

# **Financial Inclusion and Effectiveness of Monetary Policy in Developing Asia**



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# **Financial Inclusion and Effectiveness of Monetary Policy in Developing Asia**



*A Research Dissertation submitted to the Pakistan Institute of Development Economics (PIDE), Islamabad, in partial fulfillment of the requirements for the award of the degree of Masters of Philosophy in Economics & Finance*

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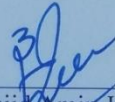


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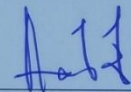
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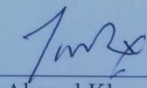
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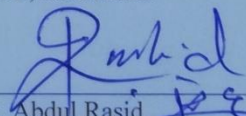
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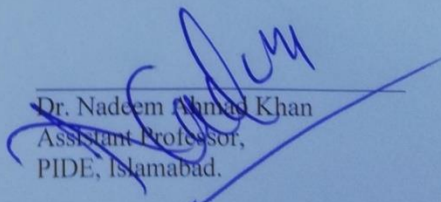
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## **Authorship Statement**

I Shujat Ali solemnly declare and affirm on oath that I myself have authored this MPhil Thesis with my own work and means, and I have not used any further means except those I have explicitly mentioned in this report. All items copied from internet or other written sources have been properly mentioned in quotation marks and with a reference to the source of citation.

*Shujat Ali*

## **Dedication**

I would like to dedicate this thesis to my loving parents for their encouragement and believing in me at every step of my life. I would not be able to achieve a single milestone in my personal as well as professional life especially this thesis without their immense support.

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## Abstract

Financial inclusion is a key policy objective in Pakistan as well as in developing Asia, as monetary policy effectiveness depends on strong monetary policy transmission mechanisms, and low levels of financial inclusion weaken the monetary policy transmission mechanisms. Using panel Vector Error Correction Model (VECM), we examine the impact of financial inclusion on monetary policy effectiveness for the panel of countries and also provide evidence on causality between financial inclusion and monetary policy effectiveness. The principal component analysis (PCA) is used to construct the financial inclusion index from multidimensional variables of financial inclusion instead of using of using different indicators individually. Annual data of twenty-four countries from developing Asia over the period 2004-2018, on variables of financial inclusion, inflation, money supply, interest rate and exchange rate, is used to undertake the assessment. We find that financial inclusion, in the long run, explains 83 percent of variation in inflation and 74 percent variation in interest rate. Further, we find unidirectional causality running from financial inclusion to percentage change in CPI. The impulse response of financial inclusion on inflation variable is significant and negative. The results reveal that financial inclusion enhances monetary policy effectiveness in developing Asia. The monetary authorities must focus to promote financial inclusion, as high financially inclusive economies have relatively smaller variations in the policy rate to stabilize prices.

**Keywords:** Financial inclusion, Effectiveness of Monetary policy, Developing Asia and VECM.

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## Acronyms

ADF	Augmented Dickey Fuller
ATM	Automated teller machine
CGAP	Consultative Group to Assist the Poor Countries
ER	Exchange Rate
FAS	Financial Access Survey
FATF	Financial Action Task Force
FI	Financial Inclusion
FII	Financial Inclusion Index
GDP	Gross Domestic Product
HDI	Human Development Index
HPI	Human Poverty Index
IFS	International Financial Statistics
IMF	International Monetary Fund
IR	Interest Rate
M2	Money Supply
NFIS	National Financial Inclusion Strategy 2015-20
PCA	Principal Component Analysis
Policy	Monetary Policy
SBP	State Bank of Pakistan
WDI	World Development Indicators

# Chapter 1: Introduction

## 1.1 Background

Monetary policy<sup>1</sup> effectiveness depends on the improvement in transmission mechanism<sup>2</sup> of the monetary policy, and improvement in the transmission mechanism of monetary policy is strongly associated with the financial inclusion. “Financial inclusion is the easy affordable access to financial services and products to fulfils the needs of payments, transactions, credit, savings and insurance delivered through sustainable and responsible way” (World Bank, 2015). The main objective of monetary policy in developing countries is price stability (Steven, K., Philip, T., and Jozef, V.,1998).

The variable used for effectiveness of monetary policy is annual percentage change in CPI [Mbutor & Uba (2013), Lapukeni (2015), Lenka and Bairwa (2016) and Evans (2016)]. The countries with higher level of financial inclusion have more effective transmission mechanisms of monetary policy than the countries with lower level of financial inclusion. In developing countries, the central banks usually do direct interventions or relatively more increases in policy rates to reduce inflation due to low level of financial inclusion (Martin, B., Thomas, B., Doreen, R., and Grace, A., T., 2017).

Financial inclusion affects economic decision makings, as economic decisions becomes more interest sensitive, the formal borrowing and lending increases or decrease with the change in borrowing and lending rate (Clarida, Richaed, Gali, J., and Gertler, M., 1999). The effect of interest

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<sup>1</sup> The central bank of a country uses monetary policy to achieve targeted inflation and price stability.

<sup>2</sup> The major channels of monetary policy transmission mechanism, interest rate, domestic asset prices, exchange rate, credit availability and inflation expectation (Steven K., Philip T. and Jozef V., 1998).

rate on investment and consumption decisions affects the goods and services demand, investment expenditures and aggregate demand become sensitive to policy rate which resultantly affects the prices of goods and services (Evans, 2016).

Financial inclusion enhances the financial system integration which also has a positive effect on monetary policy transmission mechanism, and minimize dependence on foreign loans and investment as volume of deposits increases (Mbutor and Uba, 2013). The productivity and exports increase as the financial access level, this results in maintaining external reserve level as well as stability of exchange rate reserves.

The change in interest rates may change asset prices and stronger or weaken balance sheets may result in a change in income and output. The higher policy rate also appreciates the exchange rate which results in increase in exports and imported raw material become more expensive for importing countries. In case of foreign currency debt, the value of debt alters with the change in the exchange rate, which leads to adjustments in borrowing and spending. The financially included population is more interest sensitive<sup>3</sup> and more focused in consumption smoothing. The monetary policy decisions affect saving and consumption attitude of larger set of economic agents.

Prevalence of financial exclusion has negative effects on the transmission mechanism of monetary policy due to financial decisions of large segment of financially excluded economic agents are unaffected by monetary policy stance. The financial inclusion level enhances the monetary policy effectiveness through price stability (Mbutor and Uba, 2013). The inflation has a negative

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<sup>3</sup> The variation in policy rate affects the market interest rate, which directly affects the return on savings and cost of borrowing, which affects level of financial inclusion.

relationship with financial inclusion variable, the financial inclusion significantly decreases inflation in SAARC countries (Lenka & Bairwa, 2016).

The motivation of research is that inadequate literature is available on effectiveness of monetary and the financial inclusion with varying inferences and very inadequate separate literature in this context is available for developing Asia<sup>4</sup>. In this research, financial inclusion index (FII) is constructed by using PCA technique and used this financial inclusion index as variable of financial inclusion to cover the all possible dimensions like access, usage and effectiveness of financial inclusion which is not addressed in available limited literature [Mbutor & Uba (2013), Lapukeni (2015) and Evans (2016)]. Lenka and Bairwa (2016) and Hung (2016).

In existing empirical literature, researchers used exchange rate (ER) and interest rate (IR) as controlled variable [Mbutor & Uba (2013), Lapukeni (2015) Lenka and Bairwa (2016) and Hung (2016)]. However, some researchers also used money supply (M2) as controlled variable (Lapukeni, 2015 and Evans, 2016). The exchange rate variable is incorporated by researchers, however Evans (2016) ignored exchange rate variable while modeling econometric model.

The existing literature reveals that financial inclusion enhances the effectiveness of monetary policy [Mbutor & Uba (2013), Lapukeni (2015), Lenka and Bairwa (2016) and Hung (2016)]. However, the study concluded that there is only one-way causality, running from monetary policy effectiveness to financial inclusion, exists in Africa (Evans, 2016).

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<sup>4</sup> World Economic Situation and Prospects (by the Department of Economic and Social Affairs of the United Nations Secretariat (UN/DESA) classifies all countries of the world into one of three broad categories: developed economies, economies in transition and developing economies.

This thesis documents assess the impact and directional causality between financial inclusion and effectiveness of monetary policy for developing Asia. In this study, inflation is dependent variable and financial inclusion index is independent variable; whereas, control variables are money supply (M2) is used on based on theory and exchange rate (ER) and interest rate (IR) on the basis of the key monetary policy transmission channels.

The penal Vector Error Correction Model (VECM) and granger causality are used test causal relationship by using yearly data from 2004 to 2018 on said variables of included developing Asian countries<sup>5</sup>. We find that financial inclusion, in the long run, explains eighty three percent of variation in inflation and seventy four percent variation in interest rate. This shows that the financial inclusion significantly decreases inflation in developing Asia.

Further, we find unidirectional causality running from financial inclusion and interest rate to percentage change in CPI. The impulse response shock of financial inclusion to inflation variable is significant and negative. The results reveal that financial inclusion enhances monetary policy effectiveness through price stability.

The nationwide or region wise financial inclusion strategy may aid policymakers to identify financial inclusion gaps, strengthen policies focus, enhance monitoring, enhance technology and coordination between inter-agencies. The ability of central banks to stabilize prices and inflation may be enhance through financial inclusion level. The degree of effective transmission of changes

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<sup>5</sup> The selected twenty four developing Asian countries (included on the basis of data availability) are Afghanistan, Armenia, Bangladesh, Bhutan, Hong Kong, Macao, Fiji, India, Republic of Korea, Kyrgyz, Maldives, Pakistan, Samoa, Singapore, Solomon Islands, Vanuatu, Azerbaijan, Brunei Darussalam, Indonesia, Malaysia, Mongolia, Thailand, Timor-Leste and Vietnam, (Park and Mercado Jr., 2015).



in interest rate depends on higher financial inclusion in an economy, which may reduce dependence of central bank on quantitative and direct interventions in developing countries.

The policymakers have to focus on policies to give easy affordable access loans and deposits to lower income groups to support them to participate in productive business activities and consumption smoothing against economic shocks. In addition to price stability, the expansion in formal financial sector and financial inclusiveness may reduce the cost of transaction and cash management, enhances economic growth and increases tax revenue collections.

The countries may deploy resources in development of financial and technological infrastructure for lending, borrowing and payments through formal internet and mobile financial services channels to further reduce cost of financial services, and enhances financial and technological literacy to enhance financial inclusion level for effectiveness of monetary policy.

## **1.2 Research Objectives**

Specifics objectives of the study include:

- i. To construct financial inclusion index (FII) from multidimensional variables of usage and access to financial services to arrive single comprehensive value of financial inclusion.
- ii. To determine the causal relationship (unidirectional or bi-directional) between financial inclusion and monetary policy effectiveness.
- iii. To assess impact of financial inclusion on monetary policy effectiveness in developing Asia.

### **1.3 Scope and Significance of Study**

Monetary policy effectiveness depends on improvement in monetary policy transmission mechanism, which is mainly associated with financial inclusion (SBP Vision 2020, 2015). Financial markets determine the monetary transmission channels through which monetary policy stimuli is transmitted in an economy. Financial exclusion in any economy causes distortions in accounting for monetary aggregates for monetary authorities. Majority of literature on monetary policy is based on a framework that assumes the existence of a representative household. The other way around the financial exclusion may undermine efforts to design comprehensive and consistent monetary policy. It would be a valuable study to assess the impact and directional causality between financial inclusion and effectiveness of monetary policy for developing Asia. Monetary authorities efficiently predict the impact of monetary policy shock due to financial inclusion. This study also motivates authorities, to incorporate informal financial activities in to financial system while planning and implementing monetary policy.

The yearly data from 2004 to 2018 are used to study this relationship in penal of countries. Secondly to evaluate the different inferences regarding unidirectional or bidirectional causality among monetary policy effectiveness and the financial inclusion. The selection of countries from developing Asia is on the basis of availability of data on given variables. The penal Vector Error Correction Model (VECM) is tentatively planned on the basis of behavior of data and existing literature. However, actual model is selected on the basis of order of integration and properties of data.

## **1.4 Summary and Structure of the Study**

Financial inclusion is the key policy objective in Pakistan as well as in developing Asia, as monetary policy effectiveness depends on strong monetary policy transmission mechanisms, and low levels of financial inclusion weaken the transmission mechanisms of monetary policy. Panel Vector Error Correction Model (VECM) is used to examine the impact of financial inclusion on monetary policy effectiveness for a panel of countries and also provide evidence on causality among financial inclusion and effectiveness of monetary policy.

The chapter 2 presents the existing studies review in literature about impact of FI on effectiveness of monetary policy. The data, theoretical and econometric model specifications, and methodology of estimations are described in 3<sup>rd</sup> chapter, and results and discussions are presented in chapter 4. Finally, conclusion and policy implications are presented in chapter 5.

## **Chapter 2: Literature Review**

### **2.1 Theoretical Review**

#### **2.1.1 Monetary Policy**

Monetary authorities control supply of money to achieve price stability and targeted inflation, and uses monetary policy tools to achieve policy goals. The monetary policy tools are more effective if economic agents use the formal financial products or services, infact it is evidenced that firm existence of banking sector helps in collection and redistribution of the dispersed savings in an economy (Ratti, 2012).

