Inflation Targeting in Five Asian Economies: Some Empirical Evidence

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Supervisor Dean of School

Dedicated

to

My Late father

Mr. Laxman Sethi

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CONTENT

Abbreviations

AR	Autoregression
BIS	Bank for International Settlement
BOK	Bank of Korea
BoT	Bank of Thailand
BSP	Bangko Sentral ng Pilipinas
CBI	Central Bank Independence
CPI	Consumer Price Index
ECB	European Central Bank
FCI	Financial Condition Index
FE	Fixed Effect
FSI	Financial Stability Index
FT	Financial Transparency
GDP	Gross Domestic Product
HAC	Heteroscedasticity-Autocorrelation Consistent
HDI	Human Development Index
HP	Hodrick- Prescott
HPI	Human Poverty Index
IFS	International Financial Statistics
IMF	International Monetary Fund
IRF	Impulse Response Function
IT	Inflation Targeting
LAC	Latin American and Caribbean
MPB	Monetary Policy Board
MPC	Monetary Policy Committee

NPA	Non-Performing Assets
OECD	Organization for Economic co-operation and development
OLS	Ordinary Least square
PCA	Principal Components Analysis
RE	Random Effect
SVAR	Structural Vector Autoregression
TI	Transparency Index
UNDP	United Nations Development Program
USDA	U.S Department of Agriculture
VAR	Vector Autoregression
VD	Variance Decomposition
WDI	World Development Indicator

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CHAPTER 1

Introduction, Objectives and Scope of the Study

1.1 Background of the study

Towards the end of the twentieth century market-oriented reforms took over the state dominated strategy in most of the economies in the world. The prosperity and growth of an economy was mainly left to free markets. The governments persuaded both fiscal policy and monetary policy along with trade policy to secure prosperity and economic growth in the free market. But monetary policy gained importance in market economies. In the market economy, low and stable inflation are found to have significant role in achieving a desirable growth rate. With regard to fiscal policy one finds a lot of goals with delayed legislative processes makes the policy less proactive towards changes in the market. Since monetary policy is strongly linked to inflation, one can expect the potential role of monetary policy in the free market to boost output growth. Unlike fiscal policy, monetary policy is proven to have greater flexibility to the influence real economy. Monetary policy responds quickly to sudden developments in the macroeconomy. In the situation of fluctuations in the inflation, output and employment, the government finds monetary policy as the suitable instrument to restore macroeconomic stability. Additionally, financial markets closely follow the path of monetary policy while deciding the action of investors. Thus, monetary policy has been acknowledged as an important arm of economic policy. Monetary policy has a long history right from the beginning of gold standard. Monetary policy then, was initially followed by fixing the country's currency with some fixed value of gold. Later, fixed exchange rate was followed where each country's currency was pegged to U.S dollar. After observing potential problems in the existing monetary policy, central banks switched to monetary targeting as the new form of monetary policy. In this policy, growth rate of monetary aggregates was targeted for a specified time period to achieve the goal of monetary policy. The policy was successful for a quite long period. The success of the policy to achieve macroeconomic objectives primarily depended on the stability of monetary aggregates. But later due to instability in the relationship between money supply and growth, monetary targeting was abandoned. During that time, central banks were searching for an alternative nominal anchor which can take care of macroeconomic stability.

This led to the birth of a new form of monetary policy called "inflation targeting" (IT). Different authours defined this IT policy differently considering the policy design and framework. According to Mishkin and Savastano (2001*), "IT involves the public announcement of a numerical target for inflation, a strong commitment of the central bank to price stability as monetary policy objective, and a high degree of transparency and accountability" (Samarina and Haan, 2014. P.01).* In a more comprehensive way, Mishkin (2001), defined inflation targeting *"as a recent monetary policy strategy that encompasses five main elements: (1)the public announcement of medium-term numerical targets for inflation;(2) an institutional commitment to price stability as the primary goal of monetary policy, to which other goals are subordinated; (3)an information inclusive strategy in which many variables, and not just monetary aggregates or the exchange rate, are used for deciding the setting of policy instruments; (4)increased transparency of the monetary policy strategy through communication with the public and markets about the plans, objectives, and decisions of the monetary authorities; and (5) increased accountability of the central bank for attaining its inflation objectives".* This policy has an exclusive feature of setting a quantitate target for inflation objective. This feature is designed to curb inflation expectations leading to higher flexibility in the policy for achieving macroeconomic stability. Further, the policy is designed exclusively for maintaining strong communication with the public regarding the current and future decisions in monetary policy. This enhances the predictability of the actions of monetary policy which can have positive impact on the policy outcome. These features of IT policy are found to be different form, of monetary policy. Apart from describing the unique features of IT, it is very important to point out whether IT policy follows "rules" or "discretion". Monetarists had long-standing understanding of the particular form of monetary policy to be either "rules" or "discretion". A "rule" based monetary policy requires very little macroeconomic analysis and there is absence of value judgments in the policy. Supporter of "Rules" based policy argued that, "this strategy of monetary policy helps central bankers to achieve credibility and stability". But critics pointed out that "the rules type policy has unfavourable impact on the macroeconomy". They argued that resorting to a rule-based policy reduces power of the central bank to respond to unusual circumstances. On the other hand, "discretion" was explained to be another strategy of monetary policy where the central banks do not show explicit public commitments of the policy objectives. In the real world, there is no complete discretion or there is no policy without discretion. But discretion is not fully bad for the macroeconomic stability. Discretion may reduce stability by

adhering to respond to unusual circumstances, but discretion at some level is good for the economy. Under this strategy monetary authority can exercise flexibility to respond to new developments in the macroeconomy. Since these two alternative forms of monetary policy have shown to have both pros and corns, IT policy added a new dimension to monetary policy. First of all, IT is a framework and not a rule-based policy. It follows a constraint discretion strategy while pursuing monetary policy. The constraint-discretion framework of IT helps the monetary authority to avoid the problems faced in rules-based policy and also puts a restriction on the discretion of the policy. Acknowledging the negative impact of full discretion, IT policy is designed in such a way that the monetary authority has freedom to exercise their power with some constraint.

IT policy has been a widely accepted monetary framework at the central banking circles and academic research. Though it took birth in advanced countries, emerging countries popularized this new framework with increasingly adoption of this monetary policy. IT was first implemented by New Zealand in 1990 following a large number of both developed and developing countries. By 2015, 32 countries have adopted IT policy as their monetary policy and most of them happen to be emerging countries. After a good two and half decades no single central bank has cited weakness in the IT framework.[1] The popularity of IT in emerging countries can be explained by the relative benefits of this monetary policy framework on economic performances in the member countries. Mishkin (2000) argued that IT policy could be more beneficial to emerging countries rather than industrial countries. According to Amato and Gerlach (2002), IT policy is the most important revolution in the monetary policy framework since the collapse of the Bretton Woods system in 1971. However, the experience in following IT policy is not symmetric across member countries. Different studies examining both developed and developing countries, observed some important gain after IT was adopted. This gain in the policy outcome can be price stability, robust output growth, minimal exchange rate volatility and finally, higher credibility.

In Asian countries, there are five countries namely Korea, Israel, Indonesia, Philippines and Thailand, which are following IT policy. The potential benefits of IT policy are mixed in Asia and

[1] Europian countries like Finland, Spain and Slovak Republic had earlier adopted IT policy but later joined the Euro zone by abandoning the existing policy. But this does not show the weakness of IT. Instead, it seems that IT has helped those countries to be eligible to join the euro area. Euro zone requires a minimum level of 2.5 percent of inflation like one of the criteria to become the member of euro zone. In the meantime, these countries were at high level of inflation, so they used IT policy to achieve the required rate of inflation.

vary from case to case depending upon countries. When some studies observed that IT helps to reduce inflation and inflation volatility in Asia (Goncalves and Salles, 2008; Prasertnukul et al. 2010; Valera et al. 2017), another study confirmed that inflation persistency had not declined significantly (Filardo and Genberg, 2010). But there are many studies observing significance of IT in reducing exchange rate pass-through to domestic inflation and volatility in the real effective exchange rate in IT Asian countries (Prasertnukul et al. 2010; Ouyang et al., 2016).

1.2 The present study: Motivation

It's all most two and half decades, since IT came into existence for the first time in New Zealand. Immediately after the adoption of IT a new framework of monetary policy emerged in the advanced countries. This has drawn attention of both central bankers and academic researchers to explore the potential role of IT in the macroeconomy. There has been a large number of theoretical and empirical studies in this context exploring some of the important aspects of IT. Issues like decline in inflation, volatility, exchange rate and pass-through, etc., were given due importance to highlight the significance of following IT regime. In Asia very few studies have been conducted to examine the role of IT in bringing in macroeconomic stability. When some studies observed that IT helps to reduce inflation and inflation volatility in Asia (Goncalves and Salles, 2008; Prasertnukul et al. 2010; Valera, 2017), others confirmed that inflation persistency had not declined significantly (Filardo and Genberg, 2010). But a number of studies have observed that IT had gained significant achievement in containing exchange rate pass-through to domestic inflation and volatility in the real effective exchange rate in IT Asian countries (Prasertnukul et al. 2010; Ouyang et al., 2016). But some other issues still remained unexplored for the Asian economies. First, IT countries followed a unique form of monetary policy. But the policy outcomes were not similar across member countries. When some countries experienced a low inflation rate after IT is implemented, some others found it hard to do so. A similar experience was observed in other aspects showing wide variations in policy results. One important question is raised in view of their results, i.e whether IT is adopted in different economic conditions across member countries. It is quite obvious that different levels of institutional development and macroeconomic conditions playing an important role in yielding divergent results. This may be the reason for IT to be more noticeable in emerging and developing countries than advanced countries, as they adopted IT under more difficult economic circumstances. In other words, the success of IT depends on the

conditions under which IT is implemented. It is then necessary to explore the important economic and institutional conditions under which IT is adopted. Second, IT was adopted to reduce inflation and maintain price stability. Once the policy is implemented, reduction in inflation becomes the primary focus of the monetary authority. This argument is supported in the empirical literature, where large number of studies have shown that the countries, which adopted IT have successfully reduced inflation (Goncalves and Salles, 2008; Yamada, 2013; Prasertnukul et al. 2010; Valera et al. 2017). A significant decline in inflation is evident in IT-emerging countries compared to non-IT emerging countries (Svensson, 2010) and advance countries (Petursson, 2004; Neumann and Hagen, 2002). But we all know that reduction in inflation is not a free lunch for the monetary authority. The central bank seeking lower inflation and following a disinflation policy has to bear some cost in terms of decline in output growth. This idea is traced back to 1976 when Philips curve was proposed for the first time in macroeconomic theory. The idea behind the Philips curve was the short-run tradeoff between inflation and growth. But later, Phelps (1967) and Friedman (1968) showed that Philips's observation was only true in short run indicating that there is only short-run tradeoff between inflation and growth. Amid short run tradeoff, the disinflation policy aiming at price stability has to sacrifice some amount of output growth. In other words, lowering the inflation rate has negative impact on country's GDP growth and employment. Since IT policy follows a similar path to achieve price stability, a negative impact on growth and employment is expected to be experienced here. It suggests that IT countries can solve their inflation problem but in the meantime they create the problem of declining growth and employment. This indicates that all IT member countries might experience deceleration in economic activity. But, this explanation might not hold in practice. This is because there are new Keynesian models, which argue that under a credible monetary policy disinflation action of the central banks might have zero adverse impact on growth and employment (Gali and Gertler, 1999; Gali et al., 2001 & 2005). These models point out that when a monetary policy becomes more credible, people trust on the central bank's policy increases. This high connectedness of the monetary policy with people enhances the transmission mechanism by quickening the responses of a policy change. But all these depend on the credibility of IT policy on different dimension. One of them is explicit official publication of inflation target for the monetary policy objective. The inflation target set jointly by government and central banks makes the policy credible as the public believes that the target is consistent since it is backed by government. The government's involvement in setting the objective generates more faith among

people to follow the notion that central bank's action will be consistent towards reaching the goal of monetary policy. If this holds, then IT country will face minimal or zero disinflation cost. In other words, IT countries do not need to sacrifice output and employment growth for achieving price stability objective. So, this aspect of IT needs to be studied thoroughly to find the credibility of monetary policy. Third, another aspect of any successful central bank policy is transparent monetary policy. The power of any monetary policy to affect the economy depends critically on its ability to influence market expectations about future inflation and the path of overnight interest rates (Blinder et al., 2008). An IT policy assumes significance in lowering inflation and disinflation cost by influencing the expectations. This can happen only when there is high transparency and accountability in the monetary policy. It is clearly mentioned in the designing features of IT policy that the goal of price stability can be easily achieved by laying greater focus on central bank transparency. A communication gap between both parties hinders the effectiveness of monetary policy. When people are at learning stage or they are less informed about the course of monetary policy, any change in interest rate will not yield desired results. It is because less informed candidates are not able to anticipate the likely changes in the monetary policy. This decision slows the pace of transmission mechanism and the monetary policy shock takes some time to influence the candidate variables to achieve the goal of monetary policy. This time gap reduces the effectiveness of the policy. While people are learning, an increase in inflation may lead the public to revise its estimate of long-run average inflation upward, which, in turn, raises actual inflation (Rudebusch and Williams, 2006; Berardi and Duffy, 2007). This problems necessarily calls for a transparent monetary policy, which is designed to clearly and heavily focus on the communication channels. IT is arguably one of those policy frameworks, which excessively focuses on greater communication with the public. One of the interesting features of IT policy is that it has relatively better form of communication channels. The policy framework is designed in such a way that monetary authority timely shares the policy related information with the public to enhance the power of policy. They publish policy related information like quantitative official target of inflation, press release, review report, speeches of policy strategy, model used in forecasting and the future path of monetary policy. So, the stronger form of communications has a positive impact on the macroeconomy. When people are informed about the central bank's policy actions and lastly future path of monetary policy, it becomes easier for them to respond to any unusual developments in the economy, especially say any shock (s). When an economic agents'

anticipation goes correctly with target rate, the cost of inflation stabilization is minimized and the future inflation also falls. Further, it helps them to get desired output from a likely change in the monetary policy. It is because more and more communication with public makes the policy transparent and this high transparency has positive impact on expectations. When the expectation is curbed fully, the expected inflation rate also falls thereby increasing the effectiveness of policy leading to fall in inflation at last. Additionally, any shock to the economic system has a negligible impact on the macroeconomic stability as the public is fully convinced about the likely changes in the monetary policy. All these explanations indicate that IT policy can reduce inflation expectations and inflation rate through an effective communication strategy. Fourth, apart from having those aspects, another aspect of IT policy needs rigorous attention. That aspect is the role of inflation targeting in maintain financial stability. There was a long debate over the issues regarding whether financial stability should be another objective in monetary policy. Some suggest that monetary policy and financial stability are closely related to each other. They should be pursued simultaneously to have a stable economic system. Further, as monetary policy enjoys better information sharing and proper coordination with financial sectors, it can easily influence the determinants of financial imbalances like credit, liquidity and risk taking, etc. So, reliance on supervisory and regulatory framework do not improve the financial conditions of the sector (Smets, 2014). It is argued that monetary policy seeking price stability can take care of financial stability as well (Schwartz, 1995). The supporter of this view, argue that low and stable inflation reduce uncertainty in decisions and increase in investment horizon leading to financial stability in the economy. Borio and Lowe (2002) stated that "A monetary regime that produces aggregate price stability will, as a by-product, tend to promote stability of the financial system". If this is the case, then IT policy, which is primarily focused on price stability, can promote financial stability. This also implies that the financial sector imbalances can be better protected in IT regime. This is the reason, Walsh (2009a) have said that "the ability to deal with demand shocks and financial crises can be enhanced by a commitment to an explicit (inflation) target". But the recent 2008 meltdown in U.S has proved this precondition to be irrelevant. The notion of price stability leading to financial stability was found to be wrong in light of the global financial crisis as it collapsed in the low inflation regime. The 2008 crisis took place even when U.S and other advanced countries were pursuing price stability. On the contrary, it was argued that excess focus on price stability led to lower financial stability. Rajan (2005) and White (2006) argued that one of the main reason for

rising financial market risk was due to excessively low interest rate regime in the U.S. The low interest rate regime followed by low inflation rate resulted in rising risk-taking attitude of the investors for higher return. Low return in the market induce the investor to search for an alternative investment opportunity in the leveraged assets. Additionally, Taylor (2009) showed that too low interest rate of central banks below the predicated rate in Taylor rule, resulted in housing market booms. He argued that if monetary policy had maintained an interest rate close to what was predicted by Taylor rule, housing market crash would have been avoided. This suggests that an IT policy which explicitly focuses on low inflation may experience a similar problem. Further, the sole focus on price stability may neglect imbalances in the financial markets (Frankel, 2012). Under this condition, if IT central banks respond to that, then it may violate the Tinbergen rules where number of instruments should be equal to the number objectives. All these indicate that the implementation of IT policy can lead to higher financial market instability.

1.3 Objectives

In view of the above discussion, the following objectives have been formulated.

(1) To determine the factors leading to adoption of inflation targeting.
(2) To examine the credibility of inflation targeting using the concept of sacrifice ratio.
(3) To find out transparency in inflation targeting policy and its impact on inflation.
(4) To examine the role of inflation targeting in maintaining financial stability.

1.4 Data and Methodology

1.4.1 Data

To achieve the above objectives five Asian economies namely, Korea Indonesia, Israel, Philippines, and Thailand are chosen. The reason for considering these countries is that only these five countries in Asia are follow full-fledged IT policy. Another 8 non-IT countries are used for the purpose of comparing the results. These countries are Singapore, China, India, Hong Kong, Saudi Arabia, Iran, Malaysia and Pakistan. But in chapter 5, UAE and Kuwait are considered by replacing Iran and Saudi Arabia due to unavailability of data for these countries. To avoid the self-selection problem, these non-IT countries are used in the analysis. There countries are comparable as they possess a similar kind of economy. So, in total the study uses 13 Asian countries in the analysis. An annual data set is used for all variables in the study. The time period

differs from one objective to another. For instance, Chapter 2 consists of eight variables such as inflation rate, gross public debt (% of GDP), central bank independence (% of GDP), trade openness (% of GDP), growth rate of M3, GDP growth, financial openness and government spending (% of GDP). The time period is from 1985 to 2005. The analysis in Chapter 3 employs two variables such as inflation and GDP growth for 1970-2014. Similarly, Chapter 4 considers six variables like openness, per capita income, past inflation, output gap and transparency in IT. The data period covers the annual period, 1998 to 2010. Finally, Chapter 5 considers six variables namely Financial Conditions Index(FCI), openness, M3, exchange rate volatility, central bank transparency, financial stability transparency and central bank independence from 1990 to 2015. All data are collected from WDI (World Bank), IFS (IMF), Dincer and Eichengreen (2014), Chinn and Ito (2008), Abbas et al. (2010), International Macroeconomics Data set of the U.S Department of Agriculture (USDA), Handbook of Bank of England (2012), Federal Reserve Bank of ST. Louis, Bank for International Settlement (BIS) and Bloomberg.

1.4.2 Methodology

Econometric techniques has been used in all objectives. Both parametric and non-parametric methods are employed in the study. In Chapter 2, both Panel Probit model and Probit model with (White-corrected) standard errors are employed to find the important factors that leading to IT adoption. Chapter 3 uses a non-parametric method, namely episode method to calculate sacrifice ratio and then employs a panel data regression with both fixed effect and random effect models to investigate credibility of inflation targeting. Chapter 4 uses a nonparametric method for calculating central bank transparency and then examines the relationship between IT transparency and inflation through both fixed effect and random effect models. Finally, in Chapter 5 a FCI index is calculated using UNDP method for calculating HDI, HPI, etc., and then a country fixed model is employed to study the impact of inflation targeting on financial stability.

1.5 Organization of the study

The rest of this thesis contains five chapters. Chapter 2 explores the important factors which lead to the adoption of IT policy in Asia. Chapter 3 examines the credibility of IT policy in Asia using sacrifice ratio. Chapter 4 examines the relationship between central bank transparency and

inflation. The fifth chapter investigates the role of IT in reducing financial instability. Finally, some concluding remarks are offered in the last chapter.

CHAPTER 2

Factors Leading to the Adoption of Inflation Targeting in Asia

2.1 Introduction

Inflation targeting (hereafter IT) was first implemented in New Zealand in the year 1990 following some reforms in the economy. IT policy has been a successful monetary policy, especially in emerging countries. Two and half decades is over, and no single central bank has cited the weakness in the framework.[2] The popularity of IT in emerging countries can be explained by the relative benefits of this monetary policy framework on economic performance in the member countries. Mishkin (2000) argued that IT policy could be more beneficial to emerging countries rather than industrial countries. The experiences in following IT policy has been divergent across member countries. IT policy has delivered several important positive macroeconomic outcomes in the member countries, in spite of several negative outcomes. When the implementations of IT has led the countries to achieve low inflation and inflation volatility (Bernanke et al 1999; Neumann and Hagen, 2002; Petursson, 2004; Svensson, 2010; Mishkin and Savastano, 2001; Batini and Laxton 2006; Goncalves and Salles, 2008; Gemayel *et al.*, 2011; Hallett and Libich, 2012; Gupta et al., 2016; Schmidt-Hebbel and Tapia, 2002; Edwards, 2006; Prasertnukul et al. 2010), some other studies have claimed that IT does not help to reduce inflation rate and inflation volatility (Ball and Sheridan, 2003; Lin and Ye, 2007). Similarly, Truman (2003) observed that IT policy increased economic growth, but there were some contrasting findings which document that growth volatility increase due to frequent revision of key policy rates. Additionally, it is argued that IT policy has helped to improve the central bank credibility in the monetary policy (Bordo and Siklos, 2014). But there are such studies which claimed that IT has no significant impact on increasing credibility (Brito and Bystedt, 2010; Brito, 2010).

[2] Europian countries like Finland, Spain and Slovak Republic had earlier adopted IT policy but later joined the Euro zone by abandoning the existing policy. But this does not show the weakness of IT, instead, it seems that IT has helped those countries to be eligible to join the euro area. Euro zone requires a minimum level of 2.5 percent of inflation as one of the criteria to become a member of the euro zone. In the meantime, these countries were at a high level of inflation, so they used IT policy to achieve the required rate of inflation.

The interesting fact is that the experiences of IT in terms of policy outcomes in the member countries varies from countries to countries and also in the level of economic development. When some say IT reduces inflation and inflation volatility, some says it is vague. Further, when studies find IT to be important for fostering industrial production and economic growth, some other studies have disagreed with this views. Even the achievements in transparency and credibility differ from countries to countries. This differences in the experiences raise some questions regarding the potentiality of IT policy to be the best nominal anchor in the recent times. However, instead of concentrating on this issues, it would be rationale to explore the cause which is influencing these results. In other words, is this diverse impact can be because of different institutional arrangements at the time of adoption of IT policy? Is it because of different economic conditions when IT was implemented in the both advanced and emerging countries? The answer to this question is yes, because it is argued that this difference in outcome is because of different level of institutional credibility and macroeconomic problems. Mishkin (2000) argued, in the same way, stating that IT policy can be more useful and successful in emerging economies as they have a different level of institutional developments and several other problems in the existing monetary policy which advanced countries do not have such problems. So, instead of exploring the significance of IT through macroeconomic variables, it would be good to find the conditions under which IT was adopted in Asian economies. In the literature, several studies have highlighted this issues for both developed and developing countries. For instance, Leyva (2008) estimated the major factors which are responsible for adopting IT policy in both developed and developing countries. But the study lacks robustness as it includes only small number of factors in the analysis. Further, Samarina et al. (2014) extensively studied the determinants which increase the probability of implementing IT policy in both OECD and non-OECD countries. But the major problem with those studies is that it includes periods even after IT is adopted. As their study highlights main factors which determine the decisions to implement IT, including post-IT adoption period makes analysis wrong. The factors which are affecting to IT after IT is implemented is not the concern of the study. So, studies seeking to explore the factors which raise likelihood of implementing IT, they should stick to the adoption period to avoid reverse causality and endogeneity.

In the light of above discussions, this chapter makes an attempt to explore the major factors which are responsible for the adoption of IT policy in Asia. In other words, the study seeks to find out what are the pre-conditions to implement IT policy in Asian countries. This study contributes to

the literature in three ways. First, the study overcomes the limitations of omitted variables problem due to the inclusion of few variables by past studies. The study adds a wide range of macroeconomic factors from different sectors of the economy to analyze the significant determinants which are responsible for IT adoption. This addition increases the robustness of the analysis as the decisions to adopt IT may be guided by several factors at the macroeconomic level. Second, the study restricts this analysis up to the adoption date of IT in each country to avoid the problems of reverse causality and endogeneity. The study includes observations till the adoption date and drops all other observations after that periods. The period after IT is adopted is not relevant in the analysis because inclusion of those periods will reflect the impact of IT on those variables. So, including that effects will give a noise estimation of the relevant factors because our main objective is to find factors influencing until the adoption of IT policy. Post-adoption periods is not relevant in the analysis. Third, there is no single study exclusively focusing on Asian economy which seeks to find out the important factors responsible for implementing IT policy.

The rest of the chapter is organized as the following: Section 2.2 describe the transition happened from existing monetary policy to IT policy. Review of literature is presented in Section 2.3 Section 2.4 describes the methodology of Probit model. Section 2.5 explains the data and variables. Results of the factors leading to IT adoption in Asian are discussed in sections 2.6. The concluding remarks are offered in the last section.

2.2 Implementing IT in Five Asian Economy

IT policy was introduced in Asia for the first time in 1991 when Israel decided to change its monetary policy from the existing policy. Then there are four other Asian countries which have followed this IT policy namely, Korea, Thailand and Indonesia, respectively. This section briefly describes how IT policy was implemented in Asia and how the transition happened from existing monetary policy to IT.

2.2.1 Israel

Israel in 1985 was in an extreme fiscal pressure due to war with Lebanon and extensive social expenditures. The fiscal deficit was at the top level, say 14% of GDP and debt was 80% of GDP. Amid this serious problem, Governor of Bank of Israel took a major reform where the budget deficit was put to under control, and exchange rate targeting was followed as the monetary policy.

In the initial year the currency was pegged to U.S dollar, but later it was changed to a basket of currencies. But due to rise in general price levels, the central banks had to intervene in the foreign exchange market as the rising inflation led to an appreciation of Israel's currency leading to fall in international competitiveness. To solve this, the central bank intervened in the foreign exchange market which had a negative impact on foreign currency reserves and interest rate smoothness. In 1989, the central bank of Israel changed the exchange rate targeting by putting a band in the target where the exchange rate will be allowed to fluctuate within the range. This reforms helped to fall in exchange rate volatility. Finally, in 1991, the ministry of finance along with the governor of central bank decided to adopt inflation targeting policy as the new monetary policy framework. All the macroeconomic problems led to take the reform measures where IT policy was one of the outcomes from the macroeconomic crisis. But an interesting point to observe is that IT policy was implemented when inflation was about double digit, say 14% to 15%. The inflation target was set in a range for maintaining flexibility in the policy. One of the interesting fact about this central bank is that it follows both exchange rate targeting and inflation targeting policy simultaneously. The inflation target is set by finance ministry with the consultation from Bank of Israel. But the main problem was to balance between IT and exchange rate targeting because the country like Israel can't ignore volatility in the exchange rate. Later, the country abandoned the exchange rate targeting and concentrated only on IT policy. The main aim of the monetary policy remained to achieve price stability. To achieve that, certain institutional arrangements were made. The central bank of Israel found to be showing more concern towards high transparency by better arrangement in communication with the public. It publishes minutes after two weeks from the monetary policy committee meeting. This quickness has several implications for the transparency in the monetary policy. Moreover, it publishes an extensive set of forecasts to make policy forward looking.

2.2.2 Korea

South Korea had a long history in the central banking policy from 1976 when the central bank used to focus on monetary targeting approach. In the policy, M1 was followed as the intermediate target to achieve the macroeconomic objectives. But due to instability in the M1, the policy changed its intermediate target to M2 growth rate in 1979. The stability in the M2 led the central bank to achieve a close target of monetary policy. But due to the trust account system in 1996, the M2 became unstable and a new aggregate was chosen to follow in the monetary policy. The MCT,

a broader monetary aggregates, was used to account the additional aspect of monetary aggregates such as certificate deposit, money in trust, etc. Further, East Asian crisis in 1997 hit the Korean economy badly which led to adopting some IMFs reforms measures. Out of several reforms measures one of the important reforms was to changing existing monetary regime with a better nominal anchor. Subsequently, the Bank of Korea Act (BOK Act) was implemented where IT policy was adopted as the new monetary policy. Since then the primary focus of Korean central bank is to achieve price stability. The objective was set by the central bank with the consultation of government. Till 2001, M3 growth was followed as the operational target of the IT policy. The inflation target was set in CPI index. In the beginning, only headline CPI was followed as the policy target which later changed to core CPI. This change indicates that the monetary policy avoids responding to transitory inflation in the inflation target which is good for the monetary policy. Further, the inflation target has changed from annual target to medium-term target. This change can be a good step to control long-term inflation rate by curbing people's long-term expectations. Concerning communications strategy, the Bank of Korea maintains an average level of communications with public. It publishes both the press notice and conference but takes six weeks to publish the minutes of the monetary policy review. This is a problem with the communication channels as a longer time lag is involved with publishing the policy related information to the public. Further, the absence of open letter system shows the weakness of the policy.

2.2.3 Philippines

With the establishment of central bank act 1993 Bangko Sentral ng Pilipinas (BSP) emerged as the new central bank in the Philippines exiting from Bank of Philippines. Unlike previous law, the new central bank primarily focused on price stability followed by administrative autonomy. Initially, the monetary policy strategy of BSP was monetary aggregate targeting. The monetary targeting was successful for having better and direct relationship with price levels. But due to instability in the money multiplier caused by financial liberalization, the relationship between targeted money supply and inflation became weak. This led to the failure of monetary targeting policy. In the year 2000, the monetary policy making board approved the proposal of adopting IT policy as their monetary policy. But this informal adoption of IT turned to official two years later when BSP formally announced an IT central bank. The main focus of the policy remained to

maintain price stability. The objective was set by both central bank and government. This indicates a good coordination is maintained from government side in term of fiscal policy to contain fiscal deficit and inflation. But the BSP changed institutional arrangement in the design of IT policy. Earlier, they used to follow a range target for inflation target but in 2006 that target was modified to point target with bands on either side. This change has one important implication for policy transparency. It is argued that a rage target may give flexibility to the policy but at the same time it lacks clarity on the inflation target because the precise target rate of inflation is not defined due to range target. So, by making a point target with bands, it creates both flexibility and transparency in the monetary policy framework. Apart from that, the central bank of Philippines had arranged several communication channels. They published minutes of policy discussion in a longer time gap i.e. after four weeks. But they publish both press conference and press notices to public. Further to make the communication strategy more effective, an open letter system was also imposed on the governor seeking explanations. In this system the governor is liable to give explanations in case they missed the inflation target. This restriction has a positive implication for increasing effective communication of the central bank monetary policy.

2.2.4 Indonesia

Indonesia changed its monetary policy framework partially to inflation targeting under the central bank act enacted in May 1999. This departure from previously pursued monetary targeting was due to failure in maintaining a stable relationship between money supply and growth[3] (Alamsyah et al., 2001). Concurrently, an exchange rate regime with a pre-announced crawling band was also followed as a nominal anchor. But in Asian crisis 1997 this policy was abandoned and rupiah, which is the currency of Indonesia, was left to float. Although since 2000 the central bank of Indonesia is targeting inflation it was the year July 2005 when Bank Indonesia adopted full-fledged IT framework. Instead of focusing on Base Money as an instrument, which earlier used to follow, a BI rate[4]was set after that as a key policy instrument to guide interbank money market rates (Inoue et al., 2012). In the case of targeting an appropriate index there was wide variation from the period 2000 to 2005, showing a CPI core measure was targeted before a full-fledged targeting period

[3] Instability in the relation was due to instability in income velocity of money which is caused by financial innovation and deregulation.

[4] This is a policy rate in the form of interest rate

whereas a headline CPI measure was followed from 2005. The target was set as a point target with either side tolerance band. A first quantitative target was set at 6 % with ± 1 % tolerance band. This 1 percent gap in the band continues till now signifying the need for flexibility in the policy operation. From the designing of communication and publication, it is seen that the central bank governor is not accountable for missing the target which means he is not asked for justification of why they have missed the target and what steps have to be taken for it. But the public may view this as the lack of credibility of the central bank which can lead to loss of trust on central bank monetary policy. Another lacuna in the form of not publishing minutes was evident showing a poor designing of transparency and communication framework. Notwithstanding, communicating with the public was maintained through announcing policy decisions and inflation reports.

2.2.5 Thailand

In 1984, Thailand started following a pegged exchange rate as the monetary policy where Thailand's currency-bhat, was pegged to a basket of currencies. But later in floating exchange rate regime by following IMF program, the monetary policy was changed to monetary targeting (Phuvanatnaranubala, 2005). Under this regime, a quarterly growth rate of monetary base was targeted and interest rate was used as an instrument to achieve the objective. In other words, the short-term policy rates respond by increasing interest rates if the growth rate of base money is going above the target rate which is fixed before and *vice-versa* (Fane, 2005). But due to instability in the relationship between money growth and output growth, the prediction for the growth of base money came under question. As their relationship became unstable, monetary policy authority abandoned targeting base money growth as their intermediate target in the monetary policy. In the meantime, IMF program was also discontinued. These problems forced the monetary authority of Thailand to search for an alternative monetary framework which can resolve the issues facing in the existing regime. The central bank of Thailand found IT policy as the best alternative for the monetary policy. Following this, in the year 2000 a policy making body called Monetary Policy Board (MPB) was constituted with fully empowered to guide the IT policy towards price stability in the medium term. Later, Monetary Policy Committee (MPC) was formed to replace MPB and took over all responsibility related to policy decisions. Since then Thailand has been officially targeting inflation as the intermediate target to achieve price stability in the economy. When the country adopted IT there was no central bank act to pursue an independent monetary policy; rather

central bank policy was given a *de-facto* independence for conducting monetary policy. In the year 2008, the central bank of Thailand amended The Bank of Thailand Act to pursue IT policy independently. The amended act envisaged to maintain price stability, financial stability and stability in the payment system. The MPC sets the inflation target along with the consultations of the ministry of finance. In the policy framework, to avoid the frequency of missing the target, they have followed a range target for inflation where inflation is set in a range from 0.5 to 3 %. Again to make a clear communication with the public, the range target was changed and point target with bands on either side was adopted. This change was argued to be a superior method for giving a clear indication of the future inflation path of the economy. In the beginning, they followed a zero lower bound in the inflation target but later Bank of Thailand (BoT) expressed concern over the problem of deflation in targeting a zero rate of inflation. According to BoT, a zero inflation target at lower bound of the inflation target leads to the problem of deflation. Similarly, following the MPCs suggestion there are some changes in the key policy rate. Earlier the repo rate used to be 14-days, but later they changed it to 1-day.

In the case of institutional arrangement, the BoT designs a strong communication strategy with the public. It publishes press notice and conference on the monetary policy immediately, at least after two weeks. It also has a strong rule of action for the governor of central bank for missing the inflation target, In case the inflation target missed, an open later is compulsory for the governor justifying the reason for missing the target. This type of restriction encourages the governor to take all possible action to increase transparency in monetary policy.

Table 2.1 Designing features of IT policy

	Target measure	Target 2012	Target type	Target horizon
Indonesia	HCPI	4.5%±1pp	P+T	Medium term
Philippines	HCPI	4.0%±1pp	P+T	Medium term (from 2012-14)
Israel	HCPI	1-3%	Range	Within two years
South Korea	HCPI	3%±1pp	P+T	Three years
Thailand	HCPI (a)	3.0%±1.5pp (a)	P+T	Eight quarters

Note: P+T stands for inflation target with point in band either sides. HCPI stands for headline consumer price index.

2.3 Review of Literature

IT has been very popular in emerging economies due to its various achievements. But it is observed that the achievement is different for different countries. This difference strikes an important question about IT policy is that under what conditions member countries have adopted IT policy. According to Mishkin and Schmidt-Hebbel (2001) inflation targeters exhibit some commonalities and many differences in inflation targeting preconditions, target design and operational features. It means, there are different factors which might have led to the adoption of IT policy.

Mishkin and Schmidt-Hebbel (2001) used annual data of 27 countries from 1990-1999. Several control variables were also used including exchange rate regime and monetary targeting dummy. They used a multivariate probit model in search of right variables that increase the likelihood of adopting inflation targeting. Using a set of variables they show that past high inflation increases the chances of adopting IT in the member countries. They argue that the main objective of adopting IT in emerging countries is to bring down the double digit inflation to a single digit level. Further, they find that high openness increases the likelihood of implementing IT. In other words, the countries which are more open in trade activity are prone to adopt IT. Further, low fiscal surplus ratio to GDP has a high chance of adopting IT. However, exchange rate band has no significant impact in choosing IT. But monetary targeting dummy is negatively significantly associated with the adoption of IT. This indicates that monetary targeting policy cannot be compatible simultaneously with inflation targeting policy. This is true because the failure of monetary targeting has necessitated to find out a better nominal anchor. In addition to that, high central bank independence in key instrument increases the probability of adopting IT. In other words, when the central bank has sole power over exercising its policy instrument there are more chances that the monetary authority will get discretion to maintain price stability. However, high central bank independent in goal setting is negatively associated with the implementations of IT. It means government should set the goal to benefit IT country because that objective is backed by their rolling government. Mukherjee and Singer (2008) used a spatial Probit model for both OECD and non-OECD countries from 1987-2003. They show that a high inflation and IT are positively related. In other words, a country at higher inflation level has more chance to implement IT than those which have low inflation. High GDP volatility is another important determinant which increases the likelihood of adopting IT policy. This decision is rationale in the point that countries

experiencing high fluctuations in GDP are less stable in macroeconomy which may require an alternative nominal anchor to replace existing policy. The real effective exchange rate is positively associated with IT meaning that IT can be implemented when the external value of domestic currency declines. Real interest rate is also positively related to adoption of IT. Moreover, they observed that floating exchange rate and IT are positively significantly related. It means, when a country switch to floating exchange rate regime, it becomes easier for countries who adopt IT. Neither fixed exchange rate can work alongside with IT which is not sustainable. However, they show that openness and GDP per capita are insignificant determinants in explaining the decisions to choose IT. In other words, a country can adopt IT irrespective of the performances in external trade activity and income level a country. Similarly, they find an insignificant association between central bank independence and IT. They argued that independent central bank can not necessarily lead to the adoption of IT. Instead, central bank independence comes after the adoption of IT policy. Goncalves and Carvalho (2009) estimated the same for 30 OECD countries from 1980-2006. They also show a positive relationship between IT and inflation level in OECD countries. Their point is that a country is more prone to adopt IT when it is suffering from high inflation. To reduce inflation to a low level they find IT as a better tool in current times. Further, debt and IT are found to be negatively associated. They argue that high debt stands as a tough job for the government to convince the public to belie that they will be successful in maintaining the target rate of inflation.

