

INFLATION DYNAMICS AND MONETARY POLICY IN INDONESIA

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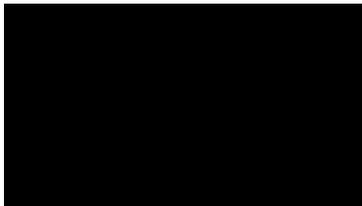
QUOTATION

‘Four things support the world: the learning of the wise, the justice of the great, the prayers of the good, and the valour of the brave.’

Prophet Muhammad S.A.W.
(570 – 632 AD)

DECLARATION

‘I, Syurkani, declare that the PhD thesis entitled Inflation Dynamics and Monetary Policy in Indonesia is no more than 100,000 words in length, exclusive of tables, figures, appendices, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work’.



Syurkani

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TABLE OF CONTENTS

QUOTATION	i
DECLARATION	ii
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	v
List of Tables	viii
List of Figures	ix
ABBREVIATIONS	x
EXECUTIVE SUMMARY	xi
ABSTRACT	xiv
CHAPTER 1 INTRODUCTION	1
1.1 Background	1
1.2 Brief overview of Indonesian economy	2
1.2.1 Macroeconomic stability in Indonesia	3
1.2.2 Fiscal policy in Indonesia	4
1.3 Objectives of the study	7
1.4. Contribution and significance of the study	8
1.5 Organization of the thesis	9
1.6 Conclusion	11
CHAPTER 2 INFLATION EXPECTATIONS AND MONETARY POLICY: REVIEW OF THE LITERATURE	12
2.1 Introduction	12
2.2 Inflation expectations	13
2.2.1 Concept and definitions	13
2.2.2 Formation of inflation expectations	18
2.2.3 The utilization of survey-based expectations data	20
2.2.4 Anchoring inflation expectations	20
2.3 Monetary policy	21
2.3.1 Approaches to monetary policy	22
2.3.2 Monetary policy rules	24
2.3.3 Inflation targeting and core inflation	25
2.4 Inflation expectations and monetary policy	28
2.5 Justification of the current study	29

CHAPTER 3 INFLATION EXPECTATIONS AND MONETARY POLICY IN INDONESIA: REVIEW OF THE RECENT DEVELOPMENTS	31
3.1 Introduction.....	31
3.2 Bank Indonesia and its institutional arrangement.....	32
3.2.1 Bank Indonesia during the New Order regime	32
3.2.2 Bank Indonesia after economic reforms	34
3.3 Monetary policy in Indonesia	36
3.3.1 Early developments.....	36
3.3.2 Instruments and transmission mechanisms.....	37
3.3.3 Financial crisis and monetary reforms.....	39
3.3.4 Recent developments	41
3.4 Inflation expectations in Indonesia	42
3.4.1 The bank’s policies on inflation.....	43
3.4.2 Adoption of inflation targeting framework.....	43
3.4.3 Survey of inflation expectations	46
3.6 Conclusion	47
CHAPTER 4 RATIONALITY OF INFLATION EXPECTATIONS IN INDONESIA	49
4.1 Introduction.....	49
4.2 Inflation expectations data	52
4.3 Econometrics of rationality.....	56
4.3.1 Unit root tests.....	57
4.3.2 Cointegration tests	59
4.3.3 Causality tests	64
4.4 Interpretations of the estimation results.....	65
4.4.1 Orders of integration	65
4.4.2 Long-run equilibrium and short-run dynamics	67
4.4.3 Causality directions.....	71
4.5 Empirical analysis.....	73
4.6 Conclusion	75
CHAPTER 5 SOURCES OF MOVEMENTS OF INFLATION EXPECTATIONS IN INDONESIA.....	76
5.1 Introduction.....	76
5.2 Data for analysis	77

5.3 Methodology.....	78
5.3.1 Principal components analysis.....	78
5.3.2 Unit root and cointegration tests.....	82
5.3.3 VAR model representation.....	83
5.4 Empirical results.....	84
5.4.1 Influencing variables.....	84
5.4.2 Stationarity and equilibrium relationships.....	88
5.5 Economic shocks and changes of expectations.....	91
5.6 Anchoring inflation expectations.....	94
5.7 Conclusion.....	95
CHAPTER 6 INFLATION EXPECTATIONS AND MONETARY POLICY RULES IN INDONESIA.....	97
6.1 Introduction.....	97
6.2 Bank Indonesia's interest rate policy.....	99
6.2.1 Operational instruments of monetary policy.....	100
6.2.2 Implication of the current conduct of monetary policy.....	105
6.3 Simple rules for monetary policy.....	107
6.4. Empirical analyses.....	113
6.4.1 Modified Taylor-rule interest rates.....	114
6.4.2 Public inflation expectations in the Taylor-rule model.....	118
6.4.3 Interest rate smoothing.....	120
6.4.4 Analysis of economic shocks.....	122
6.4.5 Empirical conclusions.....	126
6.5 Policy implications.....	126
6.5.1 Consequences on the Central Bank Act.....	127
6.5.2 Implications for future monetary policy.....	127
6.6 Conclusions.....	131
CHAPTER 7 CONCLUSION.....	132
BIBLIOGRAPHY.....	138

List of Tables

Table 1.1 Indonesian economic indicators (in per cent)	3
Table 2.1 Preconditions for inflation targeting	26
Table 3.1 General framework of monetary policy (prior to Act No. 23 of 1999)	37
Table 3.2 Directions of monetary policy during and after the financial crisis	40
Table 4.1 Unit root tests for actual inflation and inflation expectations.....	66
Table 4.2 Initial regressions of actual inflation and inflation expectations	68
Table 4.3 The DF/EG tests for the residuals of the initial regressions	68
Table 4.4 ECM estimations of actual inflation series and inflation expectations.....	69
Table 4.5 Results of the Johansen cointegration tests.....	71
Table 4.6 Results of Granger causality (pair wise) tests.....	72
Table 5.1 Principal components analysis (reduced using correlation matrix).....	84
Table 5.2 Principal components analysis (eigenvectors).....	87
Table 5.3 Principal components analysis (ordinary correlation matrix).....	87
Table 5.4 The results of the unit root tests.....	88
Table 5.5 Results of the Johansen cointegration test	89
Table 5.6 Basic estimation results of error correction models.....	90
Table 5.7 Variance decomposition of inflation expectations.....	93
Table 6.1 Descriptive statistics of tested economic variables.....	114
Table 6.2 Policy interest rates using the Taylor rule model (in per cent)	115
Table 6.3 Variable estimations using different inflation series	119
Table 6.4 Degree of persistence and speed of adjustment	121

List of Figures

Figure 3.1 Price and money supply (1958 – 1978).....	36
Figure 3.2 Bank Indonesia’s policy transmission mechanism.....	39
Figure 3.3 Annual inflation and various interest rates.....	42
Figure 3.4 Inflation targets and actual inflation (2000-2008).....	45
Figure 4.1 Price expectations survey and inflation targets	49
Figure 4.2 Actual and expected inflation rates (2001 – 2008).....	50
Figure 5.1 Scree plot (ordered eigenvalues)	85
Figure 5.2 The responses of inflation expectations to various shocks.....	92
Figure 6.1 BI rates and interest rates on time deposit in rupiah	101
Figure 6.2 SBI interest rates and inflation	102
Figure 6.3 BI rates, interbank money market and inflation	104
Figure 6.4 Modified Taylor rule (TR) rates and BI rates (BIPR)	117
Figure 6.5 BI rates, inflation expectations and rupiah exchange rates	122
Figure 6.6 World crude oil prices	123
Figure 6.7 Response of BI rates to several economic shocks.....	124

ABBREVIATIONS

ACF	Autocorrelation Function
ADB	Asian Development Bank
ADF	Augmented Dickey-Fuller Unit Root Test
ADMPR	Administrated Prices
AIC	Akaike Information Criterion
APEC	Asia Pacific Economic Cooperation
ASEAN	Association of South East Asian Nations
BI	Bank Indonesia
BIPR	Bank Indonesia's Policy Interest Rate
BIS	Bank for International Settlements
CRDW	Cointegrating Regression Durbin-Watson
CGI	Consultative Group for Indonesia
CORE	Core Inflation
CPI	Customer Price Index
DF	Dickey-Fuller Unit Root Test
DW	Durbin-Watson
ECB	European Central Bank
ECM	Error Correction Mechanism
EG	Engle-Granger Cointegration
EU	European Union
EXPI	Public Inflation Expectations
FASBI	Bank Indonesia's Funding Facility
G20	Group of Twenty of Finance Ministers and Central Bank Governors
GDP	Gross Domestic Product
IMF	International Monetary Fund
INFLY	Annual (Headline) Inflation
JSX	Jakarta Composite Price Index
LOI	Letters of Intent
LPG	Liquid Natural Gas
LPS	Indonesian Deposit Insurance
MOF	Ministry of Finance
MPR	Monetary Policy Review (published by Bank Indonesia)
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares
OMO	Open Market Operation
PCA	Principal Component Analysis
PP	Phillip-Perron Unit Root Test
REH	Rational Expectations Hypothesis
SBI	Bank Indonesia Certificates
SEKI	Indonesian Economic and Financial Statistics
SPSS	Statistical Package for Social Sciences
TR	Taylor Rule for Monetary Policy
US	United States of America
VAR	Vector Autoregression
VECM	Vector Error Correction Model

EXECUTIVE SUMMARY

This thesis investigates the conduct of monetary policy in relation to inflation targeting in Indonesia, with specific reference to the use of household survey data on inflation expectations. The theory of monetary policy suggests that in order to be successful in the implementation of inflation targeting, several conditions need to be put in place. Firstly, the monetary policy of an inflation targeting central bank needs to be forward looking. Secondly, the central bank needs to anchor public expectations about future inflation and use them as part of its policy decision-making process. Thirdly, the central bank needs to have credibility in relation to the achievement of the targets set and, where this is in doubt, there is a case for the central bank to consider adopting a transparent, rule-based monetary policy approach.

By law, Bank Indonesia adopted inflation targeting for monetary policy in 1999, and its explicit implementation started in July 2005. Bank Indonesia uses interest rates as its monetary instrument to achieve predetermined inflation targets. Although the basic requirements for implementing inflation targeting have been met, the Bank has not been successful in achieving a low and stable inflation as stipulated by the Central Bank Act, nor has it been successful in achieving the inflation targets set for it by the Indonesian Government. Among several important factors contributing to this failure may be the approach currently implemented by Bank Indonesia in the monetary policy decision-making process, and this is the focus of this thesis.

The Bank undertakes regular household surveys of price expectations as required by inflation targeting, but these data have not been explicitly used for the purpose of monetary policy decision-making process nor are the data extensively used for anchoring the public future expectations. The public appears to doubt the seriousness of the Bank's commitment to achieving low and stable inflation as the ultimate objective of monetary policy in Indonesia. Despite its limited credibility, the Bank uses a discretionary policy approach, rather than a rule-based monetary policy as advocated by the rational expectations hypothesis and by many proponents of inflation targeting. Here we seek to examine how the Bank actually implements monetary policy and whether a more rule-based approach incorporating the household

survey data of inflation expectations might contribute to developing a more credible, transparent and effective monetary policy.

There are five issues that we pursue to address this question. Firstly how does Bank Indonesia currently conduct monetary policy, and how successful is it in pursuing inflation targeting as its monetary policy regime? Secondly, are the household survey data of inflation expectations in Indonesia reliable and rational according to standard econometric tests? Thirdly, what sort of monetary policy approach should Bank Indonesia consider for a more optimal monetary policy, both in terms of transparency and credibility? Fourthly, we explore whether public expectations in Indonesia can play a useful role in that monetary policy approach. Fifthly, we also explore the implications that these findings have for the future conduct of monetary policy in Indonesia.

These issues are explored through a range of descriptive and econometric analyses, including specifying and estimating a number of Taylor rule models to assess the actual practice of Bank Indonesia in implementing monetary policy. The main conclusions of the empirical analyses reported in this thesis can be summarised as follows:

- An expectations-augmented Taylor rule model with core inflation provides a powerful replication of the Bank's policy decision process, with good statistical properties. This model is superior to others using actual inflation or the output gap, as judged by the properties of the estimated equations and by the predictions of the Bank's policy interest rate.
- In terms of such models the Bank shows a rapid speed of adjustment to changes in core inflation but little adjustment to changes in actual inflation, and generally shows a high degree of persistence in monetary policy.
- Estimated impulse response functions show that the Bank responds positively and substantially to changes in core inflation and to inflation expectations, but mainly responds negatively (if it responds at all) to changes in actual inflation.

Our overall empirical conclusion from this analysis is that, as Goeltom (2007) suggests, the Bank does indeed target core inflation as its operational variable, does

take account of inflation expectations data and sets policy in a reasonably systematic basis in relation to such variables. These findings are quite at variance with the standard description and perception of Bank Indonesia's policy.

The central policy conclusion drawn from this analysis is the actual and perceived success of Indonesian monetary policy might be greatly improved if this implicit practice of the Bank were made explicit in the formulation and operation of Indonesian monetary policy. This would require the following actions:

- The adoption of an explicit inflation target in terms of core rather than actual inflation, with the Government setting the inflation targets in such terms and amendment to the Central Bank Act to make it clear that Bank Indonesia should adjust interest rates to achieve a core inflation target.
- The adoption by Bank Indonesia of an explicit inflation expectations augmented Taylor rule approach to inflation targeting and to the setting of policy interest rates, with deviations from such a rule-based approach explained and justified if and when they occur.
- Small monthly adjustments to interest rate, as required, to achieve the core inflation target, making use of monthly data on inflation and inflationary expectations and maintaining strong continuity in monetary policy.

While recent Indonesian monetary policy has been unsuccessful in terms of the achievement of inflation targets, of stability in interest rates and of public credibility, core inflation has been quite stable and close to the overall inflation targets. These changes could build on these successes to help create a more credible and effective monetary policy regime in Indonesia.

ABSTRACT

Since the last two decades, many countries around the world have gone through a significant transformation in monetary policy. Their central banks now set low and stable inflation as their ultimate target in the long run. The main components of the successful implementation of this inflation targeting are transparency and credibility, and their accomplishment will be judged by public in their expectations about future inflation. As a result, the central banks implement a set of modern monetary policy principles to improve their transparency and credibility, and one of those modern principles is the adoption of a monetary policy rule

In this study, we attempt to investigate the conduct of monetary policy under an inflation targeting framework and explore the role of public inflation expectations in the monetary policy rule. We develop an expectations-augmented Taylor rule model for monetary policy using public inflation expectations and core inflation data to replace the traditional output gap and actual inflation, respectively.

Using Indonesian economic data, we find that Taylor rule can be performed using different monetary variables. Our expectations augmented Taylor rule model can replicate reasonably well the current Bank Indonesia's policy interest rates. Using more frequent economic time series data, our model captures unexpected shocks and responds to the shocks more quickly. Our findings offer a complement to the standard procedure of monetary policy decision-making process, particularly in a rule-based monetary policy approach.

As for Indonesia, evidence shows that the public inflation expectations are reliable and rational, and can be used as one of the key variables in the monetary policy decision making process. We also argue that targeting core inflation is more achievable for Bank Indonesia than the actual inflation. We conclude that in order to improve its transparency and credibility in its conduct of monetary policy, Bank Indonesia should consider a rule-based monetary policy approach with core inflation as its ultimate target.

CHAPTER 1

INTRODUCTION

1.1 Background

For the past twenty years, central banks around the world have gone through a remarkable transformation in their monetary policy decision-making. More and more countries are now adopting an inflation targeting framework and set a low and stable inflation as their ultimate objective of monetary policy. Consequently, unlike the past, modern central banks are required to be more transparent and credible in their actions and strategic plans. This is due to the fact that economic agents have become more concerned about the numerical targets that their central bank sets and the approaches that the bank takes to achieve those targets. As the result of these transparency and credibility issues, the central banks are forced to adopt a set of modern monetary policy principles which, in turn make them aware of whatever are the consequences of their actions, so that they will have to be very careful in choosing their policies and what they can accomplish.

As part of the modern monetary policy decision-making process, many central banks are disciplined by monetary rules aimed at ensuring that a satisfactory regulatory standard is achieved. This is important in avoiding the situation where any central bank can determine its monetary policy on a purely discretionary basis, since this practice tends to serve whatever ends may seem most pressing at any given time. Although monetary policy rules are not blindly mechanical, the central bank needs to make explicit commitments, which are useful in achieving its predetermined target. These commitments are reflected in the bank's interest rate policy as this is the most viable monetary instrument used by many inflation targeting central banks.

Furthermore, one of the most important characteristics of the inflation targeting central banks is to have a forward-looking monetary policy. Being forward looking means that in almost every part of current monetary policy decision-making, the central bank takes seriously into consideration public expectations about future price directions. In this regard, the central bank can have critical information on how the public form their expectations. Accordingly, understanding the relationship between

inflation expectations and monetary policy is important, so that the decisions made by the bank reflect the true state of the economy and anchor the expectations decisions made by the public. This is due to the fact that expectations influence the time path of the economy, and conversely the time path of the economy might otherwise also influence expectations.

Indonesia is one of many emerging economies that adopt inflation targeting as the ultimate objective of monetary policy in the long run. The most essential part of this inflation targeting is to build a highly credible central bank whose long-term single objective is to achieve a low and stable rate of inflation since monetary policy could only influence inflation in the long run. Therefore, Indonesia has transformed its central bank to follow this path with the long-run objective of achieving sustainable macroeconomic stability.

1.2 Brief overview of Indonesian economy

Indonesia is an emerging economy which has demonstrated a remarkable ability to survive the recent global economic turmoil. Although Indonesia adopts a floating exchange rate system with an open capital account regime, its economic growth has not been significantly affected by the crisis. With a population exceeding 230 million and total gross domestic product (GDP) ranking among the top 20 biggest economies in the world, Indonesia plays a very important role in the region. Indonesia is the only ASEAN country that has representation in the Group of Twenty (G20), a global economic forum consisting of a combination of advanced and developing economies with the highest total GDPs.

Table 1.1 below shows some of Indonesia's yearly economic indicators as published by the APEC Secretariat. From 2000 to 2008, Indonesian real GDP growth rate has been reasonably stable, with a low of 3.5 per cent in 2001, while the highest growth rate was achieved in 2007 of 6.3 per cent. This high economic growth provides evidence that Indonesia has been performing well after the 1997 Asian crisis. Although income distribution is a long way from the ideal, because high concentration of production and income remains in the capital city Jakarta, Indonesia

has been able to maintain its development pace through successfully sustaining stable economic growth in the long run.

Table 1.1 Indonesian economic indicators (in per cent)

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Real GDP growth	5.4	3.6	4.5	4.8	5.0	5.7	5.5	6.3	5.2
Current account	4.8	4.3	4.0	3.5	0.6	0.1	3.0	2.5	0.1
Interest rate	10.32	15.03	13.54	7.76	5.38	6.78	9.18	6.02	8.75
Exchange rate	8,422	10,261	9,311	8,577	8,939	9,705	9,159	9,143	10.895

Source: APEC Secretariat and Bank Indonesia.

The Indonesian current account balance has remained positive, with the lowest percentages occurring during 2004, 2005 and 2008. One explanation that can be provided for this is that the low current account balance in 2005 and 2008 was due to a large oil price hike in the global energy market, and particularly in 2008, the low balance was also caused by global economic slowdown as the result of the American subprime mortgage crisis. Since Indonesia is a small open economy whose domestic demands rely significantly on imported goods, this global economic recession is particularly a sensitive issue. Indonesia's energy market still relies on global energy prices and the revenues from this sector accounted for around 20 per cent of the country's total exports during that period. Any distortion in the world energy market will have a negative impact on the country's balance of payment.

Furthermore, although at a relatively high nominal level, the exchange rates between the Indonesian rupiah and the US dollar have been quite stable at around 9000 rupiahs per US dollar. This indicates that the macroeconomic performance of Indonesia has been maintained positively well. But regardless of its political instability in the early years following the domestic economic reform of 1999, Indonesia has demonstrated its important role in the regional economic development.

1.2.1 Macroeconomic stability in Indonesia

During the 1997 economic crisis, Indonesian banking industry faced the most difficult situation in the country's financial history. Most domestic banks were put in the

banking recovery scheme established by the government as the result of large rupiah depreciation. Many of the banks were collapsed, which in turn created public confusion about the future of the banking industry. To tackle this problem, Bank Indonesia as the country's central bank was required to provide assistance for banks facing liquidity problems. Accordingly, Bank Indonesia adopted a monetary control which was introduced in March 1998. The target of this monetary control was to set a ceiling on base money to avoid further deterioration of interest rates that soared to over 70 per cent. According to Goeltom (2007), the focus of this policy was to restore price stability and, in combination with other factors, to restore stability in the foreign exchange market.

Learning from this experience, the government stipulated a new central bank law in 1999 to establish a new legal framework for monetary policy in Indonesia. The main aim of the law is to increase credibility of monetary policy through central bank independence and set a nominal anchor for the public to follow. The law states that the stability of the rupiah becomes the single objective of Bank Indonesia and consequently, the Bank has to pursue its monetary policy operation in a way that supports to achieve this objective. The new law also requires Bank Indonesia to comply with international standard of financial control and to the announced inflation targets as part of its reporting function (Goeltom, 2007). Although several underlying factors played significant roles, the establishment of new monetary institutions was seen as the major factor in building short-term and longer-term macroeconomic stability in Indonesia.

