this topic have been implemented. The previous studies mainly focus on the impact of financial inclusion on macroeconomic variables such as growth rate or macroeconomic stability at country level or bank level (Thathsarani et al., 2021; Vo et al., 2019; Vo et al., 2021). While controlling inflation plays an important role in nurturing economic growth, this macroeconomic indicator has been not comprehensively addressed in studies related to financial inclusion, especially in the case of Vietnam. Also, according to the report by the World Bank Enterprise Survey (WBES) in 2018, Vietnam is characterized by the highest

access to credit. Hence, it is crucial to examine the impact of financial inclusion on the effectiveness of monetary policy in Vietnam.

2.2.2. The impact of financial technology (FinTech) on monetary policy effectiveness through the development of financial inclusion

It has been noted that financial market development has a significant role in monetary policy transmissions. In which, technologies innovation is considered as mainspring to overcome traditional impediments on the financial market, hence improving financial services as well as providing better customer experience. In other words, the development of electronic payment system will help the banking industry create a more convenient infrastructure for customers, reaching sustainable economic growth. However, the relation between FinTech and monetary policy has not been examined regularly in previous studies, especially for the case of Vietnam. Furthermore, Fiedler et al. (2017) argue that innovating financial activities is not always a mellow process.

Generally, the technological innovation in finance system would exacerbate the competition among finance sectors, hence leading the market to be more sensitive to changes in interest. Noyer (2008) denotes that employing technological activities in financial market strengthens the prominent transmission channel of monetary policy, which is interest rate. Mishra and Pradhan (2008) also implies that FinTech could improve the function of interest rate channel in transmitting monetary influences to the economy. Mehotra (2019) argues that financial technology is a part of financial inclusion. Arner et al. (2020) emphasize that FinTech could promote the development of financial inclusion development, through the four pillars including digital identity, interoperable electronic payments systems, electronic government provision of services and digital financial markets. In a similar vein, Saraswati, et al. (2020) confirm that adopting Fintech would change the structure of the payment system, which eventually influence the monetary policy.

However, financial innovation might impede the implementation of monetary policy since data seems to be more sensitive (Mishra and Pradhan, 2008). Akin to these results, Al-Lahamet al. (2009) demonstrate that the impact of FinTech on monetary policy is more effective in the short run. Fiedler et al. (2017) also assert that FinTech activities do not directly influence the conduct of monetary policy. A recent study by Mumtaz and Smith (2020) analyze the influence of FinTech on monetary policy by dividing a sample of 30 countries into pre-FinTech and post-FinTech periods. The results show that there is no difference in money circulation between the two periods. The authors also indicate that inflation can determine the development of technological innovations in the financial system.

There is no consensus on the linkage between FinTech and monetary policy effectiveness in previous studies. Also, there is a lack of literature focus on the influence of technological uptake on the development of financial inclusion, concerning the case of Vienam. According to Agyekum et al. (2021), the understanding of technology adoption is a crucial major in stimulating financial inclusion. Additionally, Demirguc-Kunt et al. (2018) assert that the innovation of finance-related technology plays an important role in enhancing financial inclusion in developing countries.

Nonetheless, financial technology in Vietnam has just entered a very beginning stage (Morgan & Trinh, 2020). Kaur (2021) and Shah and Kumar (2021) both emphasize the poor rate of financial inclusion in Vietnam, albeit the population is tech-savy. Significantly, given a high rate of technological adoption combined with a low rate of financial inclusion, Vietnam could be a potential investment destination in Southeast Asia. In brief, as FinTech plays a crucial role in facilitating a favorable environment for financial inclusion, this factor has far greater potential to flourish and automate the uses of financial services in Vietnam.

Given this backdrop, the study aims to provide new evidence on the linkage between FI and monetary policy in Vietnam, with the consideration of FinTech influence. First, by using a more comprehensive proxy of FI in Vietnam, this study will elucidate whether the involvement of FI in Vietnam helps to enhance the effectiveness of monetary policy. Thus, with a good understanding of the influence of FI on monetary policy, the State Banks of Vietnam and it governors will be able to provide appropriate strategies to achieve the desired outcomes and have a more financially inclusive society. Second, the influence of Fintech on monetary policy is still an open empirical question. Hence, another contribution of this study is the involvement of financial technology in examining the impact of financial inclusion on the formulation and implementation of monetary policy.