The monetary authorities have policy stances of either expansionary<sup>6</sup> or contractionary<sup>7</sup> monetary policy to achieve policy objective. Control of money supply is very important in the economy because excessive money supply can encourage the rise in prices of goods and ultimately lessen the purchasing power of economic agents. Conversely, the money supply that is too low would result in economic downturn (recession) and resultantly decline in people's prosperity.

Poor and financial excluded population are less affected by change in interest rate as they are not using formal financial services like formal savings and investment. Generally, financially excluded population most consume the whole income or have savings in informal channels which are less effected by monetary policy (Mehrotra & Yetman, 2014). The effectiveness of monetary policy

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<sup>6</sup> Expansionary monetary policy is to encourage economic activities, among others, by an increase in money supply (M2) with the change in discount rate.

<sup>7</sup> Whereas, the contractionary monetary policy is opted by reducing the amount of money in circulation to slow down economic activities.

increases by bringing financially excluded population in a formal financial service (Mehrotra & Yetman, 2015).

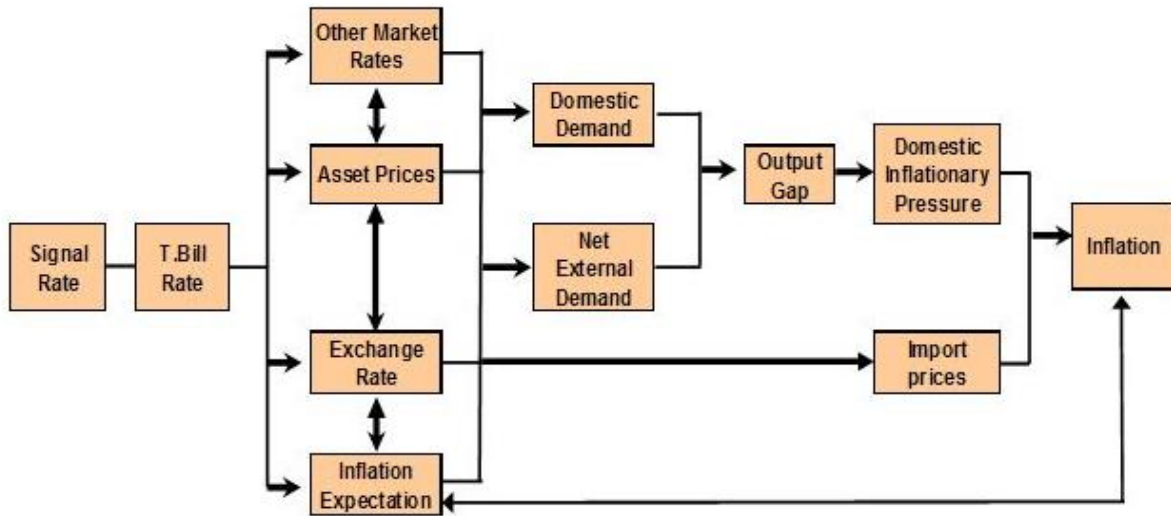
### **2.1.1.1 Monetary Policy Transmission Mechanism**

The degree of access of private sector agents to financial services, particularly services of savings and borrowings at a market interest rate, are actually associated with monetary policy and strengthen the monetary transmission. The policy interest rate is used as main policy instrument for inflation targeted monetary policy frameworks.

The neo-Keynesian macroeconomic models (used by the central banks for forecasting and analysis of policy) the monetary policy transmission rest on private expenditures which are interest elastic, consequently a rise or fall in the policy rate affects the private expenditures, which subsequently affects output and inflation.

It is assumed that private agents have easy affordable access to financial products and services like borrowing and saving at prevailing market interest rate (Berg, Andrew, Milesi-Feretti, K., Philippe, and Laxton, D., 2006) and (Clarida, Richard, Gali, J., and Gertler, M., 1999). This assumption of borrowing and saving by individuals at market interest rates is barely exists in many developing countries in which large part of population are financial excluded particularly from access to credit.

**Figure 2.1. Monetary Policy Transmission Channel**



The key channels in transmission mechanism of monetary policy are the exchange rate channel, market interest rate channel, credit channel, asset price channel and expectation channel. The monetary authorities intervene through monetary policy to affect the supply and demand for goods, services.

The policy rate or changing future policy expectations, the central bank effects the volume of asset prices, bank lending, the supply of money and the exchange rate in an economy. Through altering the reserve requirements, a central bank effects the volume of credit used by businesses, households, and the government.

The variation in supply of money in circulation affects the price of money (market interest rate), market interest rate brings effects on savings and borrowing pattern. Taylor (1995), hold that the strong consequences of market interest rate on present and future consumption spending decisions of consumers and this channel is most important channel with respect to other channels. Monetary policy also affects the asset prices and foreign exchange rate, which may affect inflation rate, and have influence on decisions regarding saving, borrowing and spending.

The progressive openness of developing economies, the exchange is also playing important role as channel of transmission mechanism of monetary policy as aggregate demand and net exports are affected by exchange rate channel. The asset prices channels, for example, real estate prices and stocks prices are also plays vital role in transmission mechanism of monetary policy.

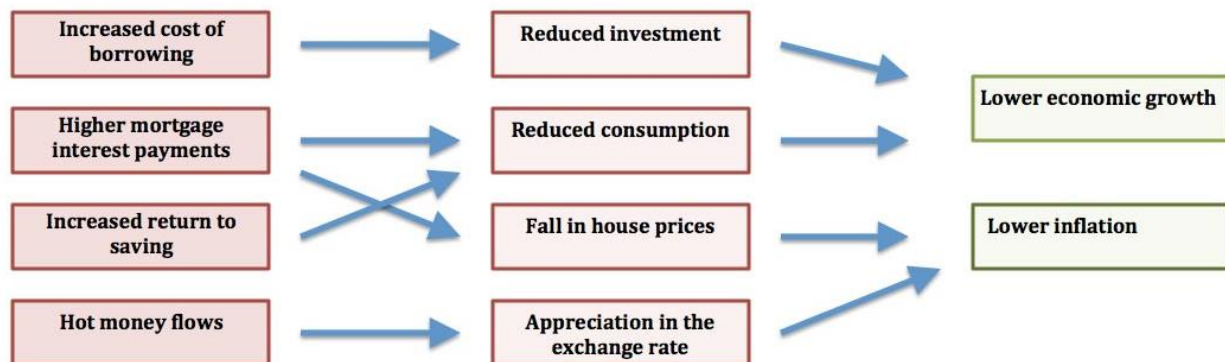
As the key focus of monetary authorities of high level of financially inclusive countries are on the policy interest rate. The expectation channel of transmission mechanism of monetary policy is now attaining more focus as the present consumption and investment decision are strongly affected by future inflation expectation due to change in policy interest rate.

#### **2.1.1.2 Effects of Monetary Policy**

The policy shock impact on a country is more prominent through higher degree of financial inclusion, it shows that higher financially inclusive countries have effective transmission mechanism of monetary policy than the less financially inclusive countries. Thus, the less financially inclusive countries have a weaker transmission mechanism of monetary policy, whereas the speed of that mechanism is faster than in the countries with high financial inclusion.

Higher interest rate cause high capital costs which in turn results reduces investment and cause and source of the occurrence of economic sluggishness (recession). Conversely, lower interest rate decreases the costs capital which encourages increased investment and growth economy.

**Figure 2.2. Effects of Higher Interest Rates on Inflation**



The change in policy rate effects the money supply in an economy which effects market interest rates. The change in market interest rate influence the cost of credit and in addition to this also effects the funds availability of creditors and debtors. The variation in interest rates effect the cost of le borrowing, effects investment and saving and ultimately effects aggregate demand by effecting the choice between current consumption and future consumption.

The change in policy rate also affect the asset prices in an economy like stocks, bonds and real estate. The change in IR may change asset prices, stronger or weaker the worth may result in a change in income and output. The higher policy rate also appreciates the exchange rate which results in increase in exports and imported raw material become more expensive for developing countries. In case of foreign currency debt, with the variations in the foreign exchange rate may also affect the debt values, which leads to adjustments in borrowing and spending.



### **2.1.1.3 Policy Rate Objectives and Effects**

The primary goal of monetary policy in developing countries is price stability<sup>8</sup> (Steven, K., Philip, T., and Jozef, V., 1998). There are no homogeneous monetary policy practices in developing countries to achieve respective objectives. Majority of the monetary authorities used the indirect instruments like reserves requirements, open market operations and standing facilities.

Monetary policy framework is composed of objectives and the monetary policy instruments that supports key objectives. These targets categorized in to ultimate targets, intermediate targets and operational targets. The ultimate target of central banks of developing countries which is legislative binding for monetary authorities.

In developing countries, the price stability or inflation control is the ultimate objectives of central banks but the central banks have multiple objectives. The intermediate targets are in line with and supports in achieving ultimate targets of central banks. Monetary aggregate, inflation and exchange rate are individual or collective target being selected as intermediate targets by central banks.

The significant control of monetary authorities on operating targets are possible through its instruments are also very important in effectiveness of monetary policy in an economy. The monetary authorities either control price of money (interest rate) or quantity of money (money supply) to achieve monetary policy target.

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<sup>8</sup> The price stability is necessary condition for maintaining financial stability but not a sufficient condition, however stability of prices is the primary goal of effectiveness of monetary policy (Mishkin, 2010).

If monetary authority targets broad money as intermediate target than interest rate is the operational target against efficient control on broad money. The monetary authorities actively use instruments such as open market operations, lending / depositing standing facility, reserve requirements and policy rate to control money supply to control inflation.

The policy rate is the key tool of monetary policy to achieve operational target due to its strong signaling effects. The rate on which central banks lends to banks is policy rate, and if overnight rate is higher than policy rate, than banks have opportunity to earn by borrowing at lesser rate for further lending to public. The policy rate announcement determines the variations in lending interest rate, and policy rate more effectively achieves the set target if strongly correlated with operational targets.

#### **2.1.1.4 Effectiveness of Monetary Policy**

The monetary authorities use monetary policy to stabilize prices, the higher inflation rate stabilizes by raising the nominal interest rate relatively greater proportion to inflation rate, therefore the real interest rises (Woodford, 2001). The less interest elasticity of private sector spending and aggregate demand indicates that the policy interest rate would be change more aggressively for anticipated variation in the target inflation.

Monetary policy effectiveness depends on development in transmission mechanism of the monetary policy, and the improvement in the transmission mechanism of monetary policy is directly associated with the financial inclusion. The financially excluded consumers have negative affect on monetary policy transmission, and financial decisions of majority of financial excluded agents are unaffected and independent from the monetary policies measures (Kahn, 2010).

The policy rate has to increase more proportionately than the inflation rate to stabilize the economic shock, the economies with higher level of financial inclusion are more capable to stabilize economic shock without disturbing economic growth (Mehrotra and Yetman, 2014). They highlighted various measures to enhance financial inclusion, to keep monetary and financial stability, to ease in consumption smoothing (Mehrotra and Yetman, 2015). Thus, increased financial inclusion brings substantial positive externality by enhancing effectiveness of monetary policy transmission.

### **2.1.2 Financial Inclusion**

Financial inclusion is the easy affordable access to financial services and products to fulfil the needs of payments, transactions, credit, savings and insurance delivered through sustainable and responsible way” (World Bank, 2015). Financial inclusion promotes savings and develops a culture of saving, improve access to credit, both entrepreneurship and consumption and also enabling payment mechanisms to be more efficient, so that strengthen the resource base of financial institutions that are able to provide economic benefits as a resource and the availability of a payment mechanism efficient and allocative (Hidayah, 2016).

The countries with a large population usually are usually more financially excluded due to less easy availability of financial services, and also have the higher ratio of poverty and inequality. Thus, inclusion finance is not an option, but it is a necessity and banking are the main driver for implementing inclusion finance (Nengsih, 2015).

Individual and firms are also having benefits from access to formal savings and borrowings by raising their welfare and wealth by increasing the employment opportunities and economic activities have multiplier effect by having higher disposable income leads to more savings results

in growth in deposit base (Khan, 2011). The access of financially excluded population in an economy has a vital importance in economic development of country as well as socially excluded population (Adenuga & Omotosho, 2013; Morgan & Pontines, 2014).

### **2.1.2.1 Dimensions of Financial Inclusion**

The monetary authorities are focused on strategies targeted to enhance financial inclusion with the increase in the volume and numbers of borrowers and depositors accounts. There are some barriers in financial inclusion and few barriers are of demand side and few barriers of supply side. Demand side barriers are income level, financial literacy level, necessity of loan, introducer requirement to open an account, and guarantor requirement for processing of secure loan etc. (Ellis, K., Lemma, A., and Rud, J., 2010).

However, the key focus in this thesis is on supply side of the financial inclusion e.g. commercial bank branches in numbers and ATMs in numbers (population wise and area wise), usage and quality of financial services. The literature reveals that there is the prominent rise in countries income level as the number of deposits increases and number of branches of commercial banks increases per 100,000 adults, and higher depositor's accounts per 100,000 adult population are experienced in high income economies (Kahn, 2010).