On the other hand, Hu (2006) show that inflation and IT can be negatively related. Using logit model into the annual observations from 1980 to 2000 for 66 countries, he shows that IT countries have implemented this new regime at a low level of inflation. His argument is that IT countries have followed a first phase of reducing inflation to a low level before adopting IT and after a low inflation level is reached a country has the preference to implement IT policy. Further, they show that external debt is associated with IT and trade openness is positively associated with IT. County's fiscal position is positively but weekly associated with the implementation of IT meaning that high fiscal position can enhance the functioning of IT regime but not significantly. Further, they show that financial depth has a positive impact on IT. He argues that high monetization can have a positive impact on adopting IT. Further, central bank independence increases the likelihood of decisions to choose IT. The autonomy of central bank functioning is most needed in an IT regime to ensure politics free working of the new regime towards achieving low and stable

inflation. The determinants like floating exchange rate regime are positively associated with IT. Since fixed exchange rate constrains IT to function loosely, the presence of floating exchange rate regime is the advantage for implementing IT. Lin and Ye (2007) used propensity scoring method for seven developed countries from 1985-1999 to find the important factors which determine the adoption of IT. They found that there is less chance of adopting IT when the level of inflation is high. So in other words, a low inflation environment is suitable for implementing IT policy. Secondly, low central bank independence and fixed exchange rate reduce probability of adopting IT. Further, high money growth also discourages a country to adopt IT policy. Higher trade openness in an economy does not support IT type monetary regime. However, real per capita GDP is insignificant in influencing the decisions to adopt IT. In a similar line, Lin and Ye (2009) used propensity scoring method for 52 developing countries from 1985-2005. Past inflation has negative impact on the decision to implement IT indicating that low inflation developing countries have supporting condition to adopt IT policy. Openness is negatively related to the choice of IT. Per capita GDP is not an important factor for influencing IT. Fixed exchange rate is negatively related to IT. Money growth is negatively influencing the choice to adopt IT. Similarly, Lucotte (2010) used a Probit model for 30 emerging countries from 1980 to 2006. They found that central bank independence is an important factor for choosing IT. Financial depth is negatively related to IT but the statistical significance is low thus indicating that these determinants do not play a significant role in decision to implement IT. This shows that less developed financial market is found to be a suitable pre-conditions for emerging countries to adopt IT policy. Further, floating exchange rate, trade openness and real GDP are positively affecting the decision to take IT. In other words, emerging countries consider high trade activity and high growth as essential preconditions which need to be fulfilled while implementing IT. But inflation rate is negatively related to IT. Moreover, Leyva (2008) employed both logit and probit models for a large dataset of countries from 1975 to 2005. Their study observed that financial openness is negatively associated with IT. In other words, a central bank which already following IT policy should not focus more on increasing transparency in financial imbalances related information. Additionally, it is also suggested that countries with high GDP have high probability of adopting IT policy. However, fiscal discipline plays an insignificant role in decisions to adopt IT. But when there are an open economy and strong financial development, there is a high probability of adopting IT. In a similar vein, Vega and Winkelried (2005) did a cross-country analysis for 109 countries for the

period 1990 to 2004. They took five-year average of observations to make a cross-sectional analysis and used propensity score method to conduct the estimation. Their empirical results reveal that the level of inflation is positively associated with IT suggesting contrary findings to what Lin and Ye (2009) found for a large sample of developing countries. However, other determinants were in line with the above arguments. The inflation volatility and openness are negatively associated with IT. But fiscal balance is positively weakly associated with IT. Similarly, high financial depth increases the probability of adopting IT policy. Another factor which is positively influencing the likelihood of implementing IT is the high investment. Moreover, De Mendonc¸a and de Guimar˜aes e Souza (2012) used propensity score matching 180 countries from 1990-2007. GDP per capita positively influence the decision to implement IT. When Government fiscal balance significantly and negatively decides to adopt IT, financial depth said it is positive. Additionally, high capital account openness and trade openness raises the probability of implementing IT policy. Past inflation and exchange rate have negative impact on the decision to adopt IT.

2.4 Empirical Methodology

A country's choice to adopt IT is a discrete behaviour over time. For instance, a country might choose to implement IT in the 1990s and another may be in 2000s. Thus, the choice to implement IT policy is qualitative in nature. But this decision to adopt IT can be captured through an IT dummy. So, a qualitative dummy dependent variable model is suitable for this study. Following Mishkin and Schmidt-Hebbel (2001) and Goncalves and Carvalho (2009) this study uses a binary Probit model in a panel framework. This panel Probit model will give us the likelihood of adopting IT in Asian economies. Since the study deals with panel data, country-specific effect should be controlled while estimating the model. But unfortunately there are no fixed effect specifications in probit model. However, an alternative method can be a logit model which captures county specific aspects in panel data analysis. But the main problem in this model is that it drops observations where IT is not implemented during the time but it is implemented for some other observations. In other words, $n_i = \sum_{t=1}^{T} y_{it} = 0$ are excluded from likelihood function (Wooldridge, 2002), where y_{it} is binary dependent variable in the latent model and *i* and *t* stand for the number of countries and length of time. So, this study does not use fixed effects model. But we use a panel probit model

with robust (White-corrected) standard errors in the analysis. We also use a Panel Probit model with random effect model.

The general structure of a multivariate latent model is specified as follows:

$$y_{it}^{*} = a + \beta Inflation_{it} + \gamma CBI_{it} + \delta Openness_{it} + \emptyset debt_{it} + \partial financial\ development_{it} + \vartheta GDP\ growth_{it} + \varphi financial\ openness_{it} + \omega Govt.spending_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

i=1,2……..N; t=1,2….T,

Where $y_{it} = 1$ if $y_{it}^{*} > 0$, $y_{it} = 0$ if $y_{it}^{*} \leq 0$; y_{it} is a discrete binary dependent variable which is set equal to 1 if a country has implemented IT and 0 if a country does not adopt IT. The right-hand side variables are explanatory variables and can be measured directly. Inflation in all thirteen countries for given period is calculated as the annual change in CPI index. CBI stands for Central bank independence. Openness refers to total trade with the external world as a percent of total GDP. Debt measures the gross public debt of a country. Financial development is measured as the ratio of M3 to GDP. GDP growth is calculated as an annual change in total GDP in a country. Financial openness is an index value stands for capital account openness. Govt. spending is defined as the total expenditure as a percentage of GDP. ε_{it} is free from serial correlation and heteroscedasticity.

Then the probability of adopting IT can be specified as follows:

$$\Pr (y_{it}=1/\ldots) = f\ (a + \beta Inflation_{it} + \gamma CBI_{it} + \delta Openness_{it} + \emptyset debt_{it} + \partial financial\ development_{it} + \vartheta GDP\ growth_{it} + \varphi financial\ openness_{it} + \omega Govt.spending_{it}) + \eta_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where, f (.) is a standard normal cumulative distribution function and η_{it} is the error term. The choice of IT is based on the information central banks have at the time of adopting this policy. The study may be irrelevant if we include the information after the IT is adopted. For instance, IT is adopted at period t, so t+1 period is not that much important as t-1 period has in the decisions making process? So, we limit our sample period till the year of adoption of IT and exclude the post-IT years. By doing so, the study avoids the problems of reverse causality and endogenous arising from it (Samarina et al., 2014).

2.5 Data and Variables Description

The study uses annual data consisting of eight variables for 13 Asian countries from 1985-2005 out of which there are five inflation targeting countries. To make two group comparable and avoid the selection bias, the study also uses six non-inflation targeting countries (hereafter non-IT) as a control group from Asia. These non-IT countries are following some other form of monetary policy like exchange rate targeting, monetary targeting, etc. This control group is chosen based on their similar economic features with IT countries. All the details are described in Table 2.2 and 2.3 regarding the name of the countries and the date of official adoption of IT policy. The eight variables which are used in the study are level of inflation, gross public debt (% of GDP), central bank independence (CBI), trade openness (% of GDP), financial development, GDP growth, financial openness and government spending (% of GDP). All the data are taken from WDI (World Bank), IFS (IMF), Dincer and Eichengreen (2014), Chinn and Ito (2008) and Abbas et al. (2010).

Table 2.2 list of countries in the sample

IT countries	Non-IT countries	
Israel	India	Singapore
Indonesia	Iran	Saudi Arabia
Philippines	China	Malaysia
Korea	Kuwait	Pakistan
Thailand		

Source: Author's calculation.

Table 2.3 official adoption year of IT in Asian countries

Asian IT countries	Official adoption*
Israel	1997
Indonesia	2005
Philippines	2002
Korea	1998
Thailand	2000

*The official adoption date of IT policy is taken from Bank of England report (2012).

Source: Author's calculation.

All the above variables are related to IT policy with different signs. A detailed description of variables and expected signs are given in Table 2.4. It is argued that adoption of IT at a high level of inflation may not result in good outcomes. So, central banks intending to follow IT, could begin

to decelerate their inflation rate to a moderately low level and then they adopt it. This indicates that low inflation can be a pre-condition for adopting IT. Thus, we can infer a negative relationship between IT and level of inflation. But there are some other studies, which have argued that high inflation can be a reason for implementing IT policy to contain rising general price levels. Their main observations are that the high inflation countries suffer from inflation uncertainty and uncertainty in investment decisions leads to low growth. Further, high inflation cause banking crisis in the economy leading to mass destruction in the financial conditions of a country. So, implementing a suitable monetary policy, which can anchor inflation as well as inflation expectations would be more useful. In this case, IT seems to be a suitable policy which can be adopted at high inflation rate to anchor inflation uncertainty. Similarly, high public debt can have negative impact on implementing IT. The reason is that a highly indebted country faces tough task in convincing private sector about their strong commitment towards low inflation. This process makes people anticipate high future inflation which further leads to non-adoption of IT. Similarly, a developed financial market can reduce short-term risk arising from the shortage of funds and can provide better allocations of resources for real economy. This way a well-functioning financial system takes care of output growth and risks. So, a positive relationship is expected to be existing between financial development and the adoption of IT. However, a negative relationship may be expected between financial development and IT, as the IT policy can strengthen the financial system. Similarly, a low economic growth can encourage for the implementation of a nominal anchor, which can give sustainable output growth by reducing uncertainty about the actions of monetary policy. So, IT as a nominal anchor can best serve to reduce the gap between monetary policy and private sector and thus, can improve the functioning of monetary policy towards higher growth. So, it can be inferred that a negative relationship can exist between GDP growth and IT policy. But trade openness can positively influence the implementation of IT. This can happen if Romer's (1993) hypothesis is true. The high open economies can reduce their inflation pressure by importing cheaper goods and making favourable for IT central banks to achieve the target. Similarly, an independent central bank can be more committed towards price stability. Interference of government can obstruct that path as they may be interested in populists' policy at time. Complete freedom in instrument operations can achieve a low and stable inflation rate. So, we can say that a positive relationship may be expected between central bank independence (CBI) and adoption of IT.

Table 2.4 List of variables and Data source

Variables	Description of variables	Expected sign	Data sources
Inflation	% change in annual CPI index	-/+	WDI, World Bank
Debt	Public debt (% of GDP)	-	IMF, Abbas et al. (2010)
Financial development	Total private credit (% GDP)	+	WDI, World Bank
GDP growth	% change in GDP	-	WDI, World Bank
Openness	Sum of export and import as percentage of GDP	+	WDI, World Bank
CBI	Central bank independence	+	Dincer and Eichengreen (2014)
Financial openness	Updated Chinn-Ito index of capital account openness	+	Chinn and Ito (2008)
Govt. spending	% change in government spending	-/+	WDI, World Bank

Source: Author's Calculation.

Additionally, it is argued that an increasing macroeconomic stability can ensure a conducive environment for implementing IT policy. But, it always does not produce desired outcome. Barro and Sala-i-Martin (1995) argue that government spending on productive capital can lead to economic growth but spending the same on unproductive capital can lead to low growth. So, the sign of relationship between government spending and IT can be either positive or negative.

2.6 Empirical Results and Discussions

2.6.1 Unit root test result

When the Probit model is used in cross-section data it raises no issues on stationarity. But when Probit model is used in panel data analysis, stationarity check is necessary. So, this study uses the panel unit root test Im et al. (2003) to test stationarity of all independent variables. This study finds Im et al. (2003) test as a suitable test because of its less restrictive nature. It enjoys more power compared to other unit root test in the Monte Carlo simulation (Baltagi, 2005).

Table 2.5 Panel Unit Root test results

Variables	Im, Pesaran and Shin W-statistics	
	Levels	Difference
Inflation	-1.473**	
Debt	0.709	-1.884**
Financial development	0.629	-1.666**
GDP per capita	1.446	1.491**
Openness	2.732	-2.826***
Financial openness	1.329	-2.249***
CBI	1.074	-2.642***
Govt. expenditure	-0.020	-1.590**

Note: ***, ** and * indicates statistical significance at 1%, 5% and 10% levels.

Source: Author's Calculation.

The test is superior to Levin et al. (2002) by allowing heterogeneity in the dynamic panel groups. The unit root test result is reported in Table 2.5 which shows that inflation is stationary at level. Other variables are stationary at first difference indicating unit root in the level of these variables. Finally, a panel probit model is estimated with random effect and the result is reported in Table 2.6. The result shows that none of the variables is statistically significant even at 10 percent level. This indicates that the variables like inflation rate, debt, openness, etc., are not significant factors that induce the Asian countries to adopt IT policy. But due to this noisy result, the final estimation is conducted by the Probit model with robust (White-corrected) standard errors. We need robust standard errors because the binary nature of our outcome induces heteroscedasticity. The result reported in Table 2.7 shows that inflation, debt and financial development are negatively related to the adoption of IT policy. This means a low inflation, low debt and low financial development create favourable condition to implement IT in Asian countries. In other words, a country having high inflation will have less tendency to switch from existing monetary policy to IT policy. But it is known that the coefficients of the result of Probit model can't be interpreted directly so, we use an average margin effect analysis.

Table 2.6 Factors leading to IT adoption in Asia (Panel Probit model with Random effect)

Factors	Coefficients
Inflation	-0.38(0.66)
Debt	-0.15 (0.38)
Financial development	-0.14 (0.73)
GDP growth	11.22 (0.56)
Openness	0.50 (0.39)
CBI	43.30 (0.31)
Financial openness	-3.47 (0.85)
Govt. spending	0.12 (0.86)
Constant	133.46 (0.46)
No. of observations	71

Source: Author's Calculation.

The estimated result is reported in Table 2.8. The result suggests that low inflation increases the probability of adopting inflation targeting in Asian economies. This is true as it is evident from figure 1 where the inflation rate at the time of adoption of IT is shown for all countries, including our sample. This is true as Masson et al. (1997) argued that the inflation targeting is effectively implemented in a low inflation environment. The member countries initially try to bring down inflation to a comfortable level and then IT is put in place. If we look at Figure 2.1, it is clear that all the countries had adopted IT when they were at low single digit inflation level. The result is in contrast with Mishkin and Schmidt-Hebbel (2001), Mukherjee and Singer (2008), and Goncalves and Carvalho (2009) who observed that a high inflation condition increased the probability of adopting IT policy. But our result supports the findings of Hu (2006), Lin and Ye (2007, 2009), Lucotte (2010), and de Mendonc¸a and de Guimar˜ aes e Souza (2012).

Table 2.7 Factors leading to IT adoption in Asia (Probit Model)

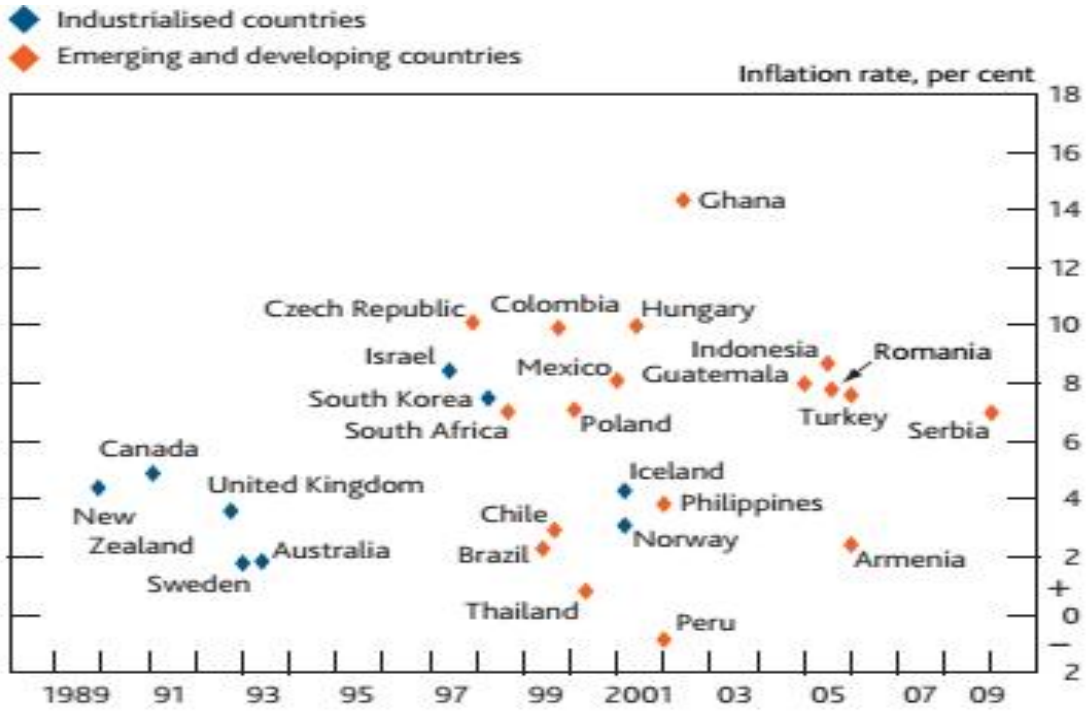
Factors	Coefficients
Inflation	-0.38 (0.00)***
Debt	-0.15 (0.00)***
Financial development	-0.14 (0.09)*
GDP growth	-11.22 (0.02)**
Openness	0.50 (0.01)***
CBI	43.29 (0.00)***
Financial openness	-3.47 (0.23)
Govt. spending	0.002 (0.40)
Constant	-133.31 (0.01)***
No. of observations	71
Pseudo-R squared	0.84

Note: ***, ** and * indicate statistical significance at 1 %, 5% and 10% levels. The model is estimated with robust (White-corrected) standard errors.

Author's Calculation.

Another significant factor is central bank independence (CBI), which raises the likelihood of implementing IT regime in Asia. The magnitude of its marginal effect is the highest among all determinants showing central bank independence is the foremost pre-condition for implementing IT policy in Asian countries. The independence of central bank in instrument setting and objective setting is a major step which can help the governor to achieve the desired rate of inflation. No political interference in the policy decisions can help the central bankers to achieve a low and stable inflation rate. This is in line with Korean experience where first political and institutional independence was ensured first by passing the Bank of Korea (BOK) act 1998. A similar case is observed in Indonesia where Central Bank Act, 1999 had given legal independence and allowed the authority to formulate and implement the monetary policy. Another factor is GDP growth, which is found to be negatively related to IT policy. In other words, low output growth has increased probability of implementing IT in the Asian economy. In addition to that, debt variable is statistically significant and bears a negative sign with IT policy. It indicates that high debt in Asian economies reduces the likelihood of adopting inflation targeting.

Figure 2.1 Inflation rate at the time of IT adoption.



Source: Bank of England Handbook (2012).

It is true because high debt may create high inflation and this leads to problem for the monetary authority to control inflation target. So, low debt can be a good pre-condition for implementing IT in Asia. But the debt coefficient is low in magnitude in the marginal effect indicating that this factor has lesser importance than central bank independence.

Similarly, openness has significant positive impact on IT. It means, when openness is high it increases the probability of adopting IT in Asia. High open economy can reduce inflation pressure and thus, make the job for IT central banks easier in achieving the target. This true when Romer's (1993) hypothesis is true for those Asian economies. Furthermore, a factor like financial development is negatively related to IT. The coefficient is statistically significant indicating that high financial development can discourage adoption of IT policy. It is because high financial development measured through M3 can cause high inflation environment, following quantity theory of money. The high inflation adversely affects the operations of financial market leading to insignificant growth effect of financial development. (Rousseau and Wachtel, 2002).

Table 2.8 Average Marginal effect analysis in Probit model

Factors	Coefficients
Inflation	-0.007 (0.02)**
Debt	-0.003 (0.00)***
Financial development	-0.002 (0.04)**
GDP growth	-0.225 (0.00)***
Openness	0.010 (0.00)***
CBI	0.868 (0.00)***
Financial openness	-0.069 (0.14)
Govt. spending	0.002 (0.40)

Note: ***, ** and * indicate statistical significance at 1 %, 5% and 10% levels.

Author's Calculation.

As there is negative growth impact of financial development, IT policy is more likely to be in the place where financial development is low. However, government spending, which is taken as a proxy for macroeconomic stability, is showing positive relationship with the implementation of IT policy. In other words, higher is the macroeconomic stability more is the chance to adopt IT policy. But this variable is insignificant in our model indicating that this pre-condition is not that important in adopting IT. Similarly, financial openness is insignificant which indicates that this factor has no role for encouraging the authority to adopt IT.

2.7 Concluding remarks

The chapter conducted an empirical analysis to explore the important factor which are responsible for adopting IT policy in Asia. The underlying rationality for this comes from the fact that countries implementing IT policy have different policy outcomes in terms of macroeconomic conditions. Since the countries have dissimilar experiences from adopting a similar monetary policy, a possible reason is given for saying that different economic and institutional conditions might be playing an important role in yielding such results. So, this chapter tried to examine the factors, which are responsible for adopting IT policy in Asia. After analyzing a set of time series variables for a long span of time, using a Probit model, the study arrived at some important conclusions. First, a low inflation condition and a high central bank independence increase the probability of adopting IT policy. This result is in contrast with Mishkin and Schmidt-Hebbel (2001), Mukherjee and Singer (2008), and Goncalves and Carvalho (2009), who observe that high inflation increases the likelihood of implementing IT. This is a major departure from the existing literature indicating differential level of macroeconomic conditions at the time of implementing IT policy. This result suggests that emerging countries adopt IT when inflation is at low level and they have high central bank independence. Further, high openness increases the probability of implementing IT in Asia. This is again a departure from the result of Gerlach (1999), Vega and Winkelried (2005) and Lin and Ye (2009) who observed that low openness has high likelihood of choosing IT policy. Second, those countries show less interest in implementing IT policy when they have high debt, high financial development and high GDP growth. In a high debt and high financial development economy it is hard to control inflation within the target as people are not easily convinced about the commitment of monetary authority. So, it suggests that a country having increasing debt along with high financial development discourages adoption of IT policy.

CHAPTER 3

Credibility of Inflation Targeting: Some Recent Asian Evidence

"*A sharp regime-shift produces credibility, and hence a shift in expectations that makes disinflation costless*" (Sargent, 1983).

3.1 Introduction

The short run trade-off between inflation and growth is well documented in macroeconomic theory. It is also suggested that a credible monetary policy can significantly lower the magnitude of this trade-off (De Roux and Hofstetter, 2014). The inflation targeting (IT) regime has been popular across the world, especially in emerging market economies since its inception in New Zealand in the early 1990's. Several studies on advanced countries find that there is no significant impact of IT on the decline in inflation level and its volatility (Ball and Sheridan 2003; Lin and Ye, 2007). However, studies that analyze emerging and developing countries show that IT significantly decreases inflation, its variability, inflation persistency and inflation expectations (Batini and Laxton 2006; Goncalves and Salles, 2008; Gemayel *et al.*, 2011; Hallett and Libich, 2012; Gupta et al., 2016). In a paper Mishkin (2000), Vegaa and Winkelried (2005) observed that emerging and developing countries benefit more from IT adoption than advanced ones. A possible explanation for this difference is that emerging and developing countries adopt IT under more difficult economic circumstances, hence the impact of IT is more noticeable for them. Additionally, credibility gains from IT adoption are higher in emerging and developing countries, because they arguably have low credibility at the start of IT regime. Mishkin (2000) argued that the IT policy can be highly useful for emerging economies avoiding several potential problems faced in other forms of monetary policy. However, the effectiveness of IT in lowering sacrifice ratio still remains debatable both in the policy circle and academic research. Sacrifice ratio is defined as the percentage loss in annual real GDP in order to achieve a 1 percentage fall in the long run inflation. When Goncalves and Carvalho (2009) are of the view that IT has significant impact in lowering sacrifice ratio, De Roux and Hofstetter (2014) show that IT and speed of

disinflation can be used alternatively as credible monetary policy to achieve lower sacrifice ratio. On the contrary, studies by Brito (2010) and Mazumder (2014) suggest that IT has no significant impact on the cost of disinflation. But it is believed that the features of IT, if explicitly mentioned, can be proved as credible monetary policy (Hallett and Libich, 2012). In other words a high level of transparency through effective communication[5], explicit quantitative target and accountability might increase the credibility of inflation targeting. As a result, expectations of people might become forward-looking, which may lower the inflation-output tradeoff because of falling nominal wage rigidity (Sargent, 1989).

In view of the above discussion, an attempt has been made in this chapter to find out the credibility of IT regime for five Asian economies. To be more specific, this paper seeks to test the significance of IT in lowering sacrifice ratio. There is a reason for choosing sacrifice ratio in the assessment of credibility of IT policy. The IT regime was adopted in order to control inflation rate which indicates the central Banks' main focus is on the rate of inflation. It has also been pointed out that disinflation was put forward immediately after the IT was adopted (Ball and Sheridan, 2005; Mishkin and Schmidt-Hebbel, 2007). So, following the Philips curve and the Okun's law there might be some short run output loss due to immediate disinflationary policy. But the New Keynesian Philips Curve shows that the disinflationary policy could be costless under a credible monetary policy. Therefore, in this paper sacrifice ratio is chosen for measuring disinflation cost for analyzing the efficacy of IT policy. The study differs from the existing literature in two ways. First, a measure of sacrifice ratio is presented that captures persistence effects, which to the best of our knowledge, has not been proposed before for the Asian economies. Although, Mazumder (2014) calculated sacrifice ratio for Asian economies implicitly, he used only Ball's (1994) method, which does not account for the persistence effects in the disinflation process.[6] It is argued that disinflationary policy or demand contraction policy can have a long-lived effect on real output

[5] Dincer and Eichengreen (2007) shows that inflation targeting is more transparent that any other regime such as exchange rate regime etc. Others like Mishkin and Posen (1997), Gurkaynak et al. (2010) Johnson (2002), Levin et al. (2004), Stone and Roger (2005) supported the views.

[6] Several studies like Zhang (2005), Hofstetter (2008), Senda and Smith (2008), De Roux and Hofstetter (2014) have found that this method underestimates the disinflation cost by neglecting the persistence effects.

(Blanchard and Summers 1986; Romer and Romer, 1989). So, high persistency effect slows down the adjustment speed of output growth required to return to its potential level when it deviates from its original level. Therefore, the additional output loss is calculated in this study, by taking into account the long-lived effects in a disinflation process, which was neglected in Ball's (1994) method.

The rest of the chapter is organized as the following: Section 3.2 briefly presents the theoretical framework of the study. Some major past studies are reviewed in Section 3.3. Section 3.4 describes the methodology of episode method. The results of sacrifice ratio in Asian economies and the significance of IT as a determinant of sacrifice ratio are discussed in sections 3.5 and 3.6 respectively. Section 3.7 presents results of the robustness test. The concluding remarks are offered in the last section.

3.2 Theoretical Framework

Of late, Sacrifice ratio has been a popular textbook concept in discussing macro-monetary policy. Mankiw (2010) defines sacrifice ratio as "*the number of percentage points of annual output lost in the process of reducing inflation by 1 percentage point*". Thus, if a country is willing to reduce inflation to a low level then it must have to tolerate the cost of disinflation in terms of low growth and high unemployment. This idea is well documented in the theory of Philips curve which states that there is an inverse relationship between unemployment and inflation. In a pioneering work, Philips (1958) argued that "a tradeoff exists between output growth and inflation". Later, Phelps (1967) and Friedman (1968) both independently discovered that the inverse relationship between unemployment and inflation held in the short run only. In the long-run, the disinflation did not have any impact on unemployment. They argued that if a country tried to reduce inflation it would incur output loss only in the short run but not in the long run. They pointed out that the consumer expectations had an important role in the short-term output loss. Okun (1978) argued that the process of disinflation involved significant amount of output loss. Taylor (1983) argued that the output loss during a disinflationary period might occur due to slow adjustment of the wages and prices over time. Though there has been several explanations for the slow adjustment of the wages and prices, Taylor's (1983) explanation stated that people's expectations were adaptive in nature and hence created an inertia. Since wage and price were directly linked to the expectations, inertia in the expectations made the process slow. Ball (1994) argued that the gradualism process created

speculation about future course of policy which led to non-adjustment of expectations. Thus, how fast the short-term trade-off disappeared depended on how quickly people adjusted their expectations of inflation. When people's expectation is rational, they revise their expectation quickly, and as a result, there is no significant amount of output loss (Sargent, 1983). Recently, one also finds use of new Keynesian Philips Curve in the monetary policy analysis. Gali and Gertler (1999) and Gali et al. (2001, 2005) proposed a new Keynesian Philips Curve which considered the forward-looking behaviour of people's expectation. Following a Calvo-type staggered price setting, this model showed that the inflation rate was positively related to both expected inflation and firm's mark up (marginal cost). This type of model assumed that the expectations process was forward looking and there was no harm in reducing inflation. In other words, the quick response of inflation to a tight monetary policy might lead to costless disinflation under full credibility. So, a country under disinflationary policy might experience negative sacrifice ratio.

3.3 Some major past studies

In a pioneering work Okuns (1969) used a Philips curve model to calculate sacrifice ratio. Using Phillips curve model, he arrived at an average sacrifice ratio of 10 percent for U.S. Gordon and King (1982) and Mankiw (1991) also used Philips curve model in calculating sacrifice ratio for the U.S. The sacrifice ratios were 3 and 2.8 respectively in these studies and were significantly lower than Okun's result. However, the Philips curve model was criticized for assuming constant tradeoffs over different time periods. So, Ball (1994) proposed an episode method to calculate sacrifice ratio by allowing time-varying trade-offs. By using an episode method technique, Ball (1994) showed that the sacrifice ratio was 1.4 in annual data and 0.8 in quarterly data for all OECD countries. After allowing for the dynamics in trade-off between output and inflation, he observed a smaller output loss of 2.4 in the U.S compared to results reported by previous studies. Bernanke et al. (1999) also estimated sacrifice ratio using Ball's type of episode method for nine OECD countries. They arrived at the magnitude of 1.35 which was closer to the findings of Ball's (1994) sacrifice ratio of 1.59. Later, Ball's episode method was modified to capture persistency effects in the calculation of sacrifice ratio. Zhang (2005) presented the estimation of sacrifice ratio of 2.5 for G-7 countries arguing that the disinflation policy had a long-lived impact on output. He argued that the sacrifice ratio calculated by Ball's (1994) method ignored additional output loss occurring

in the disinflation process. Further, Hofstetter (2008) argued that there could be hysteresis effects in the disinflation process. So, he presented sacrifice ratio with further modifications in Zhang's (2005) method for Latin American and Caribbean (LAC) countries. Interestingly, he observed a negative sacrifice ratio indicating a costless disinflation being enjoyed by the LAC countries. Sethi and Acharya (2016) calculated sacrifice ratio for India using disaggregated time series data. Using episode method, they showed that the sacrifice ratio in manufacturing sector was 0.2 which was different from the sacrifice ratio of 1.5 calculated in aggregated GDP. So, they suggested that the calculation of sacrifice ratio should account for cost of disinflation by sectors. Similarly, few other studies used structural VAR to estimate sacrifice ratio (Cecchetti, 1994). Cecchetti and Rich (2001) used three different structural VAR models in the calculation of sacrifice ratio for the U.S. They showed that the output loss numbers were 1.37, 1.27 and 9.87, respectively in the three models. The high sacrifice ratio in last model compelled them to infer that the use of more complicated SVAR model yielded imprecise estimate of disinflation cost. Durand et al. (2008) and Belke and Boing (2014) estimated sacrifice ratio for the euro area using SVAR model. The sacrifice ratios for the euro were 1.19 and 0.25 respectively. However, these studies were limited to OECD countries only. Apart from calculating sacrifice ratio, there were studies that had explored some of the important factors that could explain sacrifice ratio. When Ball (1994) argued that speed was a significant determinant of sacrifice ratio, Zhang (2005) pointed out that initial inflation was an important determinant of sacrifice ratio. Further, Senda and Smith (2008) showed that the history of inflation was negatively related to disinflation cost. Hofstetter (2008) supported the finding and argued that high inflation in Latin America and Caribbean countries had led to a very low sacrifice ratio. However, it still remained a debate whether IT could lower disinflation cost. To test the potential benefits of IT, Bernanke et al. (1999) used Ball's (1994) episode method. They suggested that IT had no effect in advanced countries at least for the first IT episode. Interestingly, Goncalves and Carvalho (2009) later showed that IT could significantly lower sacrifice ratio. Using Ball's (1994) method with quarterly data they found that IT policy could significantly reduce disinflation cost in OECD countries. However, Brito (2010) using the same sample did not find such potential benefits of IT for OECD countries. He claimed that the above finding used only a peculiar set of episodes without controlling for dissimilar economic conditions. Supporting the result, Mazumder (2014) did not find IT to be an important determinant of sacrifice ratio in both OECD and non-OECD countries. But both the studies used Ball's (1994) method, which could be questioned for

misleading the actual sacrifice ratio. On the other hand, De Roux and Hofstetter (2014) came up with new findings for the OECD countries using the same sample as that used by Goncalves and Carvalho (2009). They argued that both IT and speed could be used alternatively as credible monetary policy to achieve low sacrifice ratio. Their suggestion was that the country under IT could reduce sacrifice ratio only if they followed a path gradualism as suggested by Taylor (1983).

To sum up, the literature reviewed above shows mixed evidence regarding the credible effect of IT policy. Since different studies have shown the weakness of Ball's (1994) method stating how it neglected additional output loss occurring in the disinflation process, the methods like Zhang's (2005) and Hofstetter's (2008) could better capture the additional output loss arising from the persistence effects in the disinflation policy.

3.4 Methodology of Episode Method

In the early literature, Philips curve model is used to assess the impact of contractionary monetary policy on unemployment. Philips (1958) show that there exists an inverse relationship between inflation and unemployment. Using different versions of Philips curve model, Okun (1978) show that the reduction of a particular level of inflation is associated with some amount of output loss. But studies pointed out that Philips curve model do not allow the cost of reducing inflation to be different for different economic conditions. In other words, this model treats equal level of sacrifice ratio for both high inflation and low inflation period which is not a realistic assumption in the model. So, Gordon and King (1982) and Ball (1994) criticised the Okun's procedure of measuring sacrifice ratio for neglecting possible dynamics in sacrifice ratio. Gordon and King (1982) suggested for the use of a structural VAR (SVAR) model in the calculation of sacrifice ratio. But Cecchetti and Rich (2001) show that use of SVAR in measuring sacrifice ratio gives high imprecise estimates of sacrifice ratio. Further, Ball (1994) suggested for an episode based calculation of sacrifice ratio. The advantage of this type model is that it identifies only those periods in the full length of time series which show significant disinflation (fall in inflation). In this way the episode method calculates sacrifice ratio for different periods (high inflation and low inflation) allowing dynamics in the calculation of sacrifice ratio. This episode based calculation is more appealing while the study is evaluating the impact of disinflation policy. It is because disinflation occurs in a discontinued manners and calculating the impact of disinflationary policy considering only those periods yields actual assessment of disinflation cost. Ball (1994) for the first time,

developed an episode method to calculate sacrifice ratio. But Ball's (1994) episode method is criticised for underestimating disinflation cost. This method underestimates disinflation cost by not accounting the long-lived effect (Zhang, 2005; Senda and Smith, 2008; Hofstetter, 2008). It is argued that disinflation policy or demand contraction policy can have a long-lived effect on real output (Blanchard and Summers 1986; Romer and Romer, 1989). In other words, high persistence effect could take a longer period for the output to return to its potential level when it deviates from its original level. So, Zhang (2005) method looks suitable for this study for having both advantages as discussed above. First, this method calculates sacrifice ratio for different economic condition and thus, allows dynamics in sacrifice ratio. For instance, using this method we can see the amount of output loss in high inflation period and same in low inflation period. It is a very common fact that reducing inflation which is at a higher level would cost differently than reducing same when inflation is at low level. So, treating all periods to have similar sacrifice ratio could mislead the measurement of disinflation cost. Second, this method yields a measure of sacrifice ratio which accounts persistency effect. Zhang's (2005) method takes care of the impact of persistency effect and thus, allows the method to calculate additional sacrifice ratio which was neglected in Ball's method. Ball (1994) in his episode method assumed that the output loss occurs only one year further from the end of an episode. So, he calculated sacrifice ratio assuming that the actual output returns to the potential level one year after an episode is over. But as some noted work of Blanchard and Summers (1986) and Romer and Romer (1989) have indicated that there is persistency effect, the output loss could continue for more than one year from the end of a disinflation episode. So, constraining the output loss to get over after one year from the end of an episode neglects extra output loss happens beyond one year due to long-lived effect.

Zhang (2005) explains persistency effect through a Lucas supply curve as follows:

$$y_t - y_t^* = \alpha(\pi_t - \pi_{t-1}) + \beta(y_{t-1} - y_{t-1}^*) + \mu_t \quad \ldots\ldots(3)$$

$$\alpha > 0, 0 \leq \beta < 1$$

Where, y_t refers to actual real GDP, y_t^* is potential level of real GDP, π_t is the inflation rate and μ_t is error term. The parameter β measures the degrees of persistency. In other words, higher the β value stronger is the persistency effect and lower the β value weaker is the persistency effect. But when β value is zero then it is considered as no persistency effect. The stronger persistency effect (close to 1) reflects the fact that the output will take time to return to its normal level after a

disinflation episode. In the absence of any disinflationary episode ($\pi_t - \pi_{t-1} = 0$), the output is at its potential level ($y_{t-1} = y^*_{t-1}$) and when there is a disinflationary episode ($\pi_t - \pi_{t-1} < 0$), output falls below its potential level.