Based on the previous analysis, we propose two hypotheses:

Hypothesis 1: Financial inclusion positively influence the effectiveness of monetary policy in Vietnam.

Hypothesis 2: The adoption of financial technology will magnify the impact of financial inclusion on monetary policy in Vietnam.

3. Data and methodology

3.1. Data and measurement variables

Data used in this study was mainly originated from the World Bank database. We use quarterly data from 2009Q1 to 2019Q4 in our investigation.

In this study, we measure financial inclusion as a multidimensional index. Vo et al. (2021) measure financial inclusion in Asian countries based on supply (outreach) and demand (usage) dimensions. Generally, financial inclusion is characterized by three dimensions, which are access, usage and quality (Alliance for Financial Inclusion Data Working Group (2011) as cited by Triki and Faye (2013)). The '*Access*' dimension refers to the availability of formal financial services while 'Usage' indicates the actual usage of those services. The '*Quality*' dimension of financial inclusion requires surveys on the demand-side, which is hardly used in previous studies. Therefore, we just consider the two dimensions of financial inclusion, which consists of access and usage.

In examining the impact of financial inclusion on the monetary policy effectiveness, previous studies such as Lapukeni (2015), Lenka and Bairwa (2016) use inflation rate as the policy success. It is noted that price stability is the primary objective that is aimed by the majority of policymakers. Mishra and Pradhan (2008) define monetary policy as a set of strategies by the central bank to control the cost and use of money. Monetary policy is operated by monetary instruments such as interest rate, open market operations, which it directly influences the financial market and

later on indirectly promote economic activities. Clarida et al. (2000) indicate that targets of monetary policy include stabilizing financial system or maintaining economic activities. Cecchetti and Krause (2002) emphasize on curbing inflation as the most prioritized goal in conducting monetary policy. Hence, therefore inflation rate is used as a proxy variable of monetary policy effectiveness.

Instead of using exchange rates as a control variable, we use the economic freedom index in this study. This index is constructed based on various components including rule of law, open markets, regulatory efficiency and limited government. Thus, we aim to employ this variable as a control variable for the macroeconomic environment. Akin to previous studies (Vo et al. 2021), we include Gross domestic product growth, lending rate, broad money growth as control variables in the econometric model.

Related to the measurement of financial technology, as mobile money pilot has been not launched in Vietnam, there is no data of mobile money transactions available. Thus, in this study, we measure the adoption of financial technology by the number of transactions of inter-bank electronic payment system instead. The development of an interbank payment would encourage cashless and electronic payments in one country, which is considered as one of the initial steps of adopting FinTech in Vietnam.

Table 1. *Variables selection*

Variables	**Source**
Financial inclusion index (FII), is constructed based on four variables: ***Access indicators:*** - Number of commercial bank branches per 100,000 adults - Number of ATMs per 100,000 adults ***Usage indicators:*** - Number of credit cards per 1,000 adults - Number of debit cards per 1,000 adults	World Bank Database
Economic freedom index	The Global Economy Website
Inflation Broad money Lending rate	World Bank Database
Financial technology (FinTech)	Annual reports from State Bank of Vietnam

3.2. Methodology

3.2.1. Princinpal Component Analysis

To construct such an index for financial inclusion, we adopt a principal component analysis (PCA). This procedure was first initiated by Pearson (1901), which was then developed by Hotelling (1993). In previous studies related to financial inclusion, PCA is widely-used to reduce for dimensionality, aiming to transform the original dataset into a set of uncorrelated factors. The maximum variance among the set of initial variables is obtain by PCA method. Based on corresponding variances, the principal components are then classified. Particularly, the first component represents the most variation in the original dataset. Vyas and Kumaranayake (2006) argue that the PCA method is convenient in calculating and helps to avoid problems related to normalization or non-linear relationships.

3.2.2. Model specification

Fully modified least squares (FMOLS) has been widely applied in empirical research in finance and economics fields by many scholars, as did in Tursoy (2019). This technique was initiated by Phillips and Hansen (1990), aiming to correct the problems related to long-run equilibrium. The uses of FMOLS procedure is possible in models with unit roots and cointegrating relationships (Pedroni, 2001). As FMOLS can account for endogeneity and serial autocorrelation problems, the estimates of cointegrating coefficients are likely to be unbiased. In other words, the bias terms in OLS estimator can be removed in the FMOLS method (Cappuccio & Lubian, 1996).