The researchers in most of researches include one or two dimensions of financial inclusion like total loans and deposits percentage of GDP, commercial bank branches and ATMs population wise and area wise access and usage variables of financial inclusion. Few researchers have included various dimensions of financial inclusion and constructed an index with different methodology for measuring financial inclusion (Chakravarty & Pal, 2013; Chattopadhyay, 2011; Sarma, 2015). To

determine the extent of the development of financial inclusion activities, the various dimensions from a financial inclusion from banking services.

#### 1) Geographic Access Dimensions

This dimension used to determine the financial services access geographically to measure the access by commercial bank branches and ATMs per one-thousand-kilometer square area. The occurrence of potential obstacles to open and use bank accounts bank, such as the cost or affordability of physical access to financial services. The increase in number of bank branches are often from banks' profitability point of view not from access point of view, so that the increase in branches don't guaranteed the financial inclusion.

#### 2) Demographic Access Dimensions

This dimension also covers also covers impact of usage dimension to quantify the demographically use and access of financial products and services. There is difference between financial depth and financial inclusion, as financial depth is the concentration of wealth or financial inclusion of a smaller number of richer populations with huge amount of savings and borrowing needs to be discourage by financial institutions by giving opportunity to narrow base of customers for profit maximization.

Financial inclusion may be carried out by designing of financial services and products to enhance the use and frequency of formal deposit and loan accounts by fulfilling needs and requirements of population. In this dimension the variables of demographic usage are commercial bank branches and ATMs per one hundred thousand of adult population of country as classified by IMF in IFS statistics.

### 3) Usage Dimensions

This dimension is used to find out whether the availability of financial product and service attributes has met the needs customer. Measurement of this dimension is still difficult to do and currently several international institutions are deeply concerned financial inclusion development is drawing up indicators of dimensions quality along with the tools used.

Measuring the dimensions of quality can be approached one of them through measurement of financial literacy level. This dimension of usage of financial services by using variables of total volume of outstanding deposits and loans as percentage of gross domestic product of an economy.

#### **2.1.2.2 Effects of Financial Inclusion**

Financial access (i.e access to bank accounts) to every stakeholder of an economy even to the poorest people of society, and financial included population are more economically well off to spend more in education and investment for better returns and future endowments (Ellis, K., Lemma, A., and Rud, J., 2010).

It is evident that rate of inflation decreases with the financial inclusion, which enhances the effectiveness of monetary policy in developing countries (Mbutor & Uba, 2015; Lenka & Bairwa, 2016). The greater proportion of variation is required in policy rate to stabilize the inflationary shock in a less financially inclusive economy (Mehrotra and Yetman, 2014). Financially included population has more tendency to save, invest and through consumption smoothing ensures monetary stability of a country (Ashraf, N., Karlan, D., and Yin, W., 2006).

Financial inclusion improves monetary policy transmission mechanism by increasing the coverage and pace of transmission in formal financial system and increasing response to change in market interest rate, and market interest rates plays prominent role in economic decisions. The economic

behavior is more sensitive towards interest rates in highly financially inclusive economies (Clarida, Richaed, Gali, J., and Gertler, M., 1999).

The financially excluded population weakens the transmission mechanism of monetary policy because of less interest rate elasticity in private expenditures and resultantly monetary authorities more aggressive anti-inflationary monetary policy. Although, the rate of interest does not directly affect the consumption of financially excluded population, however it directly affects the real wages.

Inversely, less financially developed countries are unable to transmit effectiveness of monetary policy (Mehrotra and Yetman, 2014). This disability arises in an economy where financial system is less developed, and seriousness of monetary authorities are prerequisite to increase financial inclusion by increasing innovation and technology to enhance access and usage of financial services.

The financial innovations decrease the costs of services and increases the overall efficiency of the financial products and services. Infect, financially inclusive economies decrease the cash management cost, strengthening local currency and well-organized circulation of money (Mbutor & Uba, 2013). Financial inclusion is promoted by availing formal payment medium like ATM cards, cheques, mobile payments and internet payments.

### **2.1.2.3 Financial Technology and Innovation**

The expansion in financial inclusion is hindered by reasons like higher interest rates, uneven payback of loan and higher rate of dropout of people from self-help groups (Chavan & Birajdar, 2009). The several other factors consist of excessive terms and conditions, complex identification requirements, higher bank charges, access to loans and deposits, lack of financial literacy, lack of

cash in hand, distant bank branches and cultural as well as psychological dominance issues (Kempson, E., Atkinson, A., and Pilley, O., 2004).

Moreover, it is observed that there are very high operating costs and transaction costs of banks in the remote regions, this issue may be resolved through using the modern innovative financial services to reduce operating and transaction costs of banks i.e. internet banking, ATMs and mobile banking (Ratti, 2012). The increase in innovative financial inclusion automatically stabilizes prices by adjusting the rate of inflation (Ray & Pravu, 2013; Mbutor & Uba, 2013).

Financial innovation is introducing innovation in financial products, processes, instruments, technologies and markets, and imperfections in financial products and markets restricts their scope and availability (Sekhar, 2013). Financial developments and innovations enhance the access and usage to financial services and also increase in the size, strength and efficiency of the financial structure.

The inclusion of largely financially excluded population in formal financial and banking channels is becomes easy through innovation and financial technology which increases the efficiency and cost of financial services in a financial system.

### **2.1.3 Financial Inclusion and Effectiveness of Monetary Policy**

Theoretically, policy rate affects the channels of transmission i.e. market interest rate, foreign exchange rate, asset prices and inflation expectation, which affects the aggregate demand and ultimately stabilizes inflation rate. The policy rate has to move greater in order to stabilize economies where financial inclusion is low (Mehrotra and Yetman, 2014). In addition to this, the central banks more effectively control inflation without effecting economic activity with the greater financial inclusiveness.



The effect of interest rate on current and future consumption decisions changes the demand for services and goods, investment expenditures and aggregate demand become sensitive to policy rate which resultantly affects the prices of goods and services (Evans, 2016).

Financial inclusion also enhances the financial system integration which also has a positive effect on monetary policy transmission mechanism (Filardo, Andrew, H., Genberg, and B., Hofmann, 2014). Financial inclusion may minimize dependence on foreign loans and investment as volume of deposits increases (Mbutor and Uba, 2013).

The productivity and exports increase with the financial access, this results in maintaining external reserve level and also stability of exchange rate reserves. The appreciation of exchange rate leads to more expensive imports, the cost of production / products increases and exports becomes more attractive for foreigners. As the prices of imported raw material increase the supply of these goods decreases which trigger inflation.

The market interest rate may influence consumption and investment decision by having effect on the borrowing cost and earning from savings, the borrowing also decrease as the interest rate increase and profit on savings also decreases as the interest rate decreases. The higher spread due to decrease in formal financial services and higher management cost is also a hindrance in the financial inclusion.

Depreciation of local currency is another cause of financial exclusion, the individual invests in gold or hold foreign currency instead of keeping money in local bank account to avoid decrease in real value of nominal wealth, and at the expense of lender, the borrowers would be better off (Doepke and Schneider, 2006).

#### **2.1.4 Index of Financial Inclusion**

According to latest estimates of World Bank, around half of world adult population is excluded from financial services, and measuring the extent of financial inclusion is not simple task. The financial inclusion can't be measure with a single variable, i.e. bank accounts and loans (in numbers geographically and demographically) or commercial bank branches or ATMs (in numbers geographically and demographically) etc.

In case of developing Asia, very huge deviations exist in the degree of financial inclusiveness (high, medium and low). The measurement of financial inclusiveness is the multidimensional conception which cannot be measured simply with one variable for every economy to avoid biasness. The variables belong to several dimensions provide useful and interesting information to measure the financial system inclusiveness.

Otherwise, individual or partial dimensions variables provides incomplete partial information, which may drive to a misleading figure of financial inclusiveness of an economy. The requirement is to construct a reliable and comprehensive measure of financial inclusion by constructing index for developing Asia. This index covers all possible dimension and variables of financial inclusion of an economy, and a composite index comprises major dimensions by assigning weights to relevant indicators to coverage the effect of every dimension instead of indicator is biased towards one or few indicators.

The financial inclusion is measured through financial access indicators by estimating the segment of adult population of an eco-system (Honohan, 2008). The house hold data of financial access is used for development of composite financial access variable. The cross-sectional data from recent

years is used across the economies. This index provides information about financial inclusion level for specific time period and not applied in variations over time in various countries.

Sarma (2008) applied a different technique for construction of financial inclusion index. In first step, he measures several dimensional indices separately and then aggregate index is measured by aggregation of separate dimensional indices. The benefit of this technique of measurement the financial inclusion indicator without applying different weights to different dimensions.

Gupte, R., Venkataramani, B., and Gupta, D., (2012), measured financial inclusion index by using data of CGAP in 2009 and 2010 from the World Bank Group. The same methodology of geometric mean of various dimensions was used as used in computing Human Development Index in 2010 by UNDP.

Amidzic, G., Massara, A., and Mialou, A., (2014), measures a new complex index by using weights through factor analysis methodology, which was the most important and repeated argument against previously measured indices. The countries are now ranked according to new measurements based on this complex index which is an additional tool for future policy making and analysis.

According to theoretical view point, the methodologies for measurement of index may also fulfills important characteristics of mathematics such as monotonicity, boundedness, homogeneity and unit-free property. The suitable measure for computation of composite financial inclusion index is incorporation of maximum possible dimensions of FII as for comprehensive measure is not complex and complicated and used for comparison among economies over time (Sarma 2008, 2010, 2012, 2015).

### 2.1.5 Inflation

The monetary authorities set policy rate to maintain inflation<sup>9</sup> at targeted level. In general, inflation can be considered as monetary phenomena due to a decrease in the value of monetary calculation units for a commodity (Heryanto, 2010). The focus on core inflation is basically not a decent approach where level of financial inclusion is low, however monetary authorities are more focuses on headline inflation in economies where financial inclusion is low (Anand, R., Prasad, E., and Zhang, B., 2015).

There are following theories about inflation which explains this concept more deeply. The quantity theory of money is a theory put forward by Irving Fisher in 1911. Fisher believes that the main cause of inflation phenomenon is the supply of money in circulation, if there is more money in circulation than output of services and goods, than there is a continuous increase in the price of these services and goods.

The inflationary theory of monetarists argues that inflation occurs due to existence of expansionary monetary and fiscal policies so that the higher circulation of supply of money causes excess demand for goods and services but not followed by increase in production level and ultimately causing inflation. Usually contractionary monetary policy is carried out so that the money supply is available reduced.

Expansive theory put forward by Dornbusch who stated that usually economic actors have expectations of the inflation rate in the future that will come based on adaptive expectations and

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<sup>9</sup> Inflation is an increase in prices in general that exist in two different time intervals, whereas inflation is normally measured by average percentage increase in consumer price index in a given year with the previous year (Sukirno, 2004).

rational expectations which usually uses measurements in the present realistically through existing information.

Structuralist theory which states that the cause of inflation is due rigidity of the structure of a country's economy, especially in the offer food ingredients and receipt of export goods. According to this theory, inflation is the propensity to continuous rise in prices. This is not considered as inflation as price of few items only are temporarily increased due to some other reasons like disasters or seasonal holidays etc., the requirements for a consistent increase in prices needs to fulfill.

### **2.1.6 Money Supply**

The monetary policy tools used by monetary authorities are either quantity based (quantity of money supply and quantity of credit) or price based (interest rate) (Poole, 1970). The concept of money supply can be viewed from two sides, supply and demand. The interaction between the two determines the money supply in the community. The income rises, if money supply grows at a rate less than money demand, this decreases inflation, a negative relationship between inflation and growth appears. To control for this effect, money is added to our model as an exogenous variable.

Money supply is also segregated into two categories Narrow money (M1) and Broad money (M2). The money in circulation in Narrow Meaning (M1) includes currency and coins, travelers check and demand deposits. The component of currency from M1 only includes money paper and coins held by people not banks, and not including cash stored in ATMs or bank reserves (Mishkin, 2011).

Money circulating in the meaning of broader sense (M2), M2 money is sometimes referred as well with economic liquidity. Money supply M2 adds M1 to assets others that have check writing features (money market and deposit accounts money market funds) and other assets (savings and

time deposits) which is very easy to cash out, because these assets are very easy transferred to cash at a very low cost (Mishkin, 2011). The definition of M2 which is generally applicable to all countries does not exist, because it exists several things that need to be considered by each country.

### **2.1.7 Interest Rate**

Generally, the tools used by monetary authorities are either quantity based (quantity of money supply and quantity of credit) or price based (interest rate) (Poole, 1970). The financial inclusion strengthen the interest rate based monetary policy transmission at the cost of quantity-based tools.

Loan interest rates are the average interest rates weighted in one period given to the borrower or the price that must be paid by the customer borrower to the bank (Dasril, 2015). The size of the spread must be right on one side of the bank in order to obtain decent profit margins, on the other hand must be affordable and competitive for user creditor. One argument that is wide reaching is that with growing financial inclusion, the higher number of people who have access and use formal financial institutions will make aggregate demand and investment more sensitive to the monetary policy rate through the increased elasticity owing to the lending rate (Mbutor and Uba, 2013).