To supplement the above models two alternative methods are also proposed here. Our methods use the Baxter-King band-pass filter instead of HP filter to predict potential output keeping other procedure of Ball's (1994) method unchanged. These methods are named as Alt M1 and Alt M2. This additional filter is considered for one reason. The people may argue that the HP filter shows downward bias arising and thud, may not give good results. So, using an additional filter namely Baxter-King band-pass filter may show the relative variations in the result.

The episode method calculates sacrifice ratio in two steps. Firstly, to identify episodes we follow Ball's (1994) criterion. This method identifies episodes from the trend inflation. For annual data, the trend inflation is interpreted as the centered 8-quarter moving average of actual inflation. The trend inflation for year *t* is the average of four quarters inflation of that year and 2 quarters on each side. Then, from the trend inflation, inflation peak and trough are identified. In annual data, year *t* is an inflation peak (trough) if the trend inflation at *t* is higher (lower) than the *t-1* and *t+1* year. Finally, a disinflation episode is selected if the trend inflation falls by 1.5 percent or more between inflation peak and inflation trough. This criterion is intended to separate the effects of policy-induced changes in inflation from temporary shocks (Ball, 1994). Two alternative methods also follow the above procedure to identify episodes.

Secondly, the output loss is calculated in the following way. Here, it is assumed that the potential output and actual output are equal at the starting point of an episode. Then, an output gap is calculated by taking the difference between potential output and actual output. In both the methods, potential output is arrived by calculating the growth rate of HP filter. The output growth at the beginning of an episode is assumed to be the potential growth rate for that episode. Finally, the output loss is calculated by taking the difference between potential growth rate and actual growth rate. Although Hofstetter's (2008) method follows a similar procedure to calculate potential growth rate, it considers a 1-year lag before the start of an episode to calculate output loss. So, the potential output and actual output are equal 1 year prior to the beginning of an episode. It may be argued that the HP filter is biased in predicting trend output when there is a recession (Ball, 1994). However Zhang (2005) argues that using HP filter has small downward bias compared to standard

Ball's (1994) method. So two alternative measures are proposed to supplement the results. The new methods follow a similar procedure as Zhang (2005) and Hofstetter (2008) to calculate output loss but it uses Baxter-King band pass filter to predict the potential level of output.

Then, sacrifice ratio is calculated as

$$SR = \frac{Output\ Loss}{Disinflation}\ , \tag{4}$$

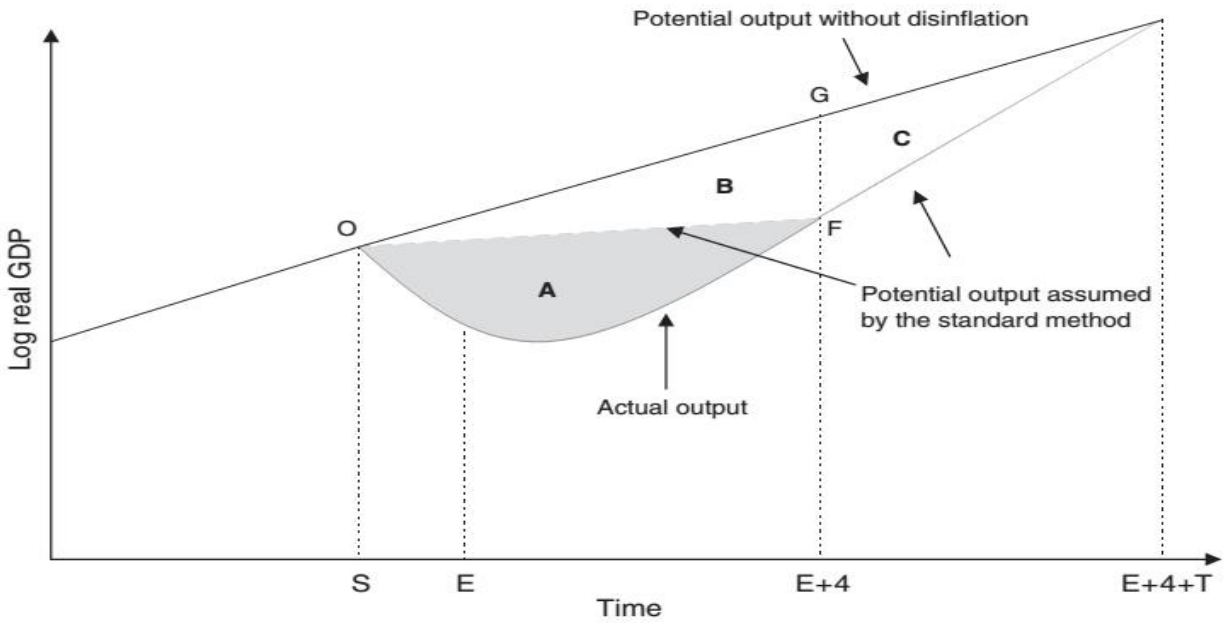
Where output loss is calculated as the difference between potential output and actual output. Disinflation is calculated as the difference between inflation at peak and inflation at trough in an episode.

Further detail regarding the calculation of output loss is shown in Figure 3.1. The diagram shows that the output loss calculated from Ball's (1994) method is lower compared to Zhang (2005) method. For a more clear illustration let's say that a disinflationary episode starts with S and ends at E. According to Ball's (1994) method, we calculate output loss up to E+4 assuming that output returns to the potential level at point F. So, the amount of output loss is the area of A. But this method forces the output to return to its potential level at E+4 which is quite restrictive. It is because there involves persistency effect in the process of output recovery. In other words, the output loss may happen even after E+4 period and may continue up to E+4+T. Here, T refers to the time period at which output converges to its potential level. Now output loss is the area of A+B. So, after accounting persistency effect the output loss is high as the areas of A+B is greater than the area of A which is calculated from standard method. Thus, it suggests that we should not neglect persistency effect while calculating output loss following a disinflationary policy.

3.5 Results and Discussion

The results are based on an annual dataset for 13 Asian economies covering the period 1970-2014. The variables used are inflation and Real GDP. The data are collected from the International Macroeconomics Data set of the U.S Department of Agriculture (USDA). Inflation is measured as the percentage change in consumer price index (CPI). Ball's (1994) method is employed to identify the episodes with one modification. The trend inflation is calculated as three-year moving average of actual inflation.

Figure 3.1 Graphical representation of calculating output loss in Episode method



Source: Zhang (2005).

Having a large sample enables a sensible comparison of the results between IT and non-IT countries. The details of all episodes and corresponding sacrifice ratios are presented in Table 3.1. Following Ball's (1994) procedure, we end up with 34 episodes, a reasonable number, in the Asian countries. It is observed that most of the countries have experienced an average number of two to four episodes with a mean length of four years in each episode.

Finally, the sacrifice ratio is calculated using Zhang (2004), Hofstetter (2008), Alt M1 and Alt M2 methods. These methods capture persistence effects in disinflation process. The basic limitation of Ball's (1994) method lies in its failure to count the long-lived effects in disinflation and as a result the extra output loss resulting from a deliberate contractionary policy is ignored. The result reported in Table 2.1 shows that the average sacrifice ratio for all the 13 Asian economies lies in the range of 0.95 to 1.58 depending upon the methods used in the calculation.

Table 3.1 Disinflationary Episodes across Samples

	Year	Length	Peak	Disinflation	Zhang	Hofstetter	Alt M1	Alt M2	Speed	IT Dummy	IT adoption year
China	1977	5	5.24	3.25	1.095901	1.3930543	0.5945	0.79137	0.2	0	
China	1987	3	14	8.8	1.029491	1.3894103	0.9859	1.33128	0.333333	0	
China	1993	6	17.72	18.16	0.671961	0.8236196	1.10279	1.34061	0.166667	0	
Hong Kong	1976	2	2.89	3.33	2.792037	4.2332706	2.7057	4.10377	0.5	0	
Hong Kong	1980	5	11.35	7.11	2.819631	3.4097449	3.02298	3.65377	0.2	0	
Hong Kong	1988	11	10.59	13.69	1.278384	1.412637	1.79859	1.98014	0.090909	0	
Indonesia	1978	7	15.5	8.89	1.491882	1.7344673	1.10979	1.28523	0.142857	0	July. 2005
Iran	1979	5	20.17	9.39	-2.66569	-3.20598	-5.6382	-6.773	0.2	0	
Iran	2006	3	18.75	4	-1.24263	-1.63702	-0.8858	-1.1612	0.333333	0	
Israel	1990	5	18.8	7.7	0.567	0.789	0.10752	0.15717	0.2	0	June. 1997
Israel	1996	5	11.22	8.74	0.4	0.45	1.59026	1.87012	0.2	1	
Israel	2001	4	2.64	2.11	-1.7	-2.11	-4.4292	-5.5163	0.25	1	
Korea	1991	6	8.03	3.42	3.889308	4.6142634	2.65797	3.17771	0.166667	0	April. 1998
Korea	1997	4	5.62	3.26	-0.33754	-0.396142	-2.0094	-2.49	0.25	1	
Kuwait	1976	10	8.54	7.52	-7.85521	-8.658337	-4.7962	-5.2934	0.1	0	
Kuwait	1988	4	7.77	7.31	-1.1995	-1.488117	-0.7125	-0.8794	0.25	0	
Malaysia	1972	3	10.79	6.83	1.853136	2.4952482	0.60929	1.21975	0.333333	0	
Malaysia	1979	6	7.39	6.74	2.483751	2.9302842	3.18927	3.75339	0.166667	0	
Malaysia	1995	6	3.8	2.4	4.948407	5.8407256	7.72474	9.07978	0.166667	0	
Malaysia	2005	4	3.69	1.87	-1.4946	-1.804118	0.5689	0.77526	0.25	0	
Pakistan	1978	7	10.69	6.09	2.094163	2.4366101	2.25266	2.61775	0.142857	0	
Pakistan	1993	8	11.69	8.58	-0.30683	-0.326553	-0.2549	-0.2681	0.125	0	
Philippines	1971	4	19.64	11.02	0.679617	0.8629644	0.35198	0.5336	0.25	0	January. 2002
Philippines	1978	3	16.27	5.16	0.061453	0.1012307	0.71354	0.97068	0.333333	0	
Philippines	1988	12	13.91	11.27	-2.96614	-3.196018	-0.7208	-0.7635	0.083333	0	
Singapore	1973	3	14.84	13.56	1.175607	1.576076	1.10077	1.47624	0.333333	0	
Singapore	1979	6	6.92	7.04	4.125443	4.7595265	4.97909	5.73512	0.166667	0	
Singapore	1989	12	3.07	3.44	11.99631	13.069613	16.1309	17.5222	0.083333	0	

Table 3.1
Continued

Taiwan	1978	6	15.03	14.86	1.620865	1.9070321	2.14623	2.51995	0.166667	0	
Taiwan	1988	13	4.26	4.45	6.493947	7.1011863	7.96428	8.68462	0.076923	0	
Thailand	1972	3	13.05	7.36	1.153649	1.5575947	1.09839	1.48392	0.333333	0	May. 2000
Thailand	1978	6	14.08	12.37	1.180005	1.3917188	1.62272	1.90822	0.166667	0	
Thailand	1995	4	6.47	5.31	0.01411	0.7656363	0.20504	0.25674	0.25	0	
Thailand	2005	4	4.11	2.04	-3.78011	-4.768133	-0.8735	-1.0463	0.25	1	
Mean ALL		**5.76**	**10.57**	**7.26**	**0.95**	**1.16**	**1.35**	**1.58**	**0.21**		
Mean (IT)		**4.5**	**5.9**	**4.3**	**-1.35**	**-1.70**	**-1.43**	**-1.79**	**0.22**		
Mean(NonIT)		**5.9**	**11.19**	**7.69**	**1.25**	**1.54**	**1.72**	**2.04**	**0.21**		

Source: Author's Calculation. Alt M1 and Alt M2 are two modified method of measuring sacrifice ratio.

This confirms a widely shared view that Ball's (1994) method underestimates the true cost of disinflation (Zhang, 2004; Hofstetter, 2008; Senda and Smith, 2008).[7] The estimated sacrifice ratio is in line with some of the recent findings in the advanced countries (Ball, 1994 and Zhang, 2005 and De Roux and Hofstetter, 2014). This high sacrifice ratio indicates that disinflation has persistence effect and thus, suggests that disinflation is costly across the Asian economies.

3.5.1 The dynamics of sacrifice ratio over four decades

Here, we allow dynamics in the trade-off by calculating episode specific sacrifice ratios (Ball, 1994). Hence, we try to look at the dynamics of sacrifice ratio by dividing the sample into four decades. The main aim of this analysis is to assess the trends of sacrifice ratios over time such as the 1970s, 1980s, 1990s and 2000s.

Sacrifice ratio in 1970s and 1980s

The average sacrifice ratio in the 1970s lies in the range of 0.57 to 0.76. But the disinflation cost in the 1980s has shown a mild increase compared to 1970s. The sacrifice ratio in the 1980s is in the range of 0.91 to 1.06.[8] These low sacrifice ratios can be explained by high initial inflation at the starting of an episode (Zhang, 2005). The mean peak level of inflation in both the decades is 14.51 and 10.46 respectively. As we know that initial inflation works as a nominal rigidity, so pursuing disinflation policy at higher peak of inflation can reduce the inflation output trade-off (Ball et al., 1988). Since the sample countries have pursued disinflation policy at the higher inflation peak, it is obvious that the sacrifice ratio will be low.

Sacrifice ratio in 1990s

We observe a higher sacrifice ratio in the 1990s compared to the previous two decades. This period has seen an increasing average sacrifice ratio compared to previous decades. The sacrifice ratio is 2.04 to 2.12 in both methods. Similar results are found by Zhang (2005) for G-7 countries. According to him, this high disinflation cost might be due to slow recovery in the output growth.

[7] We just add up the sacrifice ratio calculated by Mazumder (2014) for our sample and find sacrifice ratio as 0.11 for the same time period.

[8] We have excluded one episode of having a highlighter in the series.

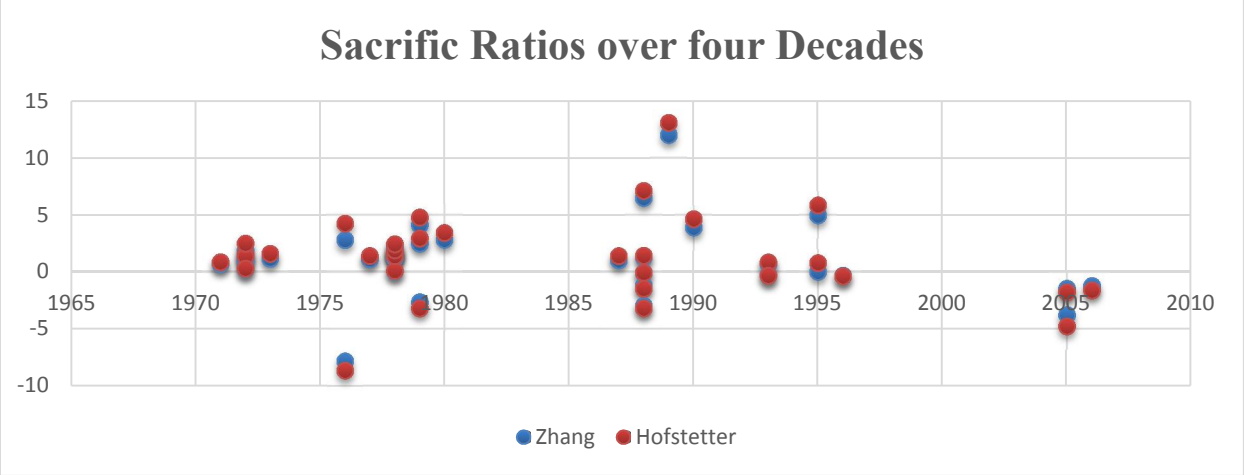
It means, after recession output takes time to return to the potential level. Further, the low inflation peak in 1990s confirms the additional source of higher sacrifice ratio. The average inflation peak is 7.68 in 1990s which is low compared to 14.51 and 10.46 in the last two decades respectively. This indicates that the country having low inflation rate at the start of a disinflation process has the tendency to suffer from high sacrifice ratio. It is obvious to believe that reducing 2 % of initial inflation is difficult than reducing 7 % of initial inflation.

Sacrifice ratio in 2000s

The period 2000s has interestingly shown a negative sacrifice ratio. This indicates that there is no harm in terms of loss in real GDP to reduce trend inflation. This result may be traced to the idea of Hofstetter (2008) where he talks about the costless disinflation for Latin American and Caribbean countries. The results remain unchanged irrespective of methods used in the calculation. One possible explanation is given by Hofstetter (2008) that the factors like trade reforms, appreciation in real exchange rate could contribute to enjoy low sacrifice ratio in the emerging economies.

Figure 3.2 shows that the dynamics of sacrifice ratio is quite different over the four decades. From the scattered plot it is evident that sacrifice ratio has increased in late 1980s and ended in late 1990s.

Figure 3.2 Sacrifice ratio over four decades



Source: Author's work

The increase in both red and blue dot in late 1980s and decline to lower level in late 1990s illustrates the trend in sacrifice ratio. Further, the extreme sides of the plot show that the sacrifice ratio is positive in 1970s and 1980s but turns negative in 2000s.

3.6 Determinants of Sacrifice Ratio: Assessing the Credibility of Inflation Targeting

In this section, we explore the important role of IT in explaining sacrifice ratio. Following past studies some of the important determinants such as IT, speed, initial inflation (peak) and length are considered here. We test the significant impact of IT in two ways. First the sacrifice ratio in IT countries is compared with non-IT countries to see whether it makes any differences? Secondly, some panel data regressions are used to test the significance of IT dummy which stands for the presence of IT policy.

So, first of all we compare the sacrifice ratio in IT and non-IT countries. Here, we follow De Roux and Hofstetter (2014) criteria to label an episode as IT episode. As per the criterion, disinflation episode occurring at least 75 percent in the IT period is identified as an IT episode.[9] The reason is that if the IT is already present for a substantial period in an episode, then benefits from IT could be still relevant. Further it is pointed out that disinflation was put forward immediately after the IT was adopted (Ball and Sheridan, 2005; Mishkin and Schmidt-Hebbel, 2007). With this criterion, 4 IT episodes are obtained for the entire sample which is lesser in number compared to 5 IT episodes found by Goncalves and Carvalho (2009) for the OECD countries. Table 3.1 reports the mean values of sacrifice ratio obtained from all four methods. The average sacrifice ratio in the IT group is in the range of -1.35 to -1.79. This kind of negative ratio is found by De Roux and Hofstetter (2014) for the OECD countries. Conversely, the non-IT set show high sacrifice ratio in a range of 1.25 to 2.04 depending upon the methods. In sum, we find that the IT countries have managed to forgo zero percent fall in real GDP in order to achieve a 1 percent fall in the long run inflation while the non-IT countries have suffered from high output loss. De Roux and Hofstetter (2014) argue that IT can reduce sacrifice ratio only if the disinflation process takes a longer period of four years. In our sample, we also observe the length of episodes under IT to be four to five years.

[9] The adoption date of IT regime is taken from Bank of England report, 2012.

Secondly, we employ a simple panel regression with heteroscedasticity-consistent standard errors (HAC) method. The regression equation for panel least square is specified as following:

$$SR_i = \delta_0 + \delta_i IT_i + \delta_i Speed_i + \delta_i Peak_i + \delta_i Length_i + \varepsilon_i \ldots\ldots(5)$$

Where, SR_i stands for sacrifice ratio in ith disinflation episodes. IT_i is a dummy variable(1 if a particular disinflationary episode falls under IT regime and 0 otherwise. The variable $Speed_i$ stands for the speed of disinflation. It explains the pace of disinflationary policy being perused. $Peak_i$ is the initial level of inflation at which disinflation takes place. $Length_i$ shows the time gap between start of an episode and end of an episode. ε_i is the error term. The panel regression results are reported in Table 3.2 which yield IT to be a significant determinant in lowering sacrifice ratio in these Asian economies. The estimation is done using HAC method. The IT coefficient lies in the range of 3.44 to 4.93 implying 3.44 percent to 4.93 percent reduction in sacrifice ratio across the four models estimated here.

Table 3.2 Determinants of Sacrifice Ratio

Dependent Variable	Zhang SR	Hofstetter SR	Alt M1 SR	Alt M2 SR
IT	-3.44***	-4.27***	-4.03***	-4.93***
	(0.99)	(1.17)	(1.52)	(1.87)
Speed	2.01	3.66	4.24	6.17
	(6.53)	(7.42)	(7.95)	(8.54)
Length	0.21	0.23	0.5	0.55
	(0.41)	(0.44)	(0.48)	(0.51)
Peak	-0.20**	-0.24**	-0.28***	-0.33***
	(0.09)	(0.10)	(0.10)	(0.12)
Constant	1.89	2.11	1.05	1.17
	(3.54)	(4.00)	(3.99)	(4.31)
R-squared	0.22	0.24	0.36	0.36

Notes: The ordinary least squired (OLS) method is used in the estimation. The dependent variable is Zhang SR, Hofstetter SR, Alt M1 and Alt M2. Zhang SR means sacrifice ratio calculated from Zhang method. A similar definition applies to Hofstetter SR, Alt M1 and Alt M2. Speed is the disinflation rate of an episode. Length is the duration of disinflation in an episode. The peak is the initial level of inflation at the beginning of an episode. IT is a dummy variable for inflation targeting regime. White robust standard errors in parentheses.

***, ** indicate 1% and 5% level of significance respectively.

Source: Author's calculation.

The result remains unchanged across the four models. The results seem to be contrary to the argument of Mazumder (2014) i.e. IT is not an important determinant of sacrifice ratio in non-OECD countries. Therefore, these results confirm the credibility aspect of inflation targeting as suggested by De Roux and Hofstetter (2014) for OECD countries. Therefore, one can infer that the IT regime works as a credible monetary policy by establishing a strong commitment to a quantitative target. Such an explicit target not only helps the public to form rational expectations but also plays an important role in reducing nominal rigidity. Strong commitment and high transparency through constant communication with economic agents effectively anchor expectations and help achieving a less costly disinflation (Sargent, 1983).

Further, the results show that the speed of disinflation is not a significant determinant of sacrifice ratio. The statistical significance of 'speed' remains low across the models not bearing the expected sign. Hence, speed is not a significant determinant in developing countries as suggested by Mazumder (2014). However, we find the peak (initial inflation) as an important determinant in lowering sacrifice ratio. The coefficient of peak is significant at 1 percent level and shows that disinflation initiated at higher peak can reduce sacrifice ratio by 20 percent in Asia. This is in line with Ball at al. (1988) who argue that high trend inflation reduces nominal rigidity leading to weak trade-off between output and inflation.

3.7 Robustness check

To check robustness of our result we run the fixed effect and random effect models on previous results. The panel regression model is specified as following:

$$SR_i = \delta_0 + \delta_i IT_i + \delta_i Peak_i + \mu_i + \varepsilon_{it} \quad \ldots\ldots(6)$$

Here, μ_i stands for unobserved fixed effect and ε_{it} stands for unobserved random coefficient. Other variables in equation (3) are similar to those in equation (2). The results obtained in section 4 are re-estimated by dropping the insignificant variables. Table 3.3 reports results of both the fixed effect (FE) and random effect models (RE). The high probability value of Hausman test does not reject the null hypothesis and favours the random effect model to be suitable in this case. However, we report the fixed effect model result in order to compare original and alternative models. The results from Table 3.3 show that IT remains a significant determinant of sacrifice ratio in RE specification after controlling peak level of inflation. The negative relationship indicates that IT in

Asia reduces sacrifice ratio by 4.2 to 5.2 percent. Further, initial inflation is statistically significant at 1% level in all the models. Similarly, in the Alt M1 and Alt M2 it is observed that the power of result increases. The IT dummy is negatively significant at 1 % and 10 % in two models. The IT coefficients show that the disinflation under IT regime can bring down disinflation cost by 4.52 and 5.26 percent respectively. The variable like initial inflation is significant in both fixed effect and random effect model which was found to be significant only for random effect model in Zhang's (2005) and Hofstetter's (2008) methods. Further, the R squired value increases to 0.33 and 0.36 for Alt M1 and Alt M2 models respectively indicating that the explanatory power of the model improves by changing the procedure in measuring output loss.

Table 3.3 Random effect model and Fixed effect model results

	Zhang SR		Hofstetter SR		Alt M1 SR		Alt M2 SR	
	FE	RE	FE	RE	FE	RE	FE	RE
IT	-4.8**	-4.22***	-5.91***	-5.20***	-4.52*	-4.86***	-5.25*	-5.26***
	(2.06)	(1.70)	(2.27)	(1.89)	(2.56)	(1.93)	(2.84)	(2.15)
Peak	-0.19	-0.21***	-0.22	-0.24***	-0.27*	-0.32***	-0.29*	-0.36***
	(0.12)	(0.10)	(0.13)	(0.11)	(0.15)	(0.11)	(0.17)	(0.12)
Constant	3.6**	3.65***	4.23**	4.30***	4.76**	5.34***	5.30*	6.11***
	(1.52)	(1.38)	(1.67)	(1.54)	(1.84)	(1.49)	(2.04)	(1.66)
R square	0.23	0.22	0.26	0.26	0.18	0.33	0.18	0.36
Hausman test P-Value	0.75		0.67		0.87		0.80	

***, ** and * indicate 1%, 5% and 10% level of significance. Robust standard error in parenthesis.

Note: FE means fixed effect model and RE means random effect model. The Hausman test suggests that the random effect model (RE) is suitable. The null hypothesis of RE is not rejected due to high p-value.

Source: Author's calculation.

3.8 Concluding remarks

To sum up the study revisits the debate on credibility of inflation targeting regime for Asian economies. The empirical findings suggest IT to be a credible monetary policy. The estimation of sacrifice ratio yields two main conclusions. First, the disinflation cost is significantly low in IT countries compared to that of the non-IT countries. The IT has potential to reduce disinflation cost by 4.22 to 5.91 percent respectively in Asian economies. The ratio remains the same irrespective of the methods used in the calculation. This result is explained by the IT being an important

determinant of sacrifice ratio. The finding is in line with Goncalves and Carvalho (2009) and De Roux and Hofstetter (2014), supporting the view that IT has credible bonus effects in member countries. Secondly, we observe that the initial inflation can significantly lower sacrifice ratio by 0.19 to 0.36 percent in emerging economies. This finding is in line with Ball *et al.* (1988) and Zhang (2005) indicating that the initial inflation reduces nominal wage rigidity Finally, we conclude that the determinants claimed to be insignificant in emerging economies by Mazumder (2014) are found to be significant in the present study. It means the findings change as a better episode method is employed in the calculation of sacrifice ratio. These results remained robust in the proposed alternative method. More importantly, the explanatory power of the regression model improves further. The coefficient of IT also increases showing a higher capacity of reducing sacrifice ratio in emerging economies. As the IT policy benefits the emerging economies and particularly Asian economies, therefore, it is suggested that emerging economies could switch to IT policy for better macroeconomic outcomes.

The above conclusion importantly highlighted the role of central bank transparency. The low sacrifice ratio in IT countries to argued to be because of high level of transparency in the central bank monetary policy. But this section doesn't deal with the measurement of transparency level in IT central bank. This issue is explored in the following chapter.

CHAPTER 4

Central Bank Transparency and Inflation Rate: Role of Inflation Targeting

4.1 Introduction

Transparency aspects are the most important discovery in today's central banking operation. There has been a dramatic shift in focus towards greater transparency in the monetary policy compared to the early days of central banking (Fry et al., 2000; Edey & Stone, 2004). There are widespread views that central banks should maintain a high level of transparency in its operation and intention under inflation targeting. It is because this arrangement can have a positive impact on inflation expectations and inflation level. The central bank transparency is understood as maintaining good communications with the public by disclosing policy related information. As there is some lag involved in the change of monetary policy stance and policy outcomes, it would be sensible to make the policy more transparent to curb inflation expectation close to target rate. Thus, when an economic agents' anticipation goes correctly with target rate the cost of inflation stabilization is minimized and the future inflation also falls. In the recent times, central banks are moving towards greater transparency about their objectives, procedures, etc., and also by disclosing models and data used in the policy assessment. A survey of 94 central banks by Fry et al. (2000) shows that around 74% of central banks focus on transparency in the monetary policy and that 78% publish the forward-looking analysis. But the transparency aspect is a qualitative issue and thus, there may not be any direct approach for measuring it. In the earlier approach, Mishkin and Posen (1997), Mishkin (2000) and Blinder et al. (2001) had put only arguments citing the importance of transparency without giving any quantitative measurement of central bank transparency. Later, an indirect way of measuring transparency was proposed in the literature through inflation expectations data (Gurkaynak et al., 2010; Johnson, 2002; Genc et al., 2011). But in a different approach, Fry et al. (2000), Siklos (2002) and Roger and Stone (2005) measured the level of transparency using an index approach. But a more comprehensive measurement was then proposed by Gerrates (2002). A Five-dimensional measure of transparency was developed by Gerrates (2002) and was followed extensively by Eijffinger and Geraats (2006), Dincer and Eichengreen

(2008) and Dincer and Eichengreen (2014). Though, several studies have measured the transparency level by constructing some indices, these studies are mostly for the industrialized countries with fewer cases for emerging economies. Dincer and Eichengreen (2008, 2014) is the only study that has considered emerging economies along with advanced countries to calculate central bank transparency. It is argued that IT Central banks frequently inform the public about their policies and performances by making consecutive speeches of monetary policy. In addition to that, IT policy follows the explicit framework of monetary policy accompanied by quantitative targets in the objectives. So, one can presume that IT central banks follow a transparent monetary policy. If that is true then IT could have positive impact on inflation expectations and level of inflation. In other words, IT policy can reduce inflation by anchoring inflation expectations.

In light of the above, our study contributes to the existing literature in three ways. First, we measure the level of transparency for the recent period by calculating a multidimensional transparency index. This method has got several important advantages over the existing method of measuring transparency. This index gives a comprehensive measure of transparency for a wide range of different aspects of monetary policy. Secondly, a modified method of measuring transparency is presented in the analysis. By looking at some of the weakness of old method, the existing method is modified by incorporating some new aspects of transparency. Those aspects are very essential while evaluating the IT policy transparency and neglecting those aspects may lead to a partial accounting of total transparency. The importance of the modified method is tested by comparing the result with the old method of measuring transparency. Thirdly, the study examines the relationship between IT policy and inflation rate in a panel data model. This relationship has not been explored before for any emerging countries, especially for Asian economies. This analysis therefore contributes to the literature to see whether IT reduces inflation.

The rest of the chapter is organized as the following: Section 3.2 presents the survey of relevant literature. The theoretical framework is given in section 3.3. Section 3.4 describes the methodology of measuring central bank transparency. The results of transparency are discussed in sections 3.5 and 3.6 respectively. Section 3.7 presents results of the relationship between IT transparency and inflation. The concluding remarks are offered in the last section.

4.2 Review of Literature

The transparency aspects in central banking policy have gained momentum in the last one and half decades compared to early days of central banking operations. The inflation targeting framework is one of the best examples of giving high priorities to the transparency of monetary policy through constant and frequent communications with the public. Over time, there have been several attempts to observe if any substantial change in the level of transparency has happened after IT. But in the early study there was not quantification of the level of transparency, instead those studies were primarily based on arguments and few simple observations (Blinder et al., 2001). In a note, Mishkin and Posen (1997) argued that the transparency level had increased in IT industrialized countries. Central banks in industrialized countries frequently inform the public about their policies and performances by making consecutive speeches on the strategy of monetary policy. The Bank of England publishes Inflation Report and Bank of Canada does a public outreach campaign. This feature of inflation targeting is the main reason for its success. There is a hard rule for central bank governor for dismissal in case of missing the target case like New Zealand. Mishkin (2000) also opined the same for IT emerging economies. While placing his argument, Mishkin (2000) says that a key element that all the central banks have achieved under IT is transparency in monetary policy. They communicate regularly through a press release on policy decision, minutes release and publishing inflation reports to the general public and market agents. That is the reason now-a-days emerging economies have maintained an equal level of transparency like the industrial economies. Mishkin (2001) argued that the success stories of Germany and Switzerland were attributed to giving vital importance to monetary targeting and consistently maintaining transparency and accountability. The Bundesbank (Central bank of Germany) and Swiss national bank (Central bank of Switzerland) followed a good way of communicating with the general public by frequently publishing and by speeches of bank officials. Apart from having these arguments and discussion, there are other studies that employed an indirect approach to measure central bank transparency. They argued that central bank transparency had strong link with inflation expectations, so studying the dynamics of inflation expectations would give an empirical assessment of transparency. Johnson (2002) made an empirical attempt to examine the impact of inflation targeting on inflation expectation among five industrial countries such as Australia, Canada, U.K, New Zealand and Sweden. A comparative analysis was also made with six non- targeting industrial countries such as U.S, Germany, Japan, Netherland, France etc. He

employed a panel approach for this study using historical data on forecasted inflation taken from Economic forecasts; a monthly worldwide survey and consensus forecasts for the time period 1984 to 1998. His findings suggest that the impact of inflation targeting on expectation has been positive and shows a significant drop in expected inflation. Coefficient of dummy variable, measuring average effects of target on the level of inflation expectation in targeting countries shows that there is a significant fall in the level of expected inflation. But if individual country is taken into consideration then it is observed that New Zealand and Sweden were the most successful IT countries to reduce inflation expectation by 8 percent and 4 percent respectively. In a similar line, Gurkaynak et al. (2010) examined the significant impact of inflation targeting on anchoring long-term inflation expectations using bond yield data for three industrialized countries such as U.S, U.K and Sweden. They took the difference between forward rates on nominal and inflation-indexed bonds as a measure of expected inflation called forward inflation compensation. To study the sensitivity of inflation compensation, they run a series of high-frequency event-study regressions. Considering different sample ranges for U.S (1998-2005), U.K (1993-2005) and Sweden (1996–2005), they found that the inflation expectation had been well anchored under the inflation targeting. The far-ahead forward inflation compensation in the U.S. exhibits substantial volatility, especially at low frequencies, and it shows a high degree of sensitivity to economic news. A similar pattern was evident in the UK before 1997, when the Bank of England was not independent. But when the Bank of England gained independence in 1997 that pattern disappeared. Comparing behavior of far-ahead forward inflation compensation in the United States with that of the United Kingdom, it is found that the U.S. with an average has the value close to 3%, more than 30 basis points higher than the average for the UK. Thus it is clear that full-fledged inflation targeting has power to anchor the private sector's expectation of inflation. Furthermore, U.S experienced larger persistency in inflation expectation, say around 0.4 percent, which is quite high compared to U.K. However, in Sweden there is no systematic relationship between the economic news and far-ahead forward inflation compensation. So, U.K and Sweden have not responded to any economic news whereas U.S expectation has influenced directly by the economic event. With the help of OLS estimation, Schmidt-Hebbel and Werner (2002) observed that inflation target has a strong influence on private sector expectations in Brazil, Mexico and Chile. Some results for Mexico and Chile show that impact of shocks on core inflation is insignificant. Thus it can be said that the central banks have gained a large amount of credibility in monetary policy due to

transparency. Additionally, some studies examined the central bank transparency aspect through the measure of inflation persistency. Dotsey (2006) observed that there persistence in inflation has declined in industrialized IT countries. Gerlach and Tillmann (2012) examined the effects of inflation targeting on the persistence of inflation in emerging economies of Asia-pacific region. They selected four countries like Korea, Thailand, Philippines and Indonesia as IT countries and five non-IT countries such as Japan, China, Singapore, Malaysia and Taiwan for comparative purpose. Quarterly data on CPI was employed from 1985Q1 to 2010Q1. They performed three tests to confirm whether IT had ability to reduce persistence in inflation, namely autoregressive test, rolling window and structural breaks. This results of autoregressive test showed that the persistency measuring coefficient β in the model declined among the inflation targeting countries. Compared with non-IT Asian countries it was found that the average level of inflation persistency in IT Asian-pacific fell to 0.27 from the earlier 0.86. Inflation persistency in non-IT Asian economies increased from 0.83 to 0.97 for the same time period. This drop in persistency shows the effectiveness of inflation targeting on anchoring inflation dynamics. Within the IT group, Indonesia is the only exception for experiencing small fall in persistency in inflation. Further, a rolling window test of the 10 year confirmed that the degree of inflation persistence had significantly declined over time. Further, from a structural break test the result confirmed that persistence had undergone a structural break in IT countries in the late 1990's due to increase in transparency and introduction of IT policy. Siklos (1999) studied the experience of inflation persistence under inflation targeting regime. He found that IT countries had shown a significant drop in the inflation persistence[10] after the adoption of this framework. Further, he argued that the United States had significant fall in inflation persistency. The author argued that there was no clear idea about which one had contributed to this success, i.e. end of Bretton wood or adoption of inflation targeting. Therefore, he employed Chow test to test structural break in the inflation process. The result showed that only Australia, Canada, and Sweden had a significant structural break in inflation persistence after inflation targeting. Except Australia, inflation targeting countries had experienced noticeable decline in inflation persistence. Ball and Sheridan (2003) attempted to measure the effects of inflation targeting (IT) on persistency in inflation. In the analysis they used seven industrialized IT and 13-non-IT industrialized countries. After estimating

[10] Inflation persistent means its current inflation is influenced strongly by its past history.

an AR (4) model they found that the coefficient measuring inflation persistency had declined from 0.4 to 0.2 after IT was adopted. It means in the pre targeting periods, a unit inflation shock in quarter t raises inflation at t+1 by more than 0.4 points, and the effect dies out slowly to 0.2 points after IT is implemented. Thus, it is confirmed that inflation persistency has gone down within IT countries after IT was adopted. However, comparing with non-IT countries, similar result was observed in non-IT countries. Vegaa and Winkelried (2005) estimated the effects of inflation targeting over inflation dynamics across the adopting countries. They used 23 IT countries and 86 non-IT countries for the purpose of comparison. Considering both industrialized and emerging countries they estimated an AR model. Their result confirms that inflation persistency has gone down in IT countries, more particularly in developing countries. This reduction shows anchoring of expectation in the economy. Baxa et al. (2012) examined the inflation dynamics such as inflation persistence under inflation targeting in the countries like the Czech Republic, Poland and Hungary. Estimating a new Keynesian Philips Curve model, the result claims that the nature of inflation process is different across the selected countries. Inflation has been less persistent in Czech Republic compared to Poland and Hungary and this persistence has been decreasing constantly. Following IMF's Code of monetary and financial policy transparency, Roger and Stone (2005) show that IT is more transparent than currency board and exchange rate pegged monetary policy. Later, the literature emerged on formulating an index to calculate the transparency level of central bank's monetary policy. In a pioneering work, Fry et al. (2000) proposed an index which considered various issues on central bank transparency. Using a sample of 94 countries they found that all the countries headed towards a high level of transparency. Around 74% of central banks consider transparency as a vital component of their monetary policy and 78% central banks publish the forward-looking analysis in the monetary policy report. Siklos (2002) then provided similar measures for twenty OECD countries but again for only one point in time, the late 1990s. The main problem with this method is that a wide range of transparency aspects in measuring transparency is not covered here. In a more comprehensive way, Gerrates (2002) proposed a five-dimensional measure of central bank transparency. He observed that these aspects are very important while assessing the level of transparency in monetary policy. So, he suggested the aspects like political transparency, economic transparency, procedural transparency, policy transparency and operational transparency. But in a more formal way, Eijffinger and Geraats (2006) constructed a transparency index for OECD countries using a five-dimensional measure of

Gerrates (2002). Considering nine major central banks they show that the all the IT central banks are more transparent than other central banks. Within the IT group Canada, New Zealand and U.K have scored highest indicating highly transparent central banks in OECD countries. The U.S, Euro zone and Japan have a meagre score of 8.5 indicating a low level of transparency in the monetary policy. Extending the study, Dincer and Eichengreen (2008) calculated central banks' transparency for 100 countries using similar five dimensional index. They followed the procedure of Gerrates (2002) and found that most of the central banks headed towards higher transparency in monetary policy. They found that this increase in transparency was higher when a country had higher political stability and a well-developed financial market. Further, Dincer and Eichengreen (2014) updated their index by taking data 2010 for the same sample. They find that all the central banks showed preference towards higher transparency over time.

