

The Impact of Financial Inclusion on Monetary Policy: A Case Study in Vietnam

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Abstract

This paper examines the impact of financial inclusion (FI) on monetary policy (MP) – a case study in Vietnam. The PCA method is used to construct a FI index- considered as a comprehensive measure of FI. To answer the main research questions, OLS and GLS models are used to analyze and to overcome the phenomenon of heteroskedasticity. Data is collected through secondary sources including World Bank and IMF reports (for the period 2004-2015). The results of empirical research indicate that there is a negative impact of FI on MP. Accordingly, FI transmits to more successful MP, making efficient financial intermediation and balances, contributing to a stable and sustainable economy. This study concludes that FI will enable monetary policy to extend its reach to the financially excluded and aid policy makers to make better predictions of movements in inflation.

Keywords: Financial inclusion (FI); financial services; monetary policy (MP).

JEL code: G2, G21, G28.

1. Introduction

Nowadays, FI has emerged as an important topic on the global agenda for sustainable economic growth. APEC economies and international organizations in general, and Vietnam in particular, have been implementing FI as an important part of their strategy to achieve sustainable growth. This is because economic opportunities are linked to access to financial services, and that access particularly affects the poor as it allows them to save, invest and benefit from credit (Subbarao, 2009). Efforts to enable most people to access formal financial services contribute to the overall efficiency of the economy and the financial system. FI, therefore, is seen as a tool to tackle the critical issues of poverty and unsustainability (Alliance for a FI, 2012). Especially for Vietnam, FI is not only important but also a priority issue. As a matter of fact, the level of access and use of formal financial services in Vietnam is low (only about 31% of adults have an account at a formal financial institution, while the level is 98.7% in Singapore¹. In Vietnam 39% of adults save outside the formal sector, “under the mattress” or using informal means including savings’ clubs; 65% send or receive remittances outside the formal system or pay school fees or utility bills in cash²). In addition, due to the relatively small size of the financial market, ASEAN countries are vulnerable to external shocks (Shimizu, 2014); and Vietnam is no different from other countries in the same region. In particular, after the global financial crisis, FI issues are even more interesting. There is no denying that financial services are closely linked to each country’s financial and economic standing. And MP is seen as a tool for stabilizing the

economy; accordingly, the way in which central banks implement MP is to rely on personal access to financial services, including savings and credit³. Obviously, there is consensus that the expansion of formal financial services for all segments of the economy will reduce informal financial services, increasing the capacity and effectiveness of MP transmission (Lapukeni, 2015). This then shows the importance of FI in the economy in general and contributes to the effectiveness of MP in particular.

The topic of FI in the past has attracted increasing interest of the academic community. There are a number of studies on this subject, but the research focuses on FI measurement and promotion (e.g. Sarma, 2008; Hannig and Jansen, 2010; Demirguc-Kunt and Klapper, 2012; Allen et al., 2016); the impact of FI on poverty reduction, income inequality and growth (e.g. Chibba, 2009; Manji, 2010; Park and Mercado, 2015; Sharma, 2016; Johal, 2016; Ghosh and Vinod, 2017); or on financial stability (e.g. Hannig and Jansen, 2010; Khan, 2011; Han and Melecky, 2013; Morgan and Pontines, 2014; Garcia, 2016). Meanwhile, there are only a few studies examining the relationship between FI and MP (Evans, 2016; Mehrotra and Nadhanael, 2016). Particularly in Vietnam as well as in the ASEAN region, almost no research exists on this topic. And this is considered to be an exciting field for further research.

In addition, although there is consensus in the understanding of FI, there is no comprehensive method to measure this (Amidžić et al., 2014; Park and Mercado, 2015; Lenka and Bairwa, 2016). Indeed, there is a shortage for most economies in terms of a systematic indicator of the use of different financial services

(Demirguc-Kunt and Klapper, 2012; Sethy, 2016). Therefore, the identification of factors measuring the level of FI for Vietnam is very necessary. The fact that empirical studies ignore the income component when examining the effects of FI on MP has created a gap that this study will fill when modeling income as an intermediate factor. Because FI makes it easy for people to access savings and borrowing tools, which help them improve their lives and earn more, thus making MP more effective (Mehrotra and Yetman, 2015; Khan, 2011). Experimental research results on the relationship between FI and MP are sometimes contradictory. Evans (2016) argues that although there is a one-way effect from MP effectiveness to FI, there seems to be no impact in the opposite direction. Lenka and Bairwa (2016) found a significant impact of FI on the effectiveness of MP; Lapukeni (2015) found that an increase in FI would contribute to improving the effectiveness of MP. It is therefore worthwhile to study the impact of FI on Vietnam's economy by determining the impact of FI on the effectiveness of MP, in order to make important conclusions in establishing a reasonable MP which contributes to improving the effectiveness of MP transmission, economic stabilization and sustainable growth.