The variation in policy rate affects the borrowing and lending behaviors due to shift of variations in banks borrowing interest rate, which affect investment and consumption decisions of individuals. The extent of transmission of transmission of change in policy rate into lending interest rate depends upon level of financial inclusion and is solely control by central bank policy rate.

The marginal cost of borrowers is affected by real interest rate, which influence the consumption behavior by substitution in present and future consumption decisions of individuals. The variation

in nominal interest rate changes the average market interest rate, which alters balance sheet and cash flow positions of borrowers.

### **2.1.8 Exchange Rate**

The monetary policy most affects the asset prices due to effect on exchange rate in many developing economies. The exchange rate is basically price or value of currency of a specific economy translated in other currencies of different countries. The exchange rate very significant influences economic decisions like spending and saving decisions, due to variations in the prices of various inputs and outputs items with the variation in exchange rates (Krugman and Obstfeld, 2004 in Bukit, 2013).

The tight monetary policy causes appreciation in exchange rate as demand for local assets increases in an exchange rate regime on floating basis and vice versa. The appreciation of exchange rate decline the local goods demand as imported goods becomes cheaper than local goods. The balance sheet effect also exists in case of holding of foreign currency debts when exchange rate appreciates. The investors are very careful in investment decisions especially in period of exchange rate depreciation, therefore exchange rate also influencing activity of the stock market as well as money market due to its returns volatility.

According to purchasing power parity theory, the price ratio of goods among countries is equal to exchange rate proportion. Therefore, decrease in purchasing power of the domestic currency of one country (the increase in home prices) is followed by relative local currency depreciation in the forex market and vice versa. The variation in exchange rate is caused due to various factors which are on fundamental, technical and market sentiments basis. Fundamental factors are related to real market indicators i.e. interest rates, inflation, interventions by monetary authorities and inflation

expectations. However, technical factors are associated with foreign exchange market demand and supply forces at certain times.

In case there is more demand for foreign currency in market than there is appreciation of exchange rate due to domestic currency depreciation and vice versa. Finally, the factor effects exchange rate is market sentiment, which is mostly affected due to market rumors, politics, which may bring variations in foreign exchange rate.

## **2.2 Empirical Literature Review**

There is limited empirical literature on monetary policy effectiveness with the increase in financial inclusion specifically in developing countries. Mbutor and Uba (2013) concluded that the association among effectiveness of monetary policy and financial inclusion in Nigeria estimated through VAR approach and included data from 1980 and 2012. The specific model linked the inflation to financial inclusion indicators cover the bank branches in numbers, total deposits and loans accounts with banks. And the results reveal that 1% rise in the aggregate credits may decrease inflation by 0.01%, but the credit is expected for investment purposes.

The coefficients of deposits and aggregate loans by branches of commercial banks in rural areas indicate that the inflation decreases with the rise of deposits and loans accounts in rural areas. The coefficient of interest rates shows that one percent rise in market interest rates may decline inflation by 0.02%. The depreciation of the Naira exchange rate by one percent may rise inflation by 0.003%.

However, the financial inclusion indicator variable (number of bank branches) coefficient was positive but did not significantly affect the monetary policy effectiveness, because bank's main objective for opening branches is largely to make profits. Though, this study lacks theoretical



support which does not give convincing results of the association between financial inclusion and effectiveness of monetary policy in Nigeria.

Mehrotra and Yetman (2014) evaluated that financial inclusion level is associated with optimal monetary policy, the ratio between output volatility to inflation volatility by using PVAR is increased. The theoretical channels also support that the financial included individual consumption and saving decision against income volatility.

However, they measured the association among financial inclusion variables on effectiveness of monetary policy variable (Mehrotra & Yetman, 2015). The authors arrived at these key inferences, first, increase in financial inclusion enables consumption smoothing, by having easier access to saving and borrowing, this makes less costly output volatility, this also helps to achieve monetary policy objectives of monetary authorities. The secondly finding is, rapid increase in financial inclusion is expected to enhance the importance of the interest rate channel of transmission mechanism of monetary policy, so that economic decisions of investment and consumption become more interest sensitive to support monetary policy objective.

Lapukeni (2015) studied the same relationship of financial inclusiveness with effectiveness of monetary policy in Malawi by using time series data set of Malawi from Q42001 - Q42013 estimated through VAR approach as used by Mbutor and Uba (2013). The results of the study show that in the short term the around thirty percent variations exist in inflation, and inflation is affected by only exchange rate variable. This is because Malawi's economy is predominantly import-based, and exchange rates affect prices, while other variables cut lag in price levels. The long-term model exhibit about seventy percent of effect in inflation variable. The coefficient of exchange rate is significant, the positive coefficient implies the depreciation ends to increase the inflation rate. Indicators of financial inclusion are empirically significant and trends show

correlations of expected results. Although the loan coefficient is not significant, it has a positive relationship.

There is negative association between loan and inflation variables if loan is taken investment purpose. However, if the new loan and loan are not production purposes, what happens is a positive correlation with inflation. The Granger Causality Test exhibit that the causality exists between money supply and deposits, exchange rates and loans, interest rates on loans and loans and inflation and the money supply.

Financial inclusion able monetary authorities to better predict and control money supply for inflation stability, so that by predicting the volume of money in circulation the monetary authorities can predict the magnitude of inflation that occurs.

Lenka and Bairwa (2016) evaluated the effectiveness of monetary policy with level of financial inclusion in SAARC countries by having data set from 2004 to 2013. The model was assessed through GLS (generalized least squares) technique with a FII as explanatory variables and the interest rate and exchange rate are control variables, and applied Random (RE) and Fixed Effects (FE) and Panel Corrected Standard Errors techniques.

The rise in financial inclusion by one percent may affect the interest rate decreases the inflation by 0.28% & 0.74% by using FE model estimation. The PCSEs model results explain that index of FI and the exchange and inflation has significant and negative relationship with interest rates.

Hung (2016) determined the association among effectiveness of monetary policy and FI in Vietnam by using time series data set from 2004 – 2015 estimated through VECM approach, due to the presence of the long-term association among financial inclusion index, exchange rate (ER), IR and inflation variables. However, results state the existence of significant association but highly

negative relationship between financial inclusion and interest rate (IR) variables. There is also very significant association but positive relationship among exchange rate variable and inflation.

Evans (2016) used VECM to estimate the relationship between effectiveness of monetary policy and financial inclusion by using data set for fifteen African countries. Proxy for effectiveness of monetary policy is inflation (annual percentage change in CPI) whereas money supply (M2) and lending interest rate are used as control variables. However, the variable for financial inclusion are total depositors in scheduled banks branches of a country (population wise). He found evidence of long run association among financial inclusion and annual percentage change in CPI, however monetary policy was not significantly affected in long-run by level of financial inclusion.

Interest rates have significant and highly positive relationship to effectiveness of policy. The financial inclusion, M2, and IR explain several roles to variations in the effectiveness of policy. However, more than forty five percent of the variations are explained in long-term by variations in IR.

Hence, unidirectional causal relationship from the effectiveness of policy to financial inclusion, but hasn't causal relationship from financial inclusion to the effectiveness policy. On the other hand, there is a two-way causality relationship among M2 and the effectiveness of policy. And similarly, two-way causal relationship exists among IR and the effectiveness of policy. He concluded that policy effectiveness is the significant effects FI in Africa, rather FI did not affect the effectiveness of policy.

### **2.3 Literature Gap**

Financial inclusion is the key policy issue for the developing countries, and there is inadequate literature is available on the effectiveness of monetary and financial inclusion level with varying

inferences and very inadequate separate literature in this context is available specifically in Pakistan and developing Asia as well.

The central bank interventions affect the monetary policy transmission channels such as asset prices, lending rate, exchange rate and money supply in an economy. The monetary policy tools used by monetary authorities are either quantity based (quantity of money supply and quantity of credit) or price based (interest rate) (Poole, 1970). If money supply grows at a rate less than money demand, this decreases inflation, a negative relationship between inflation and growth appears to control for this effect the money supply variable is included as an exogenous variable. Lenka and Bairwa (2016) ignored money supply variable in modeling and estimating the results, however other researchers incorporated money supply variable [Lapukeni (2015) and Evans (2016)].

The exchange rate has very significant influences on spending and saving decisions, the tight monetary policy appreciates ER because of rise in demand of the local assets in ER regime on floating basis and vice versa. The exchange rate variable is incorporated by researchers, being the key channel of transmission mechanism of monetary policy, however Evans (2016) ignored exchange rate variable while modeling econometric model and he concluded in contrary to other researchers that one way causality exist from policy effectiveness to financial inclusion in Africa which lacks theoretical backing.

Financial inclusion Index of developing Asia from 2004 to 2018 is not available and is required to be constructed. The measurement of financial inclusion is a multidimensional conception which could not be quantified simply by single variable from one or two of following indicators, Mbutor and Uba (2013) used bank branches (in Nos) and total borrowing and lending of as a percentage

of gross domestic product as variable of financial inclusion. Lapukeni (2015), used variables for financial inclusion such as total loans and deposits as a percentage of gross domestic product. Evans (2016), uses number of depositors with commercial banks (per 1,000 adults) as variable of financial inclusion.

Therefore, this study aims to address this gap in the literature. Overall, financial inclusion in developing Asian economies is low which weakens the transmission mechanism of monetary policy and weak transmission mechanism has adverse effects on effectiveness of policy.

## **Chapter 3: Research Methodology**

### **3.1 Data Description**

The yearly data for the period from 2004–2018 is used for estimation of cointegration among FI and effectiveness of monetary policy effectiveness. The main objective of monetary policy is price stabilization in an economy. So, inflation (annual % change in CPI) is engaged as a dependent variable to assess the effectiveness of policy (Evans (2016), Lenka and Bairwa (2016), Lapukeni (2015) and Mbutor and Uba (2013)).

The IR (average bank lending rate) and money supply (Broad money % of GDP) are used as control variables (Lapukeni, 2015 and Evans, 2016), however another control variable ER (the conversion rate of home currency in terms of foreign) is also be tested (Lenka and Bairwa (2016) Lapukeni (2015)). The higher number of people who have access and use formal financial institutions will make aggregate demand and investment more sensitive to the monetary policy rate through the increased elasticity owing to the lending rate (Mbutor and Uba, 2013). The data on variables of inflation rate, exchange rate, interest rate and money supply are collected from WDI of World Bank and IFS of IMF statistics.

The measurement of financial inclusion is a multidimensional conception which could not be quantified simply by single variable from one or two of following indicator, FII includes different dimensional variables of financial access like geographically (commercial bank branches and ATMs per 1,000 km<sup>2</sup>), demographically (commercial bank branches and ATMs per 100,000 adults), and banking penetration (Outstanding loans and deposits with commercial banks percentage of GDP (Lenka and Bairwa (2016); Hung, 2016)).

The data on two financial inclusion variables of borrowers from commercial banks per 1,000 adults and depositors in commercial banks per 1,000 adults is not completely available for all developing Asian countries, so that these variables are skipped in construction of financial inclusion index. The required data on financial inclusion is collected from the Financial Access Survey of the International Monetary Fund.

### 3.2 Methodology

After data description, the methodology of thesis is as follows. First the logic of panel VECM is given preceding by relevant tests, the methodology for panel cointegration is presented along with the logic of financial inclusion index and lastly panel causality is explained.