4.3 Theoretical linkages between central bank transparency and level of inflation

Transparency is understood to be the central bank's communication with the public regarding its monetary policy objectives, strategy, economic outlook, and the outlook for future policy decisions. Blinder et al. (2008) stated that a central bank's ability to affect economy depends on how much it influences market expectations about the future inflation and the path of overnight interest rates, and not merely on their current level. Rudebusch and Williams (2006) and Berardi and Duffy (2007) point out that while people are learning, an increase in inflation may make the public revise their estimate of long-run average inflation upward, which, in turn, raises actual inflation. Bernanke (2004) suggest that, in such situation, commitment to stronger communication opens up a clear opportunity for the central bank to improve economic performance by providing information about its long-run inflation objective. Bernanke (2004) argue that, in long run, communicating central bank’s objective and policy strategies can help to anchor inflation expectations, which can have further impact on reducing inflation. Once people are sure about the action of monetary authority, there will be impact on wage-setting and pricing behaviour and finally, inflation rate.

4.4 Multidimensional index of measuring central bank transparency

4.4.1 Methodology

Following Eijffinger and Geraats (2006) method, transparency indices of the IT central bank are calculated for five Asian economies. The method accounts five aspects of transparency such as political transparency, economic transparency, procedural transparency, policy transparency and operational transparency. The index considers 15 questions regarding five different aspects of central bank's monetary policy and the index value ranges from 0 to 15 on the basis of performances in each aspect of central bank policy. The five aspects of transparency are namely political transparency, economic transparency, procedural transparency, policy transparency and operational transparency discussed below:

- Political transparency is the openness about formal target of the policy objective. The quantitative target of the objective is disclosed to public.
- Economic transparency is basically communicating all information to the public that is used in the monetary policy decisions such as economic data, policy models, forecasts, etc.
- Procedural transparency refers to the disclosing of strategy of monetary policy. How the policy decisions are finally reached and in what way it is reached.
- Policy transparency basically displays policy decisions. It contains explanations for change in monetary policy and indication for future policy inclination.
- Operational transparency refers to putting all information about the implementation of monetary policy in the public domain.

4.4.1.1 The Eijffinger and Geraats (2006) method is described in detail here.

Political Transparency

Political transparency refers to openness about policy objectives. This comprises of formal statement of objectives, including an explicit prioritization in case of multiple goals, a quantification of the primary objective(s), and explicit institutional arrangements.

(a) Is there a formal statement of the objective(s) of monetary policy, with an explicit prioritization in case of multiple objectives?

No formal objective(s) = 0.

Multiple objectives without prioritization = 1/2.

One primary objective, or multiple objectives with explicit priority = 1.

(b) Is there a quantification of the primary objective(s)?

No=0.

Yes=1.

(c) Are there explicit contacts or other similar institutional arrangements between the monetary authorities and the government?

No central bank contracts or other institutional arrangements = 0.

Central bank without explicit instrument independence or contract = 1/2.

Central bank with explicit instrument independence or central bank contract although possibly subject to an explicit override procedure = 1.

Economic Transparency

Economic transparency focuses on the economic information that is used for monetary policy. This includes economic data, the model of the economy that the central bank employs to construct forecasts or evaluate the impact of its decisions, and the internal forecasts (model based or judgmental) that the central bank relies on.

(a) Is the basic economic data relevant for the conduct of monetary policy publicly available? (The focus is on the following five variables: money supply, inflation, GDP, unemployment rate, and capacity utilization.)

Quarterly time series for at most two out of the five variables = 0.

Quarterly time series for three or four out of the five variables = 1/2.

Quarterly time series for all five variables = 1.

(b) Does the central bank disclose the macroeconomic model(s) it uses for policy analysis?

No=0.

Yes=1.

(c) Does the central bank regularly publish its own macroeconomic forecasts?

No numerical central bank forecasts for inflation and output=0.

Numerical central bank forecasts for inflation and/or output published at less than quarterly frequency = 1/2.

Quarterly numerical central bank forecasts for inflation and output for the medium term (one to two years ahead), specifying the assumptions about the policy instrument (conditional or unconditional forecasts) = 1.

Procedural Transparency

Procedural transparency is about the way monetary policy decisions are taken.

(a) Does the central bank provide an explicit policy rule or strategy that describes its monetary policy framework?

No=0.

Yes=1.

(b) Does the central bank give a comprehensive account of policy deliberations (or explanations in case of a single central banker) within a reasonable amount of time?

No or only after a substantial lag (more than eight weeks) =0.

Yes, comprehensive minutes (although not necessarily verbatim or attributed) or explanations (in case of a single central banker), including a discussion of backward- and forward-looking arguments = 1.

(c) Does the central bank disclose how each decision on the level of its main operating instrument or target was reached?

No voting records, or only after substantial lag (more than eight weeks) = 0.

Non-attributed voting records = 1/2.

Individual voting records, or decision by single central banker = 1.

Policy Transparency

Policy transparency means prompt disclosure of policy decisions, together with an explanation of the decision, and an explicit policy inclination or indication of likely future policy actions.

(a) Are decisions about adjustments to the main operating instrument or target announced promptly?

No or only after the day of implementation = 0.

Yes, on the day of implementation = 1.

(b) Does the central bank provide an explanation when it announces policy decisions?

No=0.

Yes, when policy decisions change, or only superficially = 1/2.

Yes, always and including forwarding-looking assessments =1.

(c) Does the central bank disclose an explicit policy inclination after every policy meeting or an explicit indication of likely future policy actions (at least quarterly)?

No=0.

Yes=1.

Operational Transparency

Operational transparency concerns the implementation of the central bank's policy actions. It involves a discussion of control errors in achieving operating targets and (unanticipated) macroeconomic disturbances that affect the transmission of monetary policy. Furthermore, the evaluation of the macroeconomic outcomes of monetary policy in light of its objectives is included here as well.

(a) Does the central bank regularly evaluate to what extent its main policy operating targets (if any) have been achieved?

No or not very often (at less than annual frequency) = 0.

Yes but without providing explanations for significant deviations = 1/2.

Yes, accounting for significant deviations from target (if any); or, (nearly) perfect control over main operating instrument/target = 1.

(b) Does the central bank regularly provide information on (unanticipated) macroeconomic disturbances that affect the policy transmission process?

No or not very often = 0.

Yes but only through short-term forecasts or analysis of current macroeconomic developments (at least quarterly) =1/2.

Yes, including a discussion of past forecast errors (at least annually) = 1.

(c) Does the central bank regularly provide an evaluation of the policy outcome in light of its macroeconomic objectives?

No or not very often (at less than annual frequency) = 0.

Yes but superficially = 1/2.

Yes, with an explicit account of the contribution of monetary policy in meeting the objectives = 1.

4.4.1.2 Modified method of measuring central bank transparency

In the modified method, the study introduces few other important variables in measuring transparency retaining other aspects in the method unchanged. For instance, in the political transparency the existing method does not account for the aspect of who decides on the objective. This is equally important as the other aspects because it gives a clear indication to public whether government support is there to achieve inflation target. The support from government will increase the faith of people on monetary policy which will increase its credibility. Similarly, there is another component which also works as a transparency of policy called type of inflation target. It is very important for monetary policy to precisely define its inflation target. If the target is not defined properly then it may not give a clear indication to the market expectations. So, whether the inflation target is range or point or both matters for the policy transparency. So, in political transparency section two additions are made to account the transparency, 1) who decides the objective and 2) what is the type of inflation target. Similarly, in economic transparency section two new components are added in the calculation. First, the existing method does not account for the exchange rate changes as an important variable. It is because the model was initially developed in the context of developed countries where exchange rate problem is not of great concern for policy maker. But in emerging economies exchange rate plays an important role in the monetary policy. So publication of this variable by monetary authority has some important policy implication. Second, the existing method has neglected another component i.e. the forecast the central banks publishes to guide the forward looking policy. This aspect is included in economic transparency section. Furthermore, two additional components are added in the policy transparency aspects. This index gives the value ranging from 0 to 19 where 19 is showing the highest transparency in the monetary policy of the central banks.

Political Transparency

Political transparency refers to openness about policy objectives. This comprises of a formal statement of objectives, including an explicit prioritization in case of multiple goals, a quantification of the primary objective(s), and explicit institutional arrangements.

(a) Is there a formal statement of the objective(s) of monetary policy, with an explicit prioritization ina case of multiple objectives?

No formal objective(s) = 0.
Multiple objectives without prioritization = 1/2.

One primary objective, or multiple objectives with explicit priority = 1.

(b) Is there a quantification of the primary objective(s)?

No=0.

Yes=1.

(c) Are there explicit contacts or other similar institutional arrangements between the monetary authorities and the government?

No central bank contracts or other institutional arrangements = 0.

Central bank without explicit instrument independence or contract = 1/2.

Central bank with explicit instrument independence or central bank contract although possibly subject to an explicit override procedure = 1.

(d) Who decide the objective of inflation target?

Central bank = 1/2

Government = 1/3

Both central bank and government = 1

(e) What is the type of inflation target?

For a range type = 1/2

For a point type = 1/2

For both point with bands wither side = 1

Economic Transparency

Economic transparency focuses on the economic information that is used for monetary policy. This includes economic data, the model of the economy that the central bank employs to construct forecasts or evaluate the impact of its decisions, and the internal forecasts (model based or judgmental) that the central bank relies on.

(a) Is the basic economic data relevant for the conduct of monetary policy publicly available? (The focus is on the following four variables: money supply, inflation, interest rate, GDP and exchange rate.)

Quarterly time series for at most two out of the five variables = 1/3

Quarterly time series for three out of the five variables = 1/2.

Quarterly time series for all five variables = 1.

(b) Does the central bank disclose the macroeconomic model(s) it uses for policy analysis?

No=0.

Yes=1.

(c) What forecasted variables are published for medium term?

Inflation and GDP = 1/3

Inflation, GDP, core CPI, interest rate = 1/2

Inflation, GDP, interest rate, exchange rate, fan chart = 1

(d) Does the central bank regularly publish its own macroeconomic forecasts?

No numerical central bank forecasts for inflation and output=0.

Numerical central bank forecasts for inflation and/or output published at less than quarterly frequency = 1/2.

Quarterly numerical central bank forecasts for inflation and output for the medium term (one to two years ahead), specifying the assumptions about the policy instrument (conditional or unconditional forecasts) = 1.

Procedural Transparency

Procedural transparency is about the way monetary policy decisions are taken.

(a) Does the central bank provide an explicit policy rule or strategy that describes its monetary policy framework?

No=0.

Yes=1.

(b) Does the central bank give a comprehensive account of policy deliberations (or explanations in case of a single central banker) within a reasonable amount of time?

No or only after a substantial lag (more than eight weeks) =0.

Yes, comprehensive minutes (although not necessarily verbatim or attributed) or explanations (in case of a single central banker), including a discussion of backward- and forward-looking arguments = 1.

(c) Does the central bank disclose how each decision on the level of its main operating instrument or target was reached?

No voting records, or only after substantial lag (more than eight weeks) = 0.

Non-attributed voting records = 1/2.

Individual voting records, or decision by single central banker = 1.

Policy Transparency

Policy transparency means prompt disclosure of policy decisions, together with an explanation of the decision, and an explicit policy inclination or indication of likely future policy actions.

(a) Are decisions about adjustments to the main operating instrument or target announced promptly?

No or only after the day of implementation = 0.

Yes, on the day of implementation = 1.

(b) Does the central bank provide an explanation when it announces policy decisions?

No=0.

Yes, when policy decisions change, or only superficially = 1/2.

Yes, always and including forwarding-looking assessments =1.

(c) Does the central bank disclose an explicit policy inclination after every policy meeting or an explicit indication of likely future policy actions (at least quarterly)?

No=0.

Yes=1.

(d) How frequently does a central bank communicate with public?

Publication of inflation report less than 4 times = 1/2

Publication of inflation report four or more times = 1

(e) Does central bank release press notice and press conference about policy discussion

No = 0

Yes = 1.

Operational Transparency

Operational transparency concerns the implementation of the central bank's policy actions. It involves a discussion of control errors in achieving operating targets and (unanticipated) macroeconomic disturbances that affect the transmission of monetary policy. Furthermore, the

evaluation of the macroeconomic outcomes of monetary policy in light of its objectives is included here as well.

(a) Does the central bank regularly evaluate to what extent its main policy operating targets (if any) have been achieved?

No or not very often (at less than annual frequency) = 0.

Yes but without providing explanations for significant deviations = 1/2.

Yes, accounting for significant deviations from target (if any); or, (nearly) perfect control over main operating instrument/target = 1.

(b) Does the central bank regularly provide information on (unanticipated) macroeconomic disturbances that affect the policy transmission process?

No or not very often = 0.

Yes but only through short-term forecasts or analysis of current macroeconomic developments (at least quarterly) =1/2.

Yes, including a discussion of past forecast errors (at least annually) = 1.

(c) Does the central bank regularly provide an evaluation of the policy outcome in light of its macroeconomic objectives?

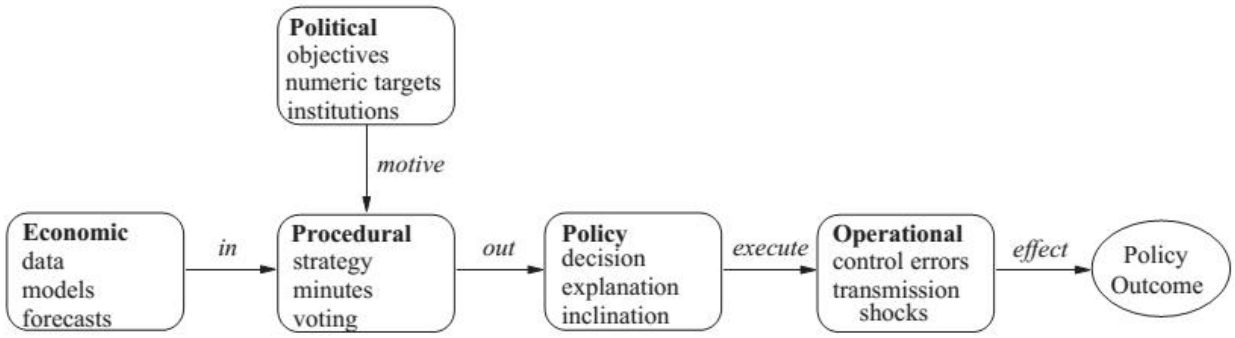
No or not very often (at less than annual frequency) = 0.

Yes but superficially = 1/2.

Yes, with an explicit account of the contribution of monetary policy in meeting the objectives = 1.

A conceptual framework is given in Figure 4.1 where the different dimensions of transparency are linked to the policy outcomes of monetary policy.

Figure 4.1 conceptual framework



4.5 Data and Variables

The data are taken from Handbook of Bank of England (2012) for the year 2012. Further, the data are collected from respective central bank's annual reports, other publications, etc. All five Asian countries such as Indonesia, Korea, Israel, Philippines, and Thailand are considered in the study. It is because these are the countries that are following inflation targeting monetary policy in Asia.

4.6 Result from old transparency index

We follow Eijffinger and Geraats (2006) method to calculate the transparency level of central bank's monetary policy. According to the criteria, transparency index can take value 0 to 15. The calculated result of transparency level is reported in Table 4.1. The value of transparency index shows a difference in transparency levels among the IT group. Israel scores 12 which is the highest in transparency index and Korea scores 9 showing a lowest among the others. This shows that in Asian IT countries Israel is the highest transparent central bank and Korea is the lowest one. Philippines maintains a high level of transparency after Israel. It's score is 11, which is more than Korea, Thailand and Indonesia. This suggests that Philippines has the highly transparent central bank after Israel. Its level of transparency is higher compared to Korea, Thailand and Indonesia. In other words, Israel and Philippines maintain good communication channel with public and financial markets. They publish all policy related information quickly in the public domain. As Korea is found to the lowest transparent central bank, one can infer that the Korean monetary authority does not give much importance to a strong communication framework. The publications of policy related information might be slow and few in numbers. From the rank it can be observed that first and second position are scored by Israel and Philippines respectively. Similarly, Korea' score is lowest among the IT group.

Further, to see if the transparency has changed over time, this study makes a comparison of the calculated transparency level with the transparency level calculated by Dincer and Eichengreen (2014) for the year 2010. In other words, a comparison is made between the transparency levels of 2012 with the transparency levels in 2010 to see the changes over two years. By comparing our result with Dincer and Eichengreen (2014), we find that the overall transparency has increased recently in all IT countries. Israel with score 11.25 in 2010 increased its score to 12 in 2012. There is a change of 0.75 within a two-year period. Similarly, other countries have also shown an increasing trend in transparency in recent times compared to the previous level. For instance, countries like Korea, Philippines and Thailand have shown relatively a higher gain in transparency compared to Israel. Korea had 8.5 transparency points in 2010 but in 2012 the points increased to 9.5 showing 1 point rise in the level of transparency. Similarly, both Philippines and Thailand scored 11 and 10 transparency point in 2012. But the point were 10 and 9, respectively two years ago. This difference can be explained by divergent institutional settings and communications of the central bank (Hammond, 2012). If we look at the institutional setting it is observed that when the South Korea arranges a meeting of monetary policy committee with a 6 weeks gap, Israel and Thailand arranges same in two weeks. Further, when Korea has no stringent rule for governor in case of mission inflation target, Thailand has such rules where governor of central bank compulsorily needs to give justification for missing the target.

Further, looking at the different aspects of transparency we observe the following.

4.6.1 Political transparency

In the political transparency, all the IT countries score full points of 3 out of 3. This indicates that all the central banks have a formal objective of monetary policy. Similarly, for the quantitative objective all have full score that shows that all the central bank in IT policy also have an explicit quantitative target. It is obvious because IT central banks are mainly known for setting an explicit target for inflation. A similar result is obtained in the case of institutional arrangement. All five IT countries have similar institutional arrangements like instrument independence, objective settings, etc. All the countries enjoy instrument independence in achieving the policy goal.

4.6.2 Economic transparency

In economic transparency, no single country has full score. This means that these countries lack full transparency in this aspect. Using this criterion we find that Israel and Korea have jointly scored the highest points in the IT group. They have scored 2.5 out of 3. These countries publish macroeconomic and forecasted data timely and by large numbers. They also publish their policy models in public. Other countries like Philippines, Thailand, and Indonesia have scored 2 out of 3 showing lower transparency. This indicates that Philippines, Indonesia do not publish their macroeconomic data and forecast to the public. They keep the model used in policy analysis as well as macroeconomic forecast as secret. They might be maintaining an internal forecast of such macroeconomic variables but those are not published in the open.

4.6.3 Procedural transparency

In this aspect, Israel and Thailand score the highest point i.e. 3 out of 3. These two countries have performed well in showing their strategy of monetary policy, decision procedure, etc. to the public. Indonesia scores 1 transparency point showing a poor level of transparency in this aspect. This may be due to late publications of policy documents. Indeed it publishes the monetary policy review report after substantial lags. But other IT countries have published their policy documents immediately. Korea and Philippines score an average level of 2 out of 3 points. This suggests that these two countries are concerned about communicating with the public about their rules of monetary policy strategy. Further, they are very much attentive towards quick publications of monetary policy decisions and the underlying rationale.

4.6.4 Policy transparency

All IT countries fail to score 3 out of 3 in this transparency aspect. Indonesia is the only country which scores the highest point of 2.5. This country is more serious about the transparency related to decisions in adjusting policy rates, future policy path and explaining the change in policy. Apart from this, no country has full transparency points. The worst score in evident in Thailand where it has score 1. Similarly, Korea and Israel have scored just 1.5 transparency points. So, all it means that these central banks don't bring their actions in the public domain like adjustment in instruments, the rationale for policy decisions, etc. Further, an indication of future policy change is also disclosed by all the central banks.

4.6.5 Operational transparency

In this section, a similar scenario is observed for all IT central banks. None of them has scored full points in transparency meaning that these countries give less importance to this aspects. They do not feel this aspect as an important part of monetary policy. Israel and Philippines have scored 2 out of 3. Similarly, Korea and Thailand have the lowest score in transparency points and it is 1. These countries do not give the information to the public about their achievements and risk associated with future actions of monetary policy. Israel scores high because it evaluates its policy outcomes and shows short-term forecast.

Next, a country wise transparency levels analysis is done to have a clear picture of country's performance.

4.6.6 Israel

Israel is the first country to adopt IT as the monetary policy in Asia. After changing the monetary policy to IT policy, Israel has initiated several changes in the monetary policy to keep the central bank transparent. The result reported in Table 4.1 shows that Israel is highly transparent. It has scored 12 in 2012 which no other central bank has scored for that year. Further, transparency has increased over time in Israel. If we compare the transparency level of 2010 with 2012 it can be seen that the level of transparency has increased by 0.75 points. However, a detailed analysis of the transparency gives different pictures on the level of transparency. For instance, political and procedural transparency are the highest in Israel. They scored 3 out of full score 3. This indicates that Israel is emphasizing more on maintaining political and procedural transparency. More precisely, the central bank does publish and communicate with public regarding its monetary policy strategy, objectives and contract with government. But in policy transparency, the country remained a poor. It scored 1.5 transparency points out of 3 only. Israel's central bank hesitates to give explanations about the changes in the monetary policy and future inclination of policy paths. However, the country maintains an average level of transparency in economic and operational transparency. It had 2.5 points in economic transparency and 2 points in operational transparency.

4.6.7 South Korea

South Korea was the second country in Asia to adopt IT policy just after Israel. But unfortunately the country followed exchange rate targeting along with IT policy as their monetary policy. Though, later they abandoned it but the institutional changes remained insignificant. The arrangement for a transparent monetary policy has been poor in Korea. In the analysis, we found Korea to be the lowest transparent central bank among Asian IT countries. But further looking into some of the sub-levels of transparency, it is observed that Korea has performed well in some aspects of transparency compared to Philippines, Thailand and Indonesia. For instance, in economic transparency Korea has scored 2.5, which equals to Israel's score.

But at the same time, Philippines, Thailand and Indonesia have scored only 2 points showing lower level of economic transparency than Korea. But in policy and operational transparency, Israel has very low score compared to other IT countries. This suggests that Korea has low transparency in aggregate level because of these aspects. The monetary authority has paid very little importance to raise transparency by giving explanations about the success of monetary policy and macroeconomic disturbances in the economy.

4.6.8 Thailand

The overall transparency in Thailand has increased over time. Thailand is the third transparent central bank in Asian IT group. It is strongly committed towards a transparent monetary policy in IT regime. The transparency score of 3 out of 3 in political aspects indicates that the country successfully handles the communication part of monetary policy with public. It publishes the explicit objective of monetary policy and institutional agreements between government and central bank. It has also got 3 out of 3 in procedural transparency. A similar score in two aspects is also achieved by Israel. It means that monetary authority always communicates with public regarding their rules of monetary policy and gives a comprehensive account of policy within a short period of time. However, the country remains very poor in policy and operational transparency. The levels of transparency is lower than Israel, Philippines and Indonesia. It has scored 1 out of 3 point in transparency index. The Thailand central bank has neglected this aspect and given less attention in the monetary policy transparency. There is no attempt from central bank to transfer information related to monetary policy to the public. The communication channels in this aspect is totally

negligible. The central bank avoids publishing the explanation for changing policy, future policy actions, etc.

4.6.9 Philippines

Philippines has maintained a good level of overall transparency. It is second in transparency ranking meaning that the Philippines central bank has shown greater concern for transparency but lesser than Israel. The overall transparency points is 11 which just 1 point lower that Israel and 1.5 points higher that Korea. In the sub-group level, it has maintained a sound level of transparency. It has scored full points in displaying monetary policy objective, quantitative target for that objective and understating conditions between central bank and government.

Interestingly, the central bank has consistently scored well in all other aspects of transparency, which is rare in our analysis. Even Israel has not achieved this type of score throughout all aspects. It has scored 2 in economic, procedural, policy and operational transparency. In this aspect, Philippines has greater advantage of enjoying one of the best transparent bank. Philippines has highest score in policy transparency compared to Israel. But the same case does not hold when economic and procedural transparencies come into the picture. In this aspect, Israel has better score in transparency compared to Philippines.

4.6.10 Indonesia

Indonesia is ranked 3rd in the transparency index, which suggests that the central bank of Indonesia has considered transparency as an important component of monetary policy. The overall transparency is higher than Korea. Further, if we compare the transparency level over time then we find that the level of transparency has increased from 2010 to 2012 by 1 point. This indicates that the transparency level is going up over time as the central bank feels the essence of changing institutional design of monetary policy. However, the transparency is not at same level throughout sub-components. In other words, for an instance, the political transparency may be different from operational transparency. By looking at those detail it is observed that Indonesia maintains a stronger form of political transparency. It scored 3 out of 3 points in that aspect meaning that Indonesia has shown commitment towards publishing the monetary policy objectives and its quantitative targets.

Table 4.1 Transparency Level in 2012

Country	Political	Economic	Procedural	Policy	Operational	Index 2012	Rank	Index 2010	Rank
Indonesia	3	2	1	2.5	1.5	10	3	9	3
Israel	3	2.5	3	1.5	2	12	1	11.25	1
Philippines	3	2	2	2	2	11	2	10	2
Korea	3	2.5	2	1.5	1	9.5	4	8.5	4
Thailand	3	2	3	1	1	10	3	9	3

Note: Scores with highest number is regarded as the highly transparent central bank and scores with smallest number is considered as low transparent central bank.

Source: Author's calculation.

Further, they have communicated with public regarding institutional agreement between the central bank and government. But it has the worst score in procedural transparency meaning that the central bank has weakly formulated transparency strategy in this aspect. The score in procedural transparency is 1. This means that the central bank avoids publishing monetary policy rules, how decisions are arrived, etc. Even Korea which is the lowest transparent central bank, has higher score in procedural transparency. But Indonesia has good score in policy transparency. It means this aspect of Indonesia central bank is highly transparent compared to Israel. The score of 2.5 is higher than 1.5 in Israel. This result suggests that a central bank is highly transparent at overall level but may not always be transparent in all aspects. There might be some countries that have low transparency in overall index but may possess high transparency in some aspects of monetary policy.

4.7 Result from modified transparency index

We have already discussed in methodology section that the old method does not capture some of the important components of central bank transparency. So, the method was modified by adding some important components of transparency. The results are given in Table 4.2. For a comparison purpose old method is also used to calculate transparency levels. The result of transparency levels reported in Table 4.2 are normalized to score 1 and 0. A score of 1 indicates highest transparent central bank and 0 indicates lowest transparent central bank. More precisely, the entire score of transparency index, which is supposed to range from 0 to 15 are now normalized and the score of transparency is kept between 0 and 1. This is done to facilitate comparison between old and new index of measuring transparency level in the central bank. If we calculate transparency level following same 0 to 15 score then our modified method will be wrong. It is because due to addition of some important components the entire score in the modified index will be 0 to 19, where 19 indicates highest transparent bank and 0 for otherwise. We can see that both indices are not comparable due to different optimal score in the index. To facilitate a better comparison, we normalize the index value to 0 to 1. The result from new index shows that Israel is the most transparent central bank followed by Philippines. The score for these countries are 0.82 and 0.74, respectively. When we compare this result with old index, a similar result is found for these two countries but with some lower score. In other words, old index also shows that Israel is the top most transparent bank and Philippines comes in second number.

But their score is different such as 0.79 and 0.72, respectively. This shows that score changes as some additional aspects of transparency are included in the index. Further, there is evidence that the transparency level and ranking changes as we account some additional dimensions of central bank transparency. For instance, take the case of Thailand. In the old index, it is observed that three countries like Indonesia, Korea and Thailand are at equal levels of transparency. But when the transparency is measured through new index, Thailand occupies 3rd rank in the transparency level and other two are in 4th rank.

All these results suggest that it would be an interesting analysis if each aspect and country are examined separately.

4.7.1. Political transparency

Surprisingly, all central banks have full score of 1 in political transparency except Israel. The central banks are strongly committed to maintaining high transparency in political aspects of monetary policy. Only Israel has not scored 1 which means that it has lower transparency in this aspect. By comparing with old index, a similar result is obtained for all countries. In other words, the results remain the same when even the method of calculating transparency is changed.

4.7.2 Economic transparency

In economic aspects, Israel has scored the highest point of 0.87 followed by Korea of 0.71. This result indicates that economic transparency is the highest in Israel and Korea is in second position. These two countries have focused on releasing macroeconomic data, forecasting data, etc., to public for a forward-looking monetary policy. Philippines and Thailand show a score of 0.62 which is the lowest in all Asian IT countries. But comparing the result of modified index with old index, it is observed that inclusion of additional components of transparency changes the transparency levels. The result calculated from old index shows that both Korea and Israel are highly transparent central banks in economic aspect. The score also changes in the old index showing 0.83 for both the IT countries. This result is different from the findings observed for new index for these countries. The new index shows that only Israel is the highly transparent central bank in economic aspect. The score for Korea is lower in new index compared to the score of old index. Similarly, Thailand which is found to be the lowest transparent bank in this aspect is having higher score in old index.

4.7.3 Procedural transparency

In procedural transparency, only Israel and Thailand maintain the highest transparency. They have scored full point of 1 indicating full transparency. Indonesia is the lowest transparent bank in this aspects. It scored 0.33 which is the lowest value in index. A similar result is obtained from the old index. This result is due to no change in this aspect between old and new index.

4.7.4 Policy transparency

In this aspect, Indonesia enjoys the highest power being the top scorer. Indonesia has scored 0.83 point which is the highest among other countries in this aspect and thus becomes the highest transparent central bank in policy transparency. Philippines becomes the second transparent bank by securing 0.80 scores. By comparing the same with old index, we find that the score remains the same for Indonesia but it changed for Philippines. The score for Philippines declined in old index. But the point to note is that the ranking remained same for those two countries in both indices. Furthermore, it is observed that the lowest transparent banks are Korea and Thailand. They have scored 0.60 each individually. Comparing the same with old index we find some different results. The transparency level is the lowest in Thailand and Korea has little higher score to be called as the third transparent bank in this aspect. The score for Thailand is 0.33 followed by 0.50 in Korea.

4.7.5 Operational transparency

In the operational transparency, both Philippines and Israel secured the highest point of 0.66 followed by the lowest central banks of Korea and Thailand. Indonesia also performs well in this aspect securing 0.50 point in the second position. But when a comparison is made with old index, the result changes significantly. In terms of the old index, Israel is the only country which has the highest score of 0.83. Philippines comes in the second number for securing 0.66 points. This finding suggests that the inference drawn from that of the new index is different from old index.

We have also carried out a country wise analysis to observe the transparency levels at country level.

4.7.6 Israel

In the new index, Israel has only full score in procedural transparency. This indicates that the Israel central bank is more transparent in this aspect. It also has advantage of being highly transparent central bank in economic aspect. It scored 0.87 which is the highest point in all other countries. But the country remained weak in policy and political transparency as the lowest score is evident among all other countries. The score is 0.70 and 0.87 respectively. When we compare this result with old index, we see some similarity in the findings with few dissimilarity. In Israel, procedural transparency remained the strongest point with lowest point in political transparency.

4.7.7 South Korea

In this country, the central bank enjoys highest power in political transparency as it scores 1. A similar result is obtained by comparing the result with the old index. But in all other aspects the Korea remained to be less transparent. For instance, in economic transparency the country remained at second rank for securing 0.71 points. Similarly, in policy and procedural transparency the score was also lower than Thailand and Philippines. But Korea has the worst score in operational transparency which is 0.33. This is lower than Indonesian and Philippines. But in old index the result is different. The Korea which is said to be securing second rank in new index changes its rank to first rank when old index score is taken into the analysis. In old index Korea scored 0.83 which equal to Israel. Further, in policy transparency the score gets changed when the old index value is taken into consideration. In the new index the country scored 0.60 but in the old index the score declines to 0.50 point.

4.7.8 Philippines

In the overall transparency rank, Philippines central bank has performed well. It is the second transparent central bank after Israel in Asia. In the Philippines, political transparency has full score in both old and new method. This means that the central bank is fully transparent in economic aspects of the monetary policy. But in economic transparency the country has lowest score along with Thailand. This can be explained by the less importance given by the Philippines central bank to increase transparency this aspect. But when we compare with old index, we see that the scores get changed in old index. The score for economic transparency is 0.66 which is higher than 0.62 in new index.

Table 4.2 New Transparency Level in 2012

Old Index of Measuring Transparency level 2012

Country	Political	Economic	Procedural	Policy	Operational	Index	Rank
Indonesia	1	0.66	0.33	0.83	0.50	0.66	3
Israel	0.83	0.83	1	0.50	0.83	0.79	1
Philippines	1	0.66	0.66	0.66	0.66	0.72	2
Korea	1	0.83	0.66	0.50	0.33	0.66	3
Thailand	1	0.66	1	0.33	0.33	0.66	3

Modified Index of Measuring Transparency level 2012

Country	Political	Economic	Procedural	Policy	Operational	Index	Rank
Indonesia	1	0.66	0.33	0.83	0.50	0.66	4
Israel	0.87	0.87	1	0.70	0.66	0.82	1
Philippines	1	0.62	0.66	0.80	0.66	0.74	2
Korea	1	0.71	0.66	0.60	0.33	0.66	4
Thailand	1	0.62	1	0.60	0.33	0.71	3

Source: Author's Calculation.

This means the new index captures some of the other aspects of transparency which drives this change. Again in both the models, procedural and operational transparency remains same. But the transparency changes in policy aspect of monetary policy. In this aspect, the country scores 0.80 which is the second highest among all other countries, but in old index the score declines to 0.66 and the ranking also.

4.7.9 Thailand

In the overall transparency, Thailand remained in the 3rd position in overall transparency among IT countries. Thailand has highest level of transparency in both political and procedural aspects. It scores full point of 1 in both aspects. A similar case is also observed in old index. These two transparency aspects have full score of 1. But the country has very poor transparency level in Economic, policy and operational aspects. In all three cases the country secures lowest rank in the level of transparency. But when the same case is compared with old index, the result seems to be changing. The score which was 0.62 in economic changes to 0.66. Similarly, the score in policy transparency is 0.60 which changes to 0.33 in the old index.

4.7.10 Indonesia

Indonesia scored the lowest in the index meaning that the central bank is the poorly transparent in monetary policy. Its rank among IT countries is 4th indicating that the communication strategy in the central bank is poor in this country. In the each aspect the transparency level is different. The country enjoys highest level of transparency in both political and policy aspects. It scores 1 and 0.83 respectively for these transparency aspects. But the same country performs worst in procedural transparency as it scores only 0.33 point. When a comparison is made with old index, the result indicates no change in score as well as in ranking of the transparency level.

4.8 Transparency and Inflation Relationship: Role of Inflation Targeting

To find out the relationship between transparency in IT countries and its relationship with inflation rate, a panel data analysis is attempted for the Asian economies in our sample.

A fixed effect panel data model is specified as:

$$Inflation_i = \delta_0 + \delta_i IT * TI_i + \delta_i X_i + \mu_i + \varepsilon_{it} \quad \ldots\ldots(7)$$

Where, $IT * TI$ stand for transparency in IT central banks. μ_i is a fixed effect dummy. In this section we examine the relationship between transparency and inflation. Some control variables are introduced in the panel regression to avoid simultaneity or omitted variable problem. X_i stands for the control variables in the panel regression equation. We regress level of inflation on a vector of economic factors, which may be correlated significantly. They are Openness (defined as proportion of total trade to total real GDP), Past inflation (defined as the inflation rate in lag 1), Financial depth (defined as the ratio of M3 to real GDP), Per capita Income (defined as the per capita GDP) and output gap (difference between potential and actual level of GDP). The sample period is from 1998 to 2010 for all 13 emerging countries in Asia out of which 5 are inflation targeting countries. The data on transparency index is collected from Dincer and Eichengreen (2014). For the control variables annual data are collected from World Development Indicators, World Bank. The expected sign between transparency and inflation is negative. It is because the high transparency in monetary policy creates an effective information channel with the public which curbs inflation expectations and thus, decline in inflation. The study uses fixed effect and random effect panel data models. The reason for choosing this method is that we have a small time series and small cross-sections in our sample. These countries are different in the level of inflation, growth and institutional settings. Studies like Fry et al. (2000) and Logger (2008) have used cross-sectional method to study the impact of central bank transparency on inflation. But the problem of using a cross-sectional method is that it may not explicitly address potential biases induced by the existence of cross-country heterogeneity, yielding misleading estimates.