This paper employs the Principal Component Analysis (PCA) method to construct a FI index - considered as a comprehensive measure of FI in Vietnam. And to answer the question of whether FI has an impact on MP in Vietnam, OLS and GLS models are used to analyze and to overcome the phenomenon of heteroskedasticity.

The rest of this paper is organized as fol-

lows. The next section provides an overview of the related literature. Section 3 discusses the data and methodology. Subsequently, I report my findings and discussion in section 4. Finally, section 5 provides conclusion and policy implications.

2. Literature review

2.1. Financial inclusion

FI is a process that ensures the accessibility, availability and use of official financial systems for all members of the economy (Sarma, 2008) at an affordable cost in a fair and transparent manner (De Koker and Jentzsch, 2013), providing timely and adequate credit (Rangarajan, 2008; Joshi et al., 2014). In addition, when referring to FI, Chakravarty and Pal (2013) and Gwalani and Parkhi (2014) also focus on access to financial services for the underprivileged and those of low-income. However, FI here does not imply that service providers ignore risks and other costs when deciding to provide financial services (Hannig and Jansen, 2010). Therefore, with the World Bank⁴, FI means individuals and businesses have access to affordable financial products and services that meet their needs and are implemented in a way that is responsible and sustainable.

However, FI is a multidimensional concept that cannot be accurately captured by individual indicators such as bank account ratios, loans, automatic teller machines (ATMs) and bank branches (Camara and Tuesta, 2014). Therefore, efforts to measure FI through multidimensional indexes have been made. A series of FI dimensions are used to estimate this problem (e.g. Demirguc-Kunt and Klapper, 2012; Gupte et al., 2012). But, the limitation of these approaches is the development of FI

measurement indices by means of averaging of the dimensions, so the weights are assigned to arbitrary factors, mainly based on the intuition of the researcher. Thus, Amidžić et al. (2014) provide a new composite index using the FA (factor analysis); the PCA method of Camara and Tuesta (2014) to determine the appropriate weight for the FI, is considered an attempt to overcome previous criticisms, and is less arbitrary in determining the overall financial size. However, the formulation of an index for FI evaluation has yet to reach an official consensus. Amidžić and his colleagues mention aspects such as outreach, use, and quality of service; Camara and Tuesta are interested in: usage, barriers, and access to services. Am-barkhane et al. (2016) developed indicators in three aspects: service needs, service delivery, and infrastructure. Thus, the literature review of FI is still a subject that researchers continue to debate.

2.2. Monetary policy

MP is macroeconomic policy implemented by the central bank to influence money supply or interest rates to achieve macroeconomic objectives and target all sectors of the economy (Lapukeni, 2015) as a goal for stabilizing inflation (Begg et al., 2008), or ensuring price stability and public confidence in the value of money (Agoba et al., 2017). MP targets are often expressed in terms of maintaining economic stability, ensuring unemployment, stabilizing the financial system, etc. (Clarida et al., 1998; Rogoff, 1985). However, in practice, Central banks can not achieve all objectives at the same time, so they have to choose the most important goal in implementing MP, usually stabilizing prices (Cecchetti and Krause, 2002).

And to achieve one of these targets, the Central Bank often uses a variety of tools, including three important tools: open market operations, interest rate policy and mandatory reserve requirements (Bean et al., 2010; Hamilton et al., 2012). Adediran et al. (2017) suggested that studies by Bernanke and Gertler (1995), Mishkin (1996) identified five channels for MP transmission: interest rates, asset prices, exchange rates, credit, and expectations. For most economies, the pursuit of price stability always leads to indirect pursuit of other goals such as economic growth, which can only take place in conditions of price stability and efficiency. Therefore, MP, to ensure that money supply is in line with growth targets of real incomes, will ensure that growth does not cause inflation.