The long run equation for the model is given below

$$INF_{it} = \beta_0 + \beta_1 M2_{it} + \beta_2 IR_{it} + \beta_3 FII_{it} + \beta_4 ER_{it} + \epsilon_{it} \dots \dots \dots (3.1)$$

Where as

INF= Inflation rate (Annual percentage change in consumer price index)

M2= Money supply (Broad Money percentage of GDP)

IR= Lending interest rate (Average bank lending interest rate)

FII= Financial inclusion index

ER= Exchange rate (in US\$ per local currency)

$\epsilon_{it}$  = white noise term

VECM Specifications restoring the relationship between long-term behavior between existing variables converging into cointegration relationships but still allowing changes dynamic change in

the short term. This cointegration is known as an error correction because if there is a deviation the long-term equilibrium may be corrected gradually through short term partial adjustments. For the adjustment of short run and deviation from long run the Panel VECM model for above equation is given below:

$$\begin{bmatrix} INF_t \\ M2_t \\ IR_t \\ FII_t \\ ER_t \end{bmatrix} = \begin{bmatrix} \pi_1 \\ \pi_2 \\ \pi_3 \\ \pi_4 \\ \pi_5 \end{bmatrix} + \begin{pmatrix} \pi_{11k} & \pi_{12k} & \pi_{13k} & \pi_{14k} & \pi_{15k} \\ \pi_{21k} & \pi_{22k} & \pi_{23k} & \pi_{24k} & \pi_{25k} \\ \pi_{31k} & \pi_{32k} & \pi_{33k} & \pi_{34k} & \pi_{35k} \\ \pi_{41k} & \pi_{42k} & \pi_{43k} & \pi_{44k} & \pi_{45k} \\ \pi_{51k} & \pi_{52k} & \pi_{53k} & \pi_{54k} & \pi_{55k} \end{pmatrix} \times \begin{bmatrix} INF_{t-k} \\ M2_{t-k} \\ IR_{t-k} \\ FII_{t-k} \\ ER_{t-k} \end{bmatrix} + \begin{bmatrix} \theta_1 \\ \theta_2 \\ \theta_3 \\ \theta_4 \\ \theta_5 \end{bmatrix} \times [ECT_{t-1}] + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \end{bmatrix} \dots \dots \dots (3.2)$$

In above equation (3.2)  $\pi$  the adjustment coefficients, while ECT is the error correction term,  $ECT_{t-1}$  is the lag error correction term and  $\varepsilon_t$  is the disturbance term. Now to examine the causality among FI and monetary policy effectiveness. The following equation of granger causality is given below.

$$(1 - L) \begin{bmatrix} INF_t \\ M2_t \\ IR_t \\ FII_t \\ ER_t \end{bmatrix} = \begin{bmatrix} \pi_1 \\ \pi_2 \\ \pi_3 \\ \pi_4 \\ \pi_5 \end{bmatrix} + \sum_{j=1}^q (1 - L) \begin{pmatrix} \pi_{11k} & \pi_{12k} & \pi_{13k} & \pi_{14k} & \pi_{15k} \\ \pi_{21k} & \pi_{22k} & \pi_{23k} & \pi_{24k} & \pi_{25k} \\ \pi_{31k} & \pi_{32k} & \pi_{33k} & \pi_{34k} & \pi_{35k} \\ \pi_{41k} & \pi_{42k} & \pi_{43k} & \pi_{44k} & \pi_{45k} \\ \pi_{51k} & \pi_{52k} & \pi_{53k} & \pi_{54k} & \pi_{55k} \end{pmatrix} \times \begin{bmatrix} INF_{t-k} \\ M2_{t-k} \\ IR_{t-k} \\ FII_{t-k} \\ ER_{t-k} \end{bmatrix} + \begin{bmatrix} \theta_1 \\ \theta_2 \\ \theta_3 \\ \theta_4 \\ \theta_5 \end{bmatrix} \times [ECT_{t-1}] + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \\ \varepsilon_{5t} \end{bmatrix} \dots \dots \dots (3.3)$$

$(1 - L)$  is a difference operator.



Measuring financial inclusion is always remain a tedious job as people have their own preferences or choices towards the use of financial services. Precisely, in less developed and developing countries, major portion of finance and financial services is not permitted to consumer or people who have actual basic need of it. Literature has used wide range of terminologies to compute financial inclusion index. Frequently, used indicators are categorized as banked population, availability of banking/financial services to the people and usage of the financial services.

In our study the measurement of financial inclusion is comprised of conception which could not be quantified simply by single variable from one or two of following indicator, financial inclusion index includes different dimensional variables of financial access like geographically (commercial bank branches and ATMs per 1,000 km<sup>2</sup>), demographically (commercial bank branches and ATMs per 100,000 adults), and banking penetration (Outstanding loans and deposits with commercial banks percentage of GDP (Lenka and Bairwa, 2016; and Hung, 2016).

The data on two financial inclusion variables of borrowers from commercial banks per 1,000 adults and depositors in commercial banks per 1,000 adults is not completely available for all developing Asian countries, so that these variables are skipped in construction of financial inclusion index. The required data on financial inclusion is collected from the Financial Access Survey of the International Monetary Fund.

Firstly, we compute the indices of dimensions or normalize the variables and then aggregate index will be computed. Each dimensional index will be computed by the following formula.

$$Dimension\ I = \frac{actual-min}{max-min} \dots \dots \dots (3.4)$$

Actual = actual value of dimension I in period t

Max= maximum value pre-determined

Min= minimum value

Aggregated index will be computed by using the similar methodology as the UNDP methodology to compute HDI index. Principal component analysis technique is used to give the weights to each dimension to compute dimensional indices and then construct aggregate index of financial inclusion to achieve a single index value. Accordingly, the  $j^{\text{th}}$  factor of FII is stated as:

$$Index_j = \sigma_{J1}X_1 + \sigma_{J2}X_2 + \sigma_{J3}X_3 + \dots + \sigma_{JP}X_P \dots \dots \dots (3.5)$$

The composition of this index entails three dimensions, each dimension is assigned with a weight ( $\sigma$ ) and covers six factors of financial development to represent financial inclusion.

(a) First Dimension: To measure geographic access to financial services by using data on number of commercial bank branches and the number of ATMs per 1,000 km<sup>2</sup>.

(b) Second Dimension: To measure the demographic availability of banking services by using data on the number of commercial bank branches and number of ATMs per 100,000 adults.

(c) Third Dimension: To measure the dimension of usage of financial services by using data of total outstanding credits and deposits as a percentage of the total GDP.

Panel VECM is preceded by the certain tests for cointegration the most widely used test is the (pedroni 1999). The cointegration is a combination of linear relationships of variables not stationary and all these variables must be integrated in the order or same degree. Variable states that are not stationary causes the possibility of a long-term relationship among variables in the system Error Correction Model (ECM).

Primarily the regression proposed by Pedroni in 1999 is

$$y_{it} = \alpha_i + \delta_i t + \beta_i X_{it} + \varepsilon_{it} \dots \dots \dots (3.6)$$

Where

$y_{it}$  and  $X_{it}$  are the variables which are integrated at first difference one for  $i = 1 \dots n$  for T period of time  $T = 1 \dots \dots T$

$$INF_{it} = \alpha_i + \delta_i t + \beta_{1i} M2_{it} + \beta_{2i} IR_{it} + \beta_{3i} FII_{it} + \beta_{4i} ER_{it} + \varepsilon_{it} \dots \dots \dots (3.7)$$

Coefficient  $\alpha_i$  from 3.6 and 3.7 permits in model for individual effect and  $\delta_i$  permits in model for time trend and  $\beta$ 's also varies with time period. So heterogenous cointegrating vectors are possible. The stationary tests are used to see whether the stationarity of data is observed or not before committing regression. Gujarati (2003) suggests that the data can be said stationary if the mean and variance are constant over time. If the data used in the model is not stationary, then the data is reconsidered validity and stability, because the regression results that come from data that is not stationary and cause spurious regression.

Therefore, following penal unit root test is performed for the estimated residuals:

$$\varepsilon_{it} = \rho_i \varepsilon_{it-1} + \omega_{it} \dots \dots \dots (3.8)$$

Under the null hypothesis of no cointegration,  $\rho_i = 1$

There are seven residual based test proposes by Pedroni (1999). The initial four tests are on the basis of penal and include four statistics: panel U, panel v, panel ADF and panel PP.

Panel v- statistics:  $Z_v = \left( \sum_{i=1}^N \sum_{t=1}^T R_{11i}^{-2} \varepsilon_{it} - 1^2 \right)^{-1} \dots \dots \dots (3.9)$

Pane  $\rho$  - statistics:  $Z_\rho = (\sum_{i=1}^N \sum_{t=1}^T R_{11i}^{-2} e_{it} - 1^2)^{-1} (\sum_{i=1}^N \sum_{t=1}^T R_{11i}^{-2} (e_{it-1} \Delta e_{it} - \lambda_i)) \dots \dots \dots (3.10)$

Pane  $\rho\rho$  - statistics:  $Z_t = (\sigma^2 \sum_{i=1}^N \sum_{t=1}^T R_{11i}^{-2} e_{it} - 1^2)^{-1/2} (\sum_{i=1}^N \sum_{t=1}^T R_{11i}^{-2} (e_{it-1} \Delta e_{it} - \lambda_i)) \dots \dots \dots (3.11)$

Pane *ADF* - statistics:  $Z_t^* = (s^* \sum_{i=1}^N \sum_{t=1}^T R_{11i}^{-2} e_{it} - 1^2)^{-1} (\sum_{i=1}^N \sum_{t=1}^T R_{11i}^{-2} (e_{it-1} \Delta e_{it} - \lambda_i)) \dots \dots \dots (3.12)$

In Pedroni (1999) tests, it  $e_{it}$ - residuals estimated from (5) and  $R_{11i}^2$  - estimated long-run covariance matrix for it  $\Delta e_{it}$ .

There are three statistics presented in Group Pedroni (1999) tests: group, group ADF and group PP. These statistics (11)-(13) are estimated be an averages of individual autoregressive parameters along with other dimensions of the panel, whereas statistics (7)-(10) are based on the clubbing residuals within dimension of the panel.

Group  $\rho$ -statistics:  $\bar{Z}_\rho = \sum_{i=1}^N (\sum_{t=1}^T e_{it} - 1^2)^{-1} \sum_{t=1}^T (e_{it-1} \Delta e_{it-\lambda}) \dots \dots \dots (3.13)$

Group  $\rho\rho$ -statistics:  $\bar{Z}_\rho = \sum_{i=1}^N (\sigma^2 \sum_{t=1}^T e_{it} - 1^2)^{-1/2} \sum_{t=1}^T (e_{it-1} \Delta e_{it-\lambda}) \dots \dots \dots (3.14)$

Group *ADF*-statistics:  $\bar{Z}_t^* = \sum_{i=1}^N (\sum_{t=1}^T S_i^* e_{it} - 1^2)^{-1/2} \sum_{t=1}^T (e_{it-1}^* \Delta e_{it-\lambda}^*) \dots \dots \dots (3.15)$

All Pedroni (1999) tests are asymptotically normal distributed. The null hypothesis, which is absence of cointegration may be accepted or rejected on the basis of critical values for these tests, calculated by Pedroni (1999). The Panel cointegration test is capable to explain cointegration relationship whether long-run equilibrium among data, but the direction of causality is not examine through this.

## **Chapter 4: Results and Discussions**

On the basis of above discussed methodology, this chapter is going to present and discuss the results for above models. However, the chapter comprise of four sections. Section 1 includes the financial inclusion index result being the first objective. Section 2 discusses the descriptive statistics including properties of data. Section 3 includes stationarity properties of the variables to determine the deterministic trend in variables. Section 4 includes cointegration results. Section 5 contains error correction and VECM also includes impulse responses and variance decompositions and section 6 deals with the granger causality.

The financial inclusion index is calculated on SPSS by using Principal Component Analysis technique, the financial inclusion index table is at appendix 1. The eigen-values of the all six factors are calculated, the highest eigen-value of the components retains more standardized variance among others, so eigen-value greater than 1 is considered for the analysis. First two components values have been used for measurement as per greater than 1 eigen-value on Scree Plot. The value contains more than one component may consider more than one principal component in the financial analysis.

Descriptive statistics for the variables are provided in below table 4.1 which shows that inflation for all countries stood at the average of 5.08 percent from the period 2004 -2018. The inflation has increased from -18.10 to 26.41 percent from 2004 -2018. The skewness and kurtosis value for inflation are -0.41 and 12.29 which shows that inflation is not normally distributed.

However, financial inclusion index embedded a mean value of 0.24 in period of 2004 -2018. It increases from -1.75 to 2.99 percent during the tenure. Skewness and kurtosis are not closer to zero

therefore the index is not normally distributed. The on average interest rate stood 12.83 from 2004 to 2014 and it increases from minimum 5.00% to maximum 19.20%, and is normally distributed.

**Table 4.1 Descriptive Statistics**

	INF	FIN	IR	M2	ER
Mean	5.081472	0.2446604	12.83670	101.7818	122.0762
Median	5.156111	-0.088710	14.00000	56.72957	61.02951
Maximum	26.41866	2.995102	19.20043	395.7172	533.4508
Minimum	-18.10863	-1.753820	5.000000	14.98698	7.751750
Std. Dev	4.938472	2.328043	4.245862	116.3333	154.6863
Skewness	-0.415006	6.352928	-0.766878	1.539874	1.533655
Kurtosis	12.29513	50.12311	2.455020	3.636101	3.678948
Jarque-Bera	272.1513	7443.833	8.279399	30.90460	30.84174
Probability	0.000000	0.000000	0.015928	0.000000	0.000000
Observation	75	75	75	75	75

**Table 4.2 Panel Unit Root results**

	<i>IPS</i>		<i>ADF</i>		<i>PP</i>	
<b><i>FIN</i></b>	1.27647	0.8991	9.93461	0.4462	5.53827	0.8525
<b><i>INF</i></b>	-1.24428	0.1067	15.3337	0.1204	21.4054	0.3455
<b><i>ER</i></b>	0.35998	0.6406	10.9491	0.3615	16.7452	0.2329
<b><i>IR</i></b>	-1.39629	0.2813	16.3002	0.4914	14.0648	0.1701
<b><i>M2</i></b>	-1.45458	0.3729	15.7779	0.1062	13.1749	0.2141

Notes: Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. *IPS* assumes asymptotic normality.

**Table 4.3 Results for Panel Unit Root First Difference**

	<i>IPS</i>		<i>ADF</i>		<i>PP</i>	
<b><i>FIN</i></b>	-0.33065	0.0705	22.3298	0.0135	31.0187	0.0006
<b><i>INF</i></b>	-3.40825	0.0002	54.8591	0.0002	98.9547	0.0023
<b><i>ER</i></b>	-1.88365	0.0298	18.2006	0.0517	24.8099	0.0057
<b><i>IR</i></b>	-4.12180	0.0000	32.5022	0.0003	29.0252	0.0012
<b><i>M2</i></b>	-3.19480	0.0007	27.4332	0.0022	43.6619	0.0000

Notes: Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. *IPS* assumes asymptotic normality.