In this study, we choose to estimate FMOLS based on prewhitening which improves the estimators of the long-run covariance matrix, in comparison to fixed bandwidth or automatic bandwidth processes. Specifically, lending support to Inder (1993), Cappuccio and Lubian (1996) argue that prewhitening operation is preferred than the latter, given finite sample properties.

The equation modelling the relationship between Financial inclusion index and Monetary policy are specified below:

$$Inflation_t = \alpha + \beta_0 FII_t + \beta_1 FreedomIndex_t + \beta_2 GDPGrowth_t + \beta_3 LendingRate_t + \beta_4 BroadMoney_t + e_t \quad (1)$$

Also, to examine whether or not financial technology could promote the relationship between financial inclusion and monetary policy effectiveness, we include a cross-product that combines FinTech and financial inclusion index.

$$Inflation_t = \alpha + \beta_0 FII_t + \beta_1 FreedomIndex_t + \beta_2 GDPGrowth_t + + \beta_3 LendingRate_t + \beta_4 BroadMoney_t + \beta_5 FII_t * FinTech_t + e_t \quad (2)$$

4. Empirical Results

4.1. Stationarity test

Economic time series usually have nonstationary characteristics. Hence, before estimating the FMOLS model, we first check the stationarity of variables to avoid spurious regression problems. The Augmented Dickey Fuller (ADF) test is used to check the stationarity property of the time series. The result from the unit root test shows that all variables in the dataset are stationary at the first difference degree. In other words, we can conclude that all variables are integrated of order 1 or I(1). The following is the test whether there a exist long-run relationship among the series in the model.

Table 2. *Augmented Dickey-Fuller Unit Root Test*

Variables	At level	At 1st difference
Financial Inclusion Index	-1.512	-3.396*
Inflation	-2.976	-2.7761*
GDP Growth	-2.934	-3.594**
Lending Rate	-1.799	-8.266***
FreedomIndex	-1.970	-3.4797*
Broad Money	0.328	-7.577***
FinTech	-1.474	-5.009***

*Note: ***, **, * denotes that results are significant at 1%, 5%, 10% respectively*

Source: Authors' computation

4.2. Cointegration test

Since the integration of order 1 is found, the Johansen cointegration test is then implemented to determine the number of cointegration relationships in the model. Result[3] reveals that the trace statistic is greater than the critical value at 5%, indicating the existence of cointegrating relationships among the set of variables. Thus, the FMOLS method then can be used to estimate the economic model

4.3. FM-OLS estimation

Different from previous studies, we employ the financial inclusion index instead of using separate indicators. In this study, the estimation of the FMOLS method takes place, which includes cointegrating relationships. Result is shown in table 3.

Table 3. *FMOLS regression*

Dependent Variable: INFLATION

Method: Fully Modified Least Squares (FMOLS)

Date: 03/27/21 Time: 19:00

Sample (adjusted): 2009Q2 2019Q1

Included observations: 40 after adjustments

Cointegrating equation deterministics: C

Long-run covariance estimate (Prewhitening with lags = 3, Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coeff.	Std. Error	t-Statistic	Prob.
FII	-0.422	0.029	-14.564	0.00
FREEDOMINDEX	0.405	0.028	14.085	0.00
GDPGROWTH	1.669	0.047	34.997	0.00
ENDINGRATE	1.210	0.012	100.145	0.00
BROAD_MONEY	0.048	0.007	6.358	0.00
C	-38.439	1.652	-23.266	0.00

R-squared	0.908	Mean dependent var	6.216
Adjusted R-squared	0.895	S.D. dependent var	4.491
S.E. of regression	1.454	Sum squared resid	71.930
Long-run variance	0.018		

Result reveals a negative impact of financial inclusion on inflation. It states that 1% increase in financial inclusion reduces 0.42% level of inflation. This indicates that monetary policy is more effective given the adoption of financial inclusion. Besides, positive correlations are found between inflation rate and other variables including economic freedom, GDP growth, lending interest rate and broad money. Most of the coefficients have expected signs, which is also consistent with the theory.