Mishkin (1996) was one of the earliest economists to study the system of channels for MP to affect price and output. Berument et al. (2007) show the relationship between the degree of openness and the effectiveness of MP on output growth and inflation. According to traditional economic theory, central banks often change the money supply to affect interest rates rather than other economic variables. According to Adams and Amel (2011), short-term interest rates should be used to designate MP. Beside the policy interest rates, money supply is also one of the important representatives of MP. By following the IS-LM model of Keynes (1936), the central bank can implement MP by changing money supply or interest rates to affect yields and other economic variables. Experimenting on the relationship between FI and MP, Lapukeni (2015), Lenka and Bairwa (2016) and Evans (2016), see inflation as a proxy variable for the success of MP: the ma-

jority of policymakers are aiming to stabilize prices.

2.3. Financial inclusion and monetary policy

Theoretical studies have discussed the implications of limited access to finance for policy response functions of the central bank and the effectiveness of MP (Gali et al., 2004). Policy signals also clearly recognize the relationship between FI and the potential for MP. Accordingly, access to basic financial services will lead to increased economic activity and employment opportunities for rural households, which will result in higher disposable income and greater savings. As well as increasing the amount of deposits stably to banks and other financial institutions access to basic financial services can increase the effectiveness of MP (Khan, 2011).

Mehrotra and Yetman (2015) also argue that FI will change the behavior of businesses and consumers, which may affect the effectiveness of MP. First, the increase in finance facilitates consumption, as households have easy access to tools for saving and borrowing. As a result, the output fluctuation is less costly, contributing to creating conditions for the central banks to maintain price stability. Secondly, enhancing FI may increase the importance of interest rates in the transmission of MP, enabling the central bank to improve the effectiveness of MP.

Besides, economies with higher FI levels tend to exhibit higher interest rate sensitivities for changes in yields and prices; raising the importance of interest rate channels in the transmission of MP (Mehrotra and Nadhanael 2016).

Lapukeni (2015) noted however, that the relationship between these two factors is that excessive access to credit can also cause financial instability by increasing the risk of bad debts; and access to credit can lead to inflation if the loans are consumer loans, not contributing to production. So when discussing the FI increase, it must be relevant and effective for the economy and the financial system in general.

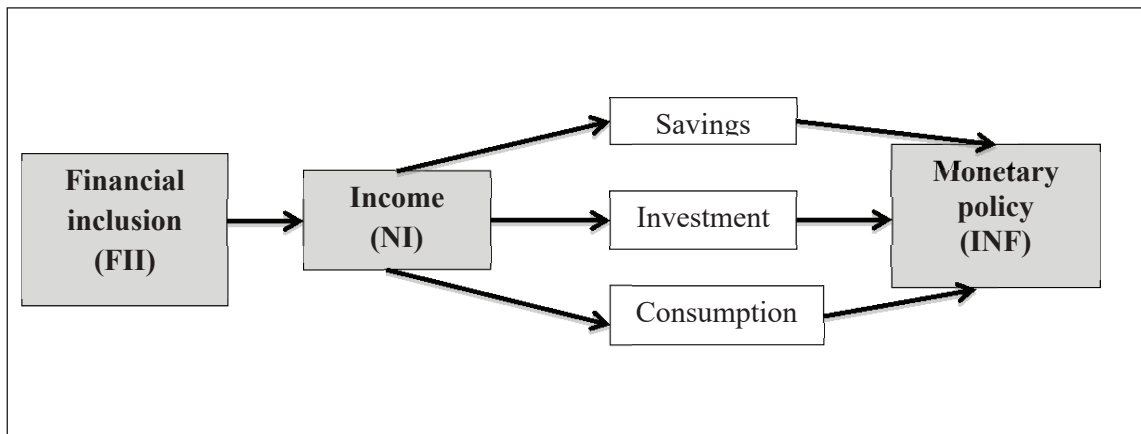
2.4. Review of relevant experimental studies

Mehrotra and Yetman (2014) using a PVAR found that the ratio of output volatility to inflation volatility increased in the share of financially included consumers in the economy when monetary policy was conducted optimally, which was consistent with the theory on limited asset market participation that only financially included households are able to smooth their consumption in response to income volatility.

Using the vector VAR model, Lapukeni (2015) examined random causalities and analyzed the fundamental trends in FI's impact on inflation - considered a proxy variable for the effectiveness of MP in Malawi (from the year 2001 to 2013). For the FI, the study used non-payment deposits and loans as a percentage of GDP. Control variables include interest rates, money supply, and exchange rates. The results show that there is a causal relationship between FI and inflation, or FI is important for a more accurate and stronger MP.