1.2.2 Fiscal policy in Indonesia

Indonesian fiscal policy has enjoyed a significant achievement of a low level of public debt. This achievement comes as the result of adopting more restrictive fiscal management. However, before the 1997 financial crisis, Indonesia implemented a much less restrictive fiscal policy resulting in large fiscal deficits funded mainly from external sources. That policy continued for several years following the crisis. For example, in 1998, government debt increased dramatically and forced the government to increase its budget deficit sharply from 2.5 per cent in 1997 to 5.7 per cent. This

resulted in the suspension of many of the government's infrastructure development programs.

According to Abimanyu (2004), sound fiscal policy is reflected in decreasing fiscal deficits which is achieved through more systematic budget forecasts, subsidy reduction, sound management of external debt, and a steady increase of tax revenues. As for the case of Indonesia, the government targets a budget deficit less than 1 per cent of GDP and the ratio of external debts to be less than 50 per cent of GDP. Abimanyu (2004) further argued that the Indonesian government can reduce the budget deficit in two ways: by increasing state revenues from taxes and by setting priorities of budget allocations while sound management of external debts can be achieved through lowering the ratio of debts to GDP and finding more alternative domestic financing sources. As a result, in 2003 the government initiated total tax and customs reforms. Among the most important steps that the government has taken with regard to these sectoral reforms is to renew the tax administration through more effective tax collection system as well as through tax extensification.

In the meantime, as the result of the fiscal reform, the government has introduced three new priorities of its budget allocations. Firstly, it has increased the effectiveness of the budget management through restructuring the government financial institutions, most notably the Ministry of Finance (MOF). In the last several years, the MOF has been restructured continuously through eliminating overlapping units and replacing them with a new and more performance based organization. The main objective of this organizational reform is to strengthen the institutional ability of the MOF in responding to rapid changes in global and domestic economic development. This reform is also directed to eliminate corruption problems among government officials, so that more optimal fiscal management can be achieved.

Secondly, the government has determined that its annual budget is mostly provided for activities that support national economic recovery. As the result of the Asian economic crisis, Indonesian economic growth fell sharply and forced the government to request assistance from the International Monetary Fund (IMF). This new economic policy direction has been successful in speeding up the national economic

recovery, and the lesson learned from the previous crisis has been used to successfully isolate the economy from the recent global economic crisis.

Thirdly, the government has also implemented more decentralized fiscal policy. In the wake of the Asian crisis, the national political agenda changed dramatically. Provincial and district governments gained more autonomous power from the central government in the form of more control in managing their budget and development programs, which resulted in changes of national economic policy. In turn, the central government set new guiding principles to regulate the relationship and coordination between the central government and the regional governments about development expenditures and revenues. A new Treasury Act of 2003 requires the central government to provide a certain percentage of national revenues for the regional governments through the so-called general allocation funds, specific allocation funds and profit sharing from natural resource exploitation. The objective of this fiscal decentralization is to minimize financing gaps in infrastructure development, and to maintain fiscal neutrality on the central government. In addition, this policy is also directed to improve the accountability and performance of the regional governments so that programs that have immediate impacts on public welfare could be directly initiated in the regions.

The most important reform that the Indonesian government has made on fiscal policy is regarding development financing. According to Abimanyu (2004), there are four steps that the government takes in optimizing its resources for development, particularly to reduce financing gaps as the result of budget deficits. Firstly, the government will make more optimal use of its reserves at the central bank. This means the government will have options to use its reserves for more productive sectors and create more investment opportunities. Secondly, the government will also make increasing revenues from asset sales and these revenues are achieved mainly through the privatization of its state-owned enterprises. Thirdly, the government issues more government bonds both for domestic and international markets, and reduces its dependence on foreign commercial loans. One of the most important actions that the government takes on debt repayments is to repurchase domestic debts by issuing long maturity government bonds (debt switching). Fourthly, the government only seeks foreign financings through official forums such as the

Consultative Group of Indonesia (CGI), instead of dealing with individual countries or multinational lenders.

Achieving long-run macroeconomic stability and relatively sound fiscal policy lay a strong foundation for more successful development in the future, particularly as Indonesia pursues to improve its active role in the global economy. However, this macroeconomic stability has not been effectively followed by successful monetary policy. As noted above, the new central bank law transforms Bank Indonesia from a government institution to be an independent central bank with authority to design and implement monetary policy, and the law sets low and stable inflation as the ultimate objective of monetary policy. However, this single objective has not been successfully achieved. The failure of the Bank to fulfil its mandate has been associated with the approach it takes in conducting monetary policy and we are interested to explore issues in this area.

1.3 Objectives of the study

Previous empirical studies conducted on monetary policy issues in Indonesia have been focused on the impact of monetary policy pursued by Bank Indonesia on exchange rate management, transmission mechanism of monetary policy and inflation targeting framework in general. However, the present study will explore empirical evidence supported by theoretical analysis for a rule-based approach to monetary policy as a complement to the current practice implemented by Bank Indonesia with an emphasis on the utilization of household survey data of inflation expectations. We set our main objective as to answer the following question: How can Bank Indonesia make better use of the household survey data of inflation expectations and develop more credible monetary policy in Indonesia? There are five issues that we pursue to address this question:

- (i) How Bank Indonesia currently conducts monetary policy in Indonesia, and how successful it is in pursuing inflation targeting as its monetary policy objective.
- (ii) Whether the household survey data of inflation expectations in Indonesia is reliable and rational according to standard econometric tests.

- (iii) What sort of monetary policy approach can Bank Indonesia consider to pursue for more optimal monetary policy, both in terms of transparency and credibility.
- (iv) Whether public expectations in Indonesia can play a useful role in that monetary policy approach.
- (v) What implications will our findings from this study have for the future conduct of monetary policy in Indonesia.

1.4. Contribution and significance of the study

The main contribution of this thesis to the body of knowledge is that it utilizes the household survey data of inflation expectations in a model of monetary policy rules. This has been done through developing a modified Taylor rule model that can make use of inflation expectations as the basis of the model estimation together with other influential economic variables such as inflation and interest rates. The result of this study suggest that the household survey data of inflation expectations can be used to replace output gaps in our modified Taylor rule model. Meanwhile, the model can reproduce central banks' policy interest rates reasonably well as in the original Taylor rule. We also find that more frequent time series data that we use in our modified Taylor rule can provide better information for policy makers and public in general, since it can accommodate unexpected shocks that occur during the examined period, so that monetary authorities can respond much faster than if less frequent data is used as in the original Taylor rule approach.

Furthermore, this study also presents its significance for monetary policy decision makers. It is, to the author's knowledge, the first and most comprehensive study on public expectations of inflation for Indonesia. Several outcomes of this thesis are expected to be useful to complement the current central bank's policy regarding the utilization of the household survey data of inflation expectations as one important variable in the determination of monetary policy. In addition, Bank Indonesia and other policy makers can also use the outcomes of this study as an input had they considered using a rule-based policy approach as the basis for monetary policy related decision-making.

1.5 Organization of the thesis

This thesis is organized into seven chapters: (i) introduction; (ii) review of the literature; (iii) analysis of the recent development of monetary policy and inflation expectations in Indonesia; (iv) testing of the rationality of inflation expectations; (v) examining the sources of movements of inflation expectations; (vi) investigating the relationship between inflation expectations and monetary policy rules; and (vii) conclusion.

Chapter 2 reviews the previous literature on inflation expectations and monetary policy rules as they are the focus of analysis in this study. This chapter surveys thoroughly two different views regarding the formations of inflation expectations: rational expectations hypothesis and adaptive expectations approach, and briefly discusses an alternative approach of near-rational expectations. The emphasis of the survey is on the utilization of survey-based data of inflation expectations in the monetary policy decision-making process. This chapter also surveys the recent literature on monetary policy rules. At the end of this chapter, it justifies the importance of this study in the theory of monetary policy.

Chapter 3 reviews the recent development of monetary policy and inflation expectations in Indonesia. The chapter analyses in detail the past and the present monetary policies of Indonesia as well as the directions of future monetary policy. This chapter also discusses the institutional arrangement and the transmission mechanism of monetary policy that is currently conducted by Bank Indonesia in order to understand what actions the Bank has taken and whether they are in compliance with the commitment set as part of inflation targeting. Several facts found from the analysis demonstrate that Bank Indonesia is not a full-fledge inflation targeting central bank. Its objective is seen as ambiguous; notwithstanding the fact that the Bank has never met its inflation targets. Interestingly, among the fundamental element of Indonesia's inflation, as suspected by the Bank, is the high contribution of public inflation expectations.

Chapter 4 investigates the household survey data of inflation expectations in Indonesia through measuring long-run equilibrium relationships between the survey data and actual inflation. This chapter attempts to identify whether public inflation expectations can be a good predictor of future actual inflation. All the estimations on inflation expectations in this chapter are based on household survey data provided by Bank Indonesia. We find that both actual inflation and inflation expectations are non-stationary, which means that in the short-run they might drift apart since they exhibit random walk individually. However, we also find that there exists a long-run equilibrium relationship between the actual inflation and the inflation expectations in Indonesia. This means that the household survey data of inflation expectations is reliable and rational and thus, it can be used as a key variable for monetary policy decision-making.

Chapter 5 analyses the formation of public inflation expectations in Indonesia. How public adjusts their expectations formation based on new information available in the market is of critical importance in this analysis. In more details this chapter examines some important monetary variables that influence the formation of inflation expectations. Our finding presents evidence that several variables do influence the movements of public inflation expectations both in the short and long runs. By estimating the response of public expectations to different shocks, we find that certain key variables are more influential in determining the sources of movements of public inflation expectations. In addition, this chapter also analyses the issues of administered prices and other certain commodities whose price are subsidized by the government as we suspect their significant influence on future public expectations.

Chapter 6 analyses the monetary policy approach currently implemented by Bank Indonesia and how the inflation expectations can play a useful role in that approach. The emphasis is put on Bank Indonesia can improve its transparency and credibility in the conduct of monetary policy by considering a rule-based policy approach. In this chapter, we develop a framework for the analysis of rule based monetary policy using the household survey data of inflation expectations as one key variable. Empirical evidence found in this study shows that the Taylor rule approach can perform relatively well using public inflation expectations with more frequent time series data.

Our finding also provides evidence that Bank Indonesia may consider using core inflation as its inflation target instead of actual (headline) inflation.

Chapter 7 concludes all the findings of this study together with some major policy implication as well as recommendations for further research.

1.6 Conclusion

This introductory chapter sets out the background and the objectives of the present study together with a brief explanation of the organization of this thesis. The next chapters will further develop this work and come into more rigorous analyses and work on achieving the objectives of the study.

CHAPTER 2
INFLATION EXPECTATIONS AND MONETARY POLICY:
REVIEW OF THE LITERATURE

2.1 Introduction

Modern macroeconomic theory has been dominated by decision making in anticipation of future uncertainties. According to Evans and Honkapohja (2001), this approach has been the central difference between economics and natural sciences where economic agents make forward-looking decisions.¹ Accordingly, in almost every part of macroeconomic decision-making, expectations play a very important role. Hence, it is crucial for a successful central bank to understand and follow public expectations, so that decisions made by the bank could reflect the true economic conditions. This is due to the fact that expectations influence the time path of the economy, while the time path of the economy might otherwise also influence the expectations (Evans and Honkapohja, 2001).

Research on inflation expectations has been extensively conducted in the past. For example, Berk and Hebbink (2006) conducted a study of inflation expectations for the European area, and they concluded that European inflation expectations were rational with data proving to be relatively robust to sudden changes in inflation and monetary policy surprises. However, another study on European inflation expectations conducted by Arnold and Lemmen (2008) found that consumer responses to their survey suggested that inflation expectations depend more on past national inflation rates than on the European Central Bank's (ECB) anchor for price stability. This indicates that inflation expectations do not converge significantly faster than actual inflation rates. Meanwhile, De Carvalho and Bugarin (2006) tested the rationality of private inflation forecasts in Chile, Brazil and Mexico, and found there was very strong evidence that inflation expectations in those countries are unbiased.

¹ For the purpose of this study, the terms economic agents (or just agents), people and public are extensively used interchangeably to refer to the same economic actors outside the government and the central bank.

This chapter reviews the previous literature on inflation expectations and monetary policy in an inflation targeting framework as they are the main topics of this study. There are three main goals of this review. Firstly, the aim is to learn from the previous findings about the relationship between inflation expectations and monetary policy. Secondly, it is to seek sufficient information regarding the utilization of survey-based data of inflation expectations in the monetary policy decision making process. Finally, the aim is to find evidence from the literature on the importance of our research focus for monetary policy.

This chapter is divided into several sections as follows. Section 2.2 explains the concepts of inflation expectations and the utilization of survey-based expectations data. Section 2.3 discusses different monetary policy approaches, including monetary policy rules and inflation targeting. Section 2.4 highlights the relationship between monetary policy and inflation expectations. Section 2.5 presents the contributions of this study and its relation with the previous studies, and section 2.6 presents the conclusion.

2.2 Inflation expectations

2.2.1 Concept and definitions

Although the existence of expectations itself has been around for many years and is as old as other economic theories, the modern concept of inflation expectations formations was proposed in a seminal work by Muth (1961). In his article, Muth (1961) explained the importance of expectations as a way to predict future events and framed that concept in formal mathematical equations. He believed that expectations are formed by economic agents from all available information, and therefore can be used to produce an estimate of future conditions such as future potential demands and consumptions. According to Pesaran (1989), expectations are needed because individuals, in deciding which course of action to follow, are constantly faced with uncertainties. He went on to say that a decision-making process is subject to uncertainty if the individual decision maker is not perfectly aware or knowledgeable of the consequences of his/her own action. In this broad sense, uncertainty may

involve imperfect information or unpredictable events, and it may be due to ignorance or chance or a combination of both.

Although many previous studies assumed a rational expectations hypothesis (REH) when discussing expectations models and formations (Evans and Honkapohja, 2001), for the purpose of this research, this section shall start by looking at two different views of expectations, the adaptive and rational views.

The adaptive expectations hypothesis was first formally introduced by Cagan (1956) and Friedman (1956) and assumes that all future events should always have a significant cause in the past. Pesaran (1989) asserted that the adaptive expectation hypothesis was originally put forward as a plausible ‘rule of thumb’ for updating or revising expectations in the light of past observed expectations errors. Accordingly, we can say that in an adaptive expectations hypothesis, what would happen in the future is mostly a replicate of what happened in the past. As a result, Widyasanti (2004) argued that under adaptive expectations, variables will change slowly. This in turn will make the adaptive expectations become backward-looking in nature, and by this we mean that a change of monetary policy in the future will not affect the current state of macroeconomic variables. Thus, any exogenous shock and policy change will not have any impact on an economy, unless it has actually occurred in the economy before and is foreseen by the economic agents (public). In the form of a simple equation, adaptive expectations can be expressed as:

$$P_t^e = P_{t-1}^e + \lambda(P_{t-1} - P_{t-1}^e) \quad (2.1)$$

where P^e is the expected inflation at time t , P_{t-1} denotes the actual inflation in the previous period, and λ is the error-adjustment coefficient which lies between 0 and 1. What can be said about the above equation is that the expectations of inflation at time t reproduce the previous expectations adjusted by error terms, in which the current expectations increase or decrease in accordance with the difference between actual inflation and previous expectations.

For all previous periods, the equation can be written as follows:

$$P_t^e = \lambda \sum_{i=0}^{\infty} ((1-\lambda)^i P_{t-1-i}) \quad (2.2)$$

which is also an autoregressive distributed lag with exponentially declining weights. Thus, the current expected inflation reflects a weighted average of all past inflation, where the weights become smaller as the data moves further from the current year to the past.

Adaptive expectations were very popular in macroeconomic analyses during 1960s and 1970s, where inflation expectations were often used in the adaptive modelling of the expectations-augmented Phillips curve (Evans and Honkapohja, 2001). However, there is a very significant weakness in this hypothesis. Although in several empirical studies the adaptive expectations could well explain many inflation phenomena, when it comes to dealing with stochastic economic shocks the agents cannot correctly forecast the future price level again in the next period, since their forecasts only include past expectations errors but leave out all the current information. As a result, the adaptive expectations hypothesis involves systematic forecasting errors (Turnovsky, 2000). Furthermore, Sargent (1987) also argued that the adaptive expectations clearly cannot capture the current available information of real variables which are needed in order to correctly forecast the future path of the economy.

The adaptive expectations also cannot improve the role of the central bank in pursuing its monetary policy, as the adaptive hypothesis tends to increase the variability of inflation and output in response to shocks. De Brouwer and Ellis (1998) found that the optimal interest rate policy cannot fully compensate for the greater variability produced when people take insufficient account of the structure of the economy and future monetary policy in forming their expectations.

On the other hand, the rational expectations hypothesis assumes that people will always form their expectations by taking into account all available information. In this regard, people are assumed to have sufficient knowledge and to be well informed about the current economic condition. Evans and Honkapohja (2001) defined rational expectations as the mathematical conditional expectation of the relevant variables.

That is, the expectations are conditioned on all of the information being available to the decision makers. Accordingly, the rational expectations hypothesis states that expectations should be identical to forecasts from the model thought to be generating the variables in question (Pearce, 1987).

As the rational expectations model incorporates all available information at the time the forecast is made, it is assumed that economic agents will not only rely on data from the past (backward looking). This means that any economic shock will be better dealt with when the agents have a better understanding of the structure of the economy and the central bank's reaction function (de Brouwer and Ellis, 1998).

Formally, the rational expectations hypothesis may be written as follows:

$$P_t^e = E_t(P_t) \quad (2.3)$$

where E_t denotes the statistical expectations conditional on information available at time t .

As mentioned above, the rational expectations hypothesis requires that the forecast made by the economic agents be consistent with the estimations generated by the model (Pearce, 1987, Turnovsky, 2000). As a result, we can make equation (2.3) to be expressed as:

$$P_t = P_t^e + e_t \quad (2.4)$$

This equation (2.4) shows that the price level should fluctuate around its forecast with a purely random error, e_t , that has zero mean. The relationship between the actual price level and its forecast should be an indicator of market efficiency. According to Turnovsky (2000), the expected prices should fully reflect available information, thus eliminating any systemic opportunities for making supernormal profits.

Despite the fact that the rational hypothesis model has been the standard assumption and widely used in the analysis of macroeconomic studies, it also faces criticisms.

The rational expectations hypothesis is often seen as impracticable on many empirical grounds. Firstly, rational expectations are costly to form and their benefits are derived from their use in economic decisions (Curtin, 2006). Curtin (2006) argued if economic agents have to incur significant costs in collecting and processing information in order to form their expectations using the relevant dynamic model, they will choose to sometimes hold less accurate expectations.

The second important issue is that central banks must have credible policy responses for the public to follow and change their expectations of the way the central banks conduct their monetary policy (de Brouwer and Ellis, 1998, Curtin, 2006). If it is not credible, the public will not alter the way they view the future. This is particularly true for inflation targeting central banks, where forward looking monetary policy is among the preconditions for a successful adoption of the inflation targeting framework (Bernanke and Mishkin, 1997, Amato and Gerlach, 2002, Fraga et al., 2003). According to Jensen (2006), without a credible commitment, the public expect policy makers to reconsider policy, every period, and take whatever action is optimal from the perspective of that point in time. As a result, policy makers' present and past actions have no effect on the public's policy forecasts, since these are produced by going over the decision process that policy makers are expected to face in the future.

The other issue raised regarding the rational expectations hypothesis is about its applicability to conform to the public aggregate behaviour. According to Sonnenschein (1972), individual behaviour regarding their future demand function is not necessarily dynamically stable. In other words, assumptions about individual behaviour do not carry over to collective behaviour of individuals (this proposition is later referred to as the Sonnenschein-Mantel-Debreu theorem). This in turns leads to the question of whether all individuals are, in practice, able to reproduce the model-consistent expectations as those of the policy makers', to the extent required for forecasting uses (Jensen, 2006, Mehra and Herrington, 2008). As a result, although there are some learning mechanisms developed by economic agents in the process of expectations formations, some authors believed that most survey data on inflation expectations do not fully conform to unbiasedness tests as measured in terms of their convergence to the actual inflation (Figlewski and Wachtel, 1981, Evans and Gulamani, 1984, Pesaran, 1985, Arnold and Lemmen, 2008).

To solve the above issues, some authors developed near-rational expectations theories, also known as bounded rationality or learning in expectations. The idea is that individuals have limited knowledge while data is costly to collect and to process, and this results in decision makers making imperfect decisions. However, they consider their decisions as rational based on the assumption that it is rational to engage in this type of decision-making process up to the point where the expected additional benefit equals the expected additional cost involved (Tisdell, 1996). So people could form their expectations based on the adaptive expectations hypothesis, but complement it with models based on the rational expectations hypothesis.