Stationarity is one of the important prerequisites in the econometric model for time series data. This Stationary Test is used for see whether the stationarity of data is observed or not before committing regression. The given above tables elucidate the results for panel unit root for all the variables at level and first difference along with their respective probabilities.

The results of IPS ADF and PP tests are clearly in the favor of first difference as it rejects the null hypothesis of unit root at level including (intercept & trend) and favor the results for first difference after including intercept and trend. Therefore, we can proceed to test the cointegration among the variables after achieving stationarity of variables at first difference.

If the data used in the model is not stationary then the data is reconsidered for validity and stability, because the regression results that come from non-stationery data and cause spurious regression. Spurious regression is regression have high  $R^2$ , but there is no meaningful relationship between the variables.

**Table 4.4 VAR Lag Selection Criterion**

<b>Lag</b>	<b>LogL</b>	<b>LR</b>	<b>FPE</b>	<b>AIC</b>	<b>SC</b>	<b>HQ</b>
0	-917.4849	NA	2.55e+08	33.54491	33.72739	33.61547
1	-551.5451	652.0383*	1055.813*	21.14709*	22.24200*	21.57050*
2	-536.0212	24.83825	1524.800	21.49168	23.49901	22.26793
3	-519.4659	23.47832	2199.260	21.79876	24.71852	22.92785
4	-500.7854	23.09595	3111.488	22.02856	25.86074	23.51049

\* indicates lag order selected by the criterion



Data series have a property that they are very sensitive to the lag selection criterion. Therefore, one must specify the total lags that should be included while proceeding the estimation. The problem appears when the lag length is too small which make the model is unable to explain the relationship. And on the contrary, if the lag length used is too large then the degree of freedom will be bigger so it is not efficient anymore.

The optimal length of lag is needed to capture the influence of each variable to other variables and determination of optimal lag can be identified through several criteria, namely Akaike Information Criterion (AIC), Schwartz Information Criterion (SIC), and Hannan-Quinn Information Criterion (HQ). The optimal lag is one lag as per results of above-mentioned table by using AIC criteria.

**Table 4.5 Pedroni Residual Cointegration Test**

Alternative hypothesis: common AR coeffs. (within-dimension)				
			Weighted	
	<u>Statistic</u>	<u>Prob.</u>	<u>Statistic</u>	<u>Prob.</u>
Panel v-Statistic	-1.518895	0.9356	-2.077007	0.9811
Panel rho-Statistic	1.080772	0.8601	1.307232	0.9044
Panel PP-Statistic	-9.846616	0.0000	-6.508462	0.0000
Panel ADF-Statistic	-3.770256	0.0001	-3.785674	0.0001
Alternative hypothesis: individual AR coeffs. (between-dimension)				
	<u>Statistic</u>	<u>Prob.</u>		
Group rho-Statistic	2.040403	0.9793		
Group PP-Statistic	-10.08284	0.0000		
Group ADF-Statistic	-3.938075	0.0000		

*Note: Automatic lag length selection based on SIC., Newey-West automatic bandwidth selection and Bartlett kernel.*

The non-stationary variable causes the possibility of a long-term relationship between variables in the system of Error Correction Model (ECM). One of the conditions for achieving a long balance length is a balance error must fluctuate around zero or in other words, the error term must be a stationary. The purpose of this cointegration test is for all variables to be integrated in same level.

The results for Pedroni Residual Cointegration Test are presented above table, where the assumption is deterministic intercept and trend it can be seen from the above table that six tests out of eleven tests are statically significant suggesting one or more long run relationship among the variables.

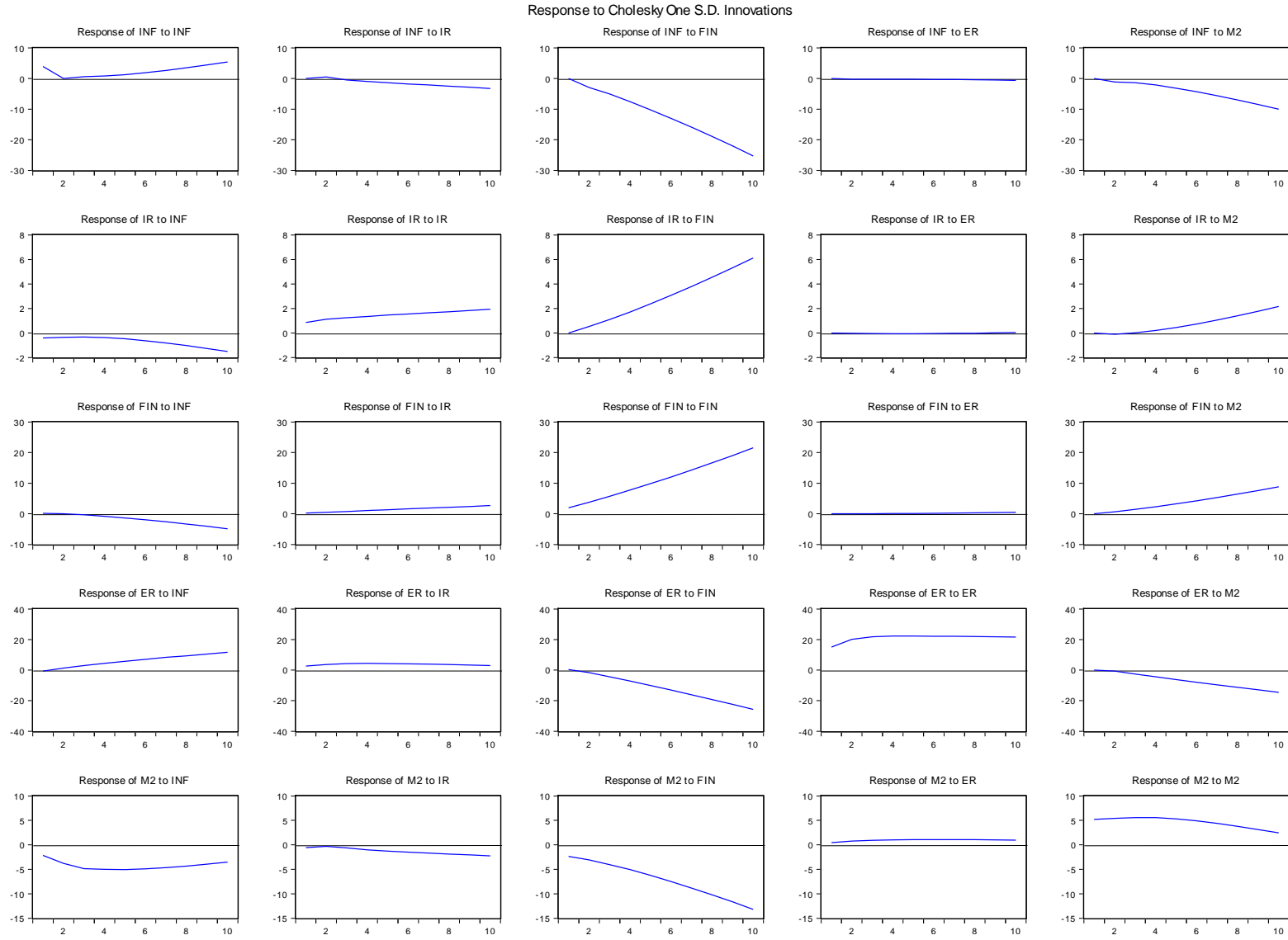
**Table 4.6 Vector Error Correction Estimates**

<i>Error Correction</i>	<i>D(INF)</i>	<i>D(ER)</i>	<i>D(FIN)</i>	<i>D(IR)</i>	<i>D(M2)</i>
<i>ECT(-1)</i>	-0.908 [-6.199]	0.655 [1.158]	0.010 [0.145]	0.023 [0.656]	-0.591 [-2.585]
<i>D(INF(-1))</i>	-0.033 [-0.354]	-0.091 [-0.254]	-0.005 [-0.126]	-0.001 [-0.081]	0.259 [ 1.787]
<i>D(ER(-1))</i>	-0.005 [-0.220]	0.346 [ 3.312]	-0.003 [-0.286]	-0.002 [-0.252]	0.021 [ 0.503]
<i>D(FIN(-1))</i>	-0.548 [-0.285]	-2.156 [-0.290]	1.070 [ 1.106]	0.207 [ 0.453]	0.474 [ 0.158]
<i>D(IR(-1))</i>	1.030 [1.909]	0.367 [ 0.176]	0.039 [ 0.143]	0.234 [ 1.825]	0.420 [ 0.499]
<i>D(M2(-1))</i>	-0.224 [-2.584]	-0.134 [-0.402]	0.130 [ 2.986]	-0.020 [-0.990]	0.038 [ 0.284]

VECM specifications restoring the relationship between long-term behavior between existing variables converging into cointegration relationships but still allowing changes dynamic change in the short term. This cointegration terminology is known as an error correction because if there is a deviation in the long-term the variable is corrected gradually through short term partial adjustments.

From above table (total number of countries are 24 and yearly data from 2004 to 2008), we can see that inflation is affected by money supply and interest rate and error correction term is -6.199 which is highly significant and negative. The results of Vector Error Correction Model are with 1-lag structure. The coefficient of money supply explains that 1 percent change in money supply, one lagged period, cause on average 22 percent decrease in inflation in current period. However, other variables are insignificant expect interest rate. The results can be understand through impulse response graphs.

**Figure 4.1 Impulse Response Function**



Impulse Response Function (IRF) is used to see the movement of the effect or impact of shock in one of the variables and its effect on that variable alone or on other variables in the present and the future period. To explore the effect of independent and exogenous variables on inflation this study considers only the first column for analysis. It can be noticed that the error correction term for inflation is negative and highly statically insignificant. The insignificant term raises a question over the long-term causality from financial inclusion index, ER, money supply and interest rate towards inflation.

However, to analyze the response of inflation to exogenous variables impulse response functions are used in this study the important variable is inflation here which measure the policy effectiveness therefore consider the first-row impulse response on inflation for results interpretation. 1% standard deviation shock is given to all exogenous variables and their response towards inflation has been analyzed.

The response of financial inclusion index towards inflation is negative and consistently declining which is consistent with the theory. However, the reaction of interest rate towards inflation start from a zero and remain consistent for a while and start gradually declining from period 3 to onwards. The impulse of exchange rate in inflation remains at zero with insignificant change. Furthermore, the response of money supply to inflation is also negative from period 1 and constant decline in inflation. However, if one percent standard deviation given to inflation than financial inclusion gradually starts declining. Similarly, positive shock to financial inclusion positive effects its self and it's gradually increases.

Variance Decomposition (VD) is used to measure the estimated error variance a variable that is how much the ability of one variable is in provide explanations on other variables or on the variable itself. The table at appendix 2 shows the forecast error variances for the above variables. The

percentage forecast error of other variables has been taken for the rate of inflation. Ten forecast period has been selected to see the response of variables in future.

These periods can be spilt into short run and long run. Short run can be taken for year one and year two. In short it can be observed that in period one inflation has been predicted 100 percent by itself. It declines to 60 percent in period two which means there exist a short run influence of inflation with respect to itself. However, other variables do not have any significant influence in short run. In long run the impact of inflation by itself is remain insignificant, while, beside financial inclusion index none of the variable have a strong significant impact on inflation and in the long run 83% of impact on monetary policy is from financial inclusion. However, in variance decomposition for interest rate the 80 % variation in interest rate is predicted from itself in short run. In long run, 74 percent variation in financial inclusion is through interest rate. Similarly, in variance decomposition for financial inclusion the 98% and 83% variation is through itself in short and long run.

**Table 4.7 Granger Causality Test**

	<u><b>F-Statistics</b></u>	<u><b>Probabilities</b></u>
$\Delta IR \rightarrow \Delta INF$	3.69409	0.0589
$\Delta INF \rightarrow \Delta IR$	2.72600	0.1034
$\Delta FIN \rightarrow \Delta INF$	4.52894	0.0370
$\Delta INF \rightarrow \Delta FIN$	0.25928	0.6123
$\Delta ER \rightarrow \Delta INF$	1.97944	0.1641
$\Delta INF \rightarrow \Delta ER$	0.42789	0.5153

$\Delta M2 \rightarrow \Delta INF$	5.30721	0.0243
$\Delta INF \rightarrow \Delta M2$	0.06341	0.8020
$\Delta FIN \rightarrow \Delta IR$	1.67613	0.1999
$\Delta IR \rightarrow \Delta FIN$	3.14147	0.0809
$\Delta ER \rightarrow \Delta IR$	1.92316	0.1701
$\Delta IR \rightarrow \Delta ER$	0.25668	0.6141
$\Delta M2 \rightarrow \Delta IR$	6.76683	0.0114
$\Delta IR \rightarrow M2$	0.44790	0.5056
$\Delta ER \rightarrow \Delta FIN$	0.73231	0.3952
$\Delta FIN \rightarrow \Delta ER$	5.87234	0.0181
$\Delta M2 \rightarrow \Delta FIN$	5.93596	0.0175
$\Delta FIN \rightarrow \Delta M2$	0.59236	0.4442
$M2 \rightarrow \Delta ER$	0.30389	0.5833
$\Delta ER \rightarrow \Delta M2$	0.57432	0.4512

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The results of granger causality test shows that there exist a one-way causality among the variables especially between financial inclusion and inflation variables. Interest rate granger cause inflation but reverse is not true. This reveals that rise in interest rate reduces the inflation rate which is supported by theory. Similarly, financial inclusion granger cause inflation but inflation does not granger cause financial inclusion, which means financial inclusion enhances effectiveness of monetary policy and control on price stability. And effectiveness of monetary policy does not

cause financial inclusion. In line with these money supply also granger cause inflation, interest rate and financial inclusion. However, inflation, interest rate and financial inclusion does not have causality towards money supply. Financial inclusion granger cause exchange rate while there is no causality from exchange rate to financial inclusion. This reveals that the financial inclusion level decreases the policy rate and the decrease in policy rate depreciates exchange rate.