In a study of SAARC countries (from the year 2004 to 2013), Lenka and Bairwa (2016) found significant effects of FI on MP. In the study, inflation was also seen as a measure of the success of MP. FI includes a number of fi-

Figure1: Framework for analyzing the impact of FI on MP



Source: Synthesis of the author from theoretical and related studies

financial access factors such as geographic access (number of commercial banks per 1,000 km², number of ATMs per 1,000 km²), demographic approach (100,000 commercial banks, ATMs per 100,000 adults), and bank penetration (balance of deposits and loans unpaid by percentage of GDP). Controlling variables include the average lending rate of commercial banks and the exchange rate. A multidimensional measure of FI was analyzed using the PCA method and the use of three models (Fixed Effects Model, Random Effects Model, and Panel Corrected Standard Error) to analyze the data considered the merits of this study.

In contrast to the above studies, the findings by Evans (2016) suggest that FI is not an important motivation for effective MP in Africa. In contrast, the effectiveness of MP is the driving force behind FI. The study uses the VECM analysis and causality analysis for African countries (from the year 2005 to 2014). In particular, FI is measured by the number of depositors at commercial banks per 1,000 adults; inflation is also considered to be a measure of

the success of MP; money supply and interest rates are used as control variables.

From theoretical research and related studies, the research analysis framework can be summarized in Figure 1.

3. Data and methodology

3.1. Data and measurement variables

This study uses annual data collected from the results of the Financial Access Survey (FAS), financial statistics from the International Monetary Fund (IMF) and data on the World Development Indicators of World Bank (WB) from the year 2004 to 2015 of Vietnam.

According to Amidžić et al. (2014) and WB⁵, there is consensus, at least from the policymakers' point of view, that FI consists of three main dimensions: the outreach, usage and quality of financial services. As can be seen, both supply and demand data are included to provide a holistic view. Therefore, based on the FI understanding of the concept and the comprehensiveness of the dimensions proposed to be included in the FI, the author relies on this approach to

select the variables that measure FI in research.

Outreach dimension: determined by geographic penetration (ATMs and bank branches per 1,000 sq. Km.), and demographic penetration (ATMs and branches per 100,000 adults). However, because the available data is limited, the author uses “ATMs per 100,000 adults” as a proxy variable for this dimension.

Use dimensions: Amidžić et al. proposed an index of deposit and loan accounts per 1,000 adults. However, Sarma (2008) cited Kempf et al. (2004) that in some countries high rates of bank account holders use very few of the services provided; therefore, a bank account is not enough for an overall financial system. Thus, this research examines the two basic services of the banking system, credits and deposits, as proposed by Lenka and Bairwa (2016). Accordingly, outstanding credits and deposits from commercial banks (% GDP) have been used to measure this dimension.

Quality of financial services: including financial literacy, disclosure requirements, dispute resolution and cost of ownership. However, because the data on this aspect is quite scarce there is a limitation in the available data. Therefore, this dimension is not considered in the calculation of the proposed FI index

In addition, from the research analysis framework, “income” is considered as an intermediary factor in the relationship between FI and MP. Thus, the author adds “income” to the research model to examine its impact on MP, and net national income per capita - NI is considered a proxy variable.

According to Mehrotra and Yetman (2015) with increasing financial integration, the number of people accessing and using formal finan-

cial institutions will make aggregate demand and investment more sensitive to MP through increasing the elasticity of lending rates. Therefore, it is necessary to implement FI through banks’ lending rates in order to affect the achievement of the ultimate objective of MP, money supply and ultimate inflation target. Thus, bank lending rates are used in the model as explanatory and control variables, and money supply is also used as an explanatory variable in the model to avoid variance.

In all MP models, inflation is the ultimate goal of any monetary institution (Lapukeni, 2015); Lenka and Bairwa, 2016). Therefore, inflation is considered a proxy variable to measure the success of MP in this study. Accordingly, the proposed research model is:

$$Y_t = \beta_0 + \beta_1 FII_t + \beta_2 NI_t + \beta_3 Ctrl_t + u_t \quad (1)$$

Where, the dependent variable Y is the rate of inflation (annual % change in consumer prices); independent variables include: FII [FI index - independent variable (ATMs per 100,000 adults; outstanding credit and deposit %GDP)] and NI- net national income per capita; Ctrl - control variables (including money supply- M2, bank lending rates- IR).