Gomes, Mendes and Mendes (2008) argued that private economic agents have forward-looking behaviour and they always try to optimize their expectations with all the available information. However, they are also allowed to make small mistakes near the rational expectations equilibrium. Furthermore, Cho (2005) mentioned that the expectations equilibrium models are built around the strong assumption on the computational and forecasting capability of the decision makers. However, this assumption cannot be always true. As the result, economic agents with boundedly rational expectations still have the capability to produce rational expectations, but they are subject to certain constraints in computational and forecasting capacity.

The present study holds the belief that economic agents are rational and will form rational expectations. However, their expectations can exhibit considerable inertia when the agents are differentially informed about the future path of the economy. This means that the economic agents will follow the adaptive hypothesis if necessary to form their forward-looking expectations. This is due to the fact that different individuals face different circumstances in their ability to collect all current information and to generate model-consistent expectations.

2.2.2 Formation of inflation expectations

The source of movements of inflation expectations have varied across different countries. De Carvalho and Bugarin (2006) tested the rationality of inflation expectations in three Latin American countries, namely Chile, Mexico and Brazil. In their study, they employed different economic variables for the three countries to test the formation of inflation expectations in those countries. For the case of Chile, they used the past period of inflation expectations, output gap, exchange rate changes, interbank interest rates, consumer price inflation and foreign inflation. The result showed that the inflation expectations are rational and affect the predetermined target. However, if shocks change the viable path of inflation, monetary policy will only be able to counterbalance the second-round effects after one year. Hence, other than the proxy of inflation targets, all the economic variables used affect the formation of inflation expectations.

For the case of Mexico and Brazil, De Carvalho and Bugarin (2006) found evidence that inflation expectations are of adaptive behaviour in nature, and the tests confirmed that past supply and demand conditions have been important in the formation of the Mexican inflation expectations. However, in contrast with Chile and Mexico, the formation of inflation expectations in Brazil has been dominated by past supply conditions and the past inflation expectations or interchangeably with current demand conditions.

Mehra and Harrington (2008) conducted tests of rational expectations for the US economy. They used several variables in their estimations, namely actual inflation, commodity prices, expected inflation itself, and the real interest rates. Among those variables, the shocks to actual inflation and oil price shocks significantly influenced the expectations while commodity prices, even though they have been one of the major sources of inflation expectations, had a decreasing influence on the formation of inflation expectations in the US. Interestingly, Mehra and Harrington (2008) found that the real interest rates have been increasingly influenced by the oil price shocks, while at the same time, together with the actual inflation has been responsible for the decline in inflation expectations.

Conversely, Madsen (1996) conducted tests of inflation expectations for EU countries. He used several variables to estimate his expectations model to proxy technological

progress: wages, the user cost of capital, prices of intermediate products, production and labour productivity. Madsen (1996) found that the tests could not give an adequate explanation of the price expectations process. He also concluded that the results from the test confirmed that expectations are somewhat adaptive and extrapolative, although the model just explained a minor proportion of the variance of inflation expectations.

2.2.3 The utilization of survey-based expectations data

The importance of direct observation of expectations for the analysis of effects of expectations on economic behaviour has long been recognized in the literature. According to Pesaran (1989), in the absence of direct measures of expectations, empirical analysis of the expectations formations can still be carried out indirectly, but they are of little help as tests of theories of expectations formation. Pesaran further stated that only when direct observations on expectations are available, is it possible to satisfactorily compare and contrast alternative models of expectations formation. In fact, most studies on inflation expectations employed direct survey data to measure the characteristics of the inflation expectations themselves or to make forecasts of future actual inflation (Leduc et al., 2007, Madsen, 1996, Mehra and Herrington, 2008, Pearce, 1987, Arnold and Lemmen, 2008).

However, Demery and Duck (2007) argued that there are differences in the expectations formed using ‘full information’ survey data and those formed using ‘partial information’ survey data. Full information rational expectations imply homogeneity of expectations, while partial information rational expectations demonstrate a substantial degree of heterogeneity of expectations observed in survey data. These differences are due to regional variations in commodity prices. Nevertheless, Demery and Duck (2007) also claimed that agents for whom accurate forecasts matter will devote more resources to reducing their forecast error variance by extending their information set. Nevertheless, Evans and Honkapohja (2001) believed that although economic agents learn from the price data of the previous periods, they also use exogenous variables and learning to update their estimates.

2.2.4 Anchoring inflation expectations

Central banks seek to achieve their predetermined inflation target as they send signals to the market about their ability to deal with inflation and to anchor public expectations. Successful inflation targeting significantly contributes to more credible monetary policy, and that more efficient policy has been the driving force behind the improvement of macroeconomic performance (Cecchetti and Debelle, 2006).

Furthermore, anchoring public expectations of inflation is important for a central bank as it gives the central bank more credibility to pursue its monetary policy objectives (Berk and Hebbink, 2006). Berk and Hebbink (2006) claimed that when a central bank lacks credibility, public expectations will exceed the bank's objective of achieving its target inflation. In the short run, this will result into higher wages demanded by households and more expensive prices charged by firms, while in the long run it might affect the stability of output growth in the economy.

Meanwhile, many economists believe that economic agents behave according to their rational expectations in responding to the central bank's monetary policy. As a result, they could change their expectations on future inflation, particularly if they do not believe in their central bank's actions. However, Gurkaynak, Sack and Swanson (2005) argued that if these economic agents had firm expectations about what inflation would be in the long run and had a high degree of confidence in those expectations, then short-term change in the CPI would not cause them to revise their views about the long-term inflation outlook. Accordingly, it is important for the central bank to anchor public expectations of inflation, so that the bank can better understand the future trends of aggregate demand in the economy in order to improve the stability of output growth.

2.3 Monetary policy

2.3.1 Approaches to monetary policy

Two different views on conducting monetary policy currently hold central bankers and academic analysts. The two views are discretionary monetary policy and monetary policy rules. Under discretion, central bankers can always accommodate some short-run objectives, which make it harder for individuals to form expectations about policy decisions in the future. Without a credible commitment, the public expect policy makers to reconsider policies in every period and take whatever action is optimal from the perspective of that point in time (Jensen, 2006). Consequently, policy makers' present and past actions have no effect on the public's policy forecasts, since they are produced by considering the decision process that policy makers are expected to face in the future.

Furthermore, discretionary monetary policy at each point in time can lead to poor long-run outcomes (Mishkin, 1999). This is due to the fact that policy makers can choose not to have any commitment in conducting their monetary policy (Clarida et al., 1999). Under discretionary monetary policy, the central banks can choose two target variables (output and inflation) and one policy instrument (interest rates). This means that the central banks do not have to commit to one particular target and they can argue that failures occur and can be caused by either of these two variables. Since the central banks cannot manipulate beliefs in the absence of commitment, they take public expectations as given in solving optimization problems (Clarida et al., 1999).

Meanwhile, Westelius (2005) claimed that by incorporating imperfect information regarding the true preferences of the monetary authorities and a consequent learning process on the part of the public, imperfect credibility and transparency can generate a substantial amount of persistence in inflation and unemployment following a disinflationary regime shift. This result is due to the failure of discretionary policy to incorporate the impact of imperfect credibility and transparency on the dynamics of inflation expectations.

On the other hand, monetary policy rule has been widely claimed to give more certainty to both central bankers and the general public in terms of future policy

direction. A central bank that commits to a tough policy rule is able to credibly signal that it will sustain over time, an aggressive response to a persistent supply shock (Clarida et al., 1999). Clarida, Gali and Gertler (1999) further argued that since inflation depends on the future course of excess demand, commitment to the tough policy rule leads to a magnified drop in inflation per unit of output loss, relative to the case of discretion.

Taylor (1993) claimed that policy rules have advantages over discretion in improving economic performance. Hence, it is important to preserve the concept of a monetary policy rule even in an environment where it is practically difficult to follow mechanically due to the occurrence of technical problems in econometric formulation. This is due to the fact that monetary policy rule reflects the commitment made by the central banks for forward-looking monetary policy. The increased role of expectations forces monetary policy makers to commit to following a policy rule instead of allowing them to pick the appropriate policy at their discretion. The basic intuition was that under a rule, the policy maker would be able to credibly commit to a sequence of policy decisions that would bring about the best long-run outcome.

Woodford (2003) argued that a notable feature of the rule-based approach to monetary policy is the increased emphasis given to a particular policy objective: maintaining a low and stable rate of inflation, which is inflation targeting. Consequently, any central bank that claims to have adopted an inflation targeting framework will automatically have to commit to a policy rule.

Furthermore, according to Woodford (2003), there is good reason for a central bank to commit itself to a systematic approach to monetary policy that not only provides an explicit framework for decision-making within the bank, but is also used to explain the bank's decision to the public. There are two important advantages of commitment to an appropriately chosen policy rule of this kind. First, the effectiveness of monetary policy depends as much on the public's expectations about the future policy as it does upon the bank's actual actions. Hence, it is important not only that a bank manages to make the right decision as often as possible, but that its actions are predictable. Secondly, assuming the public has no difficulty in correctly perceiving the pattern of the central bank's actions, if a bank acts at each date under the assumption that it

cannot commit itself to any future behaviour and is not bound by any past commitment, it will choose a systematic pattern of behaviour that is sub-optimal.

2.3.2 Monetary policy rules

The basic framework for evaluating monetary policy showed that expectations about future inflation, and the manner in which those expectations are formed have a critical role to play in determining macroeconomic outcomes in the economy. In other words, the current state of the economy depends on expectations of future inflation, which presumably would be affected by expected policy changes in the future.

There are two major simple monetary policy rules that will be discussed briefly for the purpose of this study, but only one of them will be employed for the analysis. The first one is the monetary-based rule which was proposed by McCallum (1988). The second one is the interest-rate rule, and the most famous example of this kind is the one proposed by Taylor (1993) known as the Taylor rule. Under the McCallum rule, the instrument of monetary policy is the growth rate of the monetary base that responds to the deviation of nominal GDP from its target (Widyasanti, 2004). However, the McCallum rule has not been widely used in the literature, due to its less attractiveness, and many central banks have now abandoned using money supply or having monetary base target as their monetary policy objective. The argument raised regarding this money base target is that the central banks are having difficulties in controlling money supplies, and thus this money base rule has undesirable destabilization properties (Widyasanti, 2004).

The more widely used policy rule is the Taylor rule (Taylor, 1988). With this rule, the policy instrument is the short-term interest rate, which responds to the deviation of inflation from its desired target and the deviation of nominal GDP from its potential level, which is originally written as:

$$r = p + 0.5y + 0.5(p - 2) + 2 \tag{2.5}$$

where r denotes the Federal Fund rate (issued by the US Federal Reserve as its policy interest rate), p is the rate of inflation over the previous periods (in Taylor's original model this is the previous four quarters), and y is the deviation of real GDP from its target.

The most attractive feature of this Taylor rule is its use of interest rate and inflation instruments as the basis of the model. Since more and more central banks are now implementing inflation targeting which uses interest rates as their only monetary instrument to achieve a low and stable inflation, the Taylor rule has become very popular. Williams (2003) argued that a simple and efficient rule can perform nearly as well as fully optimal policies, and even a simple rule is more robust due to its relatively low model mis-specification. He further mentioned that the transparency of this simple rule may help policy makers to commit to the rule by increasing the visibility of discretionary policy actions and thereby reducing the likelihood of deviating from the rule.

The Taylor rule has now become the operational framework for many central banks (Asso et al., 2007). The implementation of inflation targeting, commitment, transparency and independence, has become the standard practice of monetary policy conduct as compared with the 'traditional' discretionary policy, where the Taylor rule acted as an important guideline in the process.

This study will employ the Taylor monetary policy rule to analyse the monetary policy conduct in Indonesia in relation with the inflation expectations survey. The type of policy rule used will be the feedback rule (Widyasanti, 2004). As suggested by Svensson (1999), the use of the feedback rule for the conduct of monetary policy is based on its performance that similar to that of contemporaneous rule.

2.3.3 Inflation targeting and core inflation

Starting from the early 1990s, as inflation has been steadily low in many economies, discussions surrounding inflation and monetary policy have been dominated by the concept of inflation targeting. In fact, inflation targeting has been regarded by many central banks as one of the most significant frameworks for monetary policy, due to

the fact that average inflation around the world has been substantially lower since the adoption of inflation targeting.

Unlike the other monetary targets, e.g. money supply and exchange rates, which run through intermediate variables, inflation targeting pursues the objective of monetary policy directly. Batini and Laxton (2005) listed two main features that distinguish inflation targeting from other monetary targets: (i) a central bank commits to a specified numeric target for annual inflation and that target informs the market on what the central bank intend as price stability; and (ii) the inflation forecast over some horizon is the *de facto* intermediate target of policy.

Several strands of literature have discussed extensively that successful implementation of inflation targeting requires certain preconditions that need to be satisfied by an economy adopting inflation targeting, both on the monetary and fiscal sides. Table 2.1 summarizes the preconditions for a successful implementation of inflation targeting as identified in several previous studies (Masson et al., 1997, Agenor, 2000, Amato and Gerlach, 2002, Truman, 2003, Mishkin, 2004, Batini and Laxton, 2005).

Table 2.1 Preconditions for inflation targeting

<i>Preconditions</i>	Masson (1997)	Agenor (2000)	Amato (2002)	Truman (2003)	Mishkin (2004)	Batini (2005)
Central Bank Independence	√	√	√	√	√	√
Sound fiscal policy			√	√	√	
Sound financial system			√	√	√	√
Full public commitment				√	√	
Full market economy						√
No exchange rate targeting	√	√		√	√	
Accountability		√		√		
Appropriate models			√	√		√

Source: Various authors, as listed.

All the above studies concluded that an independent central bank is a very important prerequisite to have in place before adopting inflation targeting, while most of them also share the view that the inflation targeting central bank should have no other monetary targets than price stability. The above preconditions, however, do not fully

consider the different characteristics of developed and emerging market economies. Therefore, more specific preconditions for the optimal implementation of inflation targeting in emerging economies need to be identified.

Meanwhile, the inflation targeting framework adopted by central banks around the world has emphasized the concept of core inflation as the basis for monetary policy, despite this concept still being difficult to identify. This is due to the fact that for the successful implementation of inflation targeting, a credible target measure is needed. In this regard, Silver (2006) suggested that the monetary authorities could utilize core inflation measures as the operational guide for analytical and forecasting purposes with respect to achieving the target.

Furthermore, despite the many studies that have attempted to explain what core inflation is and how it is best measured, they mostly lack an adequate theoretical framework (Vega and Wynne, 2003). The best known and most widely used measures of core inflation are the exclusion method (i.e. excluding volatile commodities, such as food and energy) and the trimmed mean and weighted median methods introduced by Bryan and Cecchetti (1993). Core inflation can also be measured using the Edgeworth index (Wynne, 1999, Roberts, 2005) and the dynamic factor estimation method (Kapetanios, 2004).

Although the above methods are useful in measuring core inflation, they have common limitations in terms of difficulties in distinguishing disturbances from the persistent components. On the other hand, the adaptive measure of core inflation proposed by Cogley (2002) is powerful enough to track sudden and persistent movements of inflation due to changes in monetary policy rules; however, it only works with survey data of inflation expectation.

Despite the wide popularity of the concept of core inflation, a number of measures of core inflation also face criticism, partly due to their inability to capture all the information that might have been useful for inflation forecasts. Many of these core inflation measures also fail to meet pre-set criteria as developed by Dixon and Lim (2004).

2.4 Inflation expectations and monetary policy

Monetary policy strategies combine a privileged role for money in the monetary policy decision making process with a broad-based assessment of prospective inflationary pressures (Berk and Hebbink, 2006). Therefore, according to Berk and Hebbink (2006), it is important to stress the role played by non-monetary variables in the monetary policy strategy. In the case of the use of inflation expectations as part of the monetary policy decision-making process, it is critical to note that in order for inflation expectations to fulfil their role as an indicator variable, there needs to be a stable and statistical relationship between the inflation expectations data and actual future inflation.

Many empirical studies have been conducted using inflation expectations to understand the phenomena of monetary policy in different periods of time, for example: Leduc, Sill and Stark (2007), Demery and Duck (2007), Mehra and Herrington (2008) and Carrol (2003). Although, not all of the previous mentioned studies came up with the conclusion regarding the use of inflation expectations in monetary policy and macroeconomics, they all agree on the importance of anchoring public expectations for the use of monetary policy, particularly in dealing with monetary policy shocks.

People should make expectations based upon the assumption that they are rational and have perfect and complete information needed to replicate the central banks' decision process. Jensen (2006) claimed that optimal time-consistent policy depends on the public's policy forecasts. If the forecasters do not have all the information required to reproduce the central banks' decision process, they have to use past and present policy to learn about this process and predict future policy. Evans and Honkapohja (2002) showed that optimal economic policies should be designed to avoid instabilities that can arise from expectation errors and the corrective behaviour of economic agents in the face of such errors. Therefore, it is important for central banks to understand how the public make their predictions about the policy and how their actions affect these predictions. Furthermore, Orphanides and Williams (2003) demonstrated that when expectations are updated every period from a finite sample regression, which seems to

be what real-life econometricians do, the central bank should react more strongly to deviations of expectations from the desired inflation path than under rational expectations.

2.5 Justification of the current study

Having discussed the previous literature on inflation expectations and monetary policy as the main research subject of this study, now we outline the focus that this study will pursue, how it is related to the previous literature and how it contributes to fill a niche in the monetary policy decision-making process, particularly in emerging economies.

The survey of the previous literature has provided strong evidence on the importance of the role of inflation expectations in monetary policy decision-making. Many empirical studies have also concluded that to be able to fulfil its role as a key variable, inflation expectations data has to demonstrate a stable long-run relationship with other monetary instruments, i.e. actual inflation, interest rates and exchange rates.

On the other hand, monetary policy decision-making has been widely associated with two major regimes, discretionary policy and time-consistent policy (also known as policy rules). Most previous studies in the literature claimed that policy rules have a better performance in monetary policy decision-making over discretionary monetary policy, particularly since more and more central banks, including those in emerging economies, are adopting inflation targeting. The latter is a target rule that requires among others transparency, credibility and independency as the prerequisites for successful implementation of the framework.

Given the above evidence, there are at least two important issues that need be addressed. The first issue is regarding the relationship of survey-based data of inflation expectations and other monetary variables. Having forward-looking expectations is one of the prerequisites for inflation targeting. This issue is significant, particularly in emerging market economies, so that we are confident that successful implementation of inflation targeting is possible. The observation raised by Daiyanu and Lungu (2005) and Fraga, Goldfajn and Minella (2003), that emerging economies

are having more difficulties in the implementation of inflation targeting than more advanced economies, is important to be addressed.

The second issue is regarding the use of monetary policy rule. As suggested in the literature, inflation targeting economies are better to adopt a rule-based monetary policy approach rather than discretionary policy. This comes from previous observation that several countries whose central banks have relatively limited credibility have not been able to claim their successful achievement in meeting their predetermined inflation targets. In other words, they have not been able to fulfil their mandate as required by law to achieve a low and stable inflation in the long run. Accordingly, with such conditions, it would be favourable for central banks to consider a rule-based monetary policy approach as one way to improve their institutions' transparency and credibility. In addition, we also believe that a monetary policy rule using more frequent time series data would provide more comprehensive information to public since the public can adjust their future expectations more frequently to follow changes in monetary policy.

The following chapters will investigate both important issues, including through testing the rationality of the inflation expectations data, examining the sources of movements of the inflation expectations and in the remaining chapters to develop a modified model of policy rule so that the inflation expectations data can be fully employed in the modified model.

CHAPTER 3
INFLATION EXPECTATIONS AND MONETARY POLICY IN INDONESIA:
REVIEW OF THE RECENT DEVELOPMENTS

3.1 Introduction

Monetary policy in Indonesia is conducted by Bank Indonesia as the country's central bank. Like many other central banks around the world, Bank Indonesia (hereafter referred to as BI or the Bank) has by law an independent status which means the Government of Indonesia (hereafter referred to as the Government) cannot intervene in the Bank's operation.

In the past, the Bank had several objectives to achieve, namely low and stable inflation, sustainable balance of payments, high economic growth and adequate employment opportunities. As a result of the new Central Bank Act of 2004, the Bank's only objective now is to achieve and maintain the stability of the value of the rupiah.

The Asian financial crisis has forced the Bank to transform itself into an inflation targeting central bank, free from the Government's influence. However, since gaining its independence status in 1999, the Bank has not yet met the targeted inflation rates, although several policy changes have taken place, from using base money and stabilizing the exchange rates, to currently utilizing core inflation as the operational target. Consequently, this failure has affected the Bank's credibility as an independent central bank and as the sole authority determining monetary policy in Indonesia.

This chapter discusses the development of monetary policy and inflation expectations in Indonesia. More specifically, the aims of this chapter are: (i) to understand the directions of monetary policy in Indonesia; (ii) to learn about Bank Indonesia as the country's central bank, its objective, institutional arrangement, and the transmission mechanism of its monetary policy; (iii) to analyse the inflation expectations in Indonesia, including the adoption of inflation targeting and the inflation expectations survey; and (iv) to identify the significance of this study.