Further, those studies do not address the time varying impact of transparency on inflation. This is very important in a case where monetary authority has inclined towards higher transparency over time. It is quite obvious because at an initial level of monetary policy, the level of transparency will be low but as time passes, the central banks change their institutional settings to improve transparency. This has happened in some of the empirical studies like Dincer and Eichengreen (2014). At the beginning there may not be significant relationship between inflation and transparency, but over time the relationship might be stronger and significant. So, using fixed effect model could be a better choice to control country-specific factors without which the inference could perhaps be wrongly drawn. The panel data result with fixed effect and random effect is represented in Table 3.3. The Hausman test result suggests that fixed effect model is a robust one. The null hypothesis of random effect is rejected at 1 % level of significant except in

specification 1. The results are given in two panels such as fixed effect and random effect. The first panel (fixed effect) results clearly indicate that transparency in Asian-IT countries reduces level of inflation significantly. In the specification 1, IT*TI coefficient is -1.96 and it is significant at 1 percent level. It implies that a percentage increase in transparency reduces inflation by 1.96 percent. Similarly, in specification 4 the result shows that an increase in transparency by 1 percent leads to 2.22 percent decline in inflation. A similar result is observed across four different specifications. The R-square value of the model remains high indicating a good fit. In the initial specifications like (1), the R-squared was 0.46, but the explanatory power increases as the additional factors are included in the models. In the specifications like (3) and (5) the R-squared increase to 0.48 to 0.49. Additionally, explanatory power of transparency also increases as the additional variables are included in the model. For instance, inclusion of per capita income in specification 4 raises the explanatory power of transparency coefficient by 2.22. Similarly, in random effect model the coefficient of IT transparency remains statistically significant except specification 5. The transparency coefficient shows that a 1 percent rise in transparency leads to 1.35 to 1.65 percent decline in inflation. All these results point out that the communication strategy of IT central banks is stronger in Asia. This is shown in Table 3.4 where the communication strategy and framework are given in detail. There is high level of transparency in IT countries in every aspect such as policy, economic, and operational, etc. In non-IT countries, for instance, China, the transparency level is low compared to IT Asian economies (Dincer and Eichengreen, 2007). Similarly, Singapore has low level of transparency (Dincer and Eichengreen, 2014). Other variables that are significantly related to inflation is openness. So high openness increases inflation. The result is statistically significant at 1%, 5% and 10% respectively. The coefficient of openness is 1.35 in specification 2 indicating that a 1 percent increases in openness of a country leads to 1.35 percent rise in domestic inflation. This is true in the case of these Asian economies where exchange rate plays a significant role in the economy. The importance of exchange rate control can be seen from the experience where two Asian economies followed exchange rate targeting policy along with inflation targeting. So, it is obvious to believe that fluctuations in the exchange rate may lead to rise in inflation in the domestic economy. Similarly, the coefficient of 1.21 in specification 3 indicates that high trade activity leads to rising in inflation by 1.21 percent. This result is in line with Ajaz et al. (2016) those who show that increased trade openness increases inflation.

Table 4.3 Transparency and Inflation (Fixed Effect model)

Fixed Effect	(1)	(2)	(3)	(4)	(5)	(6)
Constant	6.04	0.02	-3.72	-24.55	-23.41	0.01
	(0.00)***	(0.99)	(0.60)	(0.14)	(0.16)	(0.99)
IT*TI	-1.96	-1.92	-1.89	-2.22	-2.00	-2.16
	(0.01)***	(0.01)***	(0.01)***	(0.00)***	(0.01)***	(0.00)***
Openness		1.35	1.21	1.34	1.24	1.41
		(0.02)**	(0.06)*	(0.02)**	(0.04)**	(0.01)***
Financial depth			0.99			
			(0.57)			
Per capita Income				2.81	2.66	
				(0.14)	(0.16)	
Past Inflation					0.10	
					(0.15)	
Output Gap						-19.31
						(0.01)***
R square	0.46	0.48	0.48	0.48	0.49	0.49
Observations	208	208	208	208	208	208

Transparency and Inflation (Random Effect model)

Random Effect	(1)	(2)	(3)	(4)	(5)	(6)
Constant	5.84	3.52	12.72	11.60	10.21	3.17
	(0.00)***	(0.18)	(0.00)***	(0.05)**	(0.00)***	(0.22)
IT*TI	-1.58	-1.47	-1.35	-1.36	-0.36	-1.65
	(0.01)***	(0.01)***	(0.02)**	(0.03)**	(0.29)	(0.00)***
Openness		0.51	0.85	0.68	-0.48	0.63
		(0.35)	(0.14)	(0.22)	(0.21)	(0.24)
Financial depth			-2.49			
			(0.02)**			
Per capita Income				1.01	0.59	
				(0.12)	(0.02)**	
Past Inflation					0.47	
					(0.00)**	
Output Gap						-18.22
						(0.02)**
R square	0.02	0.02	0.04	0.04	0.32	0.05
Observations	208	208	208	208	208	208
Hausman test	0.96(0.32)	12.01(0.00)***	14.65(0.00)***	12.58(0.00)***	63.80(0.00)***	11.85(0.00)***

The result is contradicting the theory of Romer who argues that high trade openness results in low inflation in the domestic countries. Other variables such as past inflation, per capita income and financial depth are not significantly related to inflation in the fixed effect model. The insignificant coefficient of financial depth supports the findings of Dincer and Eichengreen (2014). But the insignificant value of past inflation differs from Dincer and Eichengreen's (2014) findings where they show that past inflation has positive impact on inflation. However, in random effect model, all the three variables are found to be statistically significant. The coefficient of per capita income is 0.59 and it is significant at 5 % level. This result suggests that a rise in per-capita income by 1 percent will cause the inflation to rise by 0.59 percent. It is true due to demand theory where higher consumption demand because of higher income lead to upwards pressure on commodity prices and this lead to rising in inflation. Similarly, past inflation has positive sign and is statistically significant at 5 % level.

Table 4.4 Communication arrangement in central bank policy

Country	Open letter	Press notice/ conference	Minutes	Inflation Report	Frequency	Target set by	Published forecasts
Indonesia	No	PR	No	Yes	4	G and CB	Inflation, GDP and GDP components
Israel	No	PR	Yes after two weeks	Yes	2	G and CB	Fan chart forecasts for inflation and key policy rate. Range forecast for GDP
Philippines	Yes	PR+PC	Yes after four weeks	Yes	4	G and CB	Inflation
South Korea	No	PR+PC	Yes after six weeks	Yes	2	CB(with G)	Inflation and GDP
Thailand	Yes	PR+PC	Yes after two weeks	Yes	4	G and CB	Core inflation and GDP

Note: G and CB stand for government and central bank, respectively.

Source: Author's Calculation.

The coefficient of 0.47 indicates that the persistency effect is present in current level of inflation meaning that higher inflation in the past leads to higher inflation in the present period.

3.8. Concluding remarks

This chapter examines the relationship between central bank transparency and inflation rate for five IT countries and eight non-IT Asian economies. First, the study calculates a new transparency level for IT countries using the method of Dincer and Eichengreen (2014). Then a modified method

is proposed for measuring the transparency level following Dincer and Eichengreen (2014) method. Finally, a panel data analysis is conducted to find the relationship between transparency and inflation. After doing all the analysis the study arrives at four main conclusions. First, we observe an increasing trend in the transparency level in IT countries. Israel is found to be the most transparent central bank in Asia followed by the Philippines. Korea is the lowest transparent central bank in IT Asian countries. Secondly, we observe a differential level of transparency by looking at various aspects of transparency. For instance, when IT countries have done well in political, policy and procedural transparency by scoring high points, some low score is also evident from other aspects such as economic and operational transparency.

Thirdly, the ranking of transparency changes when a modified method is employed foe measuring transparency. More precisely, we find that in the old index countries like Indonesia, Korea and Thailand have equal level of transparency, but the same countries report different levels of transparency in the new method. For instance, Indonesia and Korea have now become low transparent central banks compared to Thailand. This result suggests that there is need for a revisit into the existing method of calculating transparency. Fourthly, from the panel data analysis we conclude that central bank transparency has significant power for reducing inflation rate in Asia. This suggests that IT countries that are focusing on promoting transparency have better advantage of experiencing low inflation and achieving target rate of inflation. The stronger communication of central bank has positive impact on the successfulness of IT policy.

This chapter and previous chapter have found positive role of IT in terms of policy outcome. We find that IT reduces disinflation cost and higher transparency level in IT countries reduces inflation significantly. But these two positive results don't necessary reflect one of the important aspects of IT policy. That aspect is financial stability. The significant role of IT policy in reducing financial stability still remains unexplored. This is dealt in the following chapter.

CHAPTER 5

Monetary Policy and Financial Stability: Role of Inflation Targeting

5.1 Introduction

Financial stability has been an important concern for central banks across the world. It is because financial instability has negative feedback effect on price stability (Bean et al., 2010; Blanchard et al., 2010; Mishkin, 2010). Further, it causes economic growth to fall significantly creating mass unemployment and loss in welfare (Cardarelli et al., 2011). The relationship between monetary policy and financial stability remained debatable in academics and policy research. Some studies argued that monetary policy should have financial stability objective in their reaction function. They should respond in time to the imbalances in financial markets (Castro, 2011; Baxa et al., 2013**)**. This action of the central bank will help the country to achieve a sound financial system. Monetary policy can easily influence the determinants of financial imbalances like credit, liquidity and risk-taking, etc., through better information sharing and strong coordination with financial sectors. Simply focusing on supervisory and regulatory tools push up vulnerabilities into financial market, and therefore monetary policy should be implemented for mitigating these problems (Smets, 2014). Akram and Eitrheim (2006) and Granville and Mallick (2009) observed that there is no trade-off between real economic stability and financial stability. In other words, monetary policy responding to financial imbalances to secure stability are unlikely to disturb macroeconomic stability. Inflation targeting policy remained a prudent policy in taking care of growing instability in the financial markets without imposing cost to the objective of price stability and real economy (Akram and Eitrheim, 2006). However, the other side of argument states that pursuing both price and financial stability has a trade-off problem (Akram et al., 2007). Therefore, focusing on financial stability objective along with price stability may lead to time-inconsistency problems. Such problem leads to an undesirable impact on both macroeconomic and financial stability (Fouejieu, 2017). Assenmacher-Wesche and Gerlach (2010) argue that the effect of policy tightening on housing prices is much less on output growth, suggesting a large collateral damage of leaning against house price bubbles. So some other way in terms of regulation and supervision

other than tightening of monetary policy could be a dominant policy in containing financial market bubbles. However, the "conventional wisdom" hypothesis documented the significance of monetary stability. According to this hypothesis, monetary policy focusing on price stability mitigates financial market imbalances and achieves financial stability (Schwartz, 1995). Woodford (2012) argues that monetary policy like inflation targeting, which encourages price stability, leads to increase in financial stability up to certain extent. This strong relationship indicates that they are dependent on each other. Supporting the views, Brunnermeier and Sannikov's (2014) argue that both price stability and financial stability are not separable from each other. So, monetary policy can achieve financial market stability without harming price stability. But, Mester (2016) views that price stability may promote financial stability but not all the time. The outbreak of 2008 crisis has proved the past consensus wrong saying that price stability is a precondition for achieving financial stability. The focus on low inflation and low-interest rate may encourage more leverage in the financial market. **(**Rajan, 2005; White, 2006; Taylor, 2009**).** This can lead to a boom in the financial market and later a financial crisis. This indicates that IT policy explicitly focusing on low inflation may experience a similar problem. Further, it is also argued that sole focus on price stability may neglect imbalances in the financial markets (Frankel, 2012; CEPR, 2013). Under this condition, if IT central bank responds to that, then it may violate the Tinbergen rules, where the number of instruments should be equal to the number objectives. So, it remains unclear whether IT reduces financial imbalances and yields a sound financial system.

There are two important issues that need a thorough examination. First, do IT central banks show serious concern towards financial imbalances? Studies have pointed out that IT is primarily committed to maintaining price stability. Of late, some studies, though not many have confirmed that IT policy shows some concern for financial stability. In this chapter an attempt is made to empirically analyze the linkage between IT policy and financial stability. More specifically, the overarching question is, “Does IT policy increase financial instability?” Before the onset of 2008 crisis the general notion was that “price stability is associated with financial stability following "conventional wisdom" hypothesis”. If we follow this hypothesis, then it is easy to infer that IT can deliver a stable financial market. In other words, under IT regime financial market functions smoothly by ensuring efficient flow of funds and risk diversifications across markets. But the outbreak of financial crisis in 2008 proved this notion wrong as the crisis took place in a low inflation regime. In other words, price stability may not a precondition to achieving financial

stability, instead it ignites financial market vulnerability. So, one may doubt on the following. If price stability is associated with greater financial market fragility, then IT policy, which is fully committed to price stability objective might face the similar problem. This means IT countries are more prone to financial market instability than countries not following price stability as their prime goal of monetary policy. But in the meantime, some studies have shown that IT policy is more transparent than non-IT policy and these findings have important implication for the relationship between IT policy and financial stability. The argument that "A transparent central bank mitigates financial market fragility through effective communication with financial markets and real economy" has been advanced by many countries. Thus, one can infer that IT being a transparent policy can achieve financial market stability by strong communications.

In view of the above, this chapter examines whether IT policy in Asia plays an important role in ensuring financial stability? Towards this objective, our work makes an empirical attempt to establish the relationship between IT and financial stability. To measure financial market instability, a financial conditioning index (FCI) is proposed by combining seven relevant indicators of financial fragility or stress. The relevant variables are identified from the survey of different kinds of literature. Our FCI index follows Human Development Index (HDI) method for calculating financial conditions. This method is nonparametric in nature and avoids weighting problem by treating all variables equally important. In a more complex system it may not be so easy to say that this particular variable contributes more in overall financial imbalances. Amid such problems, it is not advisable to follow any weighting methods to assign weights to each indicator in calculating FCI index. This justifies our reliance on weight free approach in calculating FCI index. The FCI index is calculated for a long time span from 1990 to 2014 for 12 Asian economies including 5 IT countries. In Asia little attention is paid to developing a financial stability index which can assess their financial conditions. This study is the first of its kind to attempt an empirical measurement of financial condition for 5 IT economies including 7 non-IT countries. This FCI index is similar to what European Central Bank has been using for analyzing the financial market conditions. But here we use some additional variables in our FCI index along with the variables that are suggested in ECB's FCI index. This index has one advantage over STLFSI index in U.S as we include both financial and real economy indicators for measuring financial conditions of an economy. But our FCI index is inspired from ECB's FCI index which suggested using both financial and real economy indicators while measuring financial instability.

The rest of the chapter is organized as the following: Section 5.2 provides an extensive review of past literature. Section 5.3 briefly presents the theoretical framework of the study. Section 5.4 identifies relevant variables for calculating index. Section 5.5 describes the methodology of FCI index. Data and variable are discussed in section 5.6. The results on the relationship between financial stability and IT are presented in sections 5.7 and 4.8 respectively. Section 4.9 presents results of the robustness test. Some concluding remarks are offered in the last section.

5.2 Review of Literature

The literature in this area can be primarily divided into three categories such as: a suitable definition of financial stability, an appropriate measure of financial stability and the relationship between price stability and financial stability. In the third category, inflation targeting comes as a monetary policy promoting price stability. The early literature primarily focused on defining financial stability. Indeed it is very important to have a good working definition of financial stability. It is because some useful analytical framework can be designed to examine policy issues. But unfortunately there is no unique and widely acceptable definition of financial stability. The reason for such problem is that the analysis of financial stability is at its infant stage compared to monetary and macroeconomic stability. Amid such problems, some studies have provided a comprehensive and acceptable definition of financial stability. Schinasi (2004) gave a more comprehensive definition of financial stability. According to him, financial stability is a broad concept, which encompasses different aspects of financial system such as institution, infrastructure and markets. In that system, where finance paves the way for resource allocation and risk mitigation, mobilizing savings and accumulating wealth, rising growth is not sufficient, but the smooth functioning of payment system across private and official, formal and informal, retail and wholesale should also be considered as an important dimension of financial stability. World Bank defines financial instability as *"a system-wide episode in which the financial system fails to function"*. Similarly the Hungarian National Bank, central bank of Hungary, defines financial stability as a state of financial system where key financial institutions and financial markets are resilient to an economic shock and performs its normal functioning of transferring capital to the needy sector, accumulating investment and distributing risk. Goodhart (2006) documents that there is no generally accepted definition of financial stability. In defining financial stability, he says that the level of severity of economy's key financial markets to an external shock can be taken as a

measure of strength of financial system. In a similar note, Christiansen (2001) defines financial stability as the absence of financial crisis and financial crisis is defined as a sequence of events that impede easy credit intermediation or capital allocation. After arriving at a formal definition of financial stability, some studies have proposed the empirical measurement through some observable data. In this line, Stolbov and Shchepeleva (2016) have suggested the use of residential real estate market, banking sector and sovereign debt risk as the measure of financial stress. ˇ Cihák (2004) and Boss et al. (2004) propose an early warning indicators for measuring soundness of the financial system. Aspachs et al. (2006) develop a general equilibrium model to assess the health condition of the financial system. Later they propose a financial fragility index based on a general equilibrium framework (Aspachs et al., 2007). Apart from giving a widely acceptable definition and measurement of financial stability, a lot of empirical work has been done on observable variables for establishing the relationship between monetary policy and financial stability. In examining the issues wheather IT policy shows a significant concern for financial stability, Borio and Lowe (2004) find that IT central bank in advance country does not show any concern for financial instability. By estimating a central bank reaction function for four OECD countries like Japan, USA, Germany and Australia they find that none of the central bank responds to financial instability. A developed country like Australia, which follows an inflation targeting policy does not show change in interest rate as financial imbalance. Castro (2011) examines the level of financial stability concern of the major central banks. Considering three central banks such as Bank of England, Federal Reserve Bank and European Central Bank, he estimates both linear and nonlinear Taylor rule to find whether these banks really do care for financial sector stability. The result reveals that only European Central Bank responds to financial instability. The inflation targeting central bank like Bank of England does not show any evidence of responding to the financial sector imbalances. These results suggest that IT central banks are not concerned about financial sector instability. In other words, an inference can be made from the above findings that IT policy has over looked financial sector imbalance due to its mandate towards price stability. Notwithstanding, the recent studies have confirmed that IT policy significantly shows concern towards any imbalance in financial market. On the contrary, Baxa et al. (2013) show that the central banks in U.S.A, U.K, Australia, Canada and Sweden respond significantly to a financial fragility shock. An interesting fact to observe is that four IT countries in OECD group have shown significant concern towards a financial instability by reducing key interest rates. Fouejieu (2017)

investigate that affirmation in a Taylor rule framework for some emerging countries. After estimating a reaction function they find that IT countries indeed respond to financial instability along with the objective of price stability. But it is argued that responding to financial stability by tightening the policy rates could have larger undesirable impact on real economy. Gerlach (2010) argues that the effect of a policy tightening on housing prices is much less on output growth, suggesting a large collateral damage of leaning against house price bubbles. These studies probably suggest some other way in terms of regulation and supervision other than tightening of monetary policy to contain financial market bubbles. But it can't be denied that monetary policy have some desirable impact on the banking sector's risk. Altunbas et al. (2012) find that easy monetary policy can reduce banks' risk factor in the short run. However, he warns about its long-run impact because an easy monetary policy promotes higher risk in the long run. Williams (2014) points out that the macro prudential policy can be a better policy than inflation targeting in containing financial stability. But due to some limitations in the macro-prudential policy, he argues that IT policy should incorporate financial stability objective in the monetary policy. Similarly, some studies have examined the relationship between price stability and financial stability. Brunnermeier and Sannikov's (2014) argue that price stability and financial stability are not separable from each other. So, the monetary policy showing concern towards macroeconomic stability should also be empowered with financial stability. Schwartz (1995) proposed a "conventional wisdom" hypothesis where she linked the relationship between price stability and financial stability. Focusing on banking sector, she argued that price stability could contribute to financial stability through both micro and macro channels. In micro level, low inflation, which is a proxy for price stability, leads to reduction in uncertainty, increase in investment horizon to longer time, thus leading to financial stability. At macro level, price stability increases the value of collateral and reduces financial vulnerability. Akram and Eitrheim (2006) observe that there is no trade-off between real economic stability and financial stability. They find that inflation targeting remains a prudent policy in taking care of growing instability in the financial markets without imposing cost to the objective of price stability and real economy. In a similar note, Woodford (2012) argues that monetary policy like inflation targeting, encourages price stability leading to increase in financial stability up to certain extent. He makes the point that such type of monetary policy reduces wage-price spiral, which helps to reduce financial instability. Granvill and Mallick (2009) find that there is no trade-off between monetary policy stability and financial

stability. Using a sign restrictive VAR approach, they show that monetary stability plays an important role in the long run for achieving financial stability in euro area. They argue that after a shock the financial system remains prudent and ensures efficient flow of funds and distributions of risks indicating a smooth process in the working of financial system. Smets (2014) examines the linkages between monetary policy and financial stability. He argues that monetary policy should be given due importance for making financial stability as another objective along with price stability. He puts the argument that monetary policy can easily influence the determinants of financial imbalances like credit, liquidity and risk taking, etc. It allows better information sharing and strong coordination with financial sectors. Simply focusing on supervisory and regulatory tools push up vulnerabilities into financial market, so monetary policy should be implemented for mitigating these problems. On the other hand, he suggests some negative impact of doing this in terms of risk. It is argued that monetary policy can't fully prevent the crisis which may lead to reduction in the credibility of the central bank through declining confidence channel of monetary policy. Moreover, he points out that pursuing both price and financial stability has some sorts of trade-off problems. The focus on financial stability objective along with price stability may lead to time-inconsistency problems. Therefore, he suggests that monetary policy should have financial stability objective only when macro-prudential policy fails. In contrast to their earlier work, Akram et al. (2007) finds that IT country faces trade-off between price stability and financial stability. On the other hand, they observe that this trade-off seems to be dependent on the proxies used in measuring financial stability. For some proxies, they find a weak trade-off between price stability and financial stability. Frappa and Mésonnier (2010) examine the impact of inflation targeting on financial stability for a sample of 17 OECD countries. They make use of propensity score estimation technique, which avoids self-section biases arising from choosing the inflation targeting sample, to find the relationship between inflation targeting and financial stability. Using housing price and house price-to-rent ratio as the two indicators of financial stability, they find that inflation targeting policy increases financial market instability. By comparing the result between OECD IT and non-IT countries, they find that IT policy positively and significantly influences housing prices and rent-to-price ratio. This indicates that the advance countries under IT policy can experience housing bubble which is dangerous to financial market stability. They explain this result by giving an explanation that, IT leads to lower real interest rate regime which poses risk to financial market as it fuels higher asset prices. Borio and Lowe (2002) observe a similar case where a credible

inflation targeting policy produces low inflation, credit growth and booming asset prices. First, a stable economic environment may spur optimism about the future which leads to booming of assets market. Second, improvement in the supply side and labour market may put a downward pressure on consumer prices. In order to tackle the overly optimistic expectations, Blanchard et al. (2010) and Svensson (2012a) say that the short-term interest rates should be increased by a larger amount to lower double-digit credit growth and effectively lean against overly optimistic expectations. It is because overly optimistic expectations leads to financial imbalances. Rajan (2005) argues that loose monetary policy or low interest rate regime can induce investors to find some risky investment, which offers high return because return due to low interest rate of central banks is already low. This high yield from risky assets further ignites financial innovations which leads to rise in the market risk. Supporting the above view, Taylor (2009) makes an empirical investigation to find whether easy monetary policy had to play any role in the financial instability. Using a counterfactual dynamics of housing prices from 2001 to 2009, he finds that too low interest rate of central banks below the predicated rate in Taylor rule, has resulted in housing market booms. He argues that if the monetary policy had maintained an interest rate close to what is predicted in Taylor rule, housing market crash could have been avoided. However, Mester (2016) has a balanced view regarding price stability and financial stability. He observes that price stability may promote financial stability but it can't do such thing always. Sometimes financial imbalances arise from nonbanking and other institutions. In that case the notion that "price stability can lead to financial stability" may fail. A similar kind of view is given by Bernanke and Gertler (1999, 2001) where they have shown that monetary policy should respond to a financial instability until it threatens its price stability objectives. Williams (2014) argues that there is a conflict between the objective of price stability and financial stability. Responding to financial instability may lead to undesirable long-run impact on the economic performances. But there are studies that argue that there is no serious reason to make a change in the monetary policy reaction function. Blanchard et al. (2010) opine that it is not necessary to change the priority in the reaction function of central bank's monetary policy. The focus on better cooperation with supervising body can take care of the financial stability objective. Blot et al. (2015) investigate the Schwartz's conventional wisdom hypothesis, which says that price stability can lead to financial stability for the U.S and Euro area. Their findings suggest that price stability can have both negative and positive impact on financial stability depending upon the proxy used in measuring financial stability. Using two financial stress

indices of U.S and Euro area in a VAR framework, they show that a positive inflationary shock increases financial vulnerability meaning that price stability can promote financial stability. Their first result supports the conventional wisdom hypothesis. But when the stock price, an observable variable is taken as a proxy for financial stability, the VAR result indicates a negative relationship between price stability and financial stability. In other words, central banks considering price stability as their sole purpose in the monetary policy, may face undesirable consequences of financial instability. Additionally, from the correlation test, they find that a rise in price stability can lead to decline in financial instability. Demirguc-kunt and Detragiache (1998) use a group of both developed and developing countries to find out the possible reasons for the systemic banking crisis. Using a multinomial logit model, they analyze several potential factors that can contribute to banking crisis. In the empirical result, they find that high real interest rate and high inflation increase the probability of banking crisis.

5.3 Theoretical linkage between inflation targeting and financial stability

There is no such direct theoretical model explaining how inflation targeting policy can affect financial stability except Woodford (2012). Woodford (2012) proposes a new Keynesian model to show the potential role of IT. He argues that monetary policy like inflation targeting, which encourages price stability, leads to increasing in financial stability up to certain extent. In explaining the channels, "conventional wisdom" had an indirect answer for such argument. Schwartz (1995) proposes "conventional wisdom" where she links price stability to financial stability. Focusing on banking sector, she argues that price stability can contribute to financial stability through both micro and macro channels. At micro level, low inflation, which is a proxy for price stability, leads to reduction in uncertainty, increasing investment horizon longer thus leading to financial stability. At macro level, price stability increases the value of collateral and reduces financial vulnerability. Borio and Lowe (2002) state that "A monetary regime that produces aggregate price stability will, as a by-product, tend to promote stability of the financial system". But, Rajan (2005), White (2006), Leijonhufvud (2007) and Taylor (2009) claim the above notion to be irrelevant, instead they argue that price stability can lead to financial instability. They document that price stability followed by low-interest rate regime encourages risky investment for higher return and thus, rise in overall risk in the market. Mester (2016) views that price stability may promote financial stability but it can't do such thing always as sometimes financial imbalances

arise from nonbanking and other institutions. But, Williams (2014) argues that as there is conflict between the objective of price stability and financial stability, responding to financial stability may lead to undesirable long-run impact on the economic performance.

5.4 Identifying indicators of financial stability

Several key variables are used in the literature to measure financial stability using three different jargons such as financial stress, financial conditions and financial soundness. The prominent indicators from banking, foreign exchange, debt, and equity markets are used for measuring financial market stability. Apart from this, IMF has recommended a list of indicators which can be referred for the assessment of the financial soundness of a country. Further, while Federal Reserve Bank of the U.S concentrated only financial sector indictor in measuring financial fragility, European Central Bank used additional indicators from real economic sector. As Goodhart (2006) observes that there are no generally accepted definitions of financial stability, the indicators used in measuring financial stability might very from study to study. Stolbov and Shchepeleva (2016) have suggested the use of residential real estate market, banking sector and sovereign debt risk as the measure of financial stress. In this study, we have identified 7 variables related to banking sector, foreign exchange and macroeconomic conditions. Here, first we discuss banking sector indicators and then foreign exchange followed by macroeconomic factors. IMF provided a list of financial soundness indicators which can be considered for measuring financial stability. But due to data limitations, following indicators are considered in the analysis.

Capital flows:

Following Gadanecz and Jayaram (2009), capital flow is taken as a proxy for financial instability. The capital flow is defined as the "ratio of bank's foreign assets to total assets". This ratio shows the amount of external exposure a country's banking sector has out of its total assets. A higher level of foreign assets to total assets of a banking system indicates a stronger interconnection with the world market. In this situation, financial imbalance in the external world could negatively affect the financial system of the domestic economy. But the extent to which it affects the domestic financial system depends on the level of interconnectedness with the external world. In the emerging economies it is generally considered that a higher amount of outflow is a treat to the

stability of the financial sector. So, the outflow of capital due to the shock will hamper the stability of the domestic economy.

Liquidity:

Liquidity is defined as the "banking system's credit to total deposits". Lim et al. (2011) have suggested for using liquidity as the proxy for financial instability. They argued that this ratio shows a bank's exposure to non-core funding. When deposit growth falls and credit growth rise at the faster rate than the supply of fund is managed by the non-core liability raised from the capital market. Hahm et al. (2013) view that a rise in non-core funding leads to increase in banking sector vulnerability and risk of crisis.

Interest rate spread:

Interest rate spread is defined as the "spread between lending rate and money market rate". Brave and Butters (2011) and Osorio et al. (2011) have suggested that the interest rate spread can be taken as an indicator of financial instability. A rise in the gap between lending rate and money market rate can have negative impact in the credit market. The larger gap between these rates indicates disturbances in the market which leads to a rise in financial sector fragility.

Credit growth:

Credit growth is defined as the annual growth rate of banking sector credit. Gadanecz and Jayaram (2009) viewed the importance of credit growth in reflecting the imbalances in the real economy. Osorio et al., (2011) referred to private credit as a % GDP for analysing financial instability. According to Mehrotra and Yetman (2015), credit advanced swiftly and without any regulation can disrupt the financial stability.

Non-performing assets of banks:

Non-performing assets (NPA) refers to the loan which is near to default or not been paid for long after it's due. A rise in NPA shows the poor performances of the banking sector. These bad assets increase stress for the banking system and financial system as the former system depends on the interest rate from loan. The liquidity problem also arises in the banking system due to non-payment of interest rate and loan amount. The high NPA also indicates that the banking sector has funded very risky projects or bad projects. This reduces the asset quality and profitability of banking sector

which reflects elevated risk to the banking sector stability. Following Gadanecz and Jayaram (2009), NPA is taken an indicator for measuring financial instability.

Exchange rate change:

Following Gadanecz and Jayaram (2009), domestic exchange rate against dollar is taken as an indicator of financial instability. A fall in exchange rate leads to decline in external competitiveness and hence, fall in export growth. Further, a frequent change in exchange rate may cause massive outflow of foreign capital which can further lead to financial instability.

Ratio of credit to GDP:

This ratio is defined as the percentage of private sector loan to total GDP. A rapid rise in loan can be a source of banking sector unsustainability. Demirgüç-Kunt and Detragiache (1998) argued that credit to GDP is found to be associated with the banking crisis. Rapid growth in credit to GDP leads to overheating of the economy and increasing risk in financial system.

5.5 Measuring financial stability in Asian countries

Although there is a consensus among policy makers to define price stability, a unique definition for financial stability still remain vague. Goodhart (2006) says that there are no generally accepted definitions of financial stability. Christiansen (2001) defines financial stability as the absence of financial crisis and then he defined financial crisis as the sequence of events that impede easy credit intermediation or credit allocation. Further, Goodhart (2006) points out that financial stability can be assessed by making a stress test at the micro level. In other words, individual bank's balance sheet, profits, etc., can be evaluated to know whether the banks are financially sound or not? But Hellwig (1994, 1995) recognizes what looks sound and stable at micro level may not necessarily provide same outcome at macro level. At macro level the situation might show more fragile and vulnerable as other sets of linkages are included at macro level analysis. While giving a partial definition of financial stability, Goodhart (2006) says that an economy is financially stable or not can be found by simply looking at the degree of the influence of a given external shock. The more the adverse impact of a shock on an economy, less stable is that. More formally, Borio and Drehmann (2010) defines financial stability as "a set of conditions that are sufficient to result in the emergence of financial distress/crises in response to normal-size shocks". But when it comes to observable data, variety of indicators are being used for assessing financial stability. It starts

with single variable approach like housing prices (Frappa and Mésonnier, 2010), stock prices (Blot et al., 2015) and ends with composite indicators approach where a set of variables is used to construct an index for financial stability (Bordo et al., 2000; Cardarelli et al., 2011; Brave and Butters, 2011). Despite the use of single indicator approach, composite indicators approach remains an important method for calculating financial stability. The composite indicator approach aggregates the overall information regarding the health of the financial and macroeconomic sector. Studies have shown that the use of single variable for the analysis of financial stability may not correctly reflect the financial sector imbalances (Brave and Butters, 2011). So, the use of multivariate approach can be preferred over single approach for a better assessment of financial sector vulnerability. As this multi-dimensional analysis needs the assignment of appropriate weight to the FCI index, the principal components analysis (PCA) seems to be an appropriate approach. This approach shows that by putting some correct weight on the basis of their relative contribution, the index can calculate the value which captures true financial sector instability. But Arzamasov and Penikas (2014) view that principal component analysis has certain advantage of combining a set of information but at the same time it complicates the analysis by adding too many negative weights. Further, a problem with this approach is that the varying time dynamics is neglected while assigning weights to each variable. In the PCA, weights are not assigned at each time point. Thus there is a possibility that a weight might neglect time factor in the analysis. In the time series, macroeconomic and financial variables undergo structural changes, which mean that overtime a similar pattern of relationship might not hold between two separate time periods-pre break and post-break period (Zivot and Andrew, 1992; Lumsdaine and Papell, 2003). The economic environment might be different in the 1990s than 2000s in a globalised era. As a result the relative importance of a particular variable in the financial sector might undergo several changes. Therefore, assigning a constant weigh in a long time series makes the weighting method a weak approach. Further, improper weighting in the index calculation makes the index more biased towards some particular dimensions. In light of the above-cited problem, this study avoids those by using weight free method in the construction of FCI index.

5.5.1 Constructing financial conditions index (FCI)

With the rising interest in financial stability across policymakers, a multidimensional financial instability index has been proposed for measuring financial conditions of a country. The

construction of Financial Stability Index (FSI) is similar to the method previously used by United Nations Development Programme (UNDP) for computing some popular indices such as Human Development Index, Human Poverty Index and Gender Development Index and so on. This index is different from other indices like stress index because it includes both financial sector variables along with real sector variables.

The construction of financial conditions index (FCI) follows as below:

$$FCI_t = \frac{d_{it}}{number\ of\ dimensions} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

$$\text{And } d_{it} = w_{it} * \frac{A_{it} - m_i}{M_i - m_i}$$

Where, w_{it} = Weight attached to the dimension i, $0 \leq w_i \leq 1$ for time t.

A_{it} = Actual value of dimension i for time t.

m_i = Minimum value of dimension i.

M_i = Maximum value of dimension i.

d_{it} = Dimensions of financial conditioning index i for time t.

FCI_t=Financial conditioning index for time t.

i= refers to dimensions of FCI which is nothing but the number of variables used in the calculating the index.

t= refers to the length of time period used for each dimension (variables) in FCI index.

More explicitly, we proceed in constructing the FCI as following:

Step 1:

$$d_{it} = w_1 * \frac{A_{1t} - m_1}{M_1 - m_1} + w_2 * \frac{A_{2t} - m_2}{M_2 - m_2} + w_3 * \frac{A_{3t} - m_3}{M_3 - m_3} + w_4 * \frac{A_{4t} - m_4}{M_4 - m_4} + w_5 * \frac{A_{5t} - m_5}{M_5 - m_5} + w_6 * \frac{A_{6t} - m_6}{M_6 - m_6} + w_7 * \frac{A_{7t} - m_7}{M_7 - m_7} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

Where, $d_{1t} = w_1 * \frac{A_t - m_1}{M_1 - m_1}, d_{2t} = w_2 * \frac{A_2 - m_2}{M_2 - m_2}, d_{3t} = w_3 * \frac{A_3 - m_3}{M_3 - m_3}, d_{4t} = w_4 * \frac{A_4 - m_4}{M_4 - m_4}, d_{5t} = w_5 * \frac{A_t - m_5}{M_5 - m_5}, d_{6t} = w_6 * \frac{A_t - m_6}{M_6 - m_6}\ and\ d_{7t} = w_7 * \frac{A_7 - m_7}{M_7 - m_7}$

Step 2:

$$FCI_t = \frac{d_{1t} + d_{2t} + d_{3t} + d_{4t} + d_{5t} + d_{6t} + d_{7t}}{7} \quad \text{.....(10)}$$

Here, d_{1t} stands for bank's foreign assets to total assets, d_{2t} stands for banking system's credit to total deposits, d_{3t} stands for domestic exchange rate change against dollar, d_{4t} stands for interest rate spread between lending rate and money market rate, d_{5t} stands for credit growth, d_{6t} stands for non-performing assets of banks and d_{7t} stands for credit to private sector. There is no such restriction in using the number of variables in FCI calculation. It depends on the availability of time series data for the relevant variables. In our case, we have only seven relevant variables for which we have time series data available for all 12 Asian countries. Now from the FCI index it is easy to trace the periods of financial imbalances. In the FCI index, high FCI value in a particular period indicates higher financial instability and the low FCI value indicates lower financial instability.