3.2. Methodology

In order to answer the question of what factors can be used to measure FI in Vietnam, i.e. to build a FI index (FII); based on the approach of Camara and Tuesta (2014), the author uses the PCA method to determine the weights for factors in the FII. Accordingly, the index of the jth element can be expressed:

$$FII_j = W_{j1}X_1 + W_{j2}X_2 + \dots + W_{jp}X_p \quad (2)$$

Where, FII_j is FI index, W_j is the weighting factor weights, X is the corresponding initial

value of the components and p is the number of variables (elements) in the equation.

The answer to the second question is also the main question of the study, i.e. whether FI has an impact on MP in Vietnam, Ordinary Least Squares and Generalized Least Squares models are used to analyze and to overcome the phenomenon of heteroskedasticity.

4. Results and discussion

4.1. Result of PCA

Through the PCA method, we calculated eigenvalues of the all three factors, which included: [ATMs per 100,000 adults; outstanding deposit from commercial banks (%GDP); and outstanding credit from commercial banks (% GDP)]. The highest eigenvalue of the components retains more standardized variance among others, and an eigenvalue greater than 1 is considered for the analysis. The Appendix shows the results of the PCA (Appendix 1). We can see the eigenvalues of the three principal components (PCs) are 2.85, 0.1, and 0.05. Except the first PC, no other PCs have an eigenvalue greater than 1; so we just take the first component and extract the financial outreach dimension using weights (0.9663, 0.9815, and

0.9772) assigned to the first PC (Appendix 1). By doing so, we get a composite single value index.

After checking the suitability (Kaiser-Meyer-Olkin Test) (Appendix 3) and reliability (Cronbanh's Alpha Test) of the factors (Appendix 4), we predict the FI index (FII). That index may be shown:

In this table, one can notice that from 2004 to 2008, Vietnam got a negative index for financial inclusion, which means an extreme condition of financial exclusion. From 2009 to 2015, the level of financial inclusion has improved. And we can clearly see the change of the level of financial inclusion through the graph illustrated in Figure 2.

4.2. Result of regressions models

Declare data

The analysis data as well as declaration of data is reported in Table 2. Accordingly, the potential associations amongst the variables is calculated (Table 3) and shown in Figure 3.

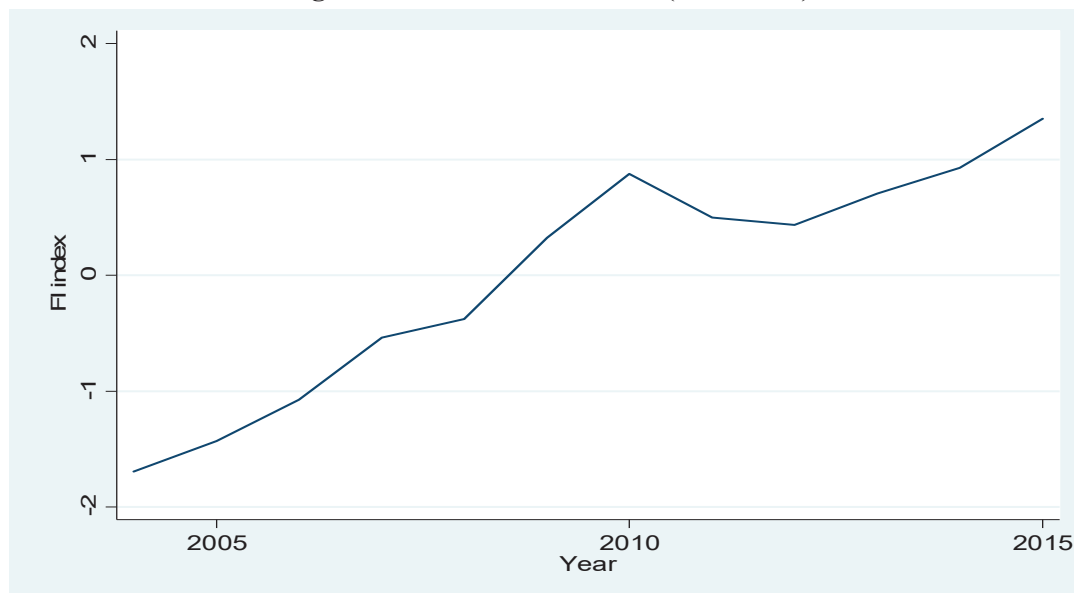
Table 4 presents the results of the OLS regression model. It explains the impacts of FI, NI, IR and M2 on the INF of an economy, which was used for effective and sound mon-