The rest of this chapter is organized as follows. Section 3.2 analyses the objectives and institutional arrangement of Bank Indonesia. Section 3.3 analyses various stages of the development of monetary policy in Indonesia. Section 3.4 discusses the inflation expectations and inflation policy in general. Section 3.5 draws conclusions and identifies the significance of this study.

3.2 Bank Indonesia and its institutional arrangement

3.2.1 Bank Indonesia during the New Order regime

The monetary policy framework in Indonesia has evolved over many years. The management of monetary policy has been conducted in various stages, from direct controls through credit and interest rate ceilings to indirect controls such as open market operations (Alamsyah et al., 2001). The current objective pursued by the Bank is the result of that long time process to find the most suitable way to address monetary issues for the benefit of the economy.

When President Soeharto was in power (known as the *New Order* regime) from March 1966 to May 1998, monetary policy was determined by the Government through a monetary board and the Bank was required to carry out the Government's policies. That practice was in accordance with the Central Bank Act No. 13 of 1968 Article 7, which was written as:

‘The core duty of the Bank is to assist the Government in (a) managing, safeguarding and maintaining the stable value of the rupiah; (b) boosting the continuity of production and development and promoting the creation of employment opportunities in order to improve the living standard of the people.’

Consequently, the Bank was expected to attain several objectives, namely low inflation, a sustainable balance of payments, high economic growth, and make available adequate opportunities for employment (Ilyas, 1998).

Regarding the status and organization of the central bank, the official *elucidation* to the above Act mentioned that the Bank was a government institution headed by a

governor with special (non-ministerial) status. It assisted the President in executing monetary policy as determined by the Government through the monetary board. Article 8 and Article 9 of the 1968 Act stated, respectively, that:

‘(1) the Bank executes the core duty referred to in Article 7 based on policy determined by the Government; (2) in determining such policy, the Government is assisted by a monetary board.’

‘(1) The monetary board assists the Government in planning and formulating monetary policy referred to in Article 8 through proposing measures in maintaining monetary stability, fostering the creation of employment opportunities, and increasing the living standard of the people; (2) The monetary board directs and coordinates the implementation of monetary policy as determined by the Government.’

This monetary board was chaired by the Minister of Finance (*ex-officio*) and its members consisted of the Bank’s governor and two economic ministers. The governor and the Bank’s board of directors were appointed directly by the President for a five-year term upon the nomination by the monetary board; however, the *elucidation* also specified that the position of the governor in the monetary board came with an exceptional privilege. The governor in his capacity as the executor of the policy was given the right to review decisions made by the board and thus to advise the President whether the board’s policy was appropriate or realistic. For that reason, the monetary board was not regarded as the highest authority of monetary policy in Indonesia.

However, in the last few years of the *New Order* regime’s government, the objectives of monetary policy changed to some extent. Huge depreciation of the rupiah, along with an inflation rate which rose to more than 70 per cent during the Asian financial crisis, forced the Bank to abandon its tasks as set by the 1968 Act. Between September 1997 and June 1998, monetary policy in Indonesia was directed to support the exchange rate (Grenville, 2000). Because Indonesia followed the IMF’s recovery programs, through a series of Letters of Intent (LOI), many of the reforms at that time, particularly in the economic and banking sectors, were aimed at achieving a stable exchange rate which was the primary concern of monetary policy decision-makers (Lane et al., 1999).

In the meantime, Ilyas (1998), who himself was once a deputy governor at the Bank, agreed that the objectives of monetary policy as set in the Act No. 13 of 1968 were broad. Consequently, the Bank faced a difficult and complex responsibility, while

many central banks around the world already enjoyed the privilege of having an independent status and one single objective of monetary policy, such as inflation control.

In the aftermath of the 1997 financial crisis, the Bank started to formulate an alternative approach to deal with chronic monetary issues, as part of the economy's structural reforms, while still attempting to achieve high economic growth. Eventually, the Bank's single objective of monetary policy came into place (Bank Indonesia, 2005). Ushering in a new era where the Bank could concentrate on maintaining low and stable inflation through an inflation targeting framework. Such a framework was initiated by the Reserve Bank of New Zealand in 1989 and has been empirically proven to be successful in lowering inflation rates for its adopting economies (Fraga et al., 2003).

3.2.2 Bank Indonesia after economic reforms

Since 1999, Bank Indonesia has enjoyed an independent status as the only authority responsible for the conduct of monetary policy in Indonesia. According to the new Central Bank Act No. 23 of 1999 as later amended to the Act No. 03 of 2004, the Bank has been given full independent status as a monetary authority, free from the Government and any other party's intervention. The amended 2004 Act, hereafter referred to as the Act, also sets the new objective of the Bank as stated in Article 7 that:

‘(1) the goal of Bank Indonesia is to achieve and maintain the stable value of the rupiah;
(2) to achieve the goal referred to in paragraph (1), Bank Indonesia shall conduct monetary policy on a sustained, consistent, and transparent basis, taking into account the general economic policies of the government.’

The structure of the Bank has also changed in accord with the Act. The Bank now has a board of governors comprising a governor, a senior deputy governor, and up to seven deputy governors. Unlike the previous Central Bank Act No. 13 of 1968 which specified the appointment of the Bank's governor and board be made directly by the President, the Act stipulates that all members of the board of governors are nominated and appointed by the President upon the approval of the Parliament.

Furthermore, the Act also allows the Parliament to establish a supervisory board whose sole task is to assist the Parliament in overseeing the Bank. The members of the supervisory board are appointed by the Parliament from society at large, based upon their knowledge and integrity, as well as experience in the fields of economics, finance, banking and law. The supervisory board assists the Parliament in exercising its legislative power, and is aimed at improving the accountability, independency, transparency and credibility of the Bank. However, the supervisory board does not have power to evaluate the performance of the Bank's board of governors nor is it involved in the Bank's decision-making process. Hence, it is merely an advisory body to the members of Parliament on the issues of monetary policy and central banking.

Meanwhile, the implementation of the Act itself has been subject to different interpretations. The Bank's objective for achieving and maintaining 'the stable value of the rupiah' has been interpreted as two objectives, that is stability in terms of prices of goods and services, and stability in terms of the rupiah's exchange rate against other currencies (McLeod, 2003, Siregar and Rajan, 2004). As a result, the Bank's current objective of monetary policy is still seen as ambiguous.

However, Alamsyah, Joseph et al. (2001) believed that arguments on the distinction between these interpretations and any attributed ambiguity about the Bank's objective may have been exaggerated. In their opinion, both exchange rate and price stability are usually closely correlated, even though they recognized that inflation targeting is different from targeting the rate of growth of monetary aggregates, exchange rates or interest rates.

In fact, the official elucidation to the Act in Article 7 clearly mentions that the objective of achieving and maintaining stability of the value of the rupiah should be seen as stability in terms of prices of goods and services as well as in terms of exchange rates, it states that:

'... the stable value of the rupiah referred to in this paragraph is the stable value of the rupiah against goods and services as well as against foreign currencies. Stable value of the rupiah against goods and services is measured by or reflected in the inflation rate. Stable value of the rupiah against foreign currencies is measured by or reflected in the movement in the exchange rate of the rupiah against foreign currencies.'

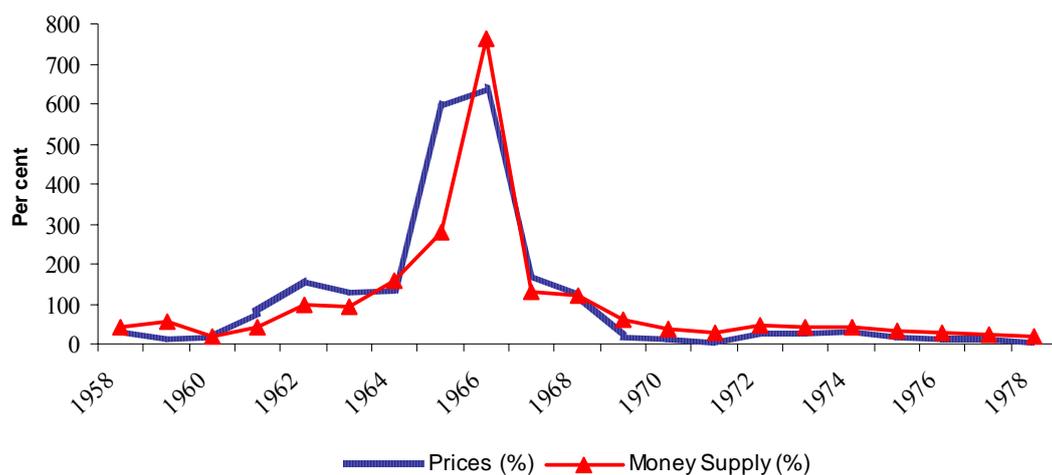
In practice, the Bank bases the stability of the rupiah mostly in terms of the prices of goods and services (Bank Indonesia, 2001).

3.3 Monetary policy in Indonesia

3.3.1 Early developments

In the late 1960s, monetary policy in Indonesia was directed towards recovering the domestic banking system that suffered from hyper-inflation (Arndt, 1979). Efforts were made to rehabilitate the banking system and were in accordance with the more liberal stance of President Soeharto's *New Order* regime. There were two purposes of monetary policy at that time: first to bring down inflation which was achieved through tight monetary control (Figure 3.1); and second to promote the banking system as a financial intermediary so that it plays an active role in economic development. According to Arndt (1979), Bank Indonesia in those early years also acted as an intermediary for accumulating 'investments' in currency and also refinancing state bank credit for priority programs.

Figure 3.1 Price and money supply (1958 – 1978)



Source: Data derived from Arndt (1979).

In the beginning of the 1970s, Indonesia initiated a stabilization program to restore economic stability aimed at laying the foundation for sustainable economic growth. This initiative was followed by reform in the area of the capital account, with the introduction of a free capital flows policy (Ilyas, 1998, Indrawati, 2002, Grenville, 2000). The reform was primarily aimed at attracting foreign capital, especially foreign direct investment, by building and maintaining foreign investors' confidence and establishing a stable environment for investment.

3.3.2 Instruments and transmission mechanisms

Meanwhile, the implementation of monetary policy in the early years was rather complex. Before the new Act was stipulated, there were several instruments used by the Bank to achieve its targets (Table 3.1). The most significant instrument was open market operations (OMO), which targeted interest rates and the monetary base in order to control money supply. The Bank was expected to promote higher economic growth, while at the same time to also create employment opportunities, lower inflation rates and to maintain the balance of payments.

Table 3.1 General framework of monetary policy (prior to Act No. 23 of 1999)

Instruments	Immediate Targets	Immediate Targets	Ultimate Targets
Open market operations	Base Money (M0) Bank reserves Interest rates	Money supply Bank lending Deposits and credits	Growth
Reserve requirements			Employment
Discount facilities			Inflation
			Balance of payments

Source: Achjar Ilyas (1998).

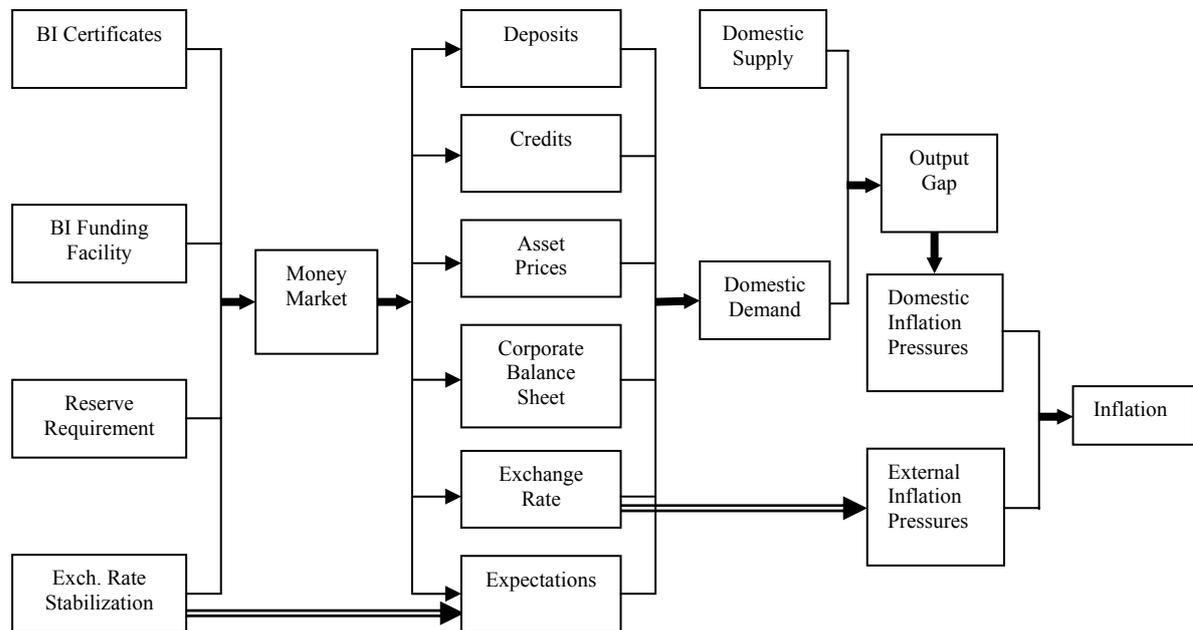
In 1983 the Bank sought to achieve the multiple objectives of monetary policy through more direct control of monetary aggregates (M1, M2) at levels that were sufficient to support the targeted rate of economic growth, but stayed away from any macroeconomic imbalance (Ilyas, 1998). In that regard, the Bank started to manage liquidity through its federal fund-like instrument, *Sertifikat Bank Indonesia* (SBI).

As the currency exchange value has a very important function in achieving monetary stability and boosting business activities, a stable rupiah exchange rate was also one of the Bank's targets. Since 1970 Indonesia has implemented at least three exchange rate systems (Bank Indonesia, 2004). A fixed exchange rate system was applied over the period of 1970 to 1978, followed by a managed floating exchange rate system. Since 14 August 1999, Bank Indonesia claims that it has implemented the free floating exchange rate system, although the Act No. 23 of 1999 was not clear in specifying the type of exchange rate system for the country as stated in the Article 12: "Bank Indonesia shall implement the exchange rate policy in accordance with the prescribed exchange rate system".

In the meantime, during the 1997 financial crisis, monetary policy was conducted mainly by using base money as the operational instrument for controlling other monetary aggregates such as broad money (Alamsyah et al., 2001). While there were multiple objectives, the anchor of monetary policy during this period was clearly the nominal exchange rate, which was managed within a relatively narrow band that depreciated at a fairly steady rate (McLeod, 1997).

As illustrated in Figure 3.2 below, the Bank currently transmits its monetary policy to inflation primarily through BI rates and expectation channels (Bank Indonesia, 2006). The Bank determines the BI rates and implements them through its SBI and *Fasilitas pembiayaan Bank Indonesia* (FASBI), reserve requirement, and the Bank's exchange rate stabilisation (intervention) policy. The effects of the BI rate flows through the money market which affects the interest rates of credits and deposits in commercial banks, the Jakarta composite index (JSX), asset prices, corporate debts and cash flow, and expectations. Eventually the policy will affect domestic demand and output which later influence inflation. The Bank's transmission mechanism for its monetary policy is through expectations channels and will be presented in the later sections of this chapter.

Figure 3.2 Bank Indonesia's policy transmission mechanism



Source: Adopted from Bank Indonesia (2006).

3.3.3 Financial crisis and monetary reforms

The East Asian economic crisis started with a huge depreciation of the Thai baht, and it quickly spread to neighbouring countries across the region. The process was notably marked by sudden and huge capital outflows from the Southeast Asian region. In the case of Indonesia, after receiving impressive amounts of net private capital inflow of up to US\$12 billion prior to the crisis, the economy experienced a net capital outflow of more than US\$14 billion in 1998. As a result, the Bank decided to focus its monetary objective on the exchange rate system. The Bank's new policy was implemented through widening the intervention band which was aimed at maintaining Indonesia's limited foreign exchange rate reserves (Indrawati, 2002).

Although it was not officially announced, Lane and Ghosh et al. (1999) stated that the exchange rate was the focus. Policy adopted during that period concentrated on exchange rate movements. Since Indonesia was under the IMF's recovery program (through a series of LOIs), the IMF believed that the exchange rate was the best available guide to policy, as no other nominal variable was immediately observable

(Lane et al., 1999). The basic objective of monetary policy in the IMF's program was to avoid an inflation-depreciation spiral. According to the IMF, based on Indonesia's experience, the possibility of having such a spiral was real.

Table 3.2 Directions of monetary policy during and after the financial crisis

	Phase I (August 1997–April 1998)	Phase II (May 1998–May 1999)	Phase III (May 1999–Jul 2005)
Objective	Goal was not clearly stated. The main task was to eliminate the effect of rupiah depreciation and maintain liquidity.	Price stability, exchange rate stability and liquidity stability.	Inflation targeting, as required by Act No. 23 of 1999.
Operating target	Base money for 12 months.	Base money targeting and other quantitative targets.	Base money through the interest rate control of SBI.
Instrument	SBI, money market intervention, foreign exchange intervention, and taking over the accounts of state-owned enterprises.	Open market operation, sterilization, and rupiah intervention.	SBI, sterilization, and rupiah intervention.

Source: Widyasanti (2004).

Monetary policy during the crisis was divided into three phases (Table 3.2). During the peak of the crisis (Phase I), the goal was not stated clearly and the focus was to minimize the risks of excessive rupiah depreciation. In Phase II (the regime changed from *Orde Baru* to *Reformasi*), both exchange rate stability and price stability were the objective, which was achieved through widening currency intervention bands. Lastly in Phase III, right after the crisis (effectively since the beginning of 2000), inflation targeting became the objective of monetary policy, while base money was still the primary operating target alongside the interest rate and the exchange rate.

However, Grenville (2000) argued that both the exchange rate and base money as prescribed by the IMF were not the appropriate guide for the setting of monetary policy in Indonesia as the crisis spread out. In his opinion, base money is a poor instrument, because its main component – currency – is demand determined, and not under the direct control of the Bank. As for the exchange rate, Grenville believed that it was driven by forces that could not be offset even by higher interest rates.

Boediono (1998) argued that the difficulties policy makers faced in controlling base money growth derived from at least two observations. First, the markets were relatively thin and fragmented. Consequently, it was very difficult for the Bank to manage system liquidity without creating pressures on interest rates. Second, in certain periods, base money is endogenous with respect to output. For example during periods of upswing in the economy, rising aggregate demand will increase foreign borrowings, while outstanding SBI will decline, both resulting in an increase in base money. In fact, Alamsyah, Joseph et.al (2001) stated that monetary policy using quantity targets has now become less effective.

Meanwhile, Indonesia had also suffered from a vulnerable balance of payment structure long before the crisis (Indrawati, 2002). What happened was that the persistent current account deficits from the service sector were funded largely by government foreign debts, and accompanied by an influx of private short-term capital. Yet according to Indrawati (2002), the absence of a proper mechanism to manage and control short-term capital – especially under conditions of increasing international capital flow – made Indonesia vulnerable to any potential capital shocks.

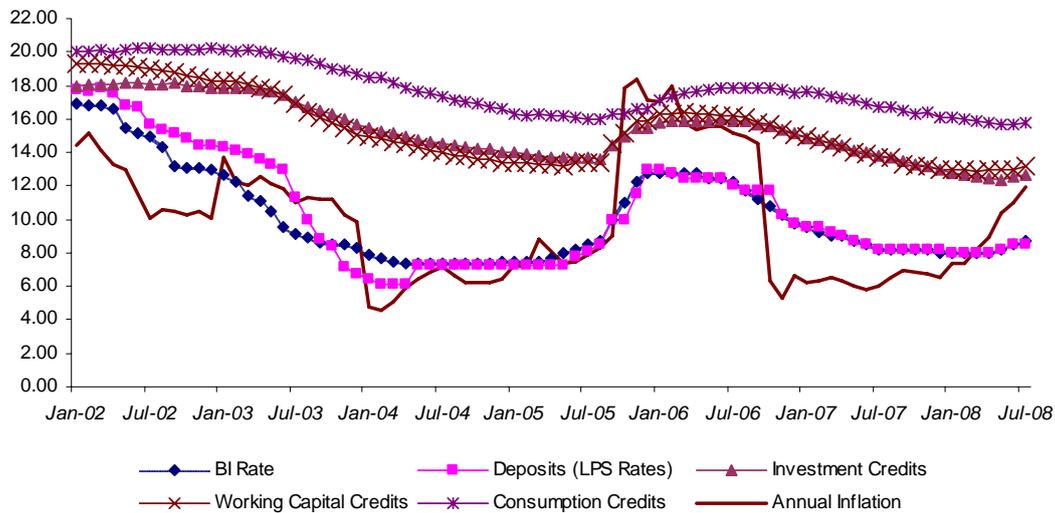
3.3.4 Recent developments

According to the Central Bank Act No. 3 of 2004, to achieve the objective of monetary policy, the Bank could utilize its open market operation, both in domestic currency (the rupiah) and in international currencies. In addition, the Bank could also utilize discount rates, minimum reserve requirements of commercial banks and through credit channels and financings.