5.6 Data and Variables

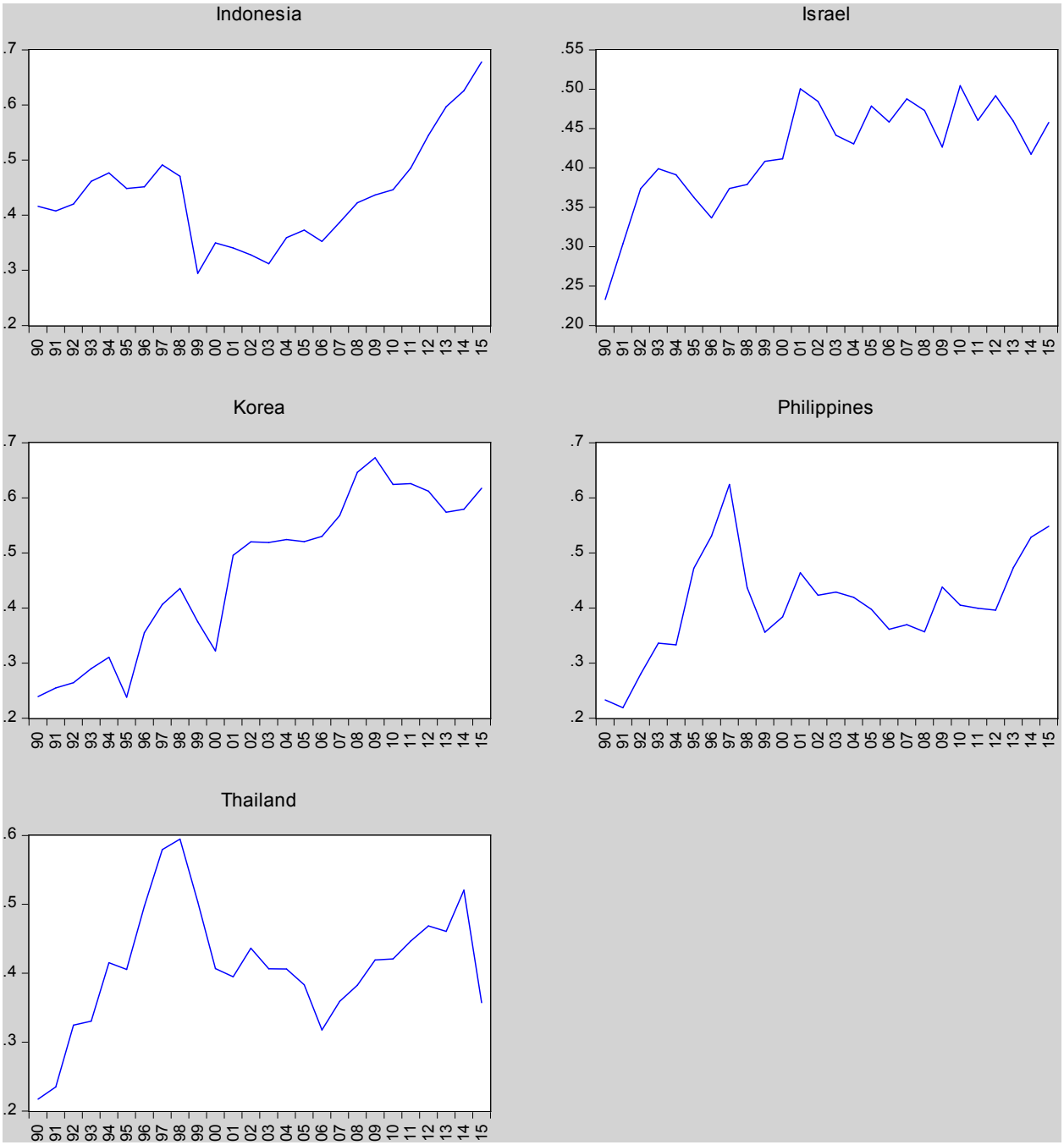
This study uses financial stability index (FCI) for all 12 Asian economies including 5 IT countries. Some control variables such as openness, M3 growth, exchange rate volatility, financial stability transparency, central bank transparency and central bank independence are included in the regression equation. The data period covers from 1990 to 2015 on an annual basis. The time series variables are collected from World Development Indicator, World Bank and Federal Reserve Bank of ST. Louis, Bank for International Settlement (BIS) and Bloomberg. The data for central bank transparency and independence are taken from Dincer and Eichengreen (2014). Similarly, data on financial stability transparency is collected from Horváth, and Vaško (2016).

5.7 Results and Discussion

First, the reliability of FCI index is tested against some of the past episodes of financial crises. More explicitly, we have analyzed the practical application of our constructed index to capture financial instability. From Figure 5.1 it is observed that all Asian countries have shown high FCI value near the East-Asian crisis 1997. This means that financial condition of these countries has shrunk during these periods. As Indonesia, Thailand, Philippines and Korea were most affected countries in East Asian crisis, they are supposed to show high FCI value around 1997. Looking at

Figure 5.1 it is clear that FCI values are high in all three East Asian countries. The FCI value is the highest in Philippines, i.e. 6.5 followed by Thailand and Indonesia. The lowest score in FCI value is observed in South Korea.

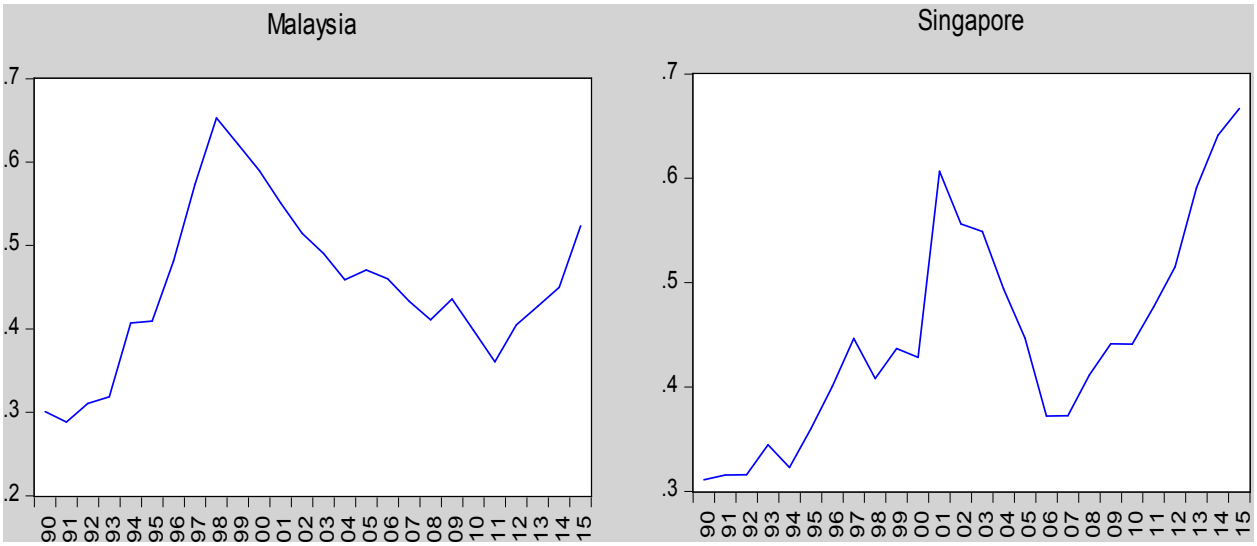
Figure 5.1 FCI in all five IT countries

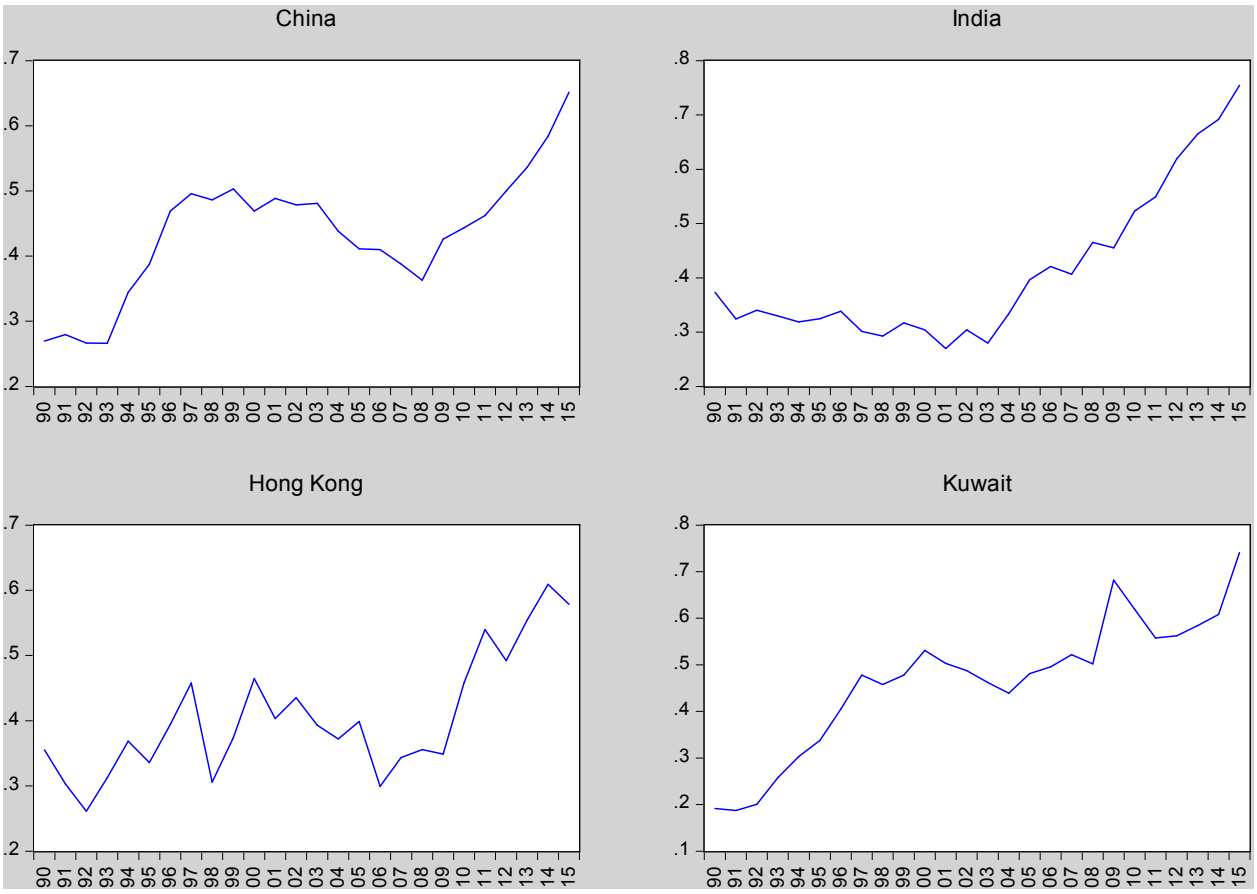


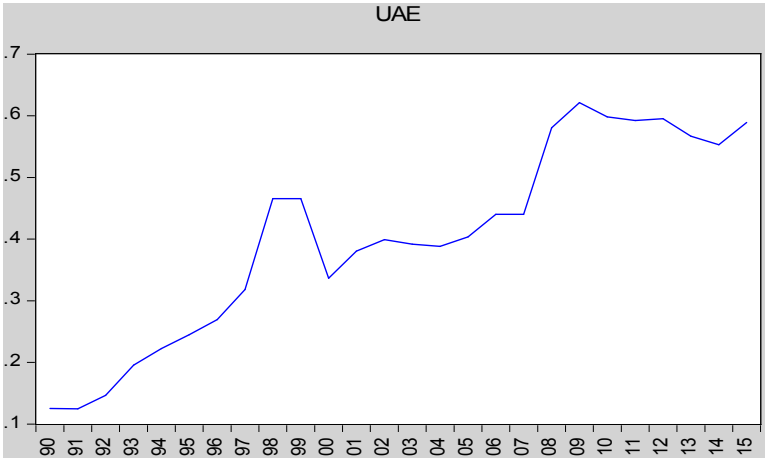
Source: Author's Calculation.

These scores of FCI index indicate that Philippines, Thailand and Indonesia were most affected countries in East Asian crisis 1997 and the least affected country was Korea. It had both systemic banking and currency crisis in 1997 and 1998 respectively, which led to rising FCI score around that particular years. Indonesia has also similar systemic banking crisis at the beginning of 1997 which is captured in the FCI index. As we can see FCI score show a peak level around 5 points indicating a high FCI value and weakening financial conditions. Similarly, we have also checked the validity of the index in the light of recent 2008 crises. By looking at the graphs of all five countries, it is observed that Korea, Philippines, Indonesia and Thailand have shown increasing FCI value during the 2008 crises period. Israel was the least affected in Asian IT countries. The FCI value in Thailand has again increased from 3.5 to all most 5 point. Similarly, Philippines has scored from 3.5 to 4.5. Korea and Indonesia have witnessed increasing FCI. South Korea has shown increasing FCI score around 2001 to 2002 due to stock market crises which indicate that our index captures financial instability arising in the market. The Philippines had sovereign debt restructuring problem in 1992 and it has been well captured in FCI index as we see the figure line. The FCI is increasing in 1991 till 2003 showing the crisis impact. So, we can say that our index is able to capture the major financial instability in the sample IT countries. The FCI index can capture major financial crises. This result strengthens our study implying that our study uses some of the relevant proxies in measuring financial instability.

Figure 5.2 FCI trend in all Non-IT countries







Source: Author's Calculation.

In the non-IT countries, FCI is also found to be a good index for capturing major financial crises or imbalances. Looking at Figure 5.2 it is observed that the FCI value in all East Asian economies has increased during East Asian crises indicating a higher financial instability. More particularly,

China, Singapore, Malaysia and Hong Kong have been affected in the 1997 East Asian crisis, as reflected in FCI value.

5.8 Relationship between inflation targeting and financial stability

In this section, we examine the role of inflation targeting regime on the financial market stability. More particularly, we try to assess the extent to which inflation targeting countries can influence financial stability than the non-inflation targeting countries. In order to do so, our empirical analysis relies on two main approaches. First, the study conducts a panel data estimation of the regression equation where the role of inflation targeting on financial stability is examined. To define the impact of inflation targeting, a dummy variable called IT is introduced which takes the value 1 if financial imbalances occur under inflation targeting regime and 0 otherwise. Second, the empirical analysis relies on the estimation of VAR model in order to confirm the relationship between price stability, monetary stability and financial stability.

5.8.1 Panel data analysis

To examine the role of inflation targeting in the financial market stability, a panel regression is estimated with country fixed effect model. This method is employed to capture heterogeneity in individual countries. To capture the influence of additional factors which can influence financial stability in the presence of inflation targeting regime, a set of control variables are introduced in the regression equation. This is done to avoid the misspecification problems arising from omitted variables in the regression. The estimated panel equation takes the following form:

$$FCI_{it} = \emptyset + \beta IT_{it} + \delta FCI_{it-1} + \gamma \mathrm{X}_{it} + \varphi_i + v_{it} \quad \text{.....(11)}$$

Where, FCI_{it} stands for financial conditioning index in ith country for t period. FCI_{it-1} is the one year lagged value of FCI_{it}. This variable captures the persistence effect of financial vulnerability. By including this lagged dependent variable the equation is now transformed into dynamic panel estimation model. IT_{it} is a dummy variable which takes the value 1 for ith country if the particular period is under IT regime and takes 0 if that period is not under IT policy. In other words, the dummy variable takes the value 1 for a country at which that country has started adopting IT policy after that and 0 for the pre-adoption period. φ_i stands for country fixed effect and v_{it} is an error term. $\emptyset$, β and γ are the regression parameter which is to be estimated. The estimation value of β will yield the magnitude of the relationship between inflation targeting policy and financial

stability. Similarly, estimation of γ yields significance of other important factors that explain financial stability in Asia. X_{it} stands for all possible control variables that can influence financial stability. They are openness, M3 growth, exchange rate volatility, financial stability transparency, central bank transparency and central bank independence.

5.8.2. Empirical Results

The regression is conducted using country fixed effect model. This specification of fixed effect can control for the country-specific characteristics and provides good estimates. The regression result is reported in Table 5.1. There is a significant positive relationship between IT and financial instability. The IT variable has positive sign and statistically significant. The coefficient value of IT lies in the range of 0.02 to 0.09 in all nine different specifications. This indicates that the adoption of IT in Asia increases financial instability by 0.02 to 0.09 percent. The result remains robust even after introducing some control variables in the panel regression. These findings suggest that the Asian economies following IT regime are financially vulnerable and unstable. The result supports the findings of Frappa and Mésonnier (2010) in OECD IT countries. The possible explanations for this result could be given as follows. First, Rajan (2005), White (2006) and Leijonhufvud (2007) claim that low-interest regime due to low inflation condition might offer low return which further encourages the investor to take high risk for getting higher return. Second, Frankel (2012) and CEPR (2013) view that single objective of inflation goal has neglected the financial sector developments and responded less to the financial sector imbalances. Apart from that, some control variables are found to be significantly related to financial instability. It is argued that financial transparency of central bank has potential role in minimizing financial sector imbalances (Born et al., 2012) and global instability (Horváth and Vaško, 2016). Transparency in the form of identifying potential shocks has a positive impact on the action of the market, which leads to stabilization of the financial system (Haldane et al., 2007). So, this argument is verified by testing the relationship between FCI and financial transparency. The result is given in Table 5.1 showing that financial transparency is positively associated with FCI. This means, an increase in central bank communication regarding financial market development has favourable impact on financial stability. In other words, a central bank having a strong communication system on financial stability can correct financial sector imbalances. The coefficient of financial transparency is -0.09 and it is significant at 1 percent level. This coefficient value indicates that a one percent

increase in financial transparency in central bank leads to a 0.09 percent reduction in financial instability. This result is in line with some of the recent findings of Born et al. (2012) and others. However, financial transparency in IT countries does not show significant relationship with financial stability. In other words, central bank communication regarding financial stability conditions has insignificant role in reducing financial instability in IT Asian economies. But the coefficient of financial transparency has negative sign meaning that an additional communication in the form of financial transparency other than central bank transparency can improve financial conditions in the IT countries. The central bank transparency in IT countries significantly reduces the financial instability. This suggests that in IT countries central bank monetary policy transparency dominates over financial transparency in reducing financial imbalances. Further, the study tests whether there are any limits to the level of financial transparency in the central banks. To do so, we generate a squared term of financial transparency and use the same in the regression equation. The result from Table 5.1 shows that financial transparency after certain level is not harmful. The variable FT*FT which measures the square time's increase in financial instability is statistically and negatively significant at 1 percent level. In other words, the square time increases in financial stability leads to reduction in financial instability. Another determinant which reduces financial instability in IT countries is central bank independence. An independent IT central bank also significantly mitigates financial market imbalances. The coefficient value of CBI is statistically negatively significant at 1 percent level. The coefficient of -0.10 indicates that an increase in central bank independence is associated with 0.10 percent decline in financial instability. Similarly, openness is significantly positively related with FCI meaning that an increase in openness raises financial market instability. This suggests that a more open economy is likely to face more financial vulnerability.

Similarly, another factor like high money growth also has positive impact on financial instability. A one percent increase in money growth leads to 0.02 to 0.05 percentage rise in financial instability. It means, rising money growth in a country is not a good sign for its financial health condition. Additionally, the result shows that high exchange rate volatility has positive impact on financial instability. The exchange rate volatility has positive sign and it is statistically significant with FCI. This suggests that the countries, which experience more exchange rate volatility are more prone to financial instability.

Table 5.1 Relationship between inflation targeting and financial instability

Dependent Variable: FCI	Country fixed effect model									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
IT	0.09	0.08	0.03	0.02	0.06	0.05	0.06	0.08	0.06	
	(0.00)*	(0.00)*	(0.06)***	(0.15)	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	
Openness		0.05	0.03	0.03	0.05	0.05	0.05	0.05	0.05	
		(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	
M3 growth			0.15	0.12						
			(0.00)*	(0.00)*						
Exchange				0.002	0.004	0.004	0.004	0.005	0.005	
Volatility				(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	
Financial					-0.09					
Transparency					(0.01)*					
IT*FT						0.006				
						(0.89)				
FT*FT							-0.001			
							(0.04)**			
IT*Transparency								-0.006		
								(0.00)*		
CBI									-0.10	
									(0.00)*	
FCI_{t-1}										0.89
										(0.00)*
Constant	0.40	0.14	-0.42	-0.32	0.09	0.10	0.10	0.09	0.09	0.05
	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*	(0.00)*
R-squared	0.10	0.24	0.35	0.38	0.34	0.33	0.34	0.35	0.35	0.79

Source: Author's calculation.

The increasing volatility creates uncertainty particularly for the financial institution and domestic economy in general which in turn leads to weak financial conditions. Further, the lagged period of FCI variable is statistically significant and bears positive sign. This indicates that financial risk in previous period positively persists to the next period. In other words, a country with more financial fragility in past years is likely to face increasing vulnerability in the present year.

5.9 Robustness Check

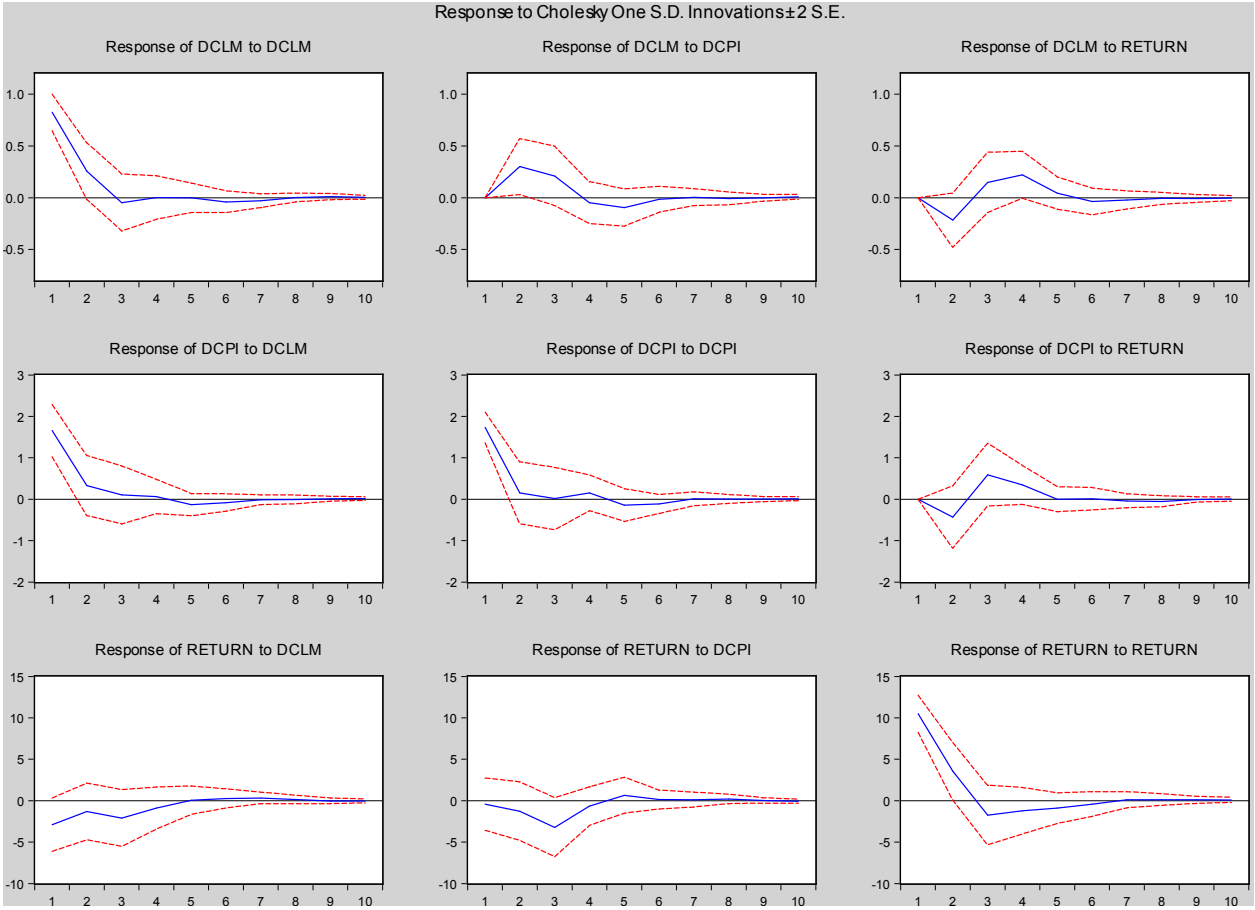
For robustness check the study employs both stock price and housing price as proxy for financial instability. Similarly, both interest rate and inflation are used for monetary and price stability respectively. A VAR model is used in the analysis and the results are analyzed through Impulse response function (IRF) and Variance Decomposition (VD) method.

5.9.1 Evidence from stock prices

Following Granville and Mallick (2009) and Blot at al. (2015) this study uses stock price as a proxy for financial instability. [11]It can be argued that this single variable is a narrow definition of financial instability, but at the same time we should admit that this is an observable variable for financial market stability. Blot at al. (2015) makes use of individual stock price as a proxy for measuring financial stability in the U.S and Europe. They also admit that the proxy is weakly representing overall financial stability in the market, but they argue that a directly observable variable should be used to assessing financial stability. The result of Impulse Response Function (IRF) for Indonesia is reported in Figure 5.3. CPI refers to inflation, TBILL refers to short-term Treasury bill rate, RETURN refers to stock market return and CLM refers to call money rate. The result shown in the 8th diagram indicates that there is a negative relationship between financial price stability and financial stability. In other words, a rise in price stability leads to fall in financial market stability. In the diagram the IRF line (blue line) shows that the stock return which is taken as a proxy for financial instability is negatively responding to a positive shock in CPI inflation which is taken the proxy for price stability. The stock market return immediately declines to negative value following a positive shock to inflation.

[11] The unit root test is conducted for all variables used in the VAR model. Some variables are taken in first difference due to unit root at the level data.

Figure 5.3 Relationship between stock return, inflation and interest rate in Indonesia



Source: Author's Calculation.

The result is in line with the findings of Blot et al. (2015) who argued that more and more price stability in U.S and Europe have resulted in more financial instability considering stock price as a proxy for financial stability. But our result does not support the "conventional wisdom", which suggests that price stability can lead to financial instability. Moreover, our findings are in line with the recent studies of White (2006) and Leijonhufvud (2007) saying that price stability can cause more financial instability. This result further confirms the "paradox of credibility" which says that price stability achieved by central banks have caused more vulnerability in the financial system. Further, following Granvill and Mallick (2009) central bank interest rate is taken as a proxy for monetary stability. The result reported in Figure 5.3 shows that there is a negative relationship between interest rate and stock return in Indonesia. The IRF result in 7th panel illustrates that a positive shock to call money rate leads to fall in stock return for entire 10 year period.

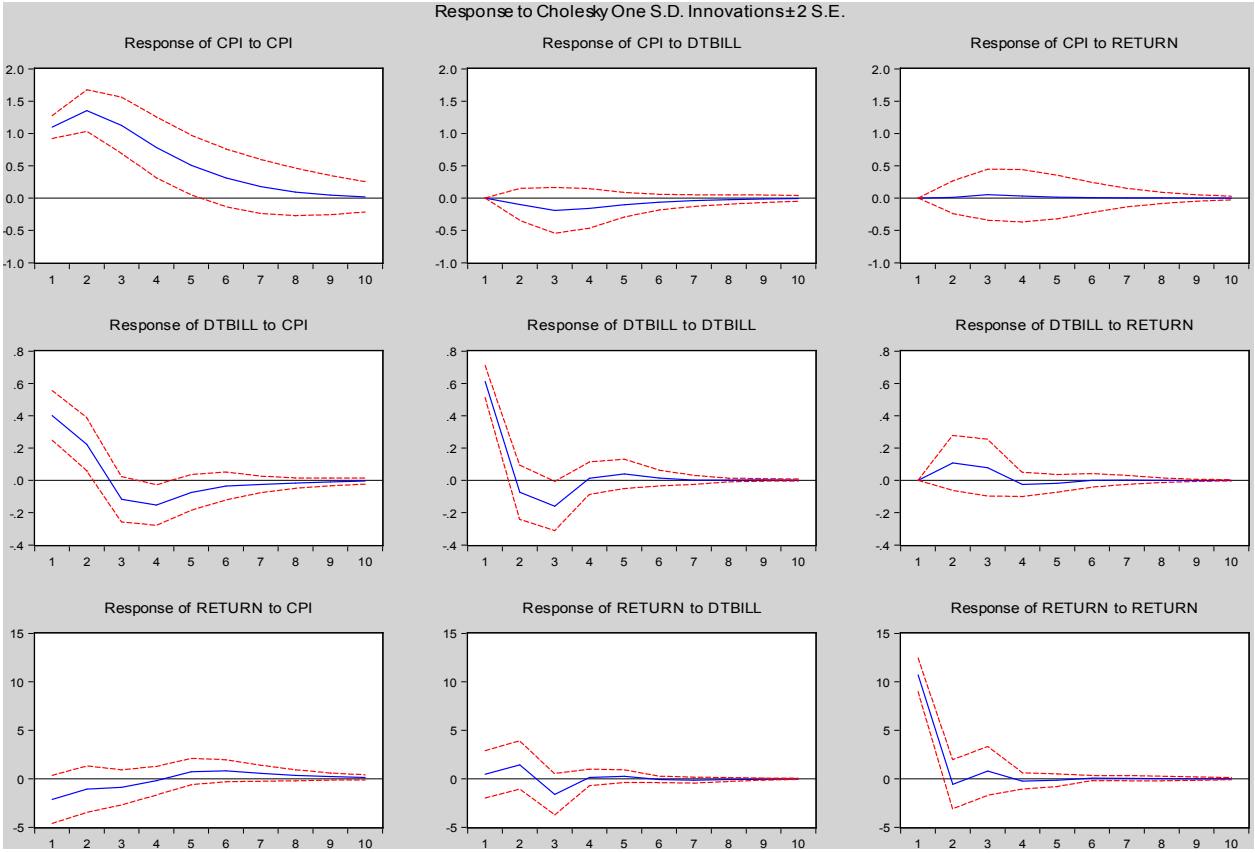
Table 5.2 Variance decomposition in Indonesia

Period	S.E.	CLM	CPI	RETURN
Variance decomposition of CLM:				
1	0.825177	100.0000	0.000000	0.000000
2	0.940228	84.48421	10.24951	5.266283
3	0.975932	78.64664	14.16025	7.193116
4	1.001796	74.63821	13.67209	11.68970
5	1.007239	73.83398	14.40749	11.75853
6	1.008815	73.76050	14.38415	11.85535
7	1.009473	73.74599	14.36794	11.88607
8	1.009526	73.73854	14.37251	11.88895
9	1.009599	73.73773	14.37044	11.89182
10	1.009642	73.73258	14.37525	11.89217
Variance decomposition of CPI:				
1	2.397707	47.74462	52.25538	0.000000
2	2.463062	47.04187	49.89538	3.062752
3	2.534812	44.58264	47.11356	8.303796
4	2.563247	43.66000	46.41559	9.924419
5	2.570737	43.67985	46.45344	9.866709
6	2.574685	43.64733	46.51457	9.838100
7	2.575044	43.63783	46.50247	9.859691
8	2.575601	43.62010	46.48262	9.897279
9	2.575629	43.62046	46.48164	9.897898
10	2.575702	43.62122	46.48127	9.897511
Variance decomposition of RETURN:				
1	10.89579	7.094413	0.153868	92.75172
2	11.61151	7.524850	1.354836	91.12031
3	12.35482	9.542110	7.990084	82.46781
4	12.46446	9.895356	8.121934	81.98271
5	12.51459	9.818053	8.330640	81.85131
6	12.52448	9.843453	8.327430	81.82912
7	12.52977	9.903048	8.329522	81.76743
8	12.53287	9.911506	8.351719	81.73678
9	12.53330	9.911365	8.351256	81.73738
10	12.53383	9.911209	8.353400	81.73539

Source: Author's Calculation.

That means a low-interest regime can encourage the investor to find more interest bearing asserts backed by high risk which further leads to more financial innovations and a rise in risk. This high risk leads to financial instability. Further the evidence from variance decomposition model (VDM) result confirms the importance of inflation in stock return. Table 5.2 shows that CPI inflation contributes 8.35 percent to stock market return and the role of its own innovation is pivotal as it explains around 81 percent variation in stock return. Further, the contribution of call money interest rate in stock market return is 9.91 percent.

Figure 5.4 Relationship between stock return, inflation and interest rate in Israel



Source: Author's Calculation.

The IRF result reported in Figure 5.4 shows similar findings in Israel. The IRF in 7th panel shows that stock return turns negative immediately following a positive shock on CPI inflation. In other words, a rise in price stability leads to decline in financial stability in Israel.

But this relationship does not hold for entire 10 year period, rather from the 5th year price stability starts benefiting stock market in promoting financial stability. Further, in the relationship between interest rate and stock return, our study observed that a positive shock to central bank interest rate reduces stock return but after two years of lags. The IRF result in 8th panel shows that the response of stock market return is positive in the immediate years. The negative effect in distant lags indicates that the influence of government Treasury bill market is slow on the stock market.

Table 5.3 Variance decomposition in Israel

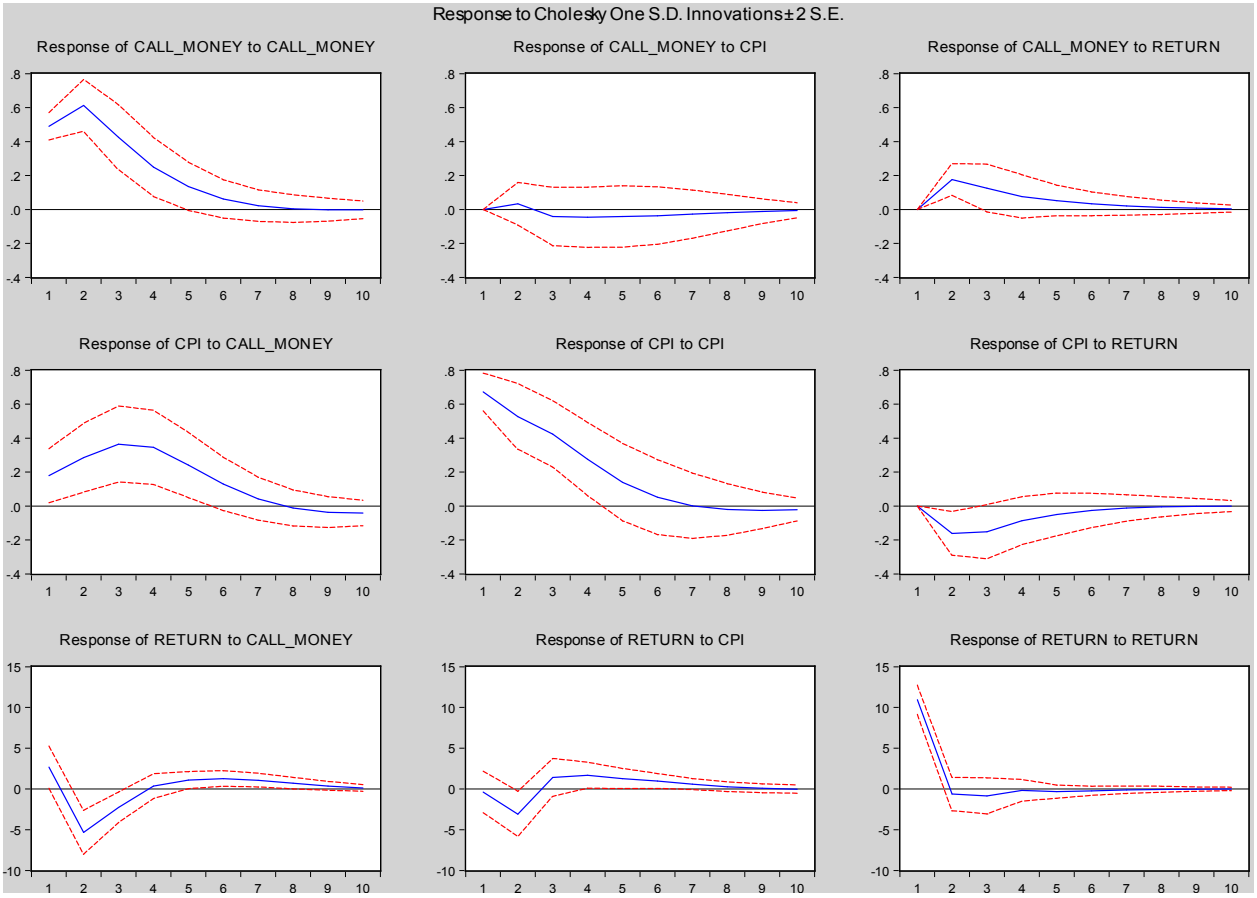
Period	S.E.	CPI	TBILL	RETURN
Variance decomposition of CPI:				
1	1.097856	100.0000	0.000000	0.000000
2	1.745988	99.67405	0.320572	0.005377
3	2.085315	98.86091	1.072196	0.066898
4	2.233705	98.47164	1.448060	0.080304
5	2.293219	98.34038	1.579016	0.080600
6	2.315239	98.29289	1.626650	0.080458
7	2.322465	98.27386	1.645606	0.080537
8	2.324493	98.26703	1.652394	0.080577
9	2.324963	98.26507	1.654347	0.080580
10	2.325045	98.26463	1.654795	0.080579
Variance decomposition of TBILL:				
1	0.732277	30.04317	69.95683	0.000000
2	0.776472	34.95469	63.12771	1.917608
3	0.805118	34.65280	62.63133	2.715877
4	0.819988	36.88517	60.40651	2.708317
5	0.824570	37.29577	59.97365	2.730583
6	0.825456	37.40258	59.87267	2.724741
7	0.825839	37.45941	59.81777	2.722825
8	0.826020	37.48622	59.79214	2.721635
9	0.826077	37.49388	59.78479	2.721334
10	0.826089	37.49539	59.78334	2.721265
Variance decomposition of RETURN:				
1	10.94426	3.790438	0.179365	96.03020
2	11.10393	4.626813	1.826654	93.54653
3	11.28323	5.098479	3.791245	91.11028

4	11.28838	5.125960	3.802359	91.07168
5	11.31650	5.524641	3.836039	90.63932
6	11.34676	6.020644	3.820536	90.15882
7	11.36171	6.249374	3.826883	89.92374
8	11.36749	6.338963	3.828604	89.83243
9	11.36980	6.375649	3.828411	89.79594
10	11.37067	6.389457	3.828367	89.78218

Source: Author's Calculation.

Additionally, the variance decomposition result is given in Table 5.3. In Israel, the contribution of inflation is 6.38 percent in stock return and call money rate explains stock return by 3.82 percent. An 89.78 percent of stock return is explained by its own innovation.

Figure 5.5 Relationship between stock return, inflation and interest rate in Korea



Source: Author's Calculation.

Similarly, stock return explains 0.08 percent development in inflation and 2.72 in call money rate which is an insignificant magnitude.