Table 1: Estimation of FI index in Vietnam

Year	FII	Year	FII
2004	-1.69586	2010	0.875955
2005	-1.43219	2011	0.497221
2006	-1.07269	2012	0.432587
2007	-0.53806	2013	0.706257
2008	-0.37594	2014	0.925121
2009	0.325	2015	1.352587

Source: Calculated by the author using PCA method on Stata 14.

Figure 2: FI index in Vietnam (2004-2015)



Source: Calculated by the author using PCA method and drawing on Stata 14

etary policy.

Then, a VIFs test is performed to check whether there are multiple collinearity problems. Multicollinearity occurs when several independent variables in a multiple regression model are closely correlated to one another. In this case, the result from Table 5 shows that there isn't multicollinearity in the model (VIFs < 10).

In general, results from Table 4 show a negative and significant relationship between FI and INF. However, after checking the defects of the model [multi-collinearity (Table 5), heterogeneity (Appendix 10), autocorrelation (Appendix 11), omitting variables (Appendix 12)], we found a problem of heteroscedasticity (Prob = $0.01 < \alpha$). Therefore, estimates may not be effective. So, to handle this problem, we use the

Table 2: Declare data

Variable	Obs	Mean	Std. Dev.	Min	Max
INF	12	9.174255	6.01076	.8786037	23.11632
FII	12	2.48e-09	1	-1.695856	1.352587
NI	12	5.746475	3.295909	-1.521328	10.31044
NI	12	11.55614	2.840744	7.1175	16.95383
M2	12	25.82612	9.637301	11.94245	49.106

Table 3: The correlation between FI index and INF

	INF	FII	NI	IR	M2
INF	1.0000				
FII	-0.1996	1.0000			
NI	-0.2837	0.3896	1.0000		
IR	0.9126*	-0.0707	-0.1549	1.0000	
M2	-0.1750	-0.5499	-0.0662	-0.1486	1.0000

GLS model to find more accurate estimates:

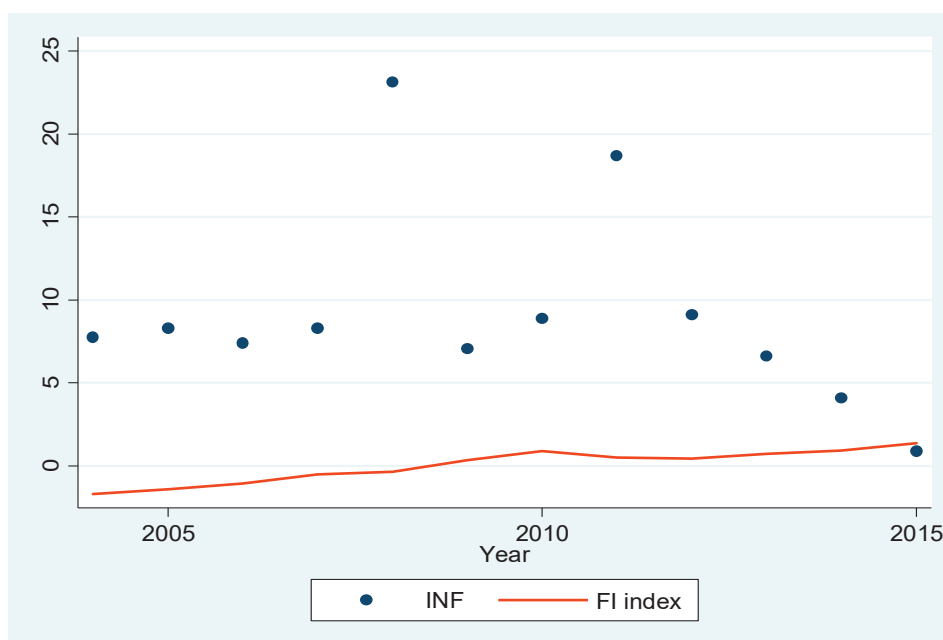
This shows that a 1% increases in FI reduces the level of the inflation by 0,74%. This result is in line with most comparable results in the literature of Lapukeni, (2015), Lenka and Bairwa, (2016). Similarly, NI, M2 is also negatively associated with inflation in Vietnam. But IR is positively associated with inflation. It can be

seen that the responses of inflation to FII, NI, and IR are consistent with theory suggestions, reacting positively to the lending interest rate and negatively to the financial inclusion index, broad money, and net income per capita.