In recent years, monetary policy implemented by Bank Indonesia has emphasized overcoming the challenges of the global oil price hikes from October 2005 (Bank Indonesia, 2005). According to Bank Indonesia, the slowing down of global economic activities, particularly in the first half of 2006, coupled with poor perception of the investment climate in Indonesia, has resulted in low credit absorption in the real sector, thus precipitating excess banking liquidity. As the result, since 2005 the Bank has introduced a tight-based monetary policy through its BI rate. Although the Bank

eased its interest rates several times to accommodate the temporarily improved economic conditions, the tight-based policy has been continued, particularly since the global oil price hikes have impacted on higher inflationary pressures (Bank Indonesia, 2006).

Figure 3.3 Annual inflation and various interest rates



Source: Bank Indonesia (SEKI).

Interestingly, according to Bank Indonesia (2006), lowering the Bank’s interest rate (the policy rate) did not boost the country’s investment as can be seen from the percentage of the credit interest rates in response to the lower BI rate. Instead, the deposit interest rate was more responsive (Figure 3.3). Burhanuddin Abdullah (2007), who was the Bank’s governor until May 2008, claimed that a high-cost economy and an optimal and uncompetitive investment climate have been the major factors impeding economic recovery. He further stated that the Bank would implement more optimal inflation targeting through an integrated framework, particularly to convince markets regarding the country’s long-run economic stability. In this regard, policies supporting longer-term capital flows would be given more priority over short-term capital.

3.4 Inflation expectations in Indonesia

3.4.1 The bank's policies on inflation

In its operation, Bank Indonesia does not use CPI inflation as a reference in determining monetary policy, but instead it utilizes core inflation, although CPI inflation is still the primary inflation target. The Bank claims core inflation is an operational target since it is more likely to give the right signal in formulating monetary policy. The Bank believes that on the occasion of demand shocks that result in high inflation, it should respond by tightening monetary policy, so that the level of inflation can be lowered (Bank Indonesia 2007c). On the other hand, when inflation increases due to interruption in the supply side, tight money policy may just worsen the price level and economic growth. Instead, the Bank responds by relaxing economic liquidity, which is necessary in stimulating increase of supply.

Furthermore, the Bank currently reports CPI inflation as the accumulation of core inflation, administered price inflation and volatile food inflation. The components of core inflation are influenced by exchange rates, output gap and inflation expectation. The administered price is determined by the government and includes, among the main items, energy (oil and gas), transportation, tobacco, water and toll roads. While volatile foods inflation is measured as the changes of price distribution of foods and food products including spices, beverages, and cooking oil.

3.4.2 Adoption of inflation targeting framework

As the outcome of monetary policy reform in 1999 following the crisis, Bank Indonesia's monetary policy objective has been to achieve a stable value of the rupiah. Stability in this sense has been interpreted by Bank Indonesia in terms of the prices of goods and services (Alamsyah et al., 2001), on account of the Bank at that time not explicitly acknowledging inflation targeting as the only policy objective. However, Widyasanti (2004) argued that Bank Indonesia has started to implement explicit inflation targeting since 1999 as demanded by the Act No. 23 of 1999. She further asserted that the Bank sets the annual growth of base money since it is used as the operational target of monetary policy.

As a matter of fact, the starting point towards the explicit inflation targeting policy change using interest rates was clearly mentioned in the Bank's 2005 annual report as follows:

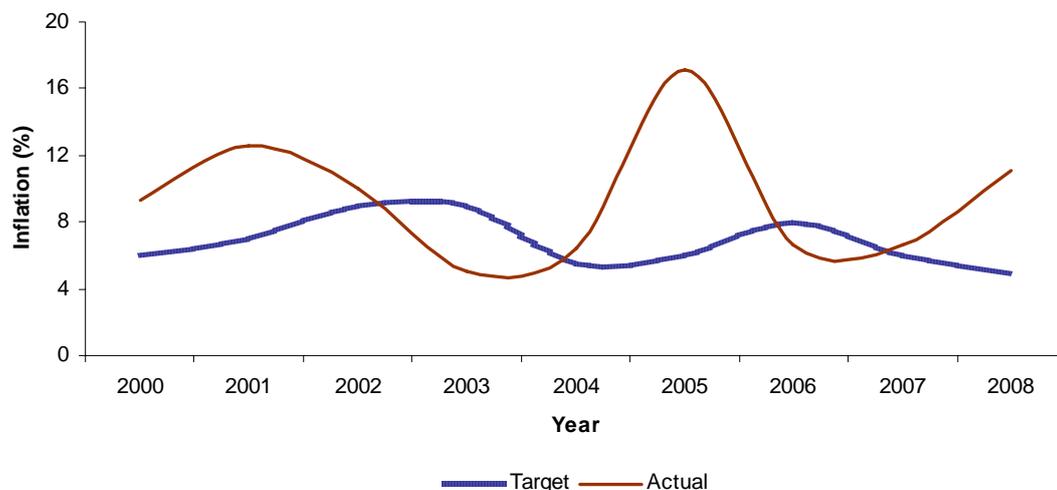
‘Signalling through base money was considered difficult to interpret and lack of clarity to direct market expectations. This prompted Bank Indonesia to improve the operational framework of monetary policy using interest rate (the BI rate) as a policy reference rate in early July 2005.’ (Bank Indonesia, 2005 p. 89).

In this regard, according to the 2004 Act the Government sets the targets, while the Bank strives to achieve them. This practice is in line with that conducted in several other inflation targeting economies such as New Zealand, Australia and the United Kingdom. In fact, Bank Indonesia claims that the targets are considered as the basis for the formulation and implementation of other monetary policy.

The first explicit inflation target was set by the Finance Minister's decree dated 6 September 2004. The period was set for three years where each year has a different target, while the type of inflation targeting adopted is yearly CPI inflation. In setting these targets the Government took into consideration certain assumptions that were reasonable at the time, such as the exchange rate and the price of oil on international markets (Bank Indonesia, 2006).

Meanwhile, domestic economic dynamics accompanied by increasing global uncertainty have already made the assumptions used in setting the initial targets to change significantly, primarily the prices of commodities set by the government and the fluctuation of world oil prices. For example, the prices of subsidized fuel were adjusted twice in 2005, causing inflation to surge to 17.11%. Consequently, the targets for the period 2000–2008 could not be achieved by the Bank (Figure 3.4). For this reason, McLeod (2008) argued that although Bank Indonesia officially commits to an inflation targeting framework by setting annual inflation targets, the Bank's actual policy actions and outcomes do not reflect this commitment.

Figure 3.4 Inflation targets and actual inflation (2000-2008)



Source: Bank Indonesia.

However, the Bank claimed that the assumptions at the time of setting the inflation targets were much different from the actual conditions. In such conditions, inflation targets deserve to be reassessed and in the Bank's opinion, without any revision the policy response would be excessive, thereby worsening economic conditions in the long term. In addition, the Bank believes that unrealistic inflation targets can result in a weak reference point for the public in taking economic decisions (Bank Indonesia, 2007b).

Widyasanti (2004) mentioned that the implementation of inflation targeting in Indonesia is not classified as a fully-fledge inflation targeting. The reason is the Bank also has to consider other factors influencing economic stability, such as output and financial system stability. Accordingly, it is justifiable for the Bank and the Government to reach an agreement concerning the mechanism for setting the targets, monitoring and controlling inflation which permits revisions to inflation targets if the current targets are no longer realistic due to extraordinary events (Bank Indonesia, 2006). In this regard, the Government makes the revisions after coordinating with the Bank.

3.4.3 Survey of inflation expectations

Expectations play a very important role in Indonesian monetary policy (Bank Indonesia, 2006). According to Bank Indonesia, improvements in the transparency of monetary policy are expected to influence public expectations which correspond to the inflation target. For that reason, the Bank frequently adopts tight monetary policy which is conducted through liquidity control, taking into consideration output growth and financial system stability.

Regarding the formation of inflation expectations in Indonesia, the Bank believed that public expectations have been influenced significantly by certain variables, both on the producers' side and on the consumers' side (Bank Indonesia, 2001). The Bank assessed that for producers and retailers, their expectations are based largely on current and past inflation (adaptive). This claim has been supported by several empirical studies (Majardi, 2004, Hutabarat, 2005). On the other hand, consumers' expectations of inflation are affected primarily by the expected increases in the prices of administered goods (i.e. transportation, communication, oil and gas) and the latest development of the rupiah exchange rates. This claim could be analysed through the movement of transportation and communication costs as well as the fluctuation of the exchange rates (Bank Indonesia, 2001).

The adaptive public expectations on inflation were believed by the Bank to be fundamental factor that spurred high inflation expectations in Indonesia. Based on historical facts, the Bank found that from the contribution side, inflation expectations which are adaptive in nature have been the largest component of inflation. Even when compared with several neighbouring economies (i.e. Malaysia, Thailand, and the Philippines), inflation expectations in Indonesia have been the highest (Bank Indonesia, 2006). This finding is in line with Majardi (2004) who found that public expectations of inflation in Indonesia historically dominated the formation of prices and wages both in the short run as well as in the long run.

Moreover, Majardi (2004) claimed that for a very long period of time, inflation expectations in Indonesia have been backward looking (adaptive) and the contribution has been very high, up to 7 per cent in his opinion, this kind of expectations tend to be

persistent and rigid. In addition, Majardi believed that inflation persistence from public expectations has been the mindset of business players and consumers in Indonesia. Accordingly, it is difficult for the Bank to implement policy that supports low inflation targets.

3.6 Conclusion

Bank Indonesia is currently one of the inflation targeting central banks in the world. The decision to adopt inflation targeting was based on an extended period of implementing various monetary policy approaches. Thus, the new Bank Indonesia Act of 2004 specifies that the Bank's objective is to achieve a stable value of the rupiah, which is interpreted by the Bank as stability in terms of prices of goods and services.

Although the Bank's current objective is to achieve a low and stable rate of inflation, it's not considered as a fully-fledged inflation targeting central bank, as the Bank still considers maintaining output growth and financial system stability as part of its tasks. Therefore, the Bank is still seen as having an ambiguous objective; notwithstanding the fact that the Bank has also never met its inflation targets. Interestingly, one of the fundamental elements of Indonesia's inflation, as suspected by the Bank, is the significant contribution of public inflation expectations.

Regarding inflation expectations itself, the Bank believes that public expectations, based on the monthly survey conducted by the Bank are adaptive, which means that the influence of past inflations on the expected inflation is still very significant. While the literature suggests that public inflation expectations should be rational, the findings of this adaptive phenomenon on the expectations survey data by the Bank have raised several important issues on the reliability of the survey, the inflation characteristics, the methodology and the formation of the expectations itself. To provide explanations to those potential questions, it is worth testing the rational expectations hypothesis for the conduct of monetary policy in Indonesia.

Furthermore, the author believes that monetary policy in Indonesia could be further improved, particularly through a better understanding of public expectations. Therefore, in the next chapters, this study will investigate the rationality of inflation expectations. It will measure the formation of expectations themselves, and develop a model to identify the nature and trends of expectations, so that the Bank can better anchor future expectations for a better and more effective monetary policy.

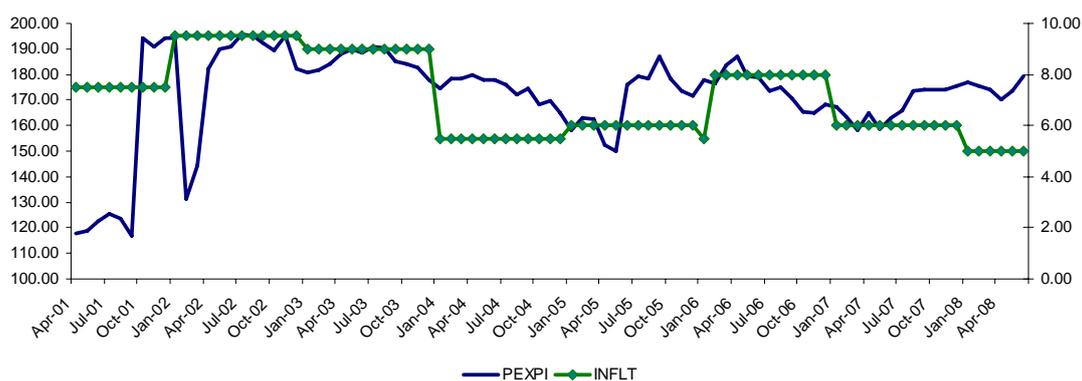
CHAPTER 4

RATIONALITY OF INFLATION EXPECTATIONS IN INDONESIA²

4.1 Introduction

Bank Indonesia has conducted an inflation expectations survey since October 1999 as part of its commitment to the implementation of an inflation targeting framework. Figure 4.1 plots the price expectations balance index (as published by the Bank) from April 2001 to June 2008.³ PEXPI (left-hand axis) is the Bank's survey-based price expectations index for the following 6-month period, while INFLT (right-hand axis) is the inflation targets set by the Government and the Bank. The figure generally shows that both inflation expectations and inflation targets move closely together in the sample periods.⁴ Accordingly, that should give an indication, although not very clearly, that the Bank has taken public inflation expectations into consideration for monetary policy decision-making, particularly in determining its inflation policy, including the annual inflation targets.

Figure 4.1 Price expectations survey and inflation targets



Source: Bank Indonesia.

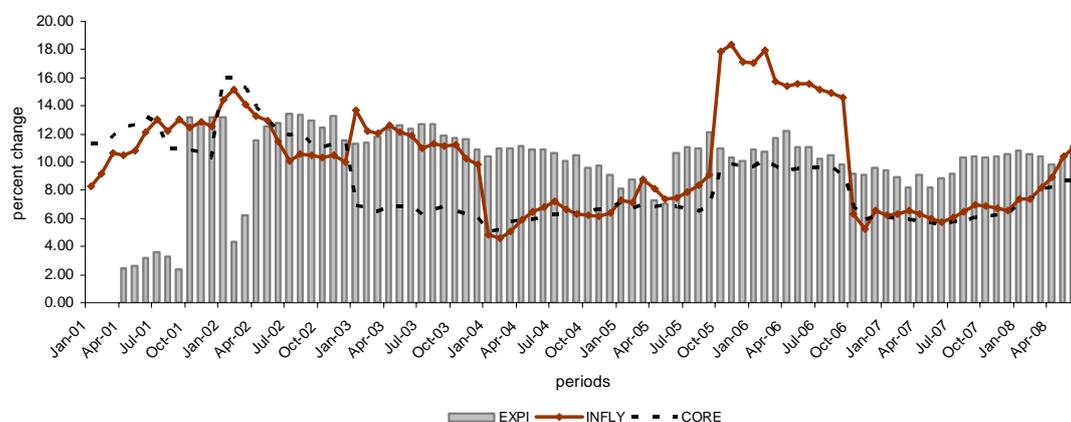
² An earlier version of this chapter has been accepted and published at Economics and Finance in Indonesia, vol. 57, no. 3, December 2009.

³ As mentioned previously, the data prior to 2001 were on trial and the Bank does not recommend using them for economic estimations.

⁴ Since the variability of inflation in Indonesia, on average, is relatively high, the gaps between the two series seem not significant, except that in the early years of the survey.

Furthermore, Figure (4.2) below illustrates public inflation expectations and actual inflation. In the graph, INFLY is the annual CPI inflation series and CORE denotes the core inflation series, while EXPI is the public inflation expectations, hereafter referred to as actual inflation, core inflation and expectations, respectively. The figure shows several developments in public expectations in the last several years. The sharp increase in public expectations which occurred during the fourth quarter of 2001 was due to domestic political changes (the sitting president was impeached by the members of parliament).

Figure 4.2 Actual and expected inflation rates (2001 – 2008)



Source: Bank Indonesia.

A sudden decrease in January 2002 was then followed by another dramatic increase during the remainder of the first quarter. The public expected prices of goods and services to increase in anticipation of the government’s decision to raise domestic fuel prices.⁵ As a matter of fact, the price shocks did occur during the period of the last quarter of 2002, caused by the government’s policy to increase the fuel prices, and followed by other decisions to increase the prices of electricity, gas (LPG) and tobacco (cigarette stamp duty).

The above figure also shows another sharp but smaller increase in price expectations during the second quarter of 2005. This dramatic jump was due to the government’s

⁵ In Indonesia, fuel is among the strategic commodities whose prices are regulated by the government. In fact, the government provides a huge subsidy for domestic fuel consumption, so that its price is affordable to low income groups.

plan to raise fuel prices as a result of the global oil price hike and the public's anticipation of that plan through their expectations. Soon after the government increased the domestic prices, both monthly inflation and annual inflation increased dramatically, from 6.9% and 9.06% (in September) to 8.70% and 17.89% (in October), respectively.

By eye-balling the graphic lines, it could be suspected that in the long run there might be a correlation between actual inflation and inflation expectations, except during a few extraordinary events such as oil price hikes and domestic political changes. The expectations successfully predicted most of the price shocks, despite the fact that they occurred after several months. It is just not clear, however, whether it is actual inflation or inflation expectations that leads the other.

Since the theory suggests that public expectations of inflation are rational, it implies that when the public form their expectations, they know completely the structure of the model governing the economy, and their forecasts should be the most optimal ones given all available information (Pearce, 1987, De Carvalho and Bugarin, 2006, Evans and Honkapohja, 2001). Accordingly, in order to fully understand the interactions between actual inflation and inflation expectations in Indonesia, tests for rationality need be conducted.

There are three objectives outlined in this chapter. These are: (i) to understand the characteristics of inflation expectations in Indonesia; (ii) to measure the long-run equilibrium relationships between survey data of inflation expectations and actual inflation; and (iii) to identify whether the public expectations of inflation are a good predictor of future actual inflation. The chapter is presented as follows. Section 4.2 provides information concerning the inflation expectations data used in this analysis and the survey data conversion methods. Section 4.3 describes the methodology employed in this analysis, including the use of unit root tests, cointegration tests and causality tests to measure the relationships between the inflation expectations and the actual inflation in Indonesia. Section 4.4 reports the interpretations of the estimation results, i.e. the integration properties, the existence of long-run equilibrium, and the short-run dynamics of the analysed variables. Section 4.5 provides the empirical

analysis about the inflation expectations in Indonesia, and section 4.6 concludes the findings.

4.2 Inflation expectations data

The inflation expectations data employed in this study were taken from the consumer surveys of Bank Indonesia. All survey data are available from the Bank, where data from recent years can be downloaded directly from the Bank's website.⁶ These consumer surveys have been conducted on a monthly basis by Bank Indonesia since October 1999. In the surveys, the Bank targets around 4655 households in 18 major cities of Indonesia (Jakarta, Bandung, Semarang, Surabaya, Medan, Makassar, Bandar-Lampung, Palembang, Banjarmasin, Padang, Pontianak, Samarinda, Manado, Denpasar, Mataram, Pangkal-Pinang, Ambon, dan Banten), and the household respondents are treated as purposive random sampling (Bank Indonesia, 2007a). Most of the survey data are gathered through telephone interviews, while the Bank's staff also meets with respondents directly on a rotational basis.

The overall survey conducted by Bank Indonesia has four sections, namely: (i) consumer confidence index aimed at understanding the respondents' belief towards the country's general economic performance in the next three and six months; (ii) price expectations over the next three months; (iii) price expectations over the next six months; and (iv) economic indicators which seek the respondents' opinion regarding the availability of goods and services, and interest rate movements, both for the next six months.

For the survey of price expectations, the respondents are asked whether prices will increase or decrease over the next determined period. The result of those qualitative survey data are then converted by the Bank into a price expectations index using the "balance statistic" (probability) method, which is defined as the difference between

⁶ <http://www.bi.go.id/web/id/Publikasi/Survei/Survei+Konsumen/>

the percentage of the surveyed respondents who expect a rise in prices ($R_{t,t+1}^e$) and the percentage of the respondents who expect a fall in prices ($F_{t,t+1}^e$) (Pesaran, 1989):⁷

$$B_{t,t+1}^e = R_{t,t+1}^e - F_{t,t+1}^e \quad (4.1)$$

where $B_{t,t+1}^e$ denotes the balance statistic of expected price changes over the period t to $t+1$.

Bank Indonesia (2007a) publishes the result of its consumer price expectations survey in the form of index series by adding a base number to $B_{t,t+1}^e$:

$$C_{t+1}^e = 100 + B_{t,t+1}^e \quad (4.2)$$

If the index (C_{t+1}^e) is 100, it means there is no change in prices, while an index that is higher than that of the previous period (t) means the prices are expected to go up and vice versa.

This study examines the survey data of price expectations for the six-month ahead period, since the three-month expectations survey was only started in January 2006. The literature also supports this period selection in that monetary policy decisions will have an effect on the economy within 6 to 18 months (Bank of England, 1999, Sellon, 2004, Ragan, 2006).

The time period examined is from 2001 to 2008 in accordance with the availability of data. In fact, Bank Indonesia started conducting its consumer survey in October 1999 as a result of the Bank Indonesia Act No. 23 of 1999 stipulated on 17 May 1999 which transformed the Bank from a central bank controlled by the government to an independent central bank, free from government interventions.⁸

⁷ The expression used by Bank Indonesia (2007) as a “balance score” method, somehow seems to be mixed with what is known as the “balance scorecard” method in Strategic Management.