In Korea, a similar negative relationship is observed between price stability and financial stability. The panel 8 in Figure 5.5 shows that inflation shocks negatively reduces the stock return. This negative relationship continues till two and half years after which stock return responded positively to the inflation shock

Table 5.4 Variance decomposition of Korea

Period	S.E.	CLM	CPI	RETURN
Variance decomposition of CLM:				
1	0.489721	100.0000	0.000000	0.000000
2	0.804588	95.06921	0.167041	4.763751
3	0.919402	94.14287	0.339715	5.517417
4	0.956912	93.72546	0.549886	5.724655
5	0.968766	93.40227	0.721889	5.875845
6	0.972008	93.18796	0.860785	5.951253
7	0.972867	93.07452	0.942571	5.982904
8	0.973138	93.02421	0.980701	5.995085
9	0.973238	93.00578	0.994996	5.999221
10	0.973270	93.00046	0.998984	6.000558
Variance decomposition of TBILL:				
1	0.694805	6.591813	93.40819	0.000000
2	0.931416	12.97215	84.01208	3.015764
3	1.096872	20.40563	75.50942	4.084947
4	1.185548	25.94028	70.02911	4.030614
5	1.218827	28.44585	67.57005	3.984104
6	1.226998	29.17349	66.84829	3.978225
7	1.227784	29.25465	66.76285	3.982507
8	1.228031	29.25217	66.76548	3.982349
9	1.228851	29.30277	66.72003	3.977198
10	1.229738	29.37447	66.65405	3.971474
Variance decomposition of RETURN:				
1	11.27067	5.623903	0.109717	94.26638
2	12.85781	21.46668	5.867890	72.66543
3	13.15879	23.43996	6.752421	69.80762

4	13.27167	23.11176	8.244592	68.64365
5	13.37917	23.39055	8.999870	67.60958
6	13.47572	23.94373	9.382866	66.67341
7	13.53086	24.37179	9.490066	66.13815
8	13.55178	24.56406	9.500010	65.93593
9	13.55689	24.61763	9.495790	65.88658
10	13.55745	24.62338	9.495542	65.88108

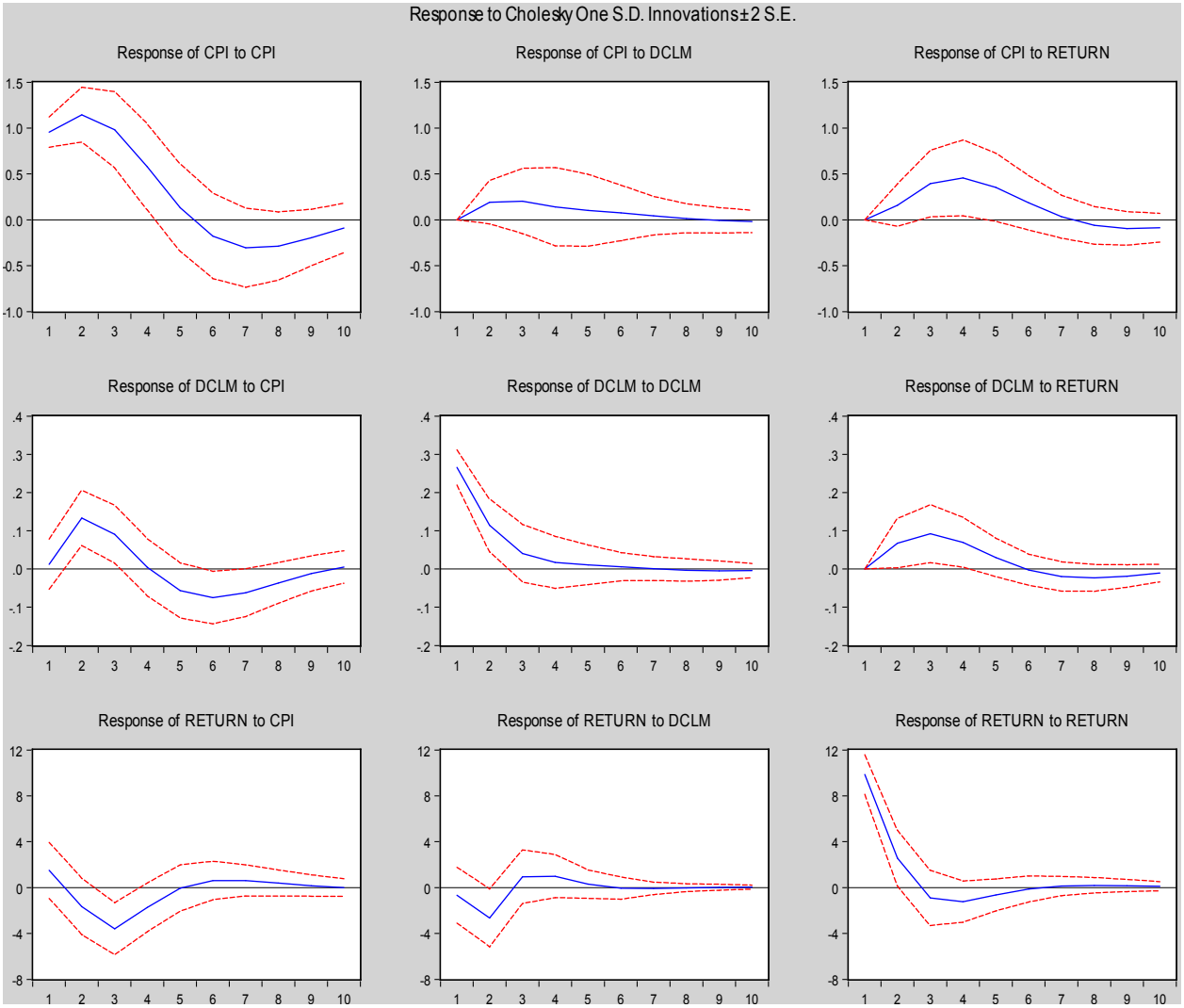
Source: Author's Calculation.

In other words, it can be argued that price stability leads to financial instability, but after certain time point price stability indeed helps in improving financial stability. This is an interesting finding on the relationship between price stability and financial stability. It is because while some of the recent major studies have highlighted the fact that price stability promotes financial market instability rejecting the idea of conventional wisdom, others argue that price stability can reduce financial instability (Schwartz, 1995; Bordo et al., 2002). Further, we observe a negative relationship between monetary policy stability and financial market stability. The negative response of stock return to a positive call money rate shock indicates that high key policy rates of the central bank can lead to fall in stock return. This is true in the sense that a high-interest rate regime discourages investor to take high risk in the project giving higher return as the risk-free return on interest-bearing assets is already high. Further, variance decomposition result reported in Table 5.4 shows the contribution of inflation and interest rate in explaining the variations in the stock return. In Korea, inflation contributes 9.49 percent in stock return and call money rate explains stock market return by 24.62 percent. Similarly, shocks steaming in stock return contribute to the development in inflation by 6 percent.

In Thailand, a similar result is obtained between price stability and financial stability. In the 7th panel of Figure 5.6, the IRF shows that stock market return declines negatively immediately following a positive shock to CPI inflation. It means a fall in inflation induces more financial instability. But after 5 years of time lag the relationship between these two variables turns positive. In other words, in short run price stability lead to rising in financial instability but in the medium-term price stability leads to financial stability. Similarly considering response of stock return to a positive interest rate shock, we find that stock returns decline to a positive interest rate shock. The IRF in 8th panel illustrates that stock market experiences a negative return immediately after

following a positive shock from the central bank interest rate. These findings are unsurprising as we know that high return due to high-interest rate changes mindset of the investor to take more leverage in the risky project. Further from the variance decomposition result, a similar but some stronger effect in found in Thailand between price stability and financial stability. About 15.83 percent of stock return in explained by inflation followed by 6.82 percent of call money rate. Here, a major portion of variation in stock return is explained by its own shocks. Further, the shock impact of stock return on inflation is stronger. A 12.71 percent growth in inflation is contributed by stock return.

Figure 5.6 Relationship between stock return, inflation and interest rate in Thailand



Source: Author's Calculation.

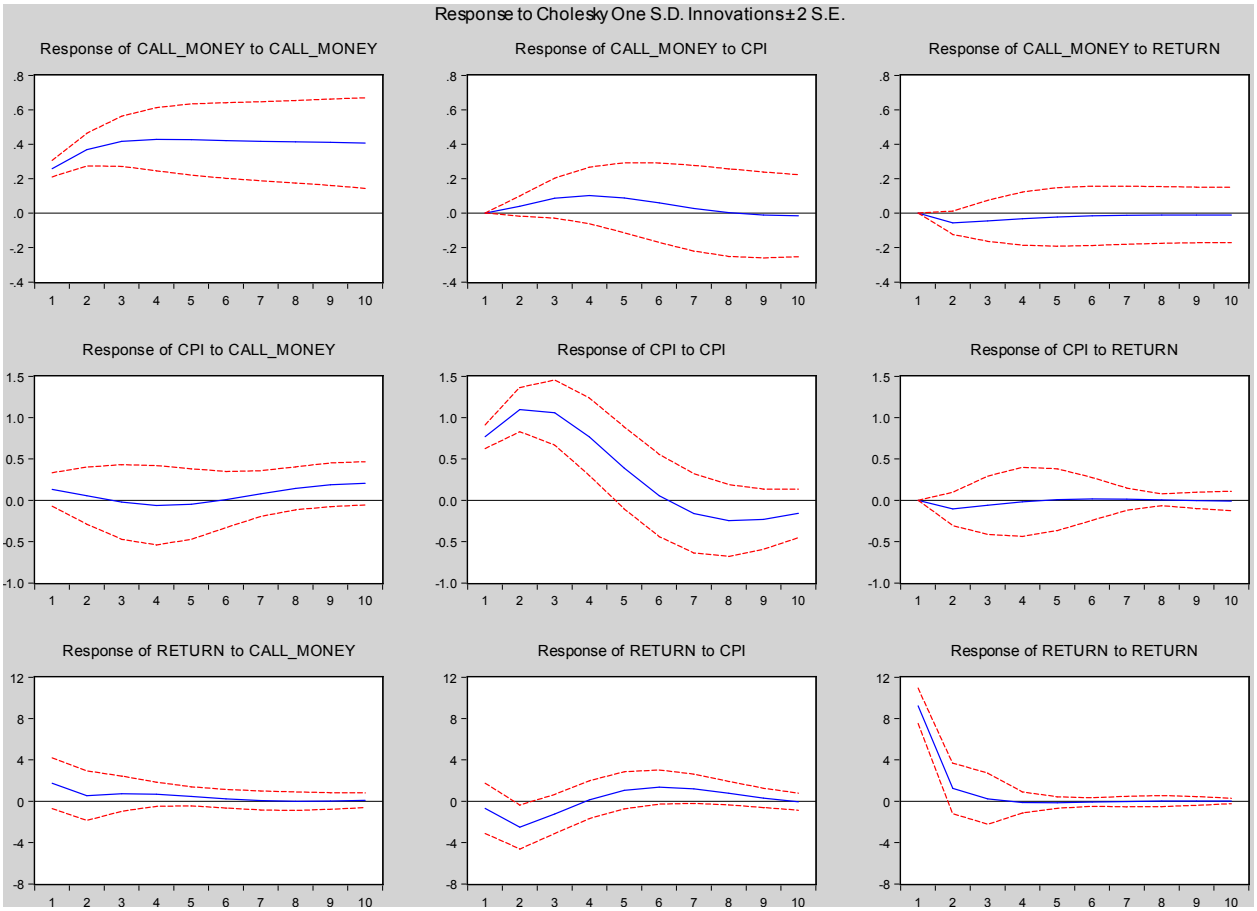
Table 5.5 Variance decomposition of Thailand

Period	S.E.	CPI	CLM	RETURN
Variance decomposition of CPI:				
1	0.955024	100.0000	0.000000	0.000000
2	1.511882	97.29530	1.586432	1.118267
3	1.855987	92.48485	2.262489	5.252661
4	2.001462	87.82867	2.449715	9.721611
5	2.039243	85.02672	2.614197	12.35908
6	2.056517	84.34691	2.702855	12.95024
7	2.079565	84.62077	2.689008	12.69022
8	2.100164	84.83351	2.641409	12.52508
9	2.111360	84.79089	2.614654	12.59446
10	2.115108	84.66795	2.612688	12.71936
Variance decomposition of CLM:				
1	0.265997	0.217613	99.78239	0.000000
2	0.325525	16.85017	78.85764	4.292189
3	0.352675	20.98049	68.51811	10.50140
4	0.359873	20.16267	66.02798	13.80935
5	0.365698	21.93556	64.02378	14.04066
6	0.373360	25.07656	61.44792	13.47552
7	0.379044	27.02837	59.61918	13.35245
8	0.381562	27.59942	58.84152	13.55906
9	0.382241	27.60014	58.64769	13.75217
10	0.382450	27.58732	58.59589	13.81679
Variance decomposition of RETURN:				
1	10.00404	2.234115	0.459683	97.30620
2	10.78917	4.273759	6.404407	89.32183
3	11.44916	13.67530	6.367487	79.95721
4	11.68692	15.32716	6.828421	77.84442
5	11.70795	15.27354	6.864654	77.86181
6	11.72454	15.49990	6.847049	77.65305
7	11.74159	15.72870	6.831967	77.43933
8	11.74986	15.81973	6.822701	77.35757
9	11.75225	15.83347	6.820311	77.34622
10	11.75279	15.83203	6.820594	77.34738

Source: Author's Calculation.

In Philippines, we find that both price stability and financial stability are negatively related. In the 8th panel of Figure 5.7, IRF result shows that stock market return declines to an inflationary shock. This result for the Philippines suggests that price stability does not promote financial stability in the economy. Furthermore, the result from the panel 7 shows that a positive call money shock increases stock return. This result is ambiguous as high-interest rate do not promote financial market to increases their leverage. However, this relationship disappears in longer lags. The variance decomposition result which is given in Table 5.6 indicates a similar finding. The result shows that CPI inflation shocks explain around 12.80 percent development in stock return and call money rate contributes 4.38 percent to stock return. The rest 82.81 is explained by its own innovative shocks. But shocks from stock return contribute an insignificant amount of magnitude, say 0.39 percent. This insignificant value indicates that stock market does not influence strongly to the variation in CPI inflation.

Figure 5.7 Relationship between stock return, inflation and interest rate in the Philippines



Source: Author's Calculation.

Table 5.6 Variance decomposition of Philippines

Period	S.E.	CLM	CPI	RETURN
Variance decomposition of CLM:				
1	0.258367	100.0000	0.000000	0.000000
2	0.455436	97.67876	0.786217	1.535025
3	0.625272	96.31239	2.354461	1.333144
4	0.765642	95.58703	3.347177	1.065792
5	0.881098	95.59332	3.538946	0.867735
6	0.978494	96.03205	3.238060	0.729891
7	1.064047	96.56239	2.806352	0.631253
8	1.141765	97.00403	2.437947	0.558026
9	1.213501	97.33073	2.166918	0.502350
10	1.279843	97.57823	1.962316	0.459455
Variance decomposition of CPI:				
1	0.779548	2.805701	97.19430	0.000000
2	1.350217	1.110730	98.28793	0.601342
3	1.717728	0.701879	98.80334	0.494785
4	1.882468	0.692464	98.88552	0.422021
5	1.922770	0.723545	98.87072	0.405731
6	1.923680	0.724970	98.86323	0.411800
7	1.931950	0.891318	98.69589	0.412792
8	1.952839	1.418028	98.17721	0.404760
9	1.975314	2.283811	97.32040	0.395788
10	1.992307	3.309098	96.30003	0.390874
Variance decomposition of RETURN:				
1	9.423317	3.445537	0.536389	96.01807
2	9.845590	3.446158	7.008956	89.54489
3	9.952237	3.903566	8.409272	87.68716
4	9.976549	4.334416	8.389245	87.27634
5	10.04444	4.490498	9.389456	86.12005
6	10.13950	4.458952	11.02063	84.52042
7	10.20934	4.402195	12.22880	83.36900
8	10.23814	4.377463	12.72202	82.90052
9	10.24274	4.373770	12.79957	82.82666
10	10.24326	4.380094	12.80126	82.81864

Source: Author's Calculation.

5.9.2 Evidence from Housing Prices

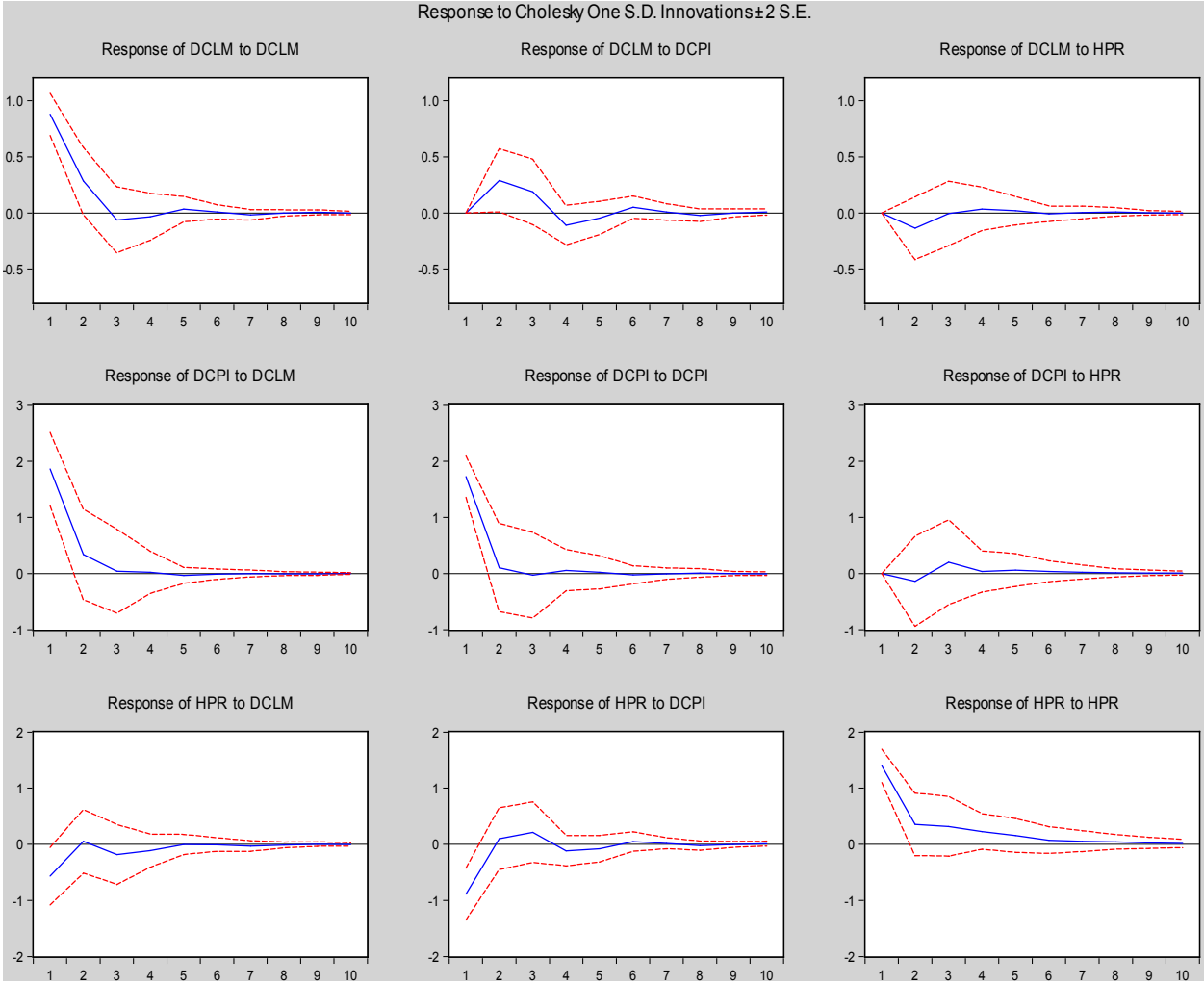
Following Granville and Mallick (2009) and Frappa and Mesonnier (2010) this study uses housing prices as a proxy for financial instability. The data is collected from Federal Reserve Bank of ST. Louis on a quarterly basis for different time length. For instance, one can see Israel (1997Q1 to 2016Q3), Korea (1998Q1 to 2016Q3), Indonesia (2005Q1 to 2016Q3), Philippines (2008Q1 to 2016Q3) and Thailand (2008Q1 to 2016Q3).[12] This discrepancy in the length of the time series is due to unavailability of data point. However, the advantage of taking these time periods is that the analysis deals with only IT period and neglects the pre-IT period to find the relationship price stability and financial stability. It is argued that this proxy is weakly representing the overall financial imbalances, but there are some good reasons to believe that housing sector boom can indicate the financial sector instability. The recent housing bubble burst in U.S is one of the examples where major financial institution collapsed leading to distortion in financial market. All this happened due to high return in real estate industry which encouraged the investor to take high risk in a low-interest rate regime.

The impulse response function (IRF) result given in Figure 5.8 shows that there is a negative relationship between housing price growth and CPI inflation. HPR refers to housing return, CPI refers to inflation and CLM refers to call money rate. The IRF lines in 8th diagram reveal that a positive inflation shock reduces housing return for the first two years and similar negative impact persists in the medium term also. This result supports the observation made by Frappa and Mesonnier (2010) for OECD IT countries. They show that adoption of IT in advanced countries have led to rise in housing price which has resulted in rising financial instability in the economy. Further, the response of CPI inflation to a one standard deviation shock in housing price seems to be negative in relationship. The IRF line reported in 6th diagram reveals that inflation declines immediately after a positive shock in housing price but the sign changes after three years. Further, a negative relationship is observed from the relationship between housing price and central bank policy rates. The IRF line in 7th diagram shows that housing price declines to negative immediately

[12] Unit root tests have been conducted for all variables and the variables are taken in first difference where they have unit root.

after a positive shock from central bank interest rate innovation. This indicates that high-interest rate in the economy leads to decline in housing return.

Figure 5.8 Relationship among housing sector return, inflation and interest rate in Indonesia



Source: Author's Calculation.

This result is in line with Taylor (2009) who argues that low-interest rate regime has resulted in higher housing prices and more financial instability in the economy. He pointed out that the cheap monetary policy has created a boom in the housing sector which later busted due to uncertainty and intense pressure in housing market leading to instability. Our result can be interpreted as that the rise in key policy rates offers good return without any risk which induces investors to pull out their funds from the risky projects. This leads to decline in demand for risky assets like real estate. In another way, we can argue that low-interest rate in the market may provoke investors for

searching a higher return investment which further may lead to increase in risk taking among the investor leading to rising in risk and uncertainty in the financial market.

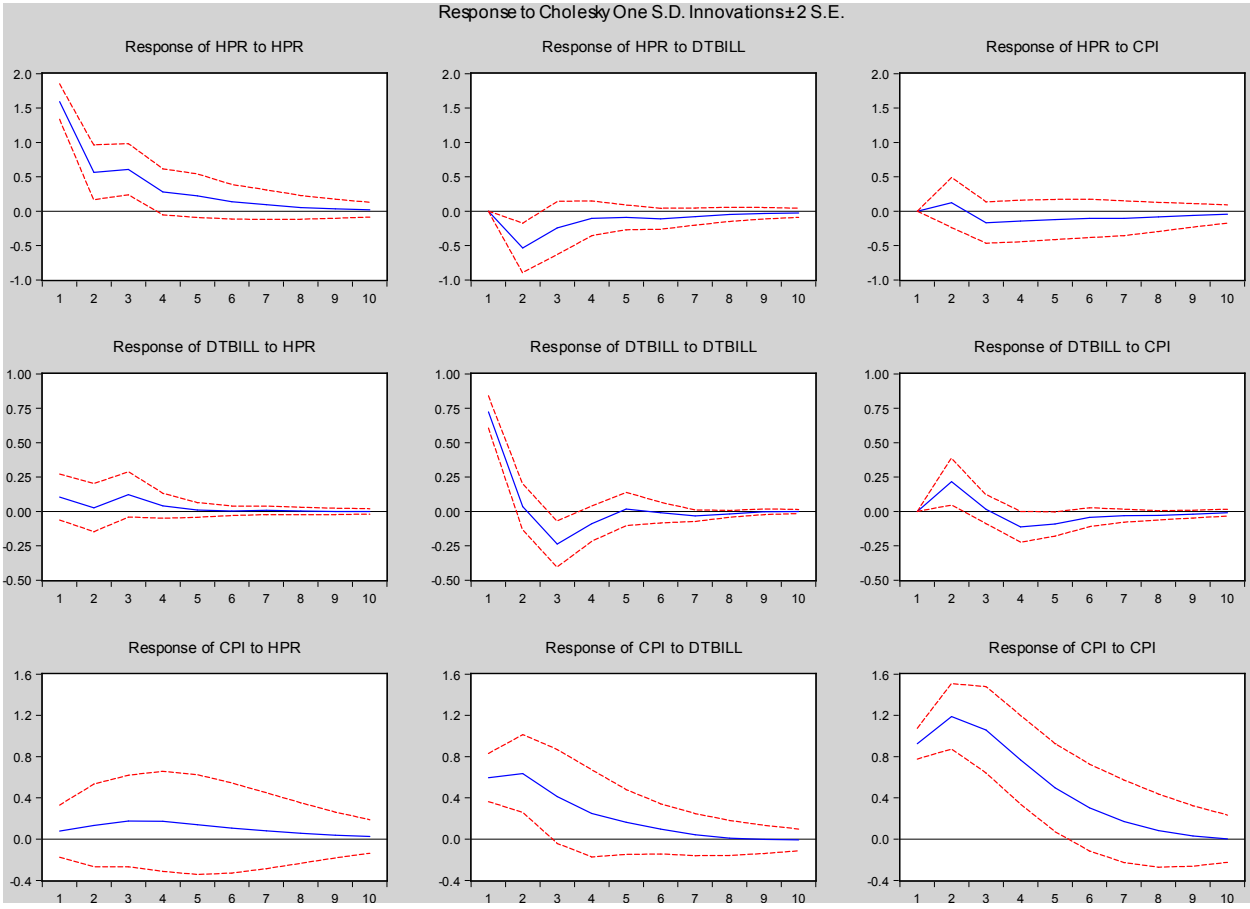
Table 5.7 Variance decomposition in Indonesia

Period	S.E.	CLM	CPI	HP
Variance decomposition of CLM:				
1	0.879371	100.0000	0.000000	0.000000
2	0.978620	89.23226	8.836177	1.931560
3	0.998300	86.13154	12.01046	1.858002
4	1.005444	85.03189	13.00901	1.959097
5	1.007217	84.84406	13.16637	1.989566
6	1.008571	84.62240	13.38651	1.991095
7	1.008750	84.61979	13.38877	1.991446
8	1.009009	84.57658	13.42722	1.996206
9	1.009026	84.57697	13.42679	1.996238
10	1.009059	84.57143	13.43238	1.996191
Variance decomposition of CPI:				
1	2.539600	53.77096	46.22904	0.000000
2	2.567988	54.33595	45.37924	0.284814
3	2.576354	54.00710	45.10002	0.892879
4	2.577326	53.97358	45.11548	0.910943
5	2.578327	53.94910	45.08656	0.964335
6	2.578761	53.93298	45.08159	0.985432
7	2.578878	53.92808	45.07781	0.994109
8	2.578924	53.92637	45.07751	0.996119
9	2.578949	53.92579	45.07664	0.997572
10	2.578962	53.92527	45.07645	0.998281
Variance decomposition of HP:				
1	1.749592	10.54184	25.73589	63.72226
2	1.788368	10.16745	24.92827	64.90429
3	1.838396	10.62862	24.95467	64.41672
4	1.859569	10.76749	24.77693	64.45558
5	1.867819	10.67324	24.74334	64.58342
6	1.869811	10.65205	24.75641	64.59154
7	1.870942	10.67039	24.73375	64.59585
8	1.871645	10.66765	24.73408	64.59827
9	1.871799	10.66590	24.73054	64.60356
10	1.871867	10.66562	24.73101	64.60337

Source: Author's Calculation.

From Table 5.7 it is observed that the majority of variation in CPI inflation is explained by interest rate (CLM) and its own innovations. Similarly, the majority of variation in housing price (HP) is explained by its own innovation. However, CPI inflation contributes 24 percent variation in housing price which is in line with the expectation. Then interest rate (CLM) contributes 10 percent variation in housing prices. Thus, the result confirms that the price stability can cause financial instability but reversely is not true in Indonesia.

Figure 5.9 Relationship between housing sector return, inflation and interest rate in Israel



Source: Author's Calculation.

In Israel, we find a similar result in the relationship between housing price and inflation but with distant lag. The IRF result reported in 3rd diagram in Figure 5.9 shows that a positive response from CPI inflation reduces housing sector return indicating a negative relationship between the

two variables. But this negative relationship does not hold in immediate lags as shown in the diagram. In the initial one and half years housing price dynamics respond positively to a positive inflation shock. The negative relationship is observed in medium-term as the IRF lines turn to negative after one and half years.

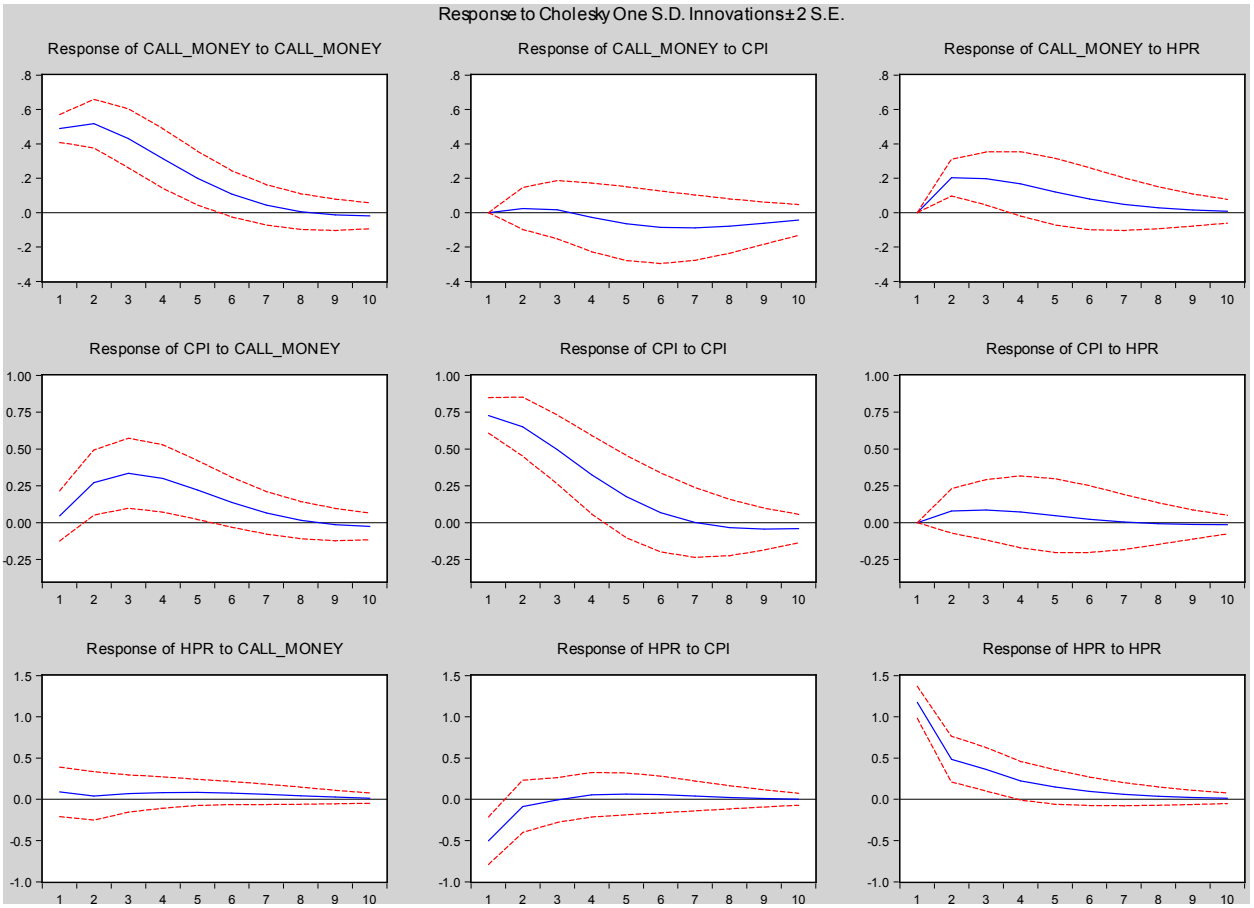
Table 5.8 Variance decomposition in Israel

Period	S.E.	HP	TBill	CPI
Variance decomposition of TBill:				
1	0.730252	2.041542	97.95846	0.000000
2	0.763015	1.991772	89.93632	8.071903
3	0.808572	4.063375	88.71028	7.226341
4	0.822287	4.162674	86.97218	8.865145
5	0.827715	4.121574	85.88024	9.998184
6	0.828890	4.111398	85.64967	10.23893
7	0.830153	4.107220	85.53981	10.35297
8	0.830885	4.101161	85.43789	10.46095
9	0.831136	4.098740	85.38814	10.51312
10	0.831199	4.098273	85.37569	10.52604
Variance decomposition of CPI:				
1	1.103188	0.486261	29.16974	70.34400
2	1.747124	0.767937	24.85682	74.37525
3	2.091648	1.238720	21.24089	77.52039
4	2.248386	1.659358	19.60170	78.73894
5	2.312995	1.935318	19.02670	79.03799
6	2.337415	2.103449	18.80742	79.08913
7	2.345395	2.204707	18.71178	79.08351
8	2.347557	2.259982	18.67895	79.06107
9	2.348068	2.286154	18.67107	79.04278
10	2.348218	2.297285	18.66990	79.03282
Variance decomposition of HP:				
1	1.594184	100.0000	0.000000	0.000000
2	1.777866	90.45070	9.069440	0.479863
3	1.902288	89.21461	9.577991	1.207394
4	1.930833	88.66980	9.592180	1.738015
5	1.949610	88.27150	9.633500	2.095001
6	1.960447	87.77645	9.859421	2.364131
7	1.967076	87.40793	9.961352	2.630715
8	1.970201	87.20373	9.990355	2.805915
9	1.971716	87.09860	10.00343	2.897969
10	1.972470	87.04297	10.01303	2.944005

Source: Author's Calculation.

This finding is in line with some recent work which argued that IT countries are more likely to increases housing prices. However, the response of CPI inflation to a positive housing price shock found to be positive throughout the period of 10 years. Although, in medium term inflation declines but remains in positive side. Additionally, we find a negative relationship between housing price and central bank interest rate. The IRF result in Diagram 2nd indicates that housing returns turn negative after a positive shock from the call money interest rate. This shows that the housing sector in Israel respond similarly as Indonesia responded to a positive interest rate shock. This similar pattern between these two variables may be attributed to the following of IT policy in these countries. Further result from variance decomposition is reported in Table 5.8. The housing price growth contributes 2.29 percent to CPI inflation and a major fraction of variation in inflation is contributed by its innovative shocks. Similarly, CPI inflation explains housing price by 2.95 percent and its own innovation explains around 87.04 percent.

Figure 5.10 Relationship between housing sector return, inflation and interest rate in Korea



Source: Author's Calculation.

This result indicates that the price stability in Israel has little significant impact on financial instability and *vice-versa*. In Korea, a similar negative relationship is observed between inflation and housing price. If we observe the 8th diagram in Figure 5.10, we find that housing price declines immediately after a positive shock from CPI inflation. It can be understood that decline in inflation, which can be considered as price stability, may lead to rising in housing prices meaning higher leverage in real estate sector. This result is quite true in the light of recent observation made by Rajan (2005) and Bolt at al. (2015). Bolt at al. (2015) argued that price stability has resulted in higher financial instability by allowing more and more investment in risker projects.

Table 5.9 Variance decomposition in Korea

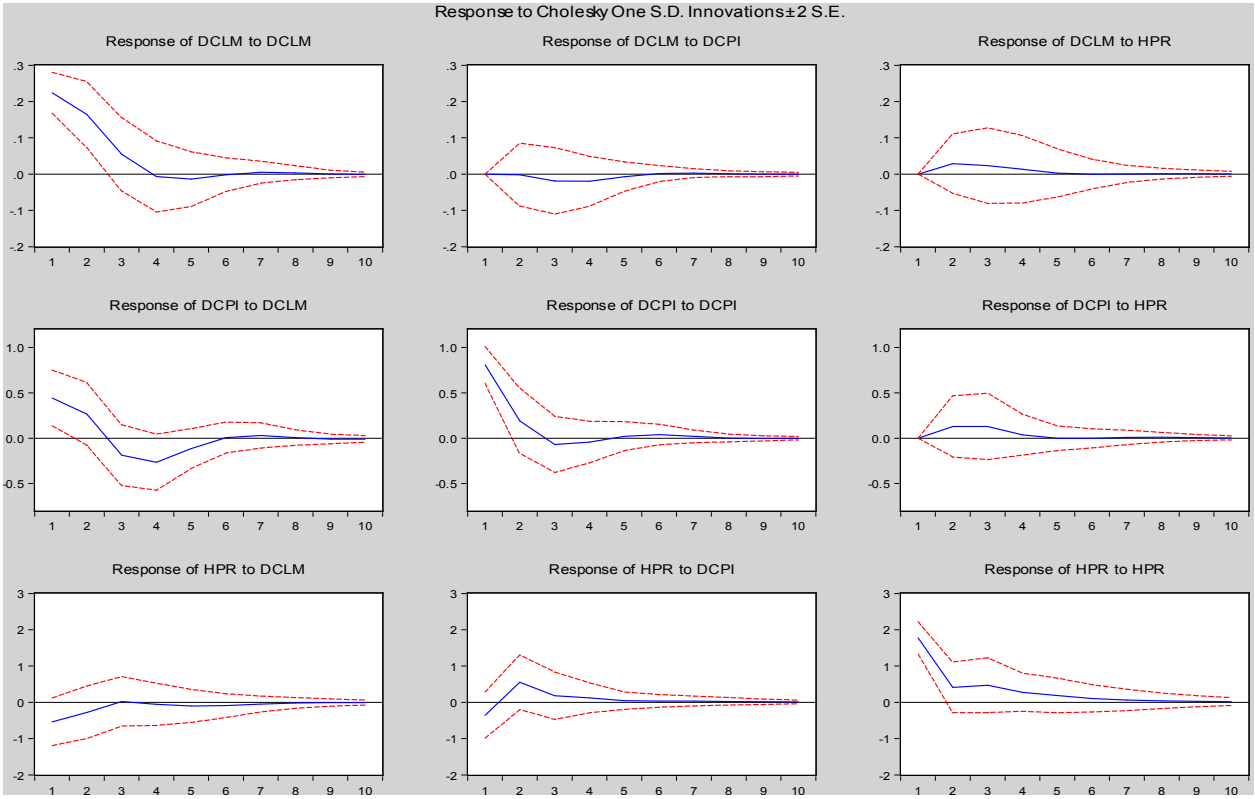
Period	S.E.	CLM	CPI	HP
Variance decomposition of CLM:				
1	0.488640	100.0000	0.000000	0.000000
2	0.740064	92.39146	0.097419	7.511125
3	0.879060	89.51374	0.104537	10.38172
4	0.948615	87.80435	0.177490	12.01816
5	0.979060	86.58719	0.610819	12.80199
6	0.991911	85.54363	1.341299	13.11507
7	0.997976	84.70170	2.109630	13.18867
8	1.001430	84.12146	2.707545	13.17099
9	1.003518	83.78934	3.073722	13.13694
10	1.004664	83.63389	3.253291	13.11282
Variance decomposition of CPI:				
1	0.728570	0.394103	99.60590	0.000000
2	1.016920	7.367051	92.02802	0.604930
3	1.182944	13.42465	85.59569	0.979655
4	1.264609	17.34529	81.47221	1.182493
5	1.296765	19.40754	79.33638	1.256081
6	1.305959	20.23438	78.49693	1.268693
7	1.307629	20.43709	78.29652	1.266394
8	1.308182	20.43466	78.29662	1.268723
9	1.309065	20.41757	78.30555	1.276876
10	1.310040	20.42731	78.28656	1.286128
Variance decomposition of HP:				
1	1.282986	0.499168	15.39100	84.10983
2	1.374971	0.518806	13.79973	85.68147
3	1.423678	0.718594	12.87555	86.40586
4	1.444335	1.010791	12.64531	86.34390
5	1.455679	1.320654	12.64272	86.03662

6	1.461758	1.566326	12.68471	85.74896
7	1.464736	1.721207	12.70568	85.57311
8	1.465981	1.799305	12.70794	85.49275
9	1.466405	1.829958	12.70458	85.46546
10	1.466517	1.838440	12.70266	85.45890

Source: Author's Calculation.