5. Conclusion and policy implications

That a large share of the population is with-

Figure 3: Correlation between FI index and INF in Vietnam (2004-2015)



Source: Calculated by the author and drawing on Stata 14

Table 4: Result of OLS regression model

INF	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
FII	-1.156459	1.061161	-1.09	0.312	-3.665707	1.352788
NI	-.1562355	.2686345	-0.58	0.579	-.7914552	.4789842
IR	1.82421	.2898155	6.29	0.000	1.138905	2.509515
M2	-.0987891	.1029697	-0.96	0.369	-.3422737	.1446955
_cons	-8.457436	4.954407	-1.71	0.132	-20.17275	3.257875

Source: Calculated by the author using OLS model on Stata 14

Table 5: Multi-collinear testing

Variable	VIF	1/VIF
FII	1.78	0.562940
M2	1.55	0.643718
NI	1.24	0.808632
IR	1.07	0.935229
Mean VIF	1.41	

Table 6: Result of GLS regression model

INF	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
FII	-.7432105	.8346238	-0.89	0.414	-2.888679	1.402258
NI	-.1686668	.2416451	-0.70	0.516	-.7898352	.4525017
IR	1.837513	.4212649	4.36	0.007	.7546172	2.920409
M2	-.0264808	.0648342	-0.41	0.700	-.1931425	.140181
_cons	-10.62814	4.841059	-2.20	0.080	-23.07248	1.8162

Source: Calculated by the author using GLS on Stata 14.

out access to a formal financial system is a common phenomenon in many emerging economies. Financial inclusion has been suggested as a tool for addressing critical issues of poverty and under-development. So it is not surprising that many central banks in emerging markets have explicit objectives regarding fi-

ancial inclusion. Data from the Global Findex database underline the importance of FI – as of 2014 in Vietnam only about one-third of adults indicated they had a transaction account with a formal financial provider, far below the regional average of 69%. Thus, Vietnam is among the 25 priority countries in which we are focusing

our financial inclusion efforts through the Universal Financial Access by 2020 Initiative⁶. The expansion of formal financial services to reach millions of underserved and underserved adults will help Vietnam achieve its goal of poverty reduction and continued dynamic growth, advancing to the vision of prosperity.

FI, as documented in the literature, brings about more economic wellbeing to individuals and small and medium enterprises. Yet little is known about its impact on MP which is seen as a tool for stabilizing the economy. Using annual data collected from the results of FAS, financial statistics from The IMF and data on The World Bank of Vietnam (from the year 2004 to 2015), we provide comprehensive empirical evidence that the impact of FI on MP is highly significant in Vietnam. The association between FI and inflation is highly negative and statistically significant. This shows that if FI increases then it may reduce the inflation rate in an economy, which causes the stability of price levels. This study investigated that if NI increases it will help to reduce inflation in the market and vice versa. Based on these research outcomes it shows that the most important task of the Government is to improve the FI, because FI helps to stabilize the price level and controls the inflation in an economy, which is essential for sustainable economic growth. This study helps policymakers and communities see the importance of FI in the economy. From there, a FI solution is integrated into the construction

and calculation of its impact on MP, improving the efficiency of MP transmission, contributing to economic stability and sustainable growth.

In Vietnam, since 2016, the State Bank of Vietnam (SBV) has been partnering the World Bank Group to develop a FI national strategy on the basis of a comprehensive approach. Although this strategy is still in the process of development, a number of key points have been identified: digital-focused finance including the transfer of government payment programs to use services and digital technology platforms; financial services to rural and ethnic minorities are backward and poverty rates are higher than the national average; and there is a need to enhance consumer protection and financial literacy to help newcomers to be better equipped with modern financial services. However, Vietnam's economy is still based on cash transactions; most adults still do not use formal financial services. So, switching to a non-cash system is a priority in enhancing efficiency, promoting business and economic development, and reducing poverty in remote rural areas where financial services providers are difficult to reach. Therefore, the expansion of formal financial services as well as FI enhancement will help Vietnam to promote the non-use of cash, and improve the effectiveness of the transmission of MP in the economy in order to achieve poverty reduction goals and sustainable growth.