## **Chapter 5: Conclusion and Policy Implications**

This thesis document impact of financial inclusion on the effectiveness of monetary policy in developing Asia. Many countries especially developing countries are engaged in the promotion of financial inclusion to control inflation. The measurement of financial inclusion is a multidimensional conception which could not be quantified simply by single variable from one or two of indicators [(Mbutors and Uba, 2013), (Lapukeni, 2015) and (Evans, 2016)]. The previous studies reveals that the financial inclusion enhances the effectiveness of monetary policy [(Mbutor & Uba, 2013), (Lapukeni, 2015), (Lenka and Bairwa, 2016) and (Hung, 2016)]. However, the penal study on African countries reveals that there is one-way causality running from effectiveness of monetary policy toto financial inclusion (Evans, 2016).

The Panel Vector Error Correction Model (VECM) approach and panel Granger causality is used to measure the impact and causality among financial inclusion and effectiveness of monetary policy in developing Asia. The annual data from 2004-2018 on variables of inflation, money supply, interest rate, exchange rate and financial inclusion is used for this penal. The study reveals that financial inclusion and effectiveness of monetary policy effectiveness are linked by a set of long-run relationships. The impulse response to financial inclusion shock on policy effectiveness is significant and negative which shows that financial inclusion enhances the effectiveness of monetary policy through price stability. However, the reaction of shock in interest rate towards inflation gradually starts declining in the short run and continue till long run. Similarly, positive shock in inflation has significant impact in financial inclusion in short run and gradually declining in long run. Variance decomposition explains that financial inclusion variable has a strong significant impact, in the long run, 83 percent of variation in monetary policy and 74 percent variation in interest rate are explained through financial inclusion in long run.

Moreover, the results of granger causality test shows that there exist a one-way causality among the variables especially between financial inclusion and inflation variables. This explains that financial inclusion and interest rate control inflation through price stability. The rise in interest rate and financial inclusion reduces inflation in an economy but inflation does not has significant impact on financial inclusion and interest rate. In addition to this, the granger one-way causality shows that the money supply also affects inflation, interest rate and financial inclusion. Therefore, this study concludes that there is one-way causality, financial inclusion has significant impact on effectiveness of monetary policy in developing Asia and monetary policy effectiveness has no significant impact on financial inclusion.

This study is a significant contribution in literature in exploring the policy gap in effectiveness of monetary policy and financial inclusion. The existence of one-way casualty from financial inclusion to effectiveness of monetary policy motivates monetary authorities and financial institutions to promote financial inclusion to achieve effectiveness of monetary policy. Monetary authorities may better predict the impact of policy rate with financial inclusion, monetary authorities relatively slighter increases the policy rate to stabilize prices in financially inclusive economy, the financial excluded population are less affected by the variation in interest rate. This study also motivates authorities, to attempt to incorporate activities outside the formal banking system while formulating and implementing monetary policy. Monetary policy stance may effectively transmitted through robust monetary policy transmission mechanism due to financial inclusion. Unbanked population in developing Asian countries is quite large, so monetary authorities would implement financial literacy programs in line with financial technology to fulfil these needs intensively and efficiently; as SBP launched National Financial Literacy Program (NFLP) with sponsorship of Asian Development Bank (ADP) in January 2012.

Majority of national and international institutions such as ADB and respective central banks in developing Asia have initiated policy initiatives and programs to enhance financial inclusion like National Financial Inclusion Strategy of Pakistan (NFIS) and SBP visions 2020 initiated by State Bank of Pakistan. Financial access to remote and rural areas should be on key priorities, the monetary authorities should be more focus on promotion and improvement of digital financial access to financial excluded population. The monetary authorities should emphasize on infrastructure development equally, because of the geographical conditions, which causes difficulties for banks to be accessible to the people who live in various corners. Therefore, Digital or mobile financial services is one of the biggest medium to enhance financial access to unbanked population. Therefore, the efforts of monetary authorities in developing Asia should be aimed to enhance financial inclusion for effectiveness of monetary policy, as inflation control is essential for sustainable economic growth.

## Appendixes

### Appendix 1: Financial Inclusion Index of 24 Developing Asian Countries

Sr #	Country	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
1	Afghanistan	-1.842	-1.592	-1.262	-0.922	-0.498	0.163	0.314	0.319	0.256	0.437	0.562	0.701	0.834	0.960	1.572
2	Armenia	-1.701	-1.268	-1.137	-1.003	-0.701	-0.439	-0.142	0.003	0.366	0.634	0.788	1.030	1.086	1.182	1.304
3	Bangladesh	-1.388	-1.264	-1.125	-1.089	-0.906	-0.641	-0.215	0.214	0.389	0.503	0.776	1.005	1.156	1.263	1.323
4	Bhutan	-1.060	-1.190	-1.114	-1.153	-0.873	-0.540	-0.027	0.409	-0.493	0.499	0.602	0.691	0.981	1.522	1.747
5	Hong Kong	-1.444	-1.267	-1.023	-0.958	-0.888	-0.591	-0.284	0.057	0.224	0.591	0.737	0.793	1.157	1.345	1.552
6	Macao	-1.246	-1.227	-0.886	-0.808	-0.615	-0.429	-0.454	-0.300	-1.182	0.118	0.432	0.916	1.175	1.567	1.934
7	Fiji	-1.913	-1.445	-0.839	-0.521	-0.257	-0.083	-0.148	-0.258	-0.433	0.071	0.872	1.178	1.234	1.169	1.374
8	India	-1.476	-1.345	-1.182	-0.942	-0.597	-0.397	-0.319	-0.082	0.143	0.394	0.844	1.065	1.164	1.304	1.424
9	Republic of Korea	-1.736	-1.601	-1.282	-1.006	-0.504	-0.257	0.048	0.473	0.655	0.671	0.747	0.815	0.820	0.837	1.320
10	Kyrgyz Republic	-1.581	-1.306	1.138	-0.594	-0.490	-0.248	-0.654	-0.356	0.069	0.428	0.779	1.247	1.210	1.297	1.338
11	Maldives	-1.754	-1.323	-0.868	-0.108	0.040	0.065	-0.080	-0.176	-0.197	-0.263	-0.089	0.017	0.905	1.704	2.127
12	Pakistan	-1.134	-0.957	-1.035	-0.667	-0.647	-0.662	-0.522	-0.490	-0.157	0.204	0.471	0.815	1.285	1.428	2.067
13	Samoa	-1.257	-0.751	-1.297	-0.904	-0.753	-0.807	-0.302	0.423	0.520	0.286	0.683	0.984	1.442	1.733	2.995
14	Singapore	-1.672	-1.607	-1.360	-1.070	-0.612	-0.153	0.192	0.502	0.716	0.772	0.775	0.710	0.703	0.959	1.145
15	Solomon Islands	-1.149	-1.437	-1.283	-1.179	-1.032	-0.936	0.610	0.867	0.935	0.993	0.790	0.828	0.726	0.726	0.542
16	Vanuatu	-1.526	-1.476	-1.465	-0.925	-0.569	-0.382	-0.069	0.045	0.636	0.766	0.944	0.933	0.833	1.008	1.246
17	Azerbaijan	-1.610	-1.526	-1.343	-0.909	-0.547	-0.157	-0.048	0.102	0.223	0.547	0.965	1.436	1.025	0.808	1.033
18	Brunei Darussalam	-2.227	-1.510	-0.975	-0.673	-0.284	0.032	0.650	0.984	1.418	0.987	0.848	0.339	0.089	0.117	0.206

<b>Sr #</b>	<b>Country</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
19	Indonesia	-1.030	-1.012	-1.064	-0.969	-0.925	-0.868	-0.878	-0.232	0.479	0.815	1.013	1.096	1.136	1.118	1.322
20	Malaysia	-2.455	-1.526	-0.762	-0.353	-0.487	1.206	0.745	0.738	0.834	0.839	0.557	0.451	0.103	-0.274	0.384
21	Mongolia	-1.495	-1.320	-1.139	-0.565	-0.718	-0.623	-0.548	0.079	0.226	0.616	0.732	0.724	1.088	1.158	1.783
22	Thailand	-2.203	-1.788	-1.201	-0.621	-0.214	0.124	0.517	0.587	0.447	0.556	0.778	0.797	0.836	0.827	0.559
23	Timor-Leste	-0.633	-0.766	-0.810	-0.668	-0.734	-0.440	-0.549	-0.644	-0.580	-0.375	0.100	0.812	1.767	1.728	1.791
24	Vietnam	-1.567	-1.337	-1.186	-0.924	-0.682	-0.265	0.008	0.171	-0.171	0.430	0.715	0.890	1.192	0.994	1.733

**Appendix 2: Variance Decomposition for Inflation**

<b>Period</b>	<b>S.E</b>	<b>INF</b>	<b>IR</b>	<b>FIN</b>	<b>ER</b>	<b>M2</b>
1	3.943524	100.0000	0.000000	0.000000	0.000000	0.000000
2	5.086682	60.10840	0.901326	33.59008	0.276183	5.124006
3	7.374989	29.20675	0.941859	63.59706	0.243341	6.010992
4	10.87985	13.98711	1.241970	77.91589	0.157586	6.697438
5	15.39347	7.650619	1.429008	83.22022	0.105050	7.595101
6	20.78880	5.023414	1.514742	84.86838	0.077206	8.516259
7	27.00086	3.941994	1.533489	85.07350	0.062858	9.388158
8	33.99105	3.547445	1.517720	84.70035	0.055719	10.17876
9	41.73451	3.474458	1.486331	84.10669	0.052501	10.88002
10	50.21506	3.555065	1.449093	83.44840	0.051456	11.49599

**Appendix 3: Variance Decomposition for Interest Rate**

<b>Period</b>	<b>S.E</b>	<b>INF</b>	<b>IR</b>	<b>FIN</b>	<b>ER</b>	<b>M2</b>
1	0.939541	20.29333	79.70667	0.000000	0.000000	0.000000
2	1.584779	12.30255	76.58725	10.60797	0.042415	0.459816
3	2.308551	7.858324	64.60100	27.24374	0.080193	0.216739
4	3.201421	5.403285	51.22785	42.79334	0.083316	0.492209
5	4.290746	4.278317	39.95664	54.35300	0.068744	1.343299
6	5.580117	3.848556	31.32424	62.25854	0.050363	2.518300
7	7.067706	3.773960	24.92147	67.47967	0.034599	3.790300
8	8.749726	3.874717	20.18685	70.88835	0.023143	5.026945
9	10.62225	4.055522	16.65113	73.10962	0.015705	6.168028
10	12.68197	4.266732	13.97088	74.55716	0.011434	7.193793

#### Appendix 4: Variance Decomposition for Financial Inclusion

Period	S.E	INF	IR	FIN	ER	M2
1	1.987743	0.523466	1.633405	97.84313	0.000000	0.000000
2	4.362664	0.111845	1.547443	95.89768	0.000186	2.442849
3	7.388252	0.199978	1.636865	93.49712	0.001600	4.664440
4	11.02106	0.605502	1.663169	91.30135	0.003957	6.426021
5	15.24199	1.100314	1.628766	89.39737	0.007301	7.866247
6	20.03150	1.604433	1.575344	87.76297	0.011280	9.045968
7	25.37473	2.082749	1.518410	86.36413	0.015542	10.01917
8	31.26090	2.521321	1.463987	85.16523	0.019835	10.82963
9	37.68270	2.916985	1.414308	84.13373	0.023997	11.51098
10	44.63591	3.271317	1.369891	83.24174	0.027940	12.08911

#### Appendix 5: Variance Decomposition for Exchange Rate

Period	S.E	INF	IR	FIN	ER	M2
1	15.21973	0.177034	2.971999	0.057680	96.79329	0.000000
2	25.60170	0.322439	3.050680	0.464480	96.08374	0.078658
3	34.38810	0.882623	3.234204	1.901780	93.37548	0.605918
4	42.27795	1.651782	3.234262	4.221905	89.36043	1.531623
5	49.77494	2.547700	3.090291	7.240299	84.41988	2.701832
6	57.20373	3.460701	2.863969	10.77908	78.89439	4.001862
7	64.77582	4.328283	2.594379	14.65925	73.07506	5.343022
8	72.63591	5.117874	2.308908	18.71904	67.19108	6.663093
9	80.88771	5.815096	2.026289	22.82226	61.41465	7.921703
10	89.60867	6.417110	1.758566	26.86089	55.86887	9.094567