Additionally, we observe something different with regard to the relationship between interest rate and housing price. The IRF result in 7th diagram reveals that hosing prices remain more or less unaffected due to rising central bank policy rates. Some declining trend is observed for the first two years but the same trend did not persist throughout the entire 10 years. This result is different from what is observed for other IT countries. But in Korea there is significant causation from price stability to financial instability. The result reported in Table 5.9 shows that housing price is dominantly governed by its own innovative shocks, i.e., 85.45 percent while the contribution of CPI inflation to housing price development is second highest, i.e., 12.70 percent.

Figure 5.11 Relationship between housing sector return, inflation and interest rate in the Philippines



Source: Author's Calculation.

In Philippines, we observe a similar kind of relationship between inflation and housing prices. The result in 8th diagram in Figure 5.11 shows that housing return responds negatively to a positive shock in inflation. In other words, low inflation can escalate housing prices to the leverage level which lead to bust in housing boom. This result in emerging IT countries is similar to that of advanced countries where it is observed that a low inflation regime maintained by Federal Reserve Bank and European Central Bank has pushed higher financial instability in housing market. Additionally, a similar result is obtained from the relationship between central bank interest rate and housing prices. The 7th diagram in the panel shows that housing return responded negatively for entire 10-year shock period. The blue line showing response pattern of housing return falls into negative zone immediately after a positive shock from call money interest rate.

Table 5.10 Variance decomposition in Philippines

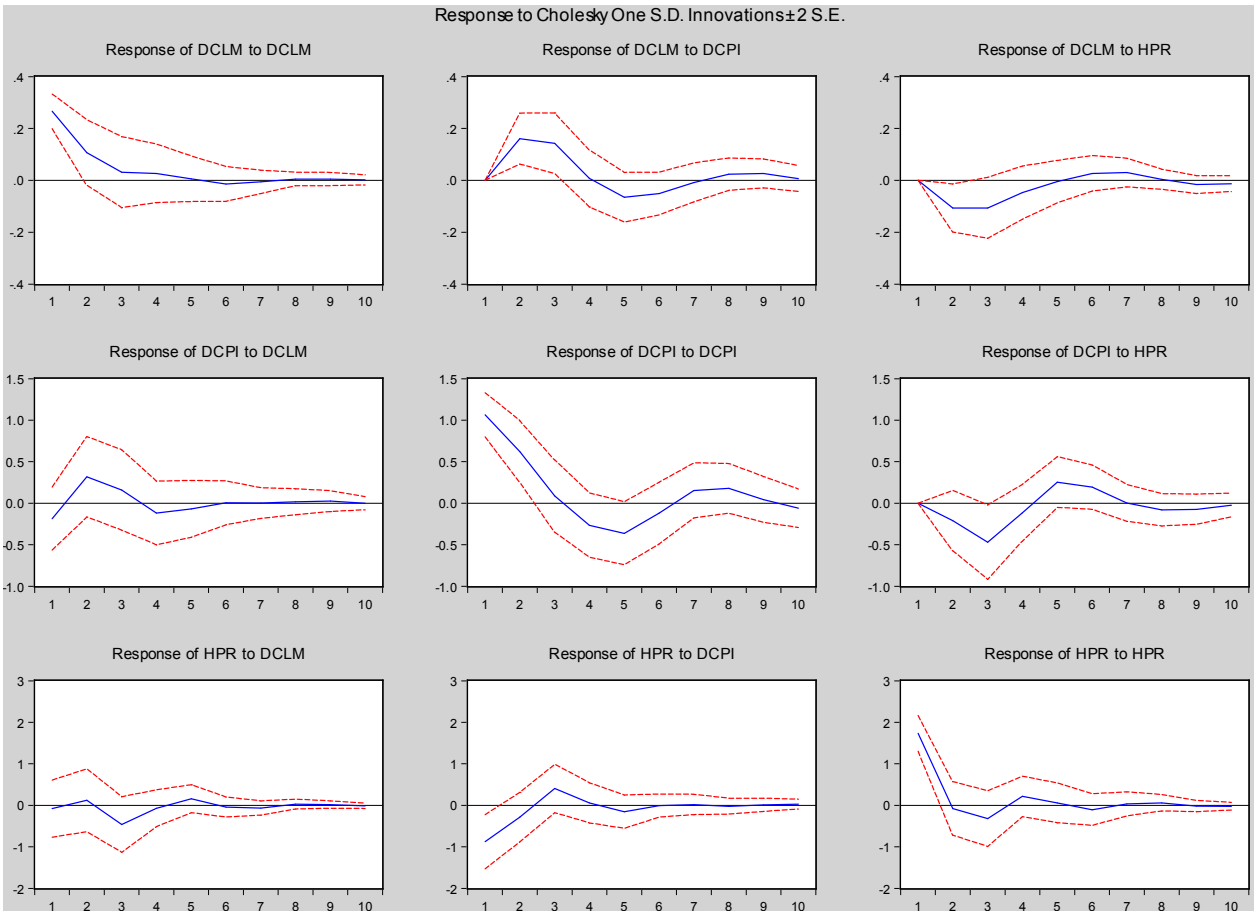
Period	S.E.	CLM	CPI	HP
Variance decomposition of CLM:				
1	0.224009	100.0000	0.000000	0.000000
2	0.279244	98.95096	0.004152	1.044891
3	0.286088	97.91037	0.435883	1.653747
4	0.287155	97.23870	0.910560	1.850742
5	0.287594	97.17667	0.967153	1.856176
6	0.287602	97.17465	0.969270	1.856077
7	0.287655	97.16766	0.976781	1.855559
8	0.287680	97.16607	0.977298	1.856628
9	0.287682	97.16482	0.977515	1.857660
10	0.287684	97.16441	0.977725	1.857866
Variance decomposition of CPI:				
1	0.922447	23.07300	76.92700	0.000000
2	0.987561	27.41070	70.87484	1.714456
3	1.015836	29.30897	67.45802	3.233004
4	1.051331	33.71121	63.14329	3.145493
5	1.057657	34.45981	62.43203	3.108160
6	1.058395	34.41639	62.47957	3.104042
7	1.059040	34.45538	62.43865	3.105967
8	1.059113	34.45538	62.43029	3.114336
9	1.059176	34.45906	62.42378	3.117154
10	1.059218	34.46377	62.41894	3.117289
Variance decomposition of HP:				
1	1.890694	8.064789	3.502820	88.43239

2	2.030579	8.856506	10.38700	80.75650
3	2.091768	8.358831	10.51929	81.12188
4	2.114204	8.257083	10.62788	81.11503
5	2.125275	8.408245	10.56276	81.02899
6	2.130247	8.555672	10.54101	80.90332
7	2.132002	8.594857	10.54574	80.85941
8	2.132609	8.598134	10.55277	80.84910
9	2.132849	8.598085	10.55502	80.84690
10	2.132953	8.598813	10.55522	80.84597

Source: Author's Calculation.

In Philippines, the housing price contributes 3.11 percent to inflation dynamics showing a minimal role. Its own innovation explains major variation in the inflation rate. But the inflation rate contributes around 10.5 percentage development in housing prices. This result confirms that price stability can influence financial stability.

Figure 5.12 Relationship between housing sector return, inflation and interest rate in Thailand



Source: Author's Calculation.

In Thailand, a similar negative relationship is observed between financial stability and price stability. The housing price, which is taken as a proxy for financial instability shows negative response after a positive shock from inflation. The diagram in 8th place in Figure 5.12 shows that housing return declines to negative zone immediately after a rise in price stability. This result contradicts the conventional wisdom that price stability can lead to financial stability. This is in line with Rajan (2005) and Bolt et al. (2015) who argue that a higher price stability can create high risk and uncertainty in the financial market as the investors' preference towards higher risk for higher return increases. Further, from 7th diagram in the same panel it is observed that a rise in central bank interest rate causes fall in housing prices. The housing return responds negatively to a positive shock from interest rate in IT countries. As we can see from the diagram, the IRF line declines after one year to a positive shock on interest rate. This result suggests that there is negative relationship between central bank policy rate and housing return. In other words, IT countries focusing on low-interest rate regime can suffer from higher financial instability in the form of boom in the housing prices. This is quite true in line with observation made by Frappa and Mesonnier (2010). They argued that implementation of IT policy has resulted in higher housing boom which may be considered as a sign of higher financial instability. This is further supported by Taylor (2009) who observe that too low-an interest rate than predicted by Taylor rule has led to higher instability in the U.S.

Table 5.11 Variance decomposition in Thailand

Period	S.E.	CLM	CPI	HP
Variance decomposition of CLM:				
1	0.266037	100.0000	0.000000	0.000000
2	0.345566	68.87813	21.58956	9.532309
3	0.389861	54.77296	30.30351	14.92353
4	0.393728	54.15943	29.74410	16.09646
5	0.399185	52.70677	31.61700	15.67623
6	0.403570	51.68646	32.54096	15.77258
7	0.404807	51.39208	32.38298	16.22494
8	0.405551	51.21898	32.60773	16.17329
9	0.406782	50.92291	32.83928	16.23781
10	0.407056	50.85568	32.82243	16.32188
Variance decomposition of CPI:				
1	1.081283	2.974305	97.02569	0.000000

2	1.305149	7.996583	89.38634	2.617073
3	1.398554	8.230960	78.23178	13.53726
4	1.433014	8.520984	77.93574	13.54328
5	1.501594	7.978205	76.81691	15.20489
6	1.518675	7.800760	75.71730	16.48194
7	1.526450	7.721576	75.96393	16.31449
8	1.538988	7.607332	76.07230	16.32037
9	1.541614	7.607781	75.89471	16.49751
10	1.542988	7.594245	75.91392	16.49184
Variance decomposition of HP:				
1	1.944300	0.165788	20.35350	79.48072
2	1.970607	0.533571	21.93975	77.52668
3	2.090209	5.393900	23.31243	71.29367
4	2.103173	5.447636	23.10041	71.45196
5	2.115687	5.936989	23.37910	70.68391
6	2.118801	5.961051	23.31199	70.72696
7	2.120181	6.052493	23.28850	70.65900
8	2.121366	6.065332	23.27524	70.65942
9	2.121577	6.070468	23.27334	70.65619
10	2.121952	6.072999	23.28242	70.64458

Source: Author's Calculation.

Further, the variance decomposition result also shows a similar result. In spite of larger variation explained by its own innovation shock, CPI inflation emerged as the second highest contributor of total housing price variations. A 23.28 percent change in housing price is responsible for inflation growth in Thailand. This indicates that price stability significantly influences financial instability.

5.10 Concluding Remarks

This chapter examined the relationship between financial stability and inflation targeting for Asian economies. Following the ECB's approach a multidimensional FCI index is calculated for measuring financial instability. Then a panel data analysis is conducted in a regression by adding IT and other control variables. Finally, robustness check is conducted using two individual indicators such as stock and housing prices as proxy for financial instability. For this a VAR based IRF analysis is employed. After estimating all these, the study provides three conclusions. First, the FCI index captures the major financial crises or imbalances correctly. This result validates FCI as a robust index for measuring financial instability. Secondly, the study finds that the implementation of IT policy in Asian economies has an adverse impact on financial stability. The adoption of IT in Asia has increased financial instability by 0.02 to 0.09 percent. This suggests

that during the IT regime financial stability has declined. The possible explanations are offered for this result. While, Rajan (2005), White (2006) and Leijonhufvud (2007) claim that low-interest regime due to low inflation condition encourage investors to take high risk, Frankel (2012) views that single objective of inflation goal has neglected the financial sector developments and responded less to the financial sector imbalances. This finding is in line with Frappa and Mésonnier (2010) and Taylor (2009). However, this finding is in contrast to Schwartz (1995) who argues that price stability can take care of financial stability. Along with this, the study also finds that high financial transparency in Asia leads to rise in financial stability. But same transparency does not help IT Asian countries to reduce financial instability. However, the central bank policy transparency indeed reduces financial instability. Thirdly, a VAR model based IRF result indicates that IT regime increases housing returns and encourages investors to take high risk. A negative relationship between housing returns and inflation confirms that IT increases financial instability. Further, it is observed that IT regime also increases stock market returns significantly indicating a possible boom in the market.

CHAPTER 6

Summary, Conclusion and Scope for Future Research

6.1 Summary the study

The unhappy experiences of developed countries with past monetary regime have led to the search for an alternative effective monetary policy. In response to that, inflation targeting (IT) has emerged as a new alternative monetary policy in the 1990s. New Zealand is the first country to adopt this policy in 1990. As of now 32 countries have implemented this policy as their monetary policy framework. Interestingly, out of 32 countries, 24 are emerging countries. The popularity of IT in emerging countries can be explained by the relative benefits of this policy on economic performances in the member countries. Research in advanced countries finds that IT has no significant impact on macroeconomic performances. However, studies that analyze emerging and developing countries show that IT significantly decreases inflation, its variability, inflation persistency and inflation expectations. In a paper Mishkin (2000), Vegaa and Winkelried (2005) observe that emerging and developing countries benefit more from IT adoption than advanced ones. A possible reason for IT being more successful is that the emerging and developing countries adopt IT under more difficult economic circumstances. In the time of IT adoption those countries are with low credibility of monetary policy. Due to this reason, IT policy is highly useful in emerging economies avoiding several potential problems faced in the past policy.

In view of the above, this study explores some of the interesting aspects of IT policy in the context of Asian economies. First, the study examines the possible factors, which have led to the adoption of IT policy in Asia. IT policy had differential policy outcomes in both developed and developing countries. We argue that different economic and institutional conditions play an important role in such results. So, the study explores both the economic and institutional conditions responsible for adopting IT policy in Asia. By employing Probit model and analyzing a set of time series for a long time span, the study shows that a low inflation environment remains a significant factor for implementing IT policy in Asia. Similarly, high central bank independence increases the probability of adopting IT policy. Similarly high openness also significantly increases the likelihood of implementing IT policy in Asia. This is true following Romer's (1993) hypothesis, which says that a more open economy has better chance to reduce domestic inflation though cheap

imports. On the other hand, the study finds that a high debt country faces problem in implementing IT policy. The likelihood of adopting IT in those countries is very low as a high debt government faces severe confidence crisis from the general public about future low inflation. Additionally, a highly developed financial market discourages the implementation of IT policy. These results suggest that emerging countries adopt IT when they have low inflation, high central bank independence and high openness. However, those countries are reluctant to adopt IT policy when they are surrounded by the problems like high debt and high financial development. Although this objective has highlighted the important differences in the factors leading to IT adoption, important issues like credibility of inflation targeting remain unexplored.

Secondly, the study explores the credibility of inflation targeting in Asia. Using an episode method to calculate sacrifice ratio the empirical findings imply that IT is a credible monetary policy. The disinflation cost is significantly low in IT countries compared to that of the non-IT countries. IT policy can reduce disinflation cost from 4.22 to 5.91 percent in Asian economies. A similar inference persists even when the method for calculating sacrifice ratio is modified. The result from modified method confirms that IT policy indeed reduces sacrifice ratio, but with a higher magnitude. The finding is in line with Goncalves and Carvalho (2009) and De Roux and Hofstetter (2014), supporting the view that IT has credible bonus effects in member countries. Apart from IT, we also observe that the initial inflation could significantly lower sacrifice ratio by 0.19 to 0.36 percent in emerging economies. This indicates that inflation rate at the time of IT adoption matters for lowering sacrifice ratio. This finding supports the argument of Ball *et al.* (1988) and Zhang (2005) indicating that the initial inflation reduces nominal wage rigidity. Another important variable which claims to have a significant impact on sacrifice ratio in OECD countries i.e. speed, turns insignificant in this analysis. This suggests that the determinants claimed to have a significant effect in advanced countries are found to be insignificant in emerging economies. Further, some determinants which used to be insignificant in emerging economies are found to be significant in the present study. This indicates that the findings change as a better episode method is employed in the calculation of sacrifice ratio. These results remain robust in the alternative methods too. Further, the explanatory power of the regression model improves when the sacrifice ratio measured through alternative method is used. The coefficient of IT shows a higher capacity of reducing sacrifice ratio in emerging economies. These positive benefits of IT suggest that the emerging economies and particularly Asian economies could switch to IT policy for better outcomes. The

above conclusion importantly highlights the role of central bank transparency. The low sacrifice ratio in IT countries is argued to be low due to high level of transparency in the central bank's monetary policy. Then, the transparency aspect is examined in the next objective.

Thirdly, the study examines the relationship between central bank transparency and inflation. Initially, following Dincer and Eichengreen's (2014) approach, central bank transparency level is calculated for 2012. Then a modified method is proposed for measuring transparency level. Finally, a panel data analysis is conducted to find the relationship between transparency and inflation. After doing all the analysis the study observes that transparency level in IT countries has increased from 2010 to 2012. Israel is found to be the most transparent central bank in Asia followed by the Philippines. Korea is the lowest transparent central bank in IT Asian countries. Further, a differential level of transparency is observed by looking at various aspects of transparency. For instance, when IT countries have done well in political, policy and procedural transparency by scoring the highest transparency score, some low score is also evident in some other aspects such as economic and operational transparency. Interestingly, use of modified method for measuring transparency brings changes in the ranking of country's transparency levels. Precisely, we find that in terms of the old index countries, like Indonesia, Korea and Thailand have an equal level of transparency, but the same countries report different levels of transparency in the modified method. For instance, Indonesia and Korea become lowest transparent central banks compared to Thailand. This result suggests that the existing method of calculating transparency needs reassessment. Further, by employing a panel data analysis, the study concludes that central bank transparency significantly reduces inflation rate in Asia. This result suggests that IT has potential to keep inflation low by adhering to higher transparency in monetary policy. In other words, stronger form of communication works as important channels for lowering inflation rate.

Fourthly, the study examines the role of inflation targeting in the financial stability of Asian economies. An empirical attempt has been made to observe whether financial system remained sound in IT regime. To do that, a multidimensional FCI index is proposed for measuring financial instability. Then a regression model is estimated with country fixed effect to avoid heterogeneity in the individual country. For robustness check, two individual indicators such as stock and housing prices are considered as a proxy for financial instability and impulse response function

(IRF) is estimated using a VAR model. The result shows that FCI index correctly captures financial imbalances in Asia. Particularly, the calculated FCI index is able to capture two important financial crises such as East Asian crisis and global financial crisis. This result validates FCI as an appropriate index for measuring financial instability. Then a panel regression is estimated using FCI as the variable for measuring financial instability. The result from panel data analysis suggests that IT policy in Asia increases financial instability. The regression coefficient of IT shows that implementation of IT increases financial instability by 0.02 to 0.09 percent. This result suggests that IT regime does not take care of financial instability; instead it helps to escalate financial imbalances. Two possible explanations are offered for this result. While Rajan (2005), White (2006) and Leijonhufvud (2007) claim that low-interest regime due to focus on low inflation boosts high risk, Frankel (2012) is of the view that single objective of inflation goal has neglected the financial sector imbalances. This finding is in line with Frappa and Mésonnier (2010) and Taylor (2009). However, the result is in contrast with Schwartz (1995) who argues that financial stability can be achieved through price stability. However, the study finds high financial transparency in Asia leading to fall in financial instability. But, IT countries promoting higher financial transparency witness insignificant impact on financial stability. Interestingly, transparency in central bank policy indeed reduces financial instability. Further, the IRF result shows that IT and financial stability are negatively related. A positive shock to inflation leads to fall in housing returns. The negative relationship between housing returns and inflation confirms IT to be encouraging financial instability. Similar findings are observed for stock returns, which are taken as proxy for financial instability. IT regime also increases stock market returns significantly indicating a possible boom in the market.

6.2 Conclusion

From Chapter 2, we observe that different institutional and macroeconomic factors drive the adoption of IT policy in Asia. The emerging economies adopt IT when inflation is at low level and they have high level of openness and central bank independence. From Chapter 3, it is inferred that inflation targeting central banks maintain credibility in their monetary policy. The sacrifice ratio in IT countries is almost zero compared to non-IT countries. From Chapter 4, it is perceived that transparency in IT countries have increased resulting in lowered inflation. From Chapter 5, it

is further observed that IT policy has not been able to contain financial imbalances in the economy. In Asia IT policy has rather reduced financial stability.

6.3 Policy suggestions

As a policy suggestion, this study suggests that inflation targeting can be an important policy for reducing disinflation cost, promoting central bank transparency. Countries seeking to adopt IT can take preliminary steps to bring down inflation, which could be suitable for adopting IT policy. But in the meantime, policy makers should consider the dark-side of IT as it encourages financial imbalances. The macro-prudential policy may be followed along with IT to curb the rising financial market risks.

6.3 Scope for Future Research

Since the area of IT is vast, there are a large number of other issues which need further study. First, as emerging countries are concerned about the exchange rate fluctuations, some future study can examine the extent to which IT can replace exchange rate targeting. In these emerging Asian economies exchange rate used to play a significant role in the monetary policy. So, the study can examine whether these countries face trade-off between IT and exchange rate fluctuations. Secondly, a credibility index can be proposed for testing the level of credibility of monetary policy in Asian IT. Thirdly, one can test whether IT improves welfare in the economy.

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MEASURING SACRIFICE RATIO BY EPISODE METHOD: METHODOLOGICAL ISSUES AND CONFLICTING RESULTS FOR AN EMERGING MARKET ECONOMY

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Abstract

This paper flags some of the important issues concerning estimation of sacrifice ratio for emerging market economies in general and for the Indian economy in particular. A survey of the most recent studies in the area and some of our own results indicates that sacrifice ratio estimates depend on ahost of factorsconnected with the episode methodology. The factors are the appropriate definition of an episode, anarbitrary length of output loss and proper measurement procedure.

Keywords: *Disinflation, Monetary policy, Sacrifice Ratio, Episode Method, Trend inflation.*

JEL Classification: *E52, E58*

1. INTRODUCTION

The measurement of sacrifice ratio, which is defined as the percent of output loss due to 1 percent fall in inflation, has been popular across the world. It is because asingle quantitative figure yields the cost of following a contractionary monetary policy. The policy maker at central banks is deeply concerned about the magnitude of disinflation cost or trade-offs because the consecutive disinflation episodes can bring recession in the economy (Romer and Romer, 1989). Thus,the measure helps the policy maker to know the magnitude of short-run trade-off to guide the policy action better.There have been numerous studies in measuring the trade-off between inflation and output. An early attempt is found in Okun (1978) where a Philips curve model is proposed to calculate the trade-off between inflation and output. After that, several other studies have used different methods to calculate trade-off magnitude showing some weakness in the Okun's (1978) method. Ball (1994) in his pioneering work argued that the traditional Phillips curve is limiting the trade-off

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to be constant across time. He proposed a non-parametric method known as episode method to calculate sacrifice ratio. The proposed method has been widely accepted in academic research(Bernanke et al., 1999; Senda and smith, 2008; Mazumder, 2014; Durai and Ramachandran, 2013; De Roux and Hofstetter, 2014; Goncalves and Carvalho, 2009; Brito, 2010). However,Cetinkaya and Yavuz (2002) argued that Ball's (1994) episode method may not be appropriateto emerging economies due its underlying assumptions in the estimation procedure. Ball's (1994) had made several assumptions to validate the model in the context of developed economies. So, the question is whether the episode method should be followed in emerging economies as it is proposedfor advanced countries. In order to validate the above argument, our study attempts to calculate the sacrifice ratio in India using Cetinkaya and Yavuz (2002) methods for both aggregated and disaggregated data. Further, we find hardly any consensus among researchers regarding the reliability of the estimation of sacrifice ratio in episode method. So, we try to bridge the gap by making an empirical analysis and highlighting the issues revolving around the episode method.

The rest of the paper is divided into 4 sections. Section 2 is areview of theliterature. Section 3 describes the episode methodology and Section 4 discusses the results. Finally, concluding remarks are offered in the last section.

2. REVIEW OF LITERATURE

Different methods have been used to calculate the sacrifice ratio in both developed and developing economies. For the first time, Okun (1978) estimates sacrifice ratio for the U.S economy. Using the Philips curve method he got an average sacrifice ratio of 10 percent. However, Ball (1994) criticized the Okun's (1987) model for giving a time invariant measure of sacrifice ratio. He argued that Ball's method assumes the disinflation cost to be same at the time of increasing inflation and declining inflation. Hedeveloped a new method called 'episode method' to calculate episode specific sacrifice ratio. Taking all OECD countries he found an average sacrifice ratio of 1.4 percentage in quarterly data and 0.8 in annual data.Later Zhang (2005) and Hofstetter (2008) modified the episode method to calculate sacrifice ratio.Using a quarterly sample from 1960Q1 to 1999Q4, Zhang (2005) found an average sacrifice ratio of 2.5 for G-7 countries which is higher than 1.4 calculated fromBall(1994). So, he pointed out that Ball's (1994) method is underestimating the true cost of disinflation policy. Hofstetter (2008) found the sacrifice ratio of 1.68 for 1970's and 1980's and negativesacrifice ratio in 1990'for LAC countries. Senda and smith (2008) used three different episode methods to calculate sacrifice ratio considering OECD countries. With a sample of both quarterly and annual time series, they found an average sacrifice ratio of 1.65 for quarterly data and 1.17 for annual data.They also observed that sacrifice ratio estimation through Zhang (2005) is higher than Ball's method and lower than Hofstetter (2008) method. Cecchetti and Rich (2010) argued that there needs to be a structural estimation of sacrifice ratio. Using quarterly data for the U.S, they came up with a figure of

sacrifice ratio that ranged from 1% to 10% across the structural VAR models. The important advantage of this method is that it separates the movement in output and inflation induced by monetary shock from other shocks.

In Indiancontext, there are few studies found calculating sacrifice ratio. For the first time, RBI (2002) found sacrifice ratio of 2 percentin India. Subsequently, Kapur and Patra (2003) found sacrifice ratio in a range of 0.5 to 4.7. They argued that the sacrifice ratio differs depending upon the inflation measure and model that were used in the estimations. Dholakia (2014) showed that the sacrifice ratio in India is 1.8 to 2.1 during the disinflationary period and 2.8 for the inflationary period. This study is quite different and interesting for giving a measure of sacrifice ratio for two different periods of the economy. Durai and Ramachandran (2013) used an episode method to estimate the sectoral sacrifice ratio. They pointed out that the negative sacrifice ratio in the firm sector gets offset by the positive sacrifice ratio in non-firm sector yielding an overall low sacrifice ratio. Recently,Dholakiaand Virinchi (2015) calculated sacrifice ratio using both regression approach and episode method. They get sacrifice ratio that ranges from 1.7 to 3.8 for different inflationmeasure and method used in the calculation.

3. THE EPISODE METHOD

There are three different episode methods in the literature to calculate sacrifice ratio. However, a vast literature is found using Ball's (1994) method to estimate the sacrifice ratio.

This method calculates episode specific sacrifice ratio. An episode is identified from trend inflation. For quarterly data, the trend inflation is calculated as centered 9 quarter moving anaverage of actual inflation. The trend inflation for a particular quarter is the average of previous four quarters' inflation and next four quarter' inflation. Then inflation peak and trough are identified from the trend inflation. A peak is identified where trend inflation is higher than previous four quarters and next four quarters. Similarly, trough is identified where trend inflation is lower than previous four quarters and next four quarters. For example, quarter t is a point of peakin the trend inflation if trend inflation at t is higher than $t\text{-}4$ and $t+4$.A similar definition is applied to find out inflation trough. Finally, a disinflation episode is identified if the trend inflation falls by 2 percent from an inflation peak to inflation trough. This 2 percentage criterion is to isolate the impact of aggregate demand policy shift from temporary fluctuations. Then, sacrifice ratio is calculated as the ratio of the cumulative output gap to decline in trend inflation in an episode.

The output gap is simply the difference between trend output and actual output. The trend output is calculated by making some assumptions. Ball (1994) assumed that the output is at the trend level (potential level) at the inflation peak and again returns back to the trend level four quarters after a disinflation episode. Then trend output is calculated by assuming that trend output grows log-linearly between the point of inflation peak and four quarters after the trough.[1]In agraphical sense,

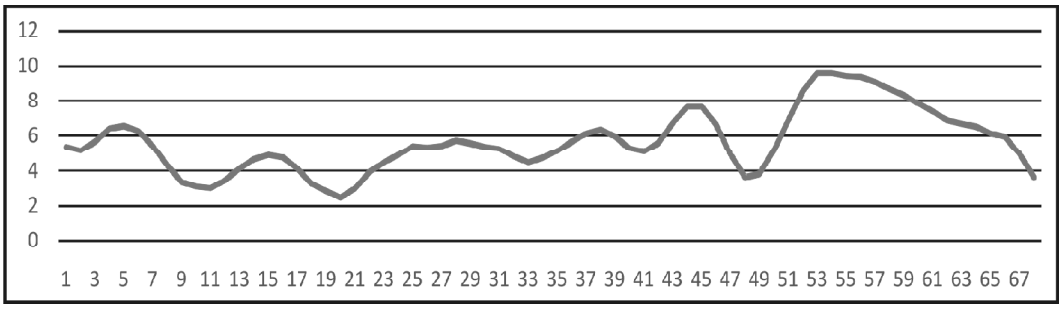
trend output is calculated by simply joining the two points of the inflation peak and four quarter after thetrough.

4. DATA AND SOME RESULTS

This study uses quarterly time series data starting from 1997Q1 to 2014Q2 and considers five variables namely, Wholesale price index (WPI), real GDP at factor cost, manufacturing GDP, IIP growth and manufacturing IIP. The WPI inflation is measured as ayear-on-year change in quarterly inflation. The other four variables are measured as the percentage change in quarterly data. All these four variables are taken in natural log except WPI inflation. The data are collected from Handbook of Statistics on Indian Economy, Reserve Bank of India.

Initially, we start calculating sacrifice ratio using Ball's (1994) method as described in section 3. By usingthe definition of 9-quarter movingaverage of trend inflation, only one episode was identified. Later it is rejected because the disinflation amount in that episode is only 1.5 percent which is not fulfilling the criteria of 2 percentages. To obtain some true disinflation episodes, we calculated trend inflation by taking centered 5 quarters moving average instead of 9 quarters.[2]By changing the definition of trend inflation we get three episodes such as 1998Q2 to 2000Q1, 2001Q1 to 2002Q3 and 2007Q3 to 2008Q3. It is further clear from the Figure 1showingepisodes are clearly visible in the trend inflation. We checked the history of thecontractionary monetary policy of the corresponding episodes. But we found only one episode that shows tight monetary policy i.e. 2007Q3 to 2008Q3.[3]So we rejected other two episodes as these periods show an expansionary action of monetary authority.

Figure 1: Trend Inflation



Source: Authors' own calculation

Finally, our calculation of sacrifice ratio is based on one episode.The estimated sacrifice ratio lies in the range between 0.3 to 1.5 percent. The positive sacrifice ratio indicates that the short term output loss following a tight monetary policy is significant in India. Table 1 shows calculated sacrifice ratio for both real GDP and IIP growth.

Table 1
Sacrifice ratio in real GDP and IIP

Episode	*SR of GDP*	*SR of IIP*
2007Q3 To 2008Q3	1.5	0.3

Source: Authors' own calculation

The calculated ratio is 1.5 percent in GDP indicating that there will be around 1.5 percent of decline in GDP growth to achieve a 1 percent fall in long run inflation. Similarly, we find sacrifice ratio of 0.3 percent in IIP implying that industrial output will be suffered by 0.3 percent by reducing 1 percent in WPI inflation. Our calculation of sacrifice ratio for GDP is in the line with the Kapur and Patra's (2003) findings but falls below the range estimated by RBI (2000) and Dholakia and Virinchi (2015).Similarly, the value of sacrifice ratio for IIP is lower if we compare the Durai and Ramachandran's (2014) estimation for non- firm sector.This result is quite problematic since we expect thehigher value of sacrifice ratio in IIP as it contains major core industry which is strongly linked to the actions of monetary policy.

Further, we proceed to calculate sacrifice ratio at disaggregated level to observe the impact of tight monetary policy. It is known that GDP contains agriculture and other sectors which may undermine the actual cost of disinflation. Similarly, IIP contains other sectors including manufacturing activity. So, we try to measure true impact of tight monetary policy by calculating the output loss in industrial activity only. Because weknew that industrial activity measured through manufacturing output would be more sensitive to the action of monetary authority than any other sectors.

Table 2
Sacrifice ratio in manufacturing GDP and manufacturing IIP

Episode	*SR of Manufacturing GDP*	*SR of Manufacturing IIP*
2007Q3 To 2008Q3	0.2	0.2

Source: Authors' own calculation

Interestingly, Table 2 shows theidentical value of sacrifice ratio for the manufacturing sectors. The estimated sacrifice ratio for manufacturing GDP and Manufacturing IIP is 0.2 percent. The estimate that we have derived is not consistent with the structural linkages usually expected to exist between monetary policy and manufacturing activity.

This inconsistency in the sacrifice ratio estimates can probably be explained by many factors. The following sections attempt explaining some such factors.

4.1. Definitions of an Episode

Ball (1994) in his seminal work introduced the 'episode method' where trend inflation is defined asa centered 9 quarter moving average of actual inflation to identify

disinflation episodes. But Cetinkaya and Yavuz (2002) argued that the nature of disinflation episode may be different for developed and developing countries pointing that Ball's (1994) procedure may not be applicable in emerging economies. So, they modified the definition and considered 5 quarter moving average as the trend inflation to find out episodes. Further, one study by Dholakia and Virinchi (2015) found an episode for the period 2010-11Q4 to 2012-13Q4 using the same sample, as we use here, for India. So, the question arises then what is the appropriate criteria to define a disinflation episode. If we follow Ball's (1994) method, then there is no episode between periods of 2010-11Q4 to 2012-13Q4. Further, the time length that is identified by Dholakia and Virinchi (2015) is just the falling portion of an episode where the only peak is evident and the trough has not been found. Similarly, if we consider the Cetinkaya and Yavuz's (2002) measure of trend inflation then it might violate the Ball's (1994) criteria to identify a disinflation period and may identify someepisodes which are transitory in nature.Again, the criteria of 2 percent fall in inflation in the episode method seem less relevant for emerging countries. The simple reason is that the supply side dominance is more in the inflation, as a result, there is hardly any scenario of stable and long-lived fall in inflation. Similarly, 2 percent criterion is also a problem for the inflation targeting countries that target annual inflation rate at 2 percent.

Furthermore, there is some difference in the calculation of trend inflation for annual and quarterly data. For annual data, the trend inflation for year t is the average of four-quarter inflation for that year and four quarters on each side. This differs from the definition of centered 9 quarter moving averageBall (1994) for quarterly data.[4] Since there are two different criteria to calculate moving average, this might create problems in getting actual inflation peak and trough in the data. It is because the annual data show smoother version of actual inflation to find out an episode. Ball (1994) found that the use of annual data undermines the true cost of output. So, in light of this debate, the appropriate definition of an episode doesn't seem to be very clear for the emerging countries.

4.2. Noisy Measurementof Sacrifice Ratio

In the episode method, it is assumed that disinflation is accompanied by only contractionary demand policy. So, the sacrifice ratio calculated from an episode is the result of contractionary monetary policy. But what would happen if the favourablesupply shock affects the inflation movement simultaneously? It is pointed out that the movement in inflation and output is not only influenced by monetary policy but the supply shock plays a role too. So, attempts without any isolation of monetary shock from other shocks would yield a noisy measure of sacrifice ratio (Cecchetti and Rich, 2001, Belke and Boing, 2014). Further, it is observed that some studies like have found such episodes that do not follow any contractionary period of monetary policy. So, such kind of problems may be serious when the study is extended to a large number of countries. For example, Mazumder (2014) calculated sacrifice ratio for all OECD and non-OECD countries without checking the history

of tight monetary policy. Moreover, the output loss depends on the measure used in predicting trend output.It is argued that simply fitting a linear trend may neglect persistence effect in the output loss.

4.3. Arbitrary Length of Output Loss

The measurement of thelength of output loss is also questionable. It is assumed that output loss happens till four quarters after the trough of an episode since output takes some time to return to the potential level. Then it is assumed that actual output returns back to the potential level after four quarter of an episode. This assumption is restrictive in nature because there is no empirical test for accounting the length of output loss and we can't force the output to return to potential level after 4 quarter. However, other two episode methods have relaxed the later assumption saying that output should not force to returns to potential level 4 quarter after a disinflation episode is over. But still, they calculate output loss till 4 quarters without giving any empirical validity of it.

5. CONCLUSION

Using episode method, we calculate sacrifice ratio of GDP, Manufacturing GDP, IIP and IIP Manufacturing. From the estimation of sacrifice ratio, we arrive at some important conclusions. The derived sacrifice ratio for India is 1.5 percent of GDP and 0.3 percent for IIP. Coincidentally, the sacrifice ratio of manufacturing GDP and IIP Manufacturing shows an equal amount of loss of output, at 0.2 percent. To conclude, we can say that the cost of disinflation cannot be undermined for Indian economy. Although episode method has an advantage over the Philips curve model, it fails to give a robust measure of disinflation cost. There ishost of factors,with respect to episode methodology, that determines the sacrifice ratio. An appropriate definition of "episode" still remains as an issue for emerging economies since Ball's (1994) criteria can't be used directly. Other factors share important relevance in determining the sacrifice ratio in Ball's (1994) method.

Notes

1. He tried using HP filter to calculate trend output however, he found that this measure is not giving the actual trend level of output.
2. This type of modification is done by Cetinkaya and Yavuz (2002) to measure the sacrifice ratio.
3. We checked the history of repo rates for all three episodes and found that only third episode shows hike in repo rates.
4. Ball (1994) defined the trend inflation for quarter t is the average of four quarters inflation of previous four quarter and next four quarters with one quarter in center.

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