⁸ From our formal communication with one of Bank Indonesia’s staff, the first early months of the survey were a trial, hence the data could not be published.

According to Pesaran (1989), surveyed respondents are assumed to have their individual subjective probability distribution $h_i(\pi_{i,t+1} | \rho_{i,t})$, hence:

$$\pi_{i,t+1}^e = E(\pi_{i,t+1} | \rho_{i,t}) \quad (4.3)$$

where $\pi_{i,t+1}^e$ is the price expectations of individual respondent i for $t+1$, and $\rho_{i,t}$ is the set of information available to individual respondent i at time t . If:

$$\Lambda_t = \bigcup_{i=1}^k \rho_{i,t} \quad (4.4)$$

where Λ_t is all the information available to the respondents at time t (assuming that every individual respondent might use a different set of information), then we have an aggregate probability distribution $h(\pi_{t+1} | \Lambda_t)$, and price expectations for time $t+1$ as:

$$\pi_{t+1}^e = E(\pi_{t+1} | \Lambda_t) \quad (4.5)$$

It is also assumed that the subjective probability distributions are independent and have the same known structure across all the respondents (Pesaran, 1989). From the above assumptions, we can write:

$$prob\{\pi_{t+1} \geq d | \rho_t\} = R_{t,t+1}^e \quad (4.6)$$

$$prob\{\pi_{t+1} \leq -d | \rho_t\} = F_{t,t+1}^e \quad (4.7)$$

where d is the response threshold consisting of $a_{i,t}$ and $b_{i,t}$ which are symmetric and remain fixed both across respondents and over time (thus, $a_{i,t} = b_{i,t} = d$). Accordingly, respondents report no change in prices if their expectations lie between $-d$ and $+d$. Since this procedure uses the uniform distribution approach with mean $\pi_{t+1}^e = E(\pi_{t+1} | \Lambda_t)$ and a constant range equal to 2δ , from equations (4.5), (4.6) and (4.7) we can derive:

$$h(\pi_{t+1} | \Lambda_t) = \frac{1}{2\delta}, \text{ for } \pi_{t+1}^e - \delta \leq \pi_{t+1} \leq \pi_{t+1}^e + \delta \quad (4.8)$$

$$R_{t,t+1}^e = \frac{\pi_{t+1}^e + \delta - d}{2\delta} \quad (4.9)$$

$$F_{t,t+1}^e = \frac{-\pi_{t+1}^e + \delta - d}{2\delta} \quad (4.10)$$

From these relationships we can estimate the inflation expectations as:

$$\pi_{t+1}^e = \delta(R_{t,t+1}^e - F_{t,t+1}^e) = \delta B_{t,t+1}^e \quad (4.11)$$

Since the theory requires that public expectations should be rational (unbiased) or expressed as $\pi_t = \alpha + \delta\pi_t^e$ (if $\alpha=0$ and $\delta = 1$, inflation expectations equal actual inflation), the parameter δ can be estimated as:

$$\delta = \frac{\sum_{t=1}^k \pi_t}{\sum_{t=1}^k B_{t-1}^e} \quad (4.12)$$

where k is the number of time periods examined.

Meanwhile, which actual inflation series is relevant for the examination of inflation expectations has not been clear-cut. There are four inflation series currently published by Statistics Indonesia. The first series is annual inflation based on the year-to-year per cent change (the current period CPI compared with the CPI of the corresponding period from the previous year). This inflation series is measured monthly and published widely by the media as headline inflation. The second series is calendar inflation or year-to-date inflation defined as the accumulation from the January inflation to the current month inflation. Statistics Indonesia regularly publishes this series. The third series is monthly inflation based on the month-to-month per cent change (the current CPI compared with the CPI of the previous month). This series is used by the Bank to highlight price movements, particularly in shorter terms, to reveal

seasonal trends (Bank Indonesia, 2007c), and it is also used by the Bank to assess price expectations. The fourth inflation series which started to be published more recently is core (underlying) inflation. However, this last series is measured mainly for the operational purposes of the Bank in setting monetary policy to achieve its annual CPI inflation targets.

Relevant theory does not suggest which specific inflation series should be used to examine the interaction between actual and expected inflations (Afriat, 2005, de Brouwer and Ellis, 1998). Previous studies have used various measures of inflation series to examine the rationality of public inflation expectations, for example see Sargent (1999), De Carvalho and Bugarin (2006), Henzel and Wollmershauser (2008). For that reason, this study utilizes both headline inflation (annual and six-monthly inflation series), as well as the core inflation series for the analyses of public inflation expectations in Indonesia.

4.3 Econometrics of rationality

To test for the rationality of inflation expectations, one needs to understand that expectations are considered rational if they are unbiased and more importantly if the individual forecasts are identical to those generated by the true model (Pearce, 1987, Begg, 1982). There are several methods that can be used to assess the rationality of inflation expectations. Most of the literature suggests that an appropriate rationality test should be able to measure the relationships of concerned variables, both in the short term and in the long term.

As for the relationship between actual inflation and the inflation expectations in Indonesia, there are three tests that have been used in several other empirical studies and will be conducted in this study. The tests are unit root tests, cointegration tests and causality tests. The objective of these tests is to have a clear view of how both actual inflation and inflation expectations move along the examined period.

4.3.1 Unit root tests

A unit root test is primarily aimed at understanding whether time-series data generated by a stochastic process achieve their stationarity in levels or differences.

According to Gujarati (1995 p. 713):

‘A stochastic process is said to be stationary if its mean and variance are constant over time and the value of the covariance between two time periods depends only on the distance or lag between the two time periods and not on the actual time at which the covariance is computed.’

Consequently, any stochastic time-series whose mean (μ_t) and variance (σ_t^2) are varying over time needs to be differenced to achieve its stationarity. If a time series is differenced d times and the result is stationary, then the stochastic process is called integrated of order d , symbolized as $I(d)$.⁹ For this reason, the unit root is also called difference-stationary model, since the stochastic time-series is stationary after having been differenced (Smith, 2000).

The unit root test is one of the tests of stationarity that has become very popular and widely used in literature. Another alternative test is the autocorrelation function (ACF) which is not discussed here.¹⁰ As such, the unit root test could also be used to examine the short-term relationship of variables through their order of integration as found in several empirical researches (Paquet, 1992, De Carvalho and Bugarin, 2006, de Brouwer and Ellis, 1998).

As commonly found in the literature, most of the time-series data, particularly those with relatively small sample sizes, are non-stationary and frequently show trend (Maddala, 2001). Therefore, transforming the non-stationary data into a stationary one (say, for the purpose of reliable estimations through Ordinary Least Square) is necessary.

Among several methods used in the literature to analyse the unit root of time-series data, the Dickey-Fuller (DF) tests developed by Dickey and Fuller (1979) is

⁹ For further explanation on integration, see Engle and Granger (1987) and Smith (2000).

¹⁰ For comprehensive discussion about the ACF test, please refer to Gujarati (1995).

considered the most popular (Charemza and Deadman, 1992, Maddala, 2001). For the purpose of this chapter, the DF test will be conducted where references to other popular tests such as the Phillip-Perron test will also be mentioned briefly to support the earlier test's results.

The Dickey-Fuller unit root test is based on the estimation of an autoregressive (AR) equation of the form:

$$\pi_t = \rho \cdot \pi_{t-1} + \varepsilon_t \quad (4.13)$$

If we subtract π_t from both sides, it results:

$$\begin{aligned} \Delta\pi_t &= \pi_t - \pi_{t-1} = \rho\pi_{t-1} - \pi_{t-1} + \varepsilon_t, \text{ and} \\ \Delta\pi_t &= (\rho - 1)\pi_{t-1} + \varepsilon_t \end{aligned} \quad (4.14)$$

$(\rho - 1)$ in equation (4.14) can be replaced by δ , thus:

$$\begin{aligned} \Delta\pi_t &= \delta\pi_{t-1} + \varepsilon_t, \text{ and} \\ \pi_t &= (1 + \delta)\pi_{t-1} + \varepsilon_t \end{aligned} \quad (4.15)$$

where $(1 + \delta)$ equals ρ in equation (4.13).

Hence the Dickey-Fuller test consists of testing the negativity of δ in the ordinary least squares regression. As such, the test is basically a test of hypothesis of $\rho = 1$ (*unit root*), where the rejection of the null hypothesis $\delta = 0$ in favour of the alternative $\delta < 0$ implies that $|\rho| < 1$ and that $\Delta\pi_t$ is integrated of order higher than zero (which means the data are not stationary in levels).

There are three types of equations in the Dickey-Fuller test, which are distinguished from one another by the inclusion of a constant and a trend (t):

$$\Delta\pi_t = \delta\pi_{t-1} + \varepsilon_t$$

$$\Delta\pi_t = \beta_1 + \delta\pi_{t-1} + \varepsilon_t$$

$$\Delta\pi_t = \beta_1 + \beta_2 t + \delta\pi_{t-1} + \varepsilon_t$$

As mentioned previously that most of time-series data are trended and non-stationary, therefore using the equation that includes both constant and trend is preferable.

However, there is a weakness in the original Dickey-Fuller test in that it does not take into account a possible autocorrelation in the error process ε_t (Charemza and Deadman, 1992). If ε_t is autocorrelated, then the OLS estimates of the above equations are not efficient. Therefore, a further Augmented Dickey-Fuller (ADF) test was re-developed by Dickey and Fuller (1981) which approximates the autocorrelation based on the following regression model:

$$\Delta\pi_t = \beta_1 + \beta_2 t + \delta\pi_{t-1} + \sum_{i=1}^k \delta_i \Delta\pi_{t-i} + \varepsilon_t \quad (4.16)$$

where k is the number of lags for $\Delta\pi_{t-i}$ which in this study is based upon the Akaike Information Criterion (AIC) automatically generated by the EViews statistical computer software program.

4.3.2 Cointegration tests

Cointegration tests are extensively carried out in economic modelling, particularly when it comes to measuring long-run relationships of variables that may drift apart in the short-run. The cointegration test is powerful due to its ability to explain the existence of an equilibrium relationship among two or more time-series, each of which is individually non-stationary (Banerjee et al., 1993). According to Smith (2000), cointegration offers an empirical way of dealing with two basic economic issues. First, cointegration makes available a technique for testing ratio stability, such as the ratios of purchasing power parity, real exchange rates, money demands, etc. Second, it also provides a method to work with the economic concept of equilibrium, particularly of non-stationary variables. Thus, with the cointegration tests, one could examine the existence of equilibrium, estimate the long-run equilibrium relationship,

and measure how the economy returns to equilibrium through the error-correction mechanism.

The concept of cointegration was introduced by Granger (1981), and later improved by Engle and Granger (1987). An important property of the concept of cointegration is that I(d) variables are said to be cointegrated, should there exist linear combinations of these variables that are stationary (Maddala and Kim, 1998, Hamilton, 1994). In a more formal definition, as put forward by Engle and Granger (1987 p. 253), we can say that:

‘Time series Y_t and X_t are said to be co-integrated of order d, b denoted $Y_t, X_t \sim CI(d, b)$ if (i) the time series Y_t and X_t are both integrated of order d , symbolized as $I(d)$; (ii) there exists a linear combination of these two variables, so that $Z_t = Y_t - \alpha X_t \sim I(d-b)$, where $d \geq b \geq 0$. The vector (α) is then called the co-integrating vector.’

If we take the results of the above unit root tests, where actual inflation and inflation expectations have been known as I(1), then both variables are said to be cointegrated if the null hypothesis of the unit root on the residuals can be rejected or expressed from equation $\pi_t = \beta_1 + \beta_2 \pi_t^e + v_t$ that the error term v_t is I(0). The Engle-Granger cointegration (hereafter referred to as the EG approach) is therefore designed for a single equation with two variables. As a result only one cointegrating relationship exists from the model.

In addition to the EG approach, there are actually other cointegration tests available in the literature, such as the cointegrating regression durbin-watson (CRDW). However, the most commonly used test is the Johansen cointegration approach developed by Soren Johansen (1988). What distinguishes the Johansen test from the EG approach is in the Johansen test’s ability to estimate the parameters of the long-run equilibrium relationship for many variables (multivariate autoregressive models), for example look at the study conducted by Narayan (2007).¹¹ Therefore, for the purpose of this chapter, both the EG two-step estimation approach and the Johansen approach will be used to test the existence of a long-run equilibrium relationship between actual

¹¹ Narayan (2007) used Johansen’s test to examine the relationship between Indonesia’s money demand (M1) and its determinants, namely real income, short-term nominal domestic and foreign interest rates, and real exchange rates. His finding indicates there exist at least three cointegrating relationships.

inflation and inflation expectations, with more emphasis being put on the Johansen test.

The EG approach starts with the tests for the order of integration to ensure that both variables are integrated of the same order $\sim I(1)$. The next step is to determine error-correction representations. The EG procedure in this study closely follows Maddala and Kim (1998).

First, we consider the following simple regression:

$$\pi_t = \beta_1 + \beta_2 \pi_t^e + \nu_t \quad (4.17)$$

This static model (4.17) can be treated as the initial equation (OLS) to find out the existence of long-run equilibrium relationships between actual inflation and inflation expectations. Since the cointegrating vector is achieved when the residual is $I(0)$, equation (4.17) can be rewritten as:

$\nu_t = \pi_t - \beta_1 - \beta_2 \pi_t^e$, and applying DF unit root on the residual, yields

$$\nu_t = \rho \nu_{t-1} + e_t \quad (4.18)$$

$$\Delta \nu_t = (\rho - 1) \nu_{t-1} + e_t \quad (4.19)$$

If the null hypothesis that ν_t has a unit root cannot be rejected, $(\pi_t - \beta_1 - \beta_2 \pi_t^e)$ is not a cointegrating relationship. On the other hand, if the null hypothesis is rejected, we can claim that (π_t, π_t^e) are cointegrated. The above model is known as the Dickey-Fuller (DF) test on residuals and it is the first step of the Engle-Granger two-step procedure.

The second step is to determine the error-correction representation. This is in line with the Granger representation theorem (Engle and Granger, 1987), which says if two time series are cointegrated, the short-term disequilibrium between the two variables can always be expressed in the error-correction form. Hence, if we take the first difference of equation (4.17), it yields:

$$\Delta\pi_t = \beta_2\Delta\pi_t^e + \Delta v_t \quad (4.20)$$

By incorporating equation (4.19) into equation (4.20), we have:

$$\begin{aligned} \Delta\pi_t &= \beta_2\Delta\pi_t^e + (\rho - 1)v_{t-1} + e_t \\ \Delta\pi_t &= \beta_2\Delta\pi_t^e + (\rho - 1)(\pi_{t-1} - \beta_1 - \beta_2\pi_{t-1}^e) + e_t \end{aligned} \quad (4.21)$$

Equation (4.21) is the error-correction model, where $(\pi_{t-1} - \beta_1 - \beta_2\pi_{t-1}^e)$ represents past disequilibrium.

In the meantime, as mentioned before, if we have more than two variables in the model, then there might exist more than one cointegrating vector. Accordingly, based upon the Granger representation theorem (Engle and Granger, 1987), if that is the case, then there should exist more than one error-correction representation of the data. This condition is accommodated in the Johansen cointegration test for multiple equations.

As in Verbeek (2004), we can write the Johansen cointegration through a simple vector autoregressive (VAR) model as follows:

$$\pi_t = \alpha_1 + \beta_{11}\pi_{t-1} + \beta_{12}\pi_{t-1}^e + \varepsilon_{1t} \quad (4.22)$$

$$\pi_t^e = \alpha_2 + \beta_{21}\pi_{t-1} + \beta_{22}\pi_{t-1}^e + \varepsilon_{2t} \quad (4.23)$$

Converting equations (4.22) and (4.23) into a matrix form:

$$\begin{bmatrix} \pi_t \\ \pi_t^e \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} + \begin{bmatrix} \beta_{11} & \beta_{12} \\ \beta_{21} & \beta_{22} \end{bmatrix} \begin{bmatrix} \pi_{t-1} \\ \pi_{t-1}^e \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \quad (4.24)$$

we could have a model for a k-dimensional vector as:

$$\vec{\pi}_t = \alpha + \Phi_1\vec{\pi}_{t-1} + \dots + \Phi_n\vec{\pi}_{t-n} + \varepsilon_t \quad (4.25)$$

where $\vec{\pi}_t$ is (π_t, π_t^e) , and Φ denotes a $k \times k$ matrix, and ε is white noise terms. In a vector error-correction model (VECM) set-up, equation (4.25) can be modified to form:

$$\Delta \vec{\pi}_t = \alpha + \Pi \vec{\pi}_{t-1} + \sum_{n=1}^{k-1} \Gamma_n \Delta \vec{\pi}_{t-n} + \varepsilon_t \quad (4.26)$$

where

$$\Pi = \sum_{n=1}^k \Phi_n - I \text{ and } \Gamma_n = - \sum_{m=n+1}^k \Phi_m \quad (4.27)$$

As stated in the Granger's representation theorem, if the coefficient matrix Π has reduced rank $r < n$, then there exist $n \times r$ matrices σ_1 and σ_2 each with rank r such that $\Pi = \sigma_1 \sigma_2'$ and $\sigma_2' \vec{\pi}_t$ is stationary $I(0)$. r is the number of cointegrating relationships (the cointegrating rank), the elements of σ_1 are the adjustment parameters in the vector error-correction model, and the maximum likelihood estimator of σ_2 is the cointegrating vector. Thus, the Johansen approach suggests two different likelihood ratio tests of the significance: the trace test (4.28) and the maximum eigenvalue test (equation 4.29) as the following:

$$J_{trace} = -T \sum_{i=r+1}^n \ln(1 - \hat{\lambda}_i) \quad (4.28)$$

$$J_{max} = -T \ln(1 - \hat{\lambda}_{r+1}) \quad (4.29)$$

where T is the utilized sample size and is i -th largest canonical correlation. The trace test tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of n cointegrating vectors, while the maximum eigenvalue test tests the

null hypothesis of r cointegrating vectors against the alternative hypothesis of $r+1$ cointegrating vectors.

4.3.3 Causality tests

Having known that two variables might demonstrate the existence of a long-run equilibrium relationship, one would further seek information regarding the direction of the relationship. In the case of the equilibrium relationship between the actual inflation and the inflation expectations, which variable leads the other needs to be tested. In that regard, causality tests are widely used in empirical economic research to show this directional feedback.

Causality in econometric modelling is different from the concept in everyday use. According to Asteriou and Hall (2007), causality here refers more to the ability to predict (therefore cause) the other. Granger (1969) developed a relatively simple test that defined causality as follows: a variable X_t is said to Granger-cause Y_t , if Y_t can be predicted with greater accuracy by using past values of variable X_t rather than not using such past values, assuming all other terms remain unchanged.

The present study follows the steps in Asteriou and Hall (2007) for the Granger causality test to determine the direction of the equilibrium relationship. The procedure involves the estimation of the following bivariate VAR models:

$$\pi_t = \alpha_1 + \sum_{i=1}^n \beta_i \pi_{t-i}^e + \sum_{j=1}^m \gamma_j \pi_{t-j} + \varepsilon_{1t} \quad (4.30)$$

$$\pi_t^e = \alpha_2 + \sum_{i=1}^n \theta_i \pi_{t-i}^e + \sum_{j=1}^m \delta_j \pi_{t-j} + \varepsilon_{2t} \quad (4.31)$$

where ε_{1t} and ε_{2t} are the error terms of both actual inflation and inflation expectations, respectively. It is assumed that they are uncorrelated white-noise error terms. As the test involves two variables in one single equation, we can perform the Granger causality test by utilizing either equation (4.30) or (4.31). To do so, if equation (4.30)

is used, we regress π_t (the actual inflation) on its own lagged terms through restricting $\beta_i = 0$:

$$\pi_t = \alpha_1 + \sum_{j=1}^m \gamma_j \pi_{t-j} + \varepsilon_{1t} \quad (4.32)$$

and obtain the residual sum of squares (RSS), symbolized as ν_r (restricted one). Next, we perform another regression of π_t on its own lagged terms plus lagged π_t^e terms in equation (4.30) to obtain the unrestricted RSS which is symbolized as ν_u (the unrestricted one). Finally, we set the null and alternative hypotheses as:

$$H0: \sum_{i=1}^n \beta_i = 0 \text{ or } \pi_t^e \text{ does not Granger-cause } \pi_t$$

$$H1: \sum_{i=1}^n \beta_i \neq 0 \text{ or } \pi_t^e \text{ does Granger-cause } \pi_t$$

and calculate the F-statistic for the normal Wald test on the coefficient restrictions given by:

$$F = \frac{(\nu_r - \nu_u) / m}{\nu_u / (n - k)} \quad (4.33)$$

which follows the $F_{m, n-k}$ distribution. Here $k=m+n+l$. If the computed F value exceeds the F-critical value, we reject the null hypothesis and conclude that π_t^e does Granger-cause π_t .