Particularly, it is expected that the growth rate has a positive impact on the inflation rate and the empirical results confirm this. Lending support to this positive relationship, Mehrotra and Yetman (2014) also found the trade-off between output and inflation. According to Mehrotra and Yetman (2014), given a high development of financial inclusion, the central banks will choose an optimal monetary policy in which controlling inflation is served as the main focus, aiming at balancing output volatility and inflation volatility.

In brief, we confirm that the development of financial inclusion would reduce inflation rate in Vietnam. Similar to Lapukeni (2015), money supply is found to significantly affects the effectiveness of monetary policy. The positive sign conforms the quantity theory of money, stating that an increase in money supply would cause an increase in inflation rate. We also find a positive

[3] Result is available upon request

relationship between lending interest rate and inflation rate, which is akin to the study of Saraswati et al. (2020) in Indonesia. This might be partly explained by the cost-push factors leading to inflation in Vietnam.

Table 4. *FMOLS regression including FinTech*

Dependent Variable: INFLATION

Method: Fully Modified Least Squares (FMOLS)

Date: 03/28/21 Time: 23:35

Sample (adjusted): 2009Q2 2019Q1

Included observations: 40 after adjustments

Cointegrating equation deterministics: C

Long-run covariance estimate (Prewhitening with lags = 3, Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDPGROWTH	1.731	0.040	42.492	0.00
FREEDOMINDEX	0.486	0.021	22.533	0.00
BROAD_MONEY	0.073	0.005	12.967	0.00
FII	-0.450	0.024	-18.278	0.00
LENDINGRATE	1.224	0.008	144.078	0.00
INTERACT	7.06E-10	2.80E-10	2.520	0.02
C	-43.664	1.299	-33.598	0.00
R-squared	0.912	Mean dependent var		6.216
Adjusted R-squared	0.896	S.D. dependent var		4.491
S.E. of regression	1.447	Sum squared resid		69.116
Long-run variance	0.009			

In this model, we examine the role of FintTech in conveying the influence of financial inclusion on monetary policy effectiveness. We then interact FinTech and Financial Inclusion Index. The result shows that signs of the coefficients are almost similar to the baseline model. The magnitude of the interaction term is quite small, indicating that interacting technological innovation with financial inclusion will not improve monetary policy effectiveness.

By and large, financial inclusion positively influences the effectiveness of monetary policy in Vietnam. FinTech plays a negligible role in transmitting the impact of financial inclusion on monetary policy effectiveness.

4.4. Robustness check[4]

To perform the robustness check, we substitute financial inclusion by the development of financial market development. This variable is gauged by the ratio of domestic to the private sector, calculated by the percentage of GDP. We also find the same results as the baseline model, which indicates that financial inclusion positively influences the monetary policy effectiveness in Vietnam.

5. Conclusion

As seen in the above analyses, the financial inclusion and monetary policy effectiveness in Vietnam are linked by a set of long-run relationships. Particularly, our findings indicate that the higher Vietnamese population accessed and used services of financial inclusion, the lower inflation rate economy has to experience. The findings are in line with Lenka and Bairwa (2016), Birgitta (2019) and Tonuchi (2021) who concluded that financial inclusion development contributes to a sound and effective monetary policy in other developing countries. In other words, an improvement of accessibility to financial products such as loans or deposits will reduce the inflation rate, which helps to stabilize the price level in Vietnam.

[4] Results will be provided upon request.

On the other hand, although as the main variable in forming financial innovation, FinTech plays a negligible role in transmitting the impact of financial inclusion on monetary policy effectiveness in Vietnam under our statistic results. This result has not shown the role of fintech development as previous studies like Douglas et al (2020), Ayse et al. (2020) and Tonuchi (2021). Fintech, meanwhile, is a means of financial inclusion (Mehrotra, 2019), and its role is particularly important in the current Covid-19 pandemic (The World Bank, 2020). In other words, the widespread of Covid-19 has accelerated the approval of Fintech in payment. Also, in the post-pandemic period, the technological innovations in financial market could help to ensure sustainable development. In principle, indicators for Fintech is a comprehensive set of metrics on the digital finance industry (mobile money, branchless banking, agent banking, e-wallets etc.); however, as mobile money pilot has been not launched in Vietnam, there is no data of mobile money transactions available and we use the transactions via electronic interbank payment instead. Hence, it might lead to undesirable research results. Therefore, we would like to propose a number of implications that aim to serve as a pedal of conducting more in-depth studies on FinTech for Vietnam. Additionally, these suggestions can be considered as the orientation for developing FinTech in Vietnam.