APPENDIX

1. Result of PCA

Factor analysis/correlation	Number of obs	=	12
Method: principal-component factors	Retained factors	=	1
Rotation: (unrotated)	Number of params	=	3

Appendix 1: Principal components

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	2.85199	2.75240	0.9507	0.9507
Factor2	0.09959	0.05117	0.0332	0.9839
Factor3	0.04842		0.0161	1.0000

LR test: independent vs. saturated: $\chi^2(3) = 43.58$ Prob> $\chi^2 = 0.0000$

Appendix 2: Factor loadings (pattern matrix) and unique variances

Variable	Factor1	Uniqueness
ATM	0.9663	0.0663
Depst	0.9815	0.0367
Loans	0.9772	0.0451

Appendix 3: Kaiser-Meyer-Olkin measure of sampling adequacy

Variable	KMO
ATM	0.8623
Depst	0.7181
Loans	0.7527
Overall	0.7719

Appendix 4: Alpha test

Item	Obs	Sign	Correlation	Correlation	Correlation	Alpha
ATM	12	+	0.9666	0.9252	0.9505	0.9746
Depst	12	+	0.9813	0.9576	0.9074	0.9515
Loans	12	+	0.9771	0.9482	0.9199	0.9583
Test scale					0.9259	0.9740

Appendix 5: Interitem correlations

	ATM	Depst	Loans
ATM	1.0000		
Depst	0.9199	1.0000	
Loans	0.9074	0.9505	1.0000

2. Result of regressions models

Appendix 6: Declare data

Variable	Obs	Mean	Std. Dev.	Min	Max
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M2	-0.1750	-0.5499	-0.0662	-0.1486	1.0000

Appendix 8: Result of OLS regression model

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Appendix 9: Multi-collinear testing

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Mean VIF	1.41	

Appendix 10: Heteroskedasticity test

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of INF

chi2(1) = 6.12

Prob > chi2 = 0.0134

Appendix 11: Breusch-Godfrey LM test for autocorrelation

lags(p)	chi2	df	Prob > chi2
1	1.617	1	0.2035
2	5.763	2	0.0560
3	7.404	3	0.0601
4	10.228	4	0.0368

H0: no serial correlation

Appendix 12: Ramsey RESET test

Ramsey RESET test using powers of the fitted values of INF

Ho: model has no omitted variables

F(3, 4) = 6.04 Prob > F = 0.0575

Appendix 13: Result of GLS regression model

INF	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
FII	-.7432105	.8346238	-0.89	0.414	-2.888679	1.402258
NI	-.1686668	.2416451	-0.70	0.516	-.7898352	.4525017
IR	1.837513	.4212649	4.36	0.007	.7546172	2.920409
M2	-.0264808	.0648342	-0.41	0.700	-.1931425	.140181
_cons	-10.62814	4.841059	-2.20	0.080	-23.07248	1.8162

Appendix 14: Heteroskedasticity test

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of INF

chi2(1) = 21.12

Prob > chi2 = 0.0605

Notes:

1. Updated data from the World Bank's 2014 World Development Indicators.
2. See at Ceyla Pazarbasioglu (2017), 'Vietnam's financial inclusion priorities: Expanding financial services and moving to a 'non-cash' economy', *The World Bank*, from <<http://blogs.worldbank.org/voices/vietnam-s-financial-inclusion-priorities-expanding-financial-services-and-moving-non-cash-economy>>.
3. See at *Monetary policy and financial inclusion* (2015), from <<http://www.moneyandbanking.com/commentary/2015/6/22/monetary-policy-and-financial-inclusion>>.
4. The World Bank (2017), *Understanding/ Poverty/ Topics/ Financial inclusion*, from <<http://www.worldbank.org/en/topic/financialinclusion/overview>>.
5. See at The World Bank (2015), *How to Measure Financial Inclusion*, from <<http://www.worldbank.org/en/topic/financialinclusion/brief/how-to-measure-financial-inclusion>>.
6. See at Ceyla Pazarbasioglu (2017), 'Vietnam's financial inclusion priorities: Expanding financial services and moving to a 'non-cash' economy', *The World Bank*, from <<http://blogs.worldbank.org/voices/vietnam-s-financial-inclusion-priorities-expanding-financial-services-and-moving-non-cash-economy>>.

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