4.4 Interpretations of the estimation results

4.4.1 Orders of integration

This section is aimed at understanding the integration properties of two stochastic time series in Indonesia, namely the actual inflation (CPI annual inflation, six-

monthly inflation and core inflation series) and the inflation expectations. We apply equation (4.16) to examine the null hypothesis of a unit root. The choice of lags for the test was based on the Akaike Information Criterion (Akaike, 1981, Thornton and Batten, 1985).

As shown in Table 4.1, all actual inflation series (INFLY, INF6M, and CORE) show that their orders of integration were achieved in first difference¹². When the ADF unit root tests for the actual inflation were performed in levels, the t-statistics they produced as one of the main indicator to claim as statistically significance were even below the 10% critical value. Since the null hypothesis of the existence of unit roots in all inflation series is rejected at 5% critical value, it means that all actual inflation series are non-stationary and integrated of order one I(1). We have also conducted the unit root tests with constant only and without constant, and found out that the unit root results remain the same qualitatively.

Table 4.1 Unit root tests for actual inflation and inflation expectations

Variables	ADF			PP Tests		Order of Integration
	Lags	Levels	D(x)*	Levels	D(x)*	
INFLY	2	-2.155	-4.539	-2.264	-7.641	I(1)
INF6M	7	-2.370	-3.911	-3.137	-7.343	I(1)
CORE	4	-2.537	-3.762	-2.537	-7.406	I(1)
EXPI	2	-2.325	-5.158	-2.805	-8.882	I(1)
	4	-2.671	-4.905	-	-	I(1)
	7	-2.053	-3.671	-	-	I(1)

Note: The decision to reject null hypothesis is based on ADF 5% critical value as -3.479 (the longest lag). Phillips-Perron (PP) 5% critical value is -3.471. (*) D(x) denotes the first difference of the tested variables. All tests are conducted with both trends and constants included.

In the mean time, all estimations for the inflation expectations (EXPI) evidently demonstrate that a stationary series is achieved after first differences for all three different lag lengths. The lag choice for the inflation expectations was to show their corresponding relationship with different actual inflation series.

¹² INFLY, INF6M and CORE represent annual CPI inflation, 6-monthly CPI inflation and annual core inflation, respectively.

For the robustness of the estimation results, in addition to the ADF tests, we also conducted the Phillip-Perron (PP) tests. The results of the PP tests support the argument that all the examined variables are integrated of order higher than zero which in this case is of order one $I(1)$. The result is also supported by the probability distribution based on MacKinnon one-sided p-values, which are all statistically significance at first differences.

Regarding the seasonality of the above time series, Haris and Solis (2003) noted that seasonal unit roots are not encountered very often in several macroeconomic time series, thus concluded as $I(1)$ with a deterministic pattern. Their argument was based on research findings by Osborn (1990) using the United Kingdom's consumption expenditure data. Therefore, we could argue that the absence of additional roots will not invalidate the non-seasonal unit root tests.

Overall, from the above unit root tests, it could be claimed that the variables are not collectively stationary in levels form, and the series (INFLY, INF6M, CORE and EXPI) are not integrated of order zero. It means that the tested variables may exhibit random walk individually as none of them are integrated of order zero $I(0)$. However, the fact that all the time series achieved their stationarity in first difference indicates that there might exist cointegration between inflation expectations and all inflation series. This means that there seems to be a stable equilibrium relationship in the long run between inflation expectations and each actual inflation series. Unfortunately, according to Charemza and Deadman (1992), applying first differences to variables leads to the loss of long-run properties, since the model in differences does not have a long-run solution.

4.4.2 Long-run equilibrium and short-run dynamics

This section provides empirical estimations on whether there exist long-run equilibrium relationships between different actual inflation series and inflation expectations in Indonesia. First, we start with initial regressions between different inflation time series and inflation expectations.

Table 4.2 Initial regressions of actual inflation and inflation expectations

	Dependent variables		
	INFLY	INF6M	CORE
C	-2.041 (-0.681)	3.217 (1.200)	0.012 (0.007)
EXPI	1.098* (3.944)	0.138 (0.556)	0.716* (4.664)

Note: * indicates statistical significance at the 5% level. Numbers in brackets are t-statistics values.

From Table 4.2, it seems that long-run relationships exist between different inflation series and inflation expectations, except for the six-monthly inflation series. The relationships are positive which means that any change in the public expectations of future inflation would, to some degree, positively affect the actual inflation. However, those initial long-run relationships could lead to spurious regression, since, as has previously been proven, all time series are integrated of order one $I(1)$. Therefore, using initial OLS regressions to show the relationship of non-stationary variables is misleading. Accordingly, cointegration tests along with the ECM will be performed to measure the long-run equilibrium and short-run dynamics.

To do so, we used equation (4.19) to obtain the DF/EG test which is basically a test for the unit roots for residuals (RESID). As can be clearly observed from Table 4.3, all values of computed t-statistic of the model variables, in the absolute term, are higher than the DF/EG 5% critical value of $|1.939|$. This means that the null hypothesis of non-cointegration is rejected and thus there exists a long-run cointegrating relationship between the actual inflation series and inflation expectations in Indonesia.

Table 4.3 The DF/EG tests for the residuals of the initial regressions

	The unit roots of the residual regressions		
	INFLY	INF6M	CORE
C	-0.2408 (-0.5474)	0.03781 (0.0850)	-0.2969 (0.2049)
RESID(-1)	-0.1706**(**) (-2.6234)	-0.2616**(**) (-2.402)	-0.1864**(**) (-3.3908)

Note: *(**) indicates statistical significance at the 5% and 10% levels, respectively.

The EG cointegration test is able to compute the cointegration of no more than two variables in one model (x,y); therefore the test can only explain the existence of one cointegrating vector. By this, we mean that there exists a single common factor underlying the actual inflation and inflation expectations, and even though in the short run these time series might walk randomly, in the long run a stable linear relationship will exist among them.

Furthermore, the DF/EG residual-based test also can only explain the existence of long-run equilibrium economic models. In fact, several authors also claim that the DF/EG test is weak, since it ignores the initial static regression while focusing more on the error dynamics (Kremers et al., 1992, Maddala and Kim, 1998, Engle and Granger, 1987). As a result, in order to understand the short-run dynamics as well as to improve the consistency of this relationship, error-correction mechanism (ECM) tests were also conducted. These tests are based on the representation provided by equation (4.21).

The results of the ECM cointegration estimation as presented below confirmed the result from the above DF/EG tests. This means that the two variables examined in this study, namely the actual inflation series (which consists of aggregate annual inflation, core inflation and aggregate six-month inflation) and the inflation expectations, seem to have a stable long-run equilibrium relationship, although there may be disequilibrium in the short run, due to random walk. From Table 4.4, we can observe that the short-run changes in the inflation expectations do not seem to influence the changes of the actual inflation.

Table 4.4 ECM estimations of actual inflation series and inflation expectations

ECM	Actual inflation series		
	INFLY	INF6M	CORE
D(EXPI)	-0.0242 (-0.0927)	0.5418 (-1.9772)	-0.0096 (-0.0882)
ECM(-1)	-0.1519**(**) (-2.6318)	-0.1560**(**) (-2.2957)	-0.1503**(**) (-3.4126)

Note: (**) indicates statistically significance at the 5% and 10% levels, respectively. The numbers in parentheses are t-statistics values.

Since the ECM also provides an explanation regarding the short-run dynamics of the model, we can see from the equation that there are movements from the short-run disequilibrium to the long-run equilibrium. What that means is that about 15% of the disequilibrium in every inflation series is corrected every period (which in this case is 6 months) towards the stable long-run equilibrium relationship. Because the expectations survey is conducted for a 6-month ahead period, we can claim that the full equilibrium, assuming other explanatory variables remain unchanged, would occur after six to seven periods. This finding is also in line with several previous studies conducted by Bank of England (1999), Sellon (2004) and Ragan (2006) where monetary policy decisions would have effects within 6 to 18 months.

From Table 4.5 below, it is shown that both the maximum eigenvalue and trace tests indicate the existence of two cointegrating ranks of their respective time series within the system, except for INFLY which unexpectedly suggests conflicting results. We observe the presence of two cointegrating vectors from the trace test statistic, while the maximum eigenvalue statistic indicates there is no cointegrating vector at both the 5% and 10% levels. Regarding the unexpected sign of the maximum eigenvalue test for INFLY, the literature suggests that both trace and maximum eigenvalue tests are very similar, whereas the power of the trace test is in some situations superior to that of the maximum eigenvalue tests (Lütkepohl et al., 2001). As a result, in this study, the trace test statistic forms the basis of the model formulation in investigating the rationality of inflation expectations in Indonesia.

Although the estimations show that both the actual inflation and the inflation expectations have cointegrating relationships, the results are not unambiguous. Relatively short sample sizes of the time series and unavailability of inflation expectations data for a period of 12 months (annual per cent change) might provide an explanation for this ambiguity. In this regard, employing much longer sample sizes as well as making available the data of expectations survey for a 12-month ahead period, so as to match the popular headline inflation series, might provide better estimation results regarding this long-run relationship.

Table 4.5 Results of the Johansen cointegration tests

H_0	H_1	Trace statistic	Max-Eigen statistic	5% critical value	10% critical value
EXPI, CORE					
$r = 0$	$r \geq 1$	25.106*(**)	20.791*(**)	14.264	12.296
$r \leq 1$	$r \geq 2$	4.314*(**)	4.314*(**)	3.841	2.705
EXPI, INF6M					
$r = 0$	$r \geq 1$	29.234*(**)	23.879*(**)	14.264	12.296
$r \leq 1$	$r \geq 2$	5.355*(**)	5.355*(**)	3.841	2.705
EXPI, INFLY					
$r = 0$	$r \geq 1$	15.926*(**)	10.354	14.264	12.296
$r \leq 1$	$r \geq 2$	5.572*(**)	5.572*(**)	3.841	2.705

Notes: * and ** denote statistical significance at the 5% and 10% levels, respectively.

4.4.3 Causality directions

Having found in the previous section that both the actual inflation and the inflation expectations in Indonesia demonstrated a long-run cointegrating relationship and short-run movements, the analysis in this section will find the causality direction of the variables. There are only two variables involved, and hence the model would be able to identify and show the strength of the Granger-causal chain between these inflation variables.

Since the Granger causality test is sensitive to different lag lengths, this study used the lag selection suggested by the Akaike Information Criterion (AIC) observed to seven in this case. However, for more reliable test results, two other lags were also used. From equations (4.30) and (4.31) we have the Granger-causality direction as provided in Table 4.6. The tests cannot reject the null hypothesis that the actual inflation does not granger-cause the inflation expectations. This means that the actual inflation cannot be used to explain the inflation expectations.

Table 4.6 Results of Granger causality (pair wise) tests

Null hypothesis	F-statistic		
	Lag (5)	Lag (6)	Lag (7)
INF6M does not Granger-cause EXPI	1.694 [0.1507]	1.637 [0.1547]	1.749 [0.1184]
EXPI does not Granger-cause INF6M	4.288*(**) [0.0022]	4.015*(**) [0.0021]	3.626*(**) [0.0030]
CORE does not Granger-cause EXPI	0.326 [0.8949]	0.243 [0.9599]	0.219 [0.9792]
EXPI does not Granger-cause CORE	5.892*(**) [0.0002]	5.331*(**) [0.0002]	4.517*(**) [0.0005]
INFLY does not Granger-cause EXPI	0.555 [0.7332]	0.932 [0.4794]	0.937 [0.4861]
EXPI does not Granger-cause INFLY	3.590*(**) [0.0067]	3.407*(**) [0.0062]	2.888* [0.0124]

Note: Since causality tests are sensitive to the numbers of lags, the tests presented in this table were conducted with different lag lengths. *(**) indicates the null hypothesis is rejected at 10% and 5% critical values, respectively. Numbers in [] are the probability values based on MacKinnon (1996) one-sided p-value.

On the other hand, the tests reject the null hypothesis that the inflation expectations do not Granger-cause the actual inflation at all lags. Therefore, it appears that Granger causality runs one-way from the inflation expectations to the actual inflation, and not the other way around. Based on this estimation, we can claim that despite some ambiguity around their relationship, inflation expectations do act as a predictor of future actual inflation.

4.5 Empirical analysis

Having completed all the above econometric estimations, we have found some interesting characteristics of inflation expectations in Indonesia. Even though many of the causes of inflation movements in the short run could not be captured by the survey data, we observe that it is important in exploring and explaining inflation in the long run, particularly in the prediction of core inflation. It appears that such a detailed dataset could be crucial in understanding long-term inflation expectations and what we know about them. Despite this, the central bank has not encouraged the use of household survey data neither has the Bank consistently utilized the survey data as the basis for their inflation policy decision-making.

According to Bank Indonesia, households in Indonesia, as respondents of the survey, lack the ability to form long-term expectations of inflation.¹³ That is also the reason the Bank has not conducted price expectations surveys for a period of 12 months or longer. This claim is supported by Tanuwidjaja and Choy (2006) in their findings that inflation expectations formed by the public tend to be backward-looking. However, even if that claim is true, this view is not especially surprising or unique to Indonesia. Survey data on expectations conducted in many countries, particularly those with households as the respondents, tend to replicate current and past economic conditions, rather than being truly forward-looking (Ranchhod, 2003, Arnold and Lemmen, 2008).

Our estimation results from the Johansen cointegration tests suggest that the relationship between the household survey data of inflation expectations and the actual inflation is positive and relatively stable. Indeed, the relationship between the survey-based expectations and various inflation series, namely annual inflation, core inflation, and six-monthly inflation are statistically significant. The estimations also provide evidence that both the expected and actual inflations have a long-run equilibrium. Through the causality tests, we have also found that the relationships run one-way from the inflation expectations to the actual inflation, not in both directions. This indicates that the inflation expectations tend to be forward-looking; thus they can be a good predictor for future inflation in Indonesia. Although the result in this study

¹³ Based on direct communication with Bank Indonesia's staff (Real Sectors Statistics Team).

is somewhat contradictory to a similar study conducted by Tanuwidjaja and Choy (2006), we could claim that our finding is in line with the previous empirical findings that producers' expectations are based on current and past inflation (adaptive) while the consumers expectations are affected mainly by the current movements of certain economic variables, such as the exchange rates and the administered goods (Majardi, 2004, Hutabarat, 2005, Bank Indonesia, 2001).

Meanwhile, the relationship between the survey data and core inflation has been relatively stronger for all the examined periods. Interestingly, the concept of core inflation itself is not widely known by the general public, since it is mainly used for central bank's internal decision-making (Mankikar and Paisley, 2002, Song, 2005, Marques et al., 2002). This strong relationship between the survey expectations data and core inflation might be explained by the selective components of the latter which exclude all volatile items (foods, energy and transportation). Relatively short sample sizes employed in this study might also be an explanation for the observed weak relationships between the inflation expectations and the actual (headline) inflation.

While the reliability of survey data in Indonesia still needs improving, the Bank should be able to utilize the expectations survey data for its policy decision-making together with other important economic variables. It is not surprising for policy makers to utilize these survey-based measures, as similar conclusions were also drawn for the US economy based on the findings that survey-based measures outperform other inflation forecasts (Ang et al., 2007).

The relatively long gap between inflation expectations and actual inflation might have been caused by the limited access of households to updated information as it could also affect their forecasts. In the meantime, the phenomenon of long convergence of inflation expectations and actual inflation has also been found in developed economies, such as the members of the European Union (Arnold and Lemmen, 2008).

4.6 Conclusion

In this chapter, we measured the inflation expectations based on household survey data provided by Bank Indonesia. As the objective of this chapter is to examine the relationships between inflation expectations and actual inflation, we found that both measures are non-stationary, which means that in the short-run they might drift apart since they exhibit random walk individually. However, we also found that there exists a long-run equilibrium relationship between the actual inflation and the inflation expectations in Indonesia.

The relationship has not been particularly strong, except for the core inflation which is not widely used by the public as a standard inflation measure. This conclusion might be partly explained as due to the relatively short sample sizes of the survey data. The inflation expectation survey in Indonesia might also have overestimated the actual inflation, where along the examined periods the forecasted inflation on average was above the actual inflation. Meanwhile, the unavailability of a longer-period expectations, e.g. 12-monthly survey, might also hinder further investigations of the relationship.

Finally, despite several limitations found with regard to the relationship between the actual inflation and the inflation expectations, these findings can make a significant contribution to monetary policy decision-making along with other important economic variables. The analysis of how these inflation expectations are formed will be conducted in the next chapter.

CHAPTER 5
SOURCES OF MOVEMENTS OF INFLATION EXPECTATIONS
IN INDONESIA¹⁴

5.1 Introduction

Understanding the formation of survey-based public expectations has long been an important subject in macroeconomic research. The issue is particularly interesting, because of the different characteristics of variables that form the expectations from one economy to another, depending upon domestic and global circumstances at the time when the expectations are formed (Dahl and Hansen, 2001). Until recently, there is no standard criterion in the literature that specifies what variables to include in the models of inflation expectations formation.

De Carvalho and Bugarin (2006) identified several economic variables affecting the inflation expectations in three countries: Chile, Mexico and Brazil. In their findings, public expectations in Chile were influenced by output gaps and the exchange rates. Mexico's inflation expectations was affected mainly by output gaps, administered prices, interest rates, exchange rates and the inflation target set by the central bank. However, Brazil demonstrated a unique behaviour where it was the inflation targets that significantly influenced the expectations, while other variables such as interest rates, past supply and demand, and inertia conditions were influential.

Furthermore, Mehra and Herrington (2008) found that the inflation expectations in the United States moved in response to several macroeconomic shocks, namely actual inflation, commodity prices, particularly oil prices, and unemployment. Surprisingly, Mehra and Herrington (2008) also claimed that the shocks of expected inflation itself had been one of the major sources of movement in the U.S. expectations.

Bank Indonesia (2003) reported that public expectations of inflation in Indonesia was mainly affected by the exchange rates, administered price inflation and inertia

¹⁴ Part of this chapter was presented at the 14th Indonesia Forum at the University of Melbourne in May 2008 and has been published at the *Empirical Economics Letters*., vol. 8, no. 9, 2009.

conditions. While the inertia has been influential in determining the wages and prices at production levels (Majardi, 2004), the case has not been proven for the consumer survey data of inflation expectations. Therefore, instead of assuming that we know the equation that determines the formation of inflation expectations in Indonesia, for the purpose of this study we make the much less restrictive assumption that the public can use any economic information that is publicly available to make their expectations.

This chapter analyses how inflation expectations are formed, and how the public adjust their expectations according to changes in economic circumstances. There several specific issues emphasized in the analysis of this chapter. Firstly, this chapter will look in details the variables that influence the formation of inflation expectations. Secondly, it will analyse the changes in economic circumstances that affect the movements of inflation expectations, and thirdly, it investigates the way Bank Indonesia anchors public expectations.

This chapter is divided into seven sections. Section 5.2 discusses the sources of data for analysis. Section 5.3 develops the econometric measures of the movements of the inflation expectations. Section 5.4 interprets the estimation results. Section 5.5 analyses the impact of economic shocks on the expectations. Section 5.6 puts forward evidence on the usefulness of anchoring inflation expectations, and section 5.7 draws some conclusions.

5.2 Data for analysis

The data used in this chapter cover a wide range of macroeconomic variables in order to identify all variables possibly influencing the relationship of the public expectations and the outcomes of actual inflation. The decision to identify all possible variables comes as a result of the lack of agreements among researchers as to what specific variables to include in the estimations of the public expectations of inflation. The potential variables considered here include administered price inflation (ADMPI), Jakarta composite stock index (JCSX), money supply M1 in log (LM1), deposit guarantee interest rate (LPSR), US\$ exchange rate in log (USXRI), consumption credit interest rate (CONSR), investment credit interest rate (INVR),

working capital credit interest rate (WKCPR), inflation expectations (EXPI), and Bank Indonesia's policy interest rates (BIPR), which monetary policy are implemented through.

As has been described in the previous chapter, the measure of inflation expectations used in this analysis is derived from the monthly survey data conducted by Bank Indonesia. The Bank requires voluntary participation of the surveyed households by answering a set of questionnaires as well as by random phone interviews. The question asked is how the households foresee the next six-month inflation compared with the current actual rate, whether will increase, decrease or stay neutral. In the meantime, the monetary policy rates are determined by the Board of Governors of Bank Indonesia in its monthly meeting. The Board decides whether to increase, decrease, or leave unchanged the current policy rate and their decision is announced to the public as the BI Rate. Nowadays, the BI Rate is the most important monetary instrument that the Bank uses to execute its monetary power, and the impact can be seen in the movements of domestic interest rates and the Rupiah exchange rates.

All economic time series data employed in this chapter were gathered from the publications of Statistics Indonesia and Bank Indonesia. Both institutions are the primary sources of government and economic data for Indonesia. They are also the main sources of data for publications released by major international financial institutions, such as the International Monetary Fund (IMF), the World Bank, and Asian Development Bank (ADB) (ADB, 2008, IMF, 2008, World Bank, 2008). Where missing data occurred, other alternative sources were used, including the World Bank Development database, the Bank for International Settlements (BIS) statistics, and the IMF International Financial Statistics.