#1. Government should build up a payment platform that 100% of Vietnam's population could access and use

Speaking at a conference named "Electronic money on mobile subscribers to improve financial inclusion" (May 2019), Hung M. Nguyen, the Minister of Information and Communication, said that Vietnam is aiming for included development by E-commerce, start-up, innovation; but, forgot to mention one of the most important platforms to promote them is the payment platform[5]. From there, in order to build up financial inclusion in Vietnam, the payment platform must reach 100% of the population. In fact, in Vietnam, many customer segments cannot fully access banking services; especially the poor, the young, the unemployed, the uneducated, and those living in rural and remote areas. The percentage of people using credit cards is still low, but the density of mobile subscribers has existed over 100% for many years. Due to the popularity and small value payments, Mobile Money will contribute to the banking system and other non-cash payment systems to provide a full range of payment methods for people based on their desires. your bridge. Therefore, Prime Minister Phuc X. Nguyen has just signed a Decision approving the pilot deployment of mobile money on March 9, 2021. Because this is just in the pilot phase, the government needs to build a solid legal corridor for this type of service. If the identification of customers, spam sim management and anonymous transactions are not strictly implemented, Mobile Money can be a channel to "wash trade". Therefore, it is essential to coordinate between State Bank, the Ministry of Information and Communications, and the Ministry of Public Security in supervising and controlling Mobile Money implementation.

#2. Regulators should be proactive and plan to build a data protection legislation

One of the problems preventing FinTech's growth in developing countries like Vietnam

[5] Source: https://mic.gov.vn/mra/Pages/TinTuc/139041/Tien-dien-tu-tren-thue-bao-di-dong---giai-phap-sang-tao-thuc-day-chuyen-doi-so-va-phat-trien-tai-chinh-toan-dien.html

is the fear of losing privacy confidentiality when using online financial services. As a result, increasing trust and cybersecurity in Fintech is crucial. To do this, the government and regulators need to build a strict legal framework to protect users. Regulators worldwide are pushing to enact data privacy protection legislation. For example, the European Commission has issued the General Data Protection Regulation (GDPR) to reform the protection of personal data across the European Union. The GDPR is a new set of rules, designed to give EU citizens more control over their personal data. The Penalties for violations of GDPR's regulations are very high. Accordingly, there are two penalties, up to a maximum of €20 million or 4% of global revenue (whichever is higher), plus the data subjects have the right to claim damages.

Another example for worldwide legislation is law in the U.S. Although there are not yet any separate federal laws for the protection of privacy data, several states in the U.S. have proposed their own data protection laws which establish several rights like GDPR. For instance, California Consumer Privacy Act (CCPA) was enacted in June 2018. It is also the most comprehensive data privacy law in the U.S. untill now. Like the GDPR, this legislation establishes certain rights for consumers, including "right to know", "right to access", "right to refuse" and "right to undo". In addition, the CCPA significantly expands the definition of personal information, requiring companies to make significant changes in the way they operate. Its penalty is up to $7,500 per breach with no maximum punishment level.

Unlike above countries, in Vietnam, regulations in protecting privacy data are not homogenous and still scattered in many different legal documents (Law on Electronic Transactions, Law on Information Technology, Law on Protection of Consumer Rights, Law on Cyber Information Security, Law on Cyber Security, Decree No. 52/2013 / ND-CP on e-commerce and Decree No. 72/2013 / ND-CP on management, providing and using Internet services and information on the network and so on). This problem results in overlap, inconsistency and difficulty in implementing regulations (Vu & Le, 2020). Therefore, Vietnam needs to study, build and issue a separate legal document to protect privacy data, which fully specifies the concepts, principles, institutions and separate data protection institutions. The Vietnamese privacy data protection legislation also needs to specify the limits of the rights, the conditions and restrictions in exploiting, using and disseminating privacy data. Also, Vietnam governors needs to add more stricter sanctions on violations. This is because the penalty levels regulated in the current law is very low compared to worldwide standard and not commensurate with the danger of data violation.

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