### Appendix 6: Variance Decomposition for Money Supply

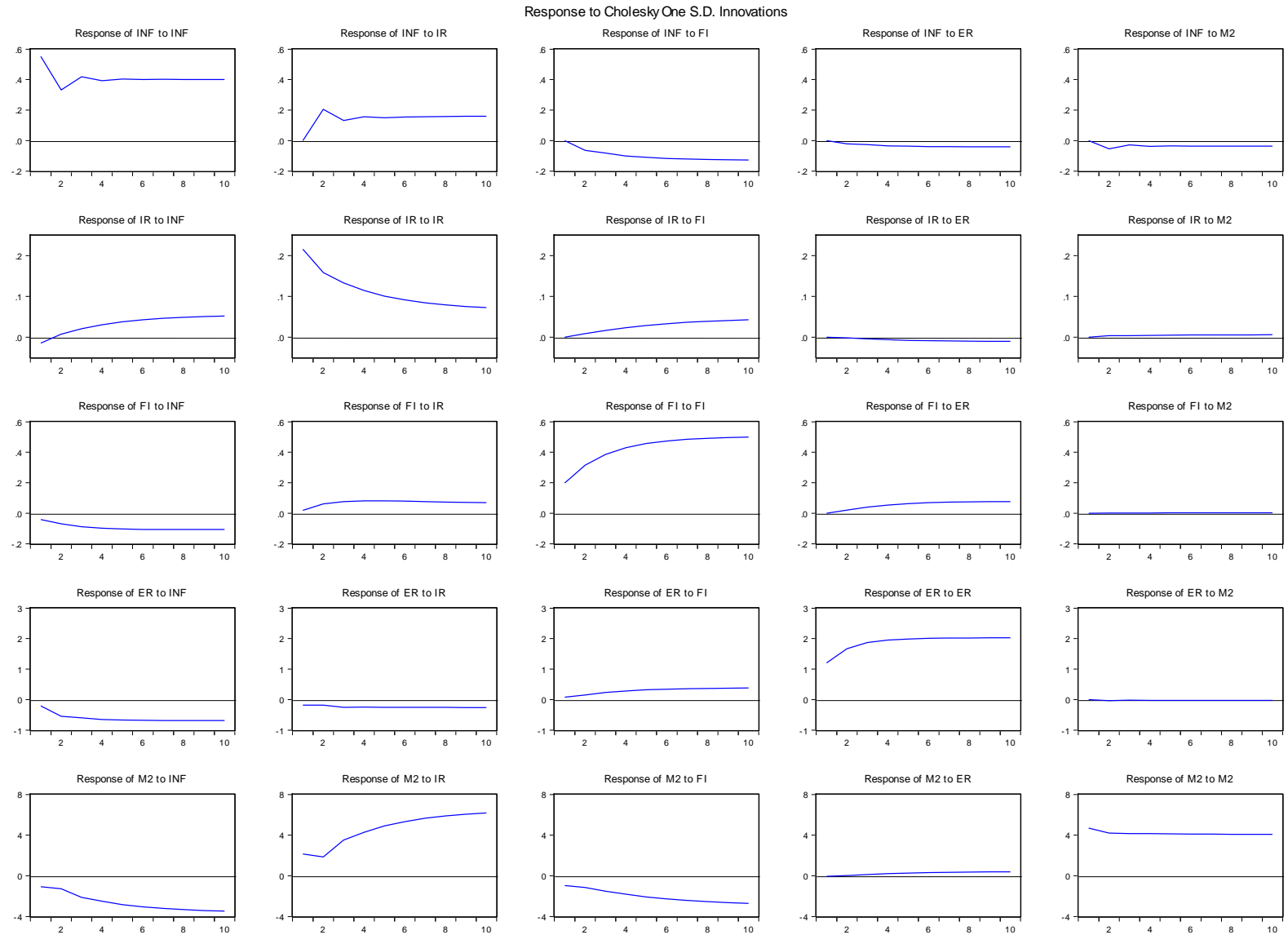
Period	S.E	INF	IR	FIN	ER	M2
1	6.149681	12.15266	0.827792	14.47482	0.628011	71.91672
2	9.562027	20.53454	0.428612	16.12608	0.925087	61.98568
3	12.79870	25.96950	0.462712	19.04437	1.027784	53.49563
4	15.74271	27.27153	0.719276	22.97795	1.100396	47.93086
5	18.52950	27.09378	0.983430	27.94679	1.130816	42.84518
6	21.24279	25.96249	1.237305	33.73575	1.125158	37.93930
7	23.96448	24.18222	1.469349	40.08635	1.090266	33.17182
8	26.77096	21.99382	1.670875	46.70640	1.032568	28.59633
9	29.72872	19.59387	1.837580	53.29918	0.958574	24.31080
10	32.89352	17.14507	1.968119	59.59958	0.874560	20.41267

### Appendix 7: Vector Error Correction (Oil Importing Developing Asian Countries)

<i>Error Correction</i>	<i>D(INF)</i>	<i>D(IR)</i>	<i>D(FIN)</i>	<i>D(ER)</i>	<i>D(M2)</i>
<i>ECT (-1)</i>	-0.085 [-2.248]	0.048 [ 3.275]	0.001 [ 0.021]	-0.036 [-0.428]	-1.761 [-4.773]
<i>D(INF(-1))</i>	-0.340 [-3.395]	-0.012 [-0.312]	0.002 [ 0.078]	-0.421 [-1.871]	1.109 [ 1.136]
<i>D(IR(-1))</i>	0.643 [ 2.074]	-0.029 [-0.246]	0.150 [ 1.314]	0.207 [ 0.297]	-9.065 [-3.005]
<i>D(FIN(-1))</i>	-0.293 [-0.983]	0.003 [ 0.029]	0.582 [ 5.267]	0.204 [ 0.305]	-0.012 [-0.004]
<i>D(ER(-1))</i>	-0.022 [-0.397]	0.000 [ 0.023]	0.016 [ 0.813]	0.388 [ 3.091]	-0.023 [-0.042]
<i>D(M2(-1))</i>	-0.010 [-0.829]	-7.985 [-0.016]	0.000 [ 0.052]	-0.007 [-0.254]	-0.079 [-0.657]



## Appendix 8: Impulse response function (Oil Importing Developing Asian Countries)



**Appendix 9: Granger Causality Test (Oil Importing Developing Asian Countries)**

	<u>F-Statistics</u>	<u>Probabilities</u>
$\Delta IR \rightarrow \Delta INF$	1.75337	0.1900
$\Delta INF \rightarrow \Delta IR$	1.72572	0.5717
$\Delta FIN \rightarrow \Delta INF$	1.72572	0.1934
$\Delta INF \rightarrow \Delta FIN$	0.25928	0.6123
$\Delta ER \rightarrow \Delta INF$	1.87067	0.1760
$\Delta INF \rightarrow \Delta ER$	0.94390	0.3348
$\Delta M2 \rightarrow \Delta INF$	3.59960	0.0621
$\Delta INF \rightarrow \Delta M2$	0.17088	0.6807
$\Delta FIN \rightarrow \Delta IR$	0.03838	0.8453
$\Delta IR \rightarrow \Delta FIN$	0.18027	0.6725
$\Delta ER \rightarrow \Delta IR$	0.47750	0.4919
$\Delta IR \rightarrow \Delta ER$	0.14842	0.7013
$\Delta M2 \rightarrow \Delta IR$	12.6812	0.0007
$\Delta IR \rightarrow M2$	0.48912	0.4867
$\Delta ER \rightarrow \Delta FIN$	0.00616	0.9377
$\Delta FIN \rightarrow \Delta ER$	2.63033	0.1095
$\Delta M2 \rightarrow \Delta FIN$	0.62975	0.4302
$\Delta FIN \rightarrow \Delta M2$	0.00110	0.9737
$M2 \rightarrow \Delta ER$	0.10718	0.7444
$\Delta ER \rightarrow \Delta M2$	0.49232	0.4853

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**Appendix 10: Variance Decomposition (Oil Importing Developing Asian Countries)**

<b>Period</b>	<b>S.E</b>	<b>INF</b>	<b>IR</b>	<b>FIN</b>	<b>ER</b>	<b>M2</b>
1	0.551561	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.680725	89.39426	8.994216	0.867671	0.104118	0.639740
3	0.814852	88.71066	8.912361	1.628868	0.183754	0.564353
4	0.924829	86.92831	9.734733	2.449498	0.277280	0.610179
5	1.027353	85.86922	10.02921	3.137464	0.353955	0.610150
6	1.120871	84.90394	10.33031	3.728931	0.419284	0.617540
7	1.208070	84.12955	10.55660	4.221219	0.472285	0.620353
8	1.289700	83.46912	10.75783	4.634241	0.515672	0.623144
9	1.366724	82.91085	10.93169	4.981164	0.551180	0.625119
10	1.439768	82.43215	11.08568	5.274843	0.580529	0.626800

**Appendix 11: Variance Decomposition (Oil Importing Developing Asian Countries)**

<b>Period</b>	<b>S.E</b>	<b>INF</b>	<b>IR</b>	<b>FIN</b>	<b>ER</b>	<b>M2</b>
1	0.216632	0.480828	99.51917	0.000000	0.000000	0.000000
2	0.268762	0.380855	99.50748	0.092877	0.004870	0.013918
3	0.301041	0.770481	98.82190	0.356516	0.025574	0.025532
4	0.324349	1.538945	97.56105	0.798750	0.061952	0.039300
5	0.343028	2.563361	95.87891	1.394762	0.108952	0.054017
6	0.359115	3.733696	93.93286	2.103219	0.161222	0.069003
7	0.373624	4.967783	91.85239	2.881301	0.214764	0.083766
8	0.387099	6.208052	89.73497	3.691942	0.267072	0.097969
9	0.399841	7.417569	87.64768	4.506558	0.316773	0.111420
10	0.412029	8.574396	85.63341	5.304926	0.363238	0.124028

**Appendix 12: Variance Decomposition (Oil Importing Developing Asian Countries)**

<b>Period</b>	<b>S.E</b>	<b>INF</b>	<b>IR</b>	<b>FIN</b>	<b>ER</b>	<b>M2</b>
1	0.204050	4.016173	0.939884	95.04394	0.000000	0.000000
2	0.387743	4.276126	2.734983	92.71560	0.272407	0.000888
3	0.561129	4.518519	3.174161	91.67879	0.627460	0.001068
4	0.720146	4.603140	3.188454	91.26879	0.938238	0.001379
5	0.865158	4.623386	3.080348	91.11254	1.182116	0.001612
6	0.997629	4.604972	2.937728	91.08847	1.366994	0.001831
7	1.119306	4.568462	2.794739	91.12879	1.505987	0.002023
8	1.231805	4.524075	2.662834	91.19988	1.611018	0.002194
9	1.336521	4.477818	2.545367	91.28317	1.691301	0.002346
10	1.434610	4.432794	2.442325	91.36882	1.753578	0.002480

**Appendix 13: Variance Decomposition (Oil Importing Developing Asian Countries)**

<b>Period</b>	<b>S.E</b>	<b>INF</b>	<b>IR</b>	<b>FIN</b>	<b>ER</b>	<b>M2</b>
1	1.236424	2.839184	2.225539	0.432488	94.50279	0.000000
2	2.162998	7.318165	1.454467	0.653128	90.54680	0.027445
3	2.939131	8.050141	1.529598	0.976166	89.42349	0.020602
4	3.607437	8.615931	1.489551	1.266577	88.60805	0.019886
5	4.193294	8.909607	1.470150	1.519438	88.08212	0.018683
6	4.717739	9.109028	1.451794	1.729710	87.69143	0.018035
7	5.194642	9.240207	1.440506	1.902880	87.39890	0.017502
8	5.633990	9.332721	1.433643	2.044924	87.17161	0.017104
9	6.042888	9.399128	1.430319	2.161897	86.99187	0.016782
10	6.426598	9.448383	1.429311	2.258863	86.84692	0.016522

**Appendix 14: Variance Decomposition (Oil Importing Developing Asian Countries)**

<b>Period</b>	<b>S.E</b>	<b>INF</b>	<b>IR</b>	<b>FIN</b>	<b>ER</b>	<b>M2</b>
1	5.362086	4.110303	15.98473	3.133624	0.005794	76.76555
2	7.262644	5.338127	15.20656	4.191961	0.004349	75.25900
3	9.448400	8.200860	22.90274	5.073729	0.017819	63.80485
4	11.58816	10.06101	28.82728	5.837104	0.043710	55.23090
5	13.69837	11.46323	33.43617	6.463103	0.070011	48.56749
6	15.73212	12.44218	36.84410	6.982147	0.092873	43.63869
7	17.67957	13.15525	39.40115	7.412057	0.111194	39.92035
8	19.53512	13.68112	41.34789	7.770146	0.125524	37.07532
9	21.30075	14.07934	42.85895	8.069656	0.136653	34.85540
10	22.98084	14.38710	44.05300	8.321506	0.145342	33.09305

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