5.3 Methodology

5.3.1 Principal components analysis

In order to select only the most fitting variables that best explain the movements of the inflation expectations, this study utilizes the principal components analysis method. This method, hereafter referred to as PCA is one of the multivariate methods

of analysis and has been used widely with multidimensional data sets (for example De Carvalho and Bugarin, 2006). The use of PCA allows the number of variables in a multivariate data set to be reduced, while retaining as much of the variation present in the data set as possible (Smith, 2002).

This reduction is achieved by taking n variables X_1, X_2, \dots, X_n and finding the combinations of these to produce principal components (PCs), say, PC_1, PC_2, \dots, PC_n , which are uncorrelated. These PCs are termed eigenvectors. PCs are ordered so that PC_1 exhibits the greatest amount of the variation, PC_2 exhibits the second greatest amount of the variation, and so on. That is $\text{var}(PC_1) \geq \text{var}(PC_2) \geq \dots \geq \text{var}(PC_n)$, where $\text{var}(PC_n)$ expresses the variance of PC_n in the data set being considered. $\text{Var}(PC_n)$ is also called the eigenvalue of PC_n .

When using PCA, it is hoped that the eigenvalues of most of the PCs will be so low as to be virtually negligible. Where this is the case, the variation in the data set can be adequately described by means of a few PCs where the eigenvalues are not negligible. Accordingly, some degree of economy is accomplished as the variation in the original number of variables (X variables) can be described using a smaller number of new variables (PCs).

The analysis is performed on a data set of n variables (X_1, X_2, \dots, X_n) for m individuals. From this data set, a corresponding squared covariance or correlation matrix can be calculated. For the covariance matrix the following equation can be used:

$$\text{Cov}(X_j, X_k) = \frac{\sum_{i=1}^m (X_{ij} - \bar{X}_j)(X_{ik} - \bar{X}_k)}{(m-1)} \quad (5.1)$$

where $\bar{X}_j = \frac{\sum_{i=1}^m X_{ij}}{m}$ and $j, k = 1, 2, 3, \dots, n$.

It also could be expressed in the following form:

$$S = \begin{bmatrix} S_{11} & S_{12} & S_{13} & S_{1n} \\ S_{21} & S_{22} & S_{23} & S_{2n} \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ S_{n1} & S_{n2} & S_{n3} & S_{nn} \end{bmatrix} \quad (5.2)$$

where S is the covariance matrix, S_{jk} is the covariance of variables X_j and X_k when $j \neq k$, and the diagonal element S_{jj} is the variance of X_j when $j=k$.

The covariance matrix is used when the variables are measured on comparable scales. However, when variables have different units or widely different scales, a correlation matrix where variables are standardized should be used (Smith, 2002). PCA is thus concerned with finding the variances and coefficients of the data set, in other words, finding the eigenvalues and eigenvectors of the sample correlation matrix. Eigenvectors (PCs) and their associated eigenvalues can be calculated from the correlation matrix by an iterative process.

The first principal component (PC_1) is a linear combination of the original variables $X_1, X_2, X_3, \dots, X_n$,

$$PC_1 = a_{11}X_1 + a_{12}X_2 + a_{13}X_3 + \dots + a_{1n}X_n = \sum_{j=1}^n a_{1j}X_j \quad (5.3)$$

$$PC_1 = \sum_{j=1}^n a_{1j}X_j \quad (5.4)$$

and it is subject to the condition that:

$$a_{11}^2 + a_{12}^2 + a_{13}^2 + \dots + a_{1n}^2 = 1 \quad (5.5)$$

where $a_{11}, a_{12}, \dots, a_{1n}$ are coefficients assigned to the original n variables for PC_1 .

Accordingly, the eigenvalue of PC_1 is as large as possible given the constraint on the constant a_{1j} . The constraint must be imposed in order to avoid the increasing of the eigenvalue of PC_1 by simply increasing one or more of the a_{1j} value.

Similarly, we could write the second principal component as:

$$PC_2 = \sum_{j=1}^n a_{2j} X_j \quad (5.6)$$

and is subject to the constraint that:

$$a_{21}^2 + a_{22}^2 + a_{23}^2 + \dots + a_{2n}^2 = 1 \quad (5.7)$$

and we could write n principal component as:

$$PC_n = \sum_{j=1}^n a_{nj} X_j \quad (5.8)$$

where the eigenvalue of PC_n is as large as possible subject to the constraint that:

$$a_{n1}^2 + a_{n2}^2 + a_{n3}^2 + \dots + a_{nm}^2 = 1 \quad (5.9)$$

It is also a condition that all individual principal components are uncorrelated.

Furthermore, Smith (2002) listed other important properties of eigenvectors or PCs which are: (i) eigenvectors can only be found for squared matrices; (ii) not all squared matrices have eigenvectors, however a correlation (or covariance) matrix will always have eigenvectors (the same number as there are variables); (iii) length does not affect whether a vector is a particular eigenvector, direction does; and (iv) eigenvectors and eigenvalues always come in pairs.

Jolliffe (1986) mentioned that treating time series data in the PCA is different from ordinary independent data. As most time series data are interdependent through their closeness in time, it is often found that time series data are highly influential to each other, for example, through seasonal dependence for annual data series or through their degree of association for observation separated by periods (monthly, quarterly or

yearly data). As a result, it might be possible to retain the original components with the highest variance as the representative of each principal component.

5.3.2 Unit root and cointegration tests

As in the previous chapter, to measure the stationarity of all examined variables, we employ the augmented Dicky-Fuller (ADF) test (Dickey and Fuller, 1981). The equation can be expressed as follows:

$$\Delta\pi_t = \delta\pi_{t-1} + \sum_{i=1}^k \delta_i \Delta\pi_{t-i} + \varepsilon_t \quad (5.10)$$

$$\Delta\pi_t = \beta_1 + \delta\pi_{t-1} + \sum_{i=1}^k \delta_i \Delta\pi_{t-i} + \varepsilon_t \quad (5.11)$$

$$\Delta\pi_t = \beta_1 + \beta_2 t + \delta\pi_{t-1} + \sum_{i=1}^k \delta_i \Delta\pi_{t-i} + \varepsilon_t \quad (5.12)$$

The unit root tests will be conducted without constant and trends (equation 5.10) so as to capture the characteristics of the tested variables.

Since the cointegration tests of the variables in this chapter involved more than two variables, the Engle-Granger cointegration approach cannot be used. Instead, the tests were conducted using the Johansen cointegration tests (Johansen, 1991). From the previous chapter, we can write the Johansen's cointegration equations which consist of the trace test and the maximum eigenvalue test as:

$$\Delta\vec{\pi}_t = \alpha + \Pi \vec{\pi}_{t-1} + \sum_{n=1}^{k-1} \Gamma_n \Delta\vec{\pi}_{t-n} + \varepsilon_t \quad (5.13)$$

where:

$$\Pi = \sum_{n=1}^k \Phi_n - I \text{ and } \Gamma_n = - \sum_{m=n+1}^k \Phi_m \quad (5.14)$$

Thus, the trace test can be expressed as:

$$J_{trace} = -T \sum_{i=r+1}^n \ln(1 - \hat{\lambda}_i) \quad (5.15)$$

and the maximum eigenvalue is represented as:

$$J_{\max} = -T \ln(1 - \hat{\lambda}_{r+1}) \quad (5.16)$$

5.3.3 VAR model representation

A vector autoregression (VAR) is used to show the interrelationship between variables in a system when each variable does not only depend on its own lags, but also on the lags of other variables. Here we use a VAR model that allows for the potential presence of contemporaneous feedbacks among all the influencing variables contained in the system. The procedure presented in this section followed Hamilton (1994). From the VAR model we had in the previous chapter, we can write:

$$\bar{\pi}_t = \alpha + \Phi_1 \bar{\pi}_{t-1} + \dots + \Phi_n \bar{\pi}_{t-n} + \varepsilon_t \quad (5.17)$$

where $\bar{\pi}_t$ is a vector of variables, Φ is a matrix of structural coefficients, and ε_t is a vector of structural shocks. As in the literature, we assume that structural shocks have zero means and are uncorrelated with each other. Furthermore, to identify the impulse response functions, we could derive the model from equation (5.17) and since any covariance stationary has a Wold representation in the form:

$$\bar{\pi}_t = \alpha + \varepsilon_t + \Psi_1 \varepsilon_{t-1} + \Psi_2 \varepsilon_{t-2} + \Psi_3 \varepsilon_{t-3} + \dots \quad (5.18)$$

then, the matrix Ψ_s has the interpretation:

$$\frac{\partial \bar{\pi}_{i,t+s}}{\partial \varepsilon_{j,t}} = \psi_s \quad (5.19)$$

that is the row i , column j element of Ψ_s identifies the consequences of a one-unit increase in the j th variable's innovation at time t ($\varepsilon_{j,t}$) for the value of the i th variable at time $t+s$ ($\bar{\pi}_{i,t+s}$), holding all other innovations at all times constant.

5.4 Empirical results

5.4.1 Influencing variables

Based on several previous empirical studies on inflation expectations (Arnold and Lemmen, 2008, Choy et al., 2006, Sargent et al., 2006, Tyziak and Stanislawska, 2006), we present below the PCA's estimation results from a wide set of potential variables that we consider the public in Indonesia might use to form their expectations.

Table 5.1 Principal components analysis (reduced using correlation matrix)

Number	Eigenvalue	Difference	Proportion	Cumulative eigenvalue	Cumulative proportion
1	5.441250*	4.024814	0.6802	5.441250	0.6802*
2	1.416437*	0.617269	0.1771	6.857687	0.8572*
3	0.799168	0.542066	0.0999	7.656855	0.9571
4	0.257102	0.205760	0.0321	7.913957	0.9892
5	0.051342	0.026285	0.0064	7.965299	0.9957
6	0.025057	0.018122	0.0031	7.990356	0.9988
7	0.006935	0.004227	0.0009	7.997292	0.9997
8	0.002708	---	0.0003	8.000000	1.0000

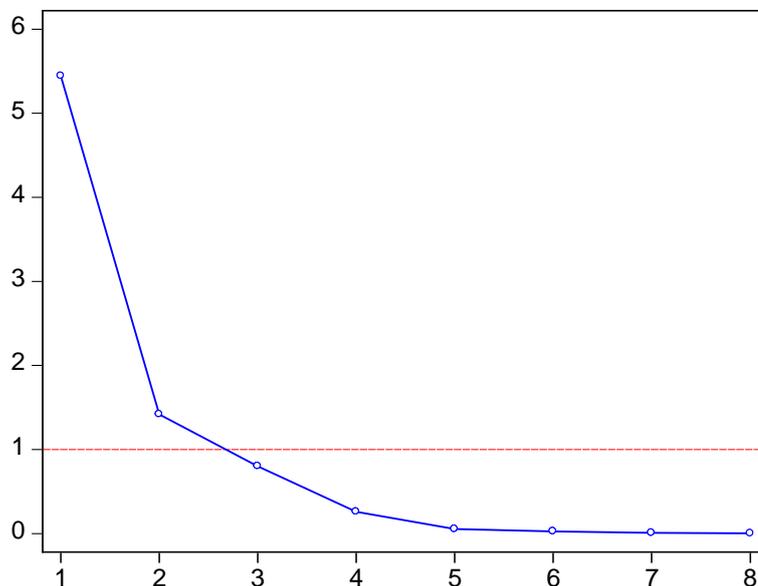
Notes: Sum of the Eigenvalue = 8 and the average = 1. * means the number of principal components retained.

Table 5.1 shows the eigenvalues of the correlation matrix. First, in order to decide how many PCs should be retained, we have to start from the first component, the one with the largest eigenvalue that describes a certain proportion of the total variance. As clearly shown, the first component accounts for 68.02% of the total information. However, the literature suggests that a sufficient percentage to represent the total variation is 70% to 90% (Jolliffe, 1986, Lance et al., 2006). Accordingly, we have to look at the second component which accounts for 17.71%. Thus, the combination of the first and second components accounts for 85.72% of the total information, which is sufficient.

Furthermore, according to Kaiser's rule (Lance et al., 2006), the principal components to be retained are those whose eigenvalue is ≥ 1 , and if that is the case, there are two components that fulfil the criterion (PC₁ and PC₂). The decision for retaining those whose eigenvalue ≥ 1 is due to the fact that the PCA was conducted using a correlation matrix, where this calculation assumes standardised scores for the variables, i.e. a mean of 0 and a standard deviation of 1.0, because the variables share the same scale loading (sum of the eigenvalue = 8 and the average = 1).

For the robustness, Figure 5.1 below illustrates the scree plot of ordered eigenvalues of the principal components. In a scree plot, eigenvalues are plotted against the principal components. The component numbers are listed on the x-axis, while the eigenvalues are listed on the y-axis. As demonstrated in the graph, the first two dots of 8 components (PC₁ and PC₂) lie above the line (the variance of a standardized variable = 1.0) while the third dot (PC₃) lies below the line. Based on the above criteria, we could only have two principal components for the analysis.

Figure 5.1 Scree plot (ordered eigenvalues)



The next stage is to look at the eigenvectors. As has been explained previously, Table 5.2 below shows eight potential variables, which possibly influence formation of inflation expectations in Indonesia: ADMPR, JCSX, LM1, LPSR, USXRI, CONSR,

INVR, and WKCPR. The measured variable is EXPI, and the monetary policy is achieved through BIPR (Bank Indonesia's policy interest rates)

Table 5.2. shows that the first component (PC_1), CONSR, INVR, WKCPR and LPSR show significant positive correlations, while JSCX and LM1 show the opposite. On the second component (PC_2), there are three variables showing strong positive correlations, namely LPSR, USXRI and ADMPR. Since we only have two principal components to choose from, then we abandon all the other principal components (PC_3 to PC_8). This result tells us that there are two different factors that might explain the movements of inflation expectations in Indonesia, and one of the original variables (LPSR) is found in both factors.

Based on the information below and taking into consideration the correlation matrix presented in Table 5.3, we can determine the variables that influence the formation of inflation expectations based upon the highest positive variances (eigenvectors). PC_1 is represented by CONSR, INVR, WKCPR, and LPSR. However, since INVR, CONSR, and WKCPR are all very highly correlated to each other (all represents credit rates), then we have to decide which of the three credit rates we choose. We chose CONSR based upon the assumption that CONSR represents more closely day-to-day household consumption. The other variable is LPSR as selected by the PCA. PC_2 is represented by the three variables with the highest variances (eigenvectors), namely ADMPR, LPSR and USXRI. The fact that we selected LPSR from the beginning, instead of the Bank Indonesia policy rate (BIPR), as one component is reflected by its responsiveness to market fluctuations. According to Bank Indonesia (2006), the Bank's interest rate policy does not largely provide immediate impact on credit rates, but it does make the deposit rates become more responsive.

Table 5.2 Principal components analysis (eigenvectors)

Variable	PC 1*	PC 2*	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8
LPSR	0.343363	0.391306^	0.351891	0.297885	-0.585043	-0.264880	-0.226450	0.229571
USXRI	-0.196168	0.628927^	-0.435839	0.539296	0.248811	0.152070	0.008848	0.007941
CONSR	0.402260^	-0.206001	0.193175	0.229878	0.411601	0.456448	-0.535617	0.202347
INVR	0.424007^	-0.002699	0.094262	0.107465	0.369032	-0.217246	0.659168	0.426491
WKCPR	0.415125^	0.124603	0.204503	0.125749	0.118198	0.001479	0.164562	-0.844664
ADMPR	0.269426	0.570123^	-0.081753	-0.732129	0.105165	0.180730	-0.093887	0.084469
JSCX	-0.349595	0.168765	0.596241	0.030194	-0.101937	0.596154	0.351875	0.057267
LM1	-0.367274	0.199598	0.485805	-0.057402	0.504773	-0.512940	-0.259891	-0.022881

Notes: * means the number of principal components retained. ^ denotes components association in each retained principal component.

Table 5.3 Principal components analysis (ordinary correlation matrix)

Variable	LPSR	USXRI	CONSR	INVR	WKCPR	ADMPR	JSCX	LM1
LPSR	1.000000							
USXRI	-0.107672	1.000000						
CONSR	0.694877	-0.641326	1.000000					
INVR	0.815012	-0.468985	0.952855	1.000000				
WKCPR	0.907447	-0.384391	0.912709	0.978158	1.000000			
ADMPR	0.736151	0.149291	0.372157	0.593711	0.672515	1.000000		
JSCX	-0.391040	0.321001	-0.717214	-0.764957	-0.661782	-0.418931	1.000000	
LM1	-0.454698	0.397145	-0.784768	-0.801959	-0.714029	-0.397613	0.966449	1.000000

Accordingly, one would suspect that the inflation expectations in Indonesia are influenced by administered price inflation, exchange rates, deposit interest rates and consumption credits. Next, we will conduct the unit root and cointegration tests in order to see if a long-run relationship exists between the inflation expectations and all individual variables. If the tests do not confirm all the variables, then we have to drop the variables that are not significant.

5.4.2 Stationarity and equilibrium relationships

As shown in Table 5.4, all tested variables show that their orders of integration were achieved in first difference, except CONSR. When the ADF unit root tests were performed in levels, the t-statistics they produced as one of the main indicators to claim statistical significance was even below the 5% critical value. Since the null hypothesis of the existence of unit roots in LPSR, ADMPR, CONSR and USXRI is rejected at 5% critical value, it means that they are non-stationary and must be tested for higher order of integration. The results as presented in the table show that, except for CONSR, all variables are integrated of order I(1), while the stationarity of CONSR is achieved on the order I(2). Consequently, we have to leave CONSR out as it has not been qualified.

Table 5.4 The results of the unit root tests

Variables	ADF			Order of integration
	Lags	Levels	D(x)*	
LPSR	1	-2.215	-3.212	I(1)
ADMPR	1	-1.551	-5.475	I(1)
CONSR	1	-1.232	-2.851	I(2)
USXRI	1	-0.255	-7.571	I(1)

Note: The decision to reject null hypothesis is based on ADF 5% critical value as -2.902. D(x)* denotes the first difference of the tested variables, except for CONSR which is integrated of order I(2).

Table 5.5 Results of the Johansen cointegration test**Variables: EXPI, LPSR, ADMPR, USXRI**

H₀	H₁	Trace statistic	95% critical value	Max-Eigen statistic	95% critical value
-	$r \geq 0$	54.50333*(*)	47.85613	28.01159**(**)	27.58434
$r = 0$	$r \geq 1$	26.49175	29.79707	12.49802	21.13162
$r \leq 1$	$r \geq 2$	13.99373	15.49471	10.01142	14.26460
$r \leq 2$	$r \geq 3$	3.982308*(*)	3.841466	3.982308**(**)	3.841466

Note: * and ** denote statistical significance at the 5% and 10% levels, respectively.

As has been described in the previous chapter, Haris and Solis (2003) noted that seasonal unit roots are not encountered very often in several macroeconomic time series, based on research findings by Osborn (1990) using the United Kingdom's consumption expenditures. Therefore, we also could argue here that the absence of additional roots will not invalidate the non-seasonal unit root tests.

Next, we applied the Johansen cointegrating test, and the results are presented in Table 5.5 above. It is shown that both the trace test and the maximum eigenvalue test indicated the existence of one cointegrating rank of their respective time series within the system. We observe that the present of one cointegrating vector from the trace test and the maximum eigenvalue statistic confirms that there exists at least one long-run equilibrium relationship between EXPI and the tested variables (ADMPR, LPSR, USXRI).

Having done the above analysis, we can now run a vector autoregression (VECM) to see the relationship between EXPI and all influential variables, both in the short run and long run in order to understand how each variable makes adjustment towards the long-run equilibrium.

Table 5.6 Basic estimation results of error correction models

EXPI = 615.13 + 1.6LSPR – 66.88USXRI + 0.07ADMPR			
	(7.654)**	(7.115)**	(1.879)*
Variable	Coefficient	T-statistics	
ECM	0.025796	0.36635	
EXPI(-1)	-0.009438	-0.06246	
LPSR(-1)	0.065929	0.22558	
USXRI(-1)	-3.627703	-0.57699	
ADMPR(-1)	0.029225	1.27386	

Note: * and ** denotes statistical significance at 10% and 5% levels respectively.

The above results are consistent with the Johansen estimations, where in the long-run there exists an equilibrium relationship between EXPI and all influential variables, although such a relationship does not exist in the short run. From the long run equation, we can observe that the movements of the deposit interest rates have significant impact on the expectations. This impact could be explained by the fact that an increase in the long-run interest rates would result in an increase in the costs of investment, and eventually this would affect the prices of goods produced in the market.

The same observation could also be made for the exchange rates and the administered price, where in the long run an appreciation of the rupiah would eventually increase the prices of goods, although this would be the other way around in the short run. Interestingly, the impact of the administered price is not really significant in the long run. This means that as time passes, the impact of fiscal policy on prices and expectations would gradually decline, while the impact of the monetary policy still exists at least until the medium term. This is in line with the theory where the long-run prices would not be influenced by the monetary policy, but would be adjusted in accordance with the output growth (Roberts, 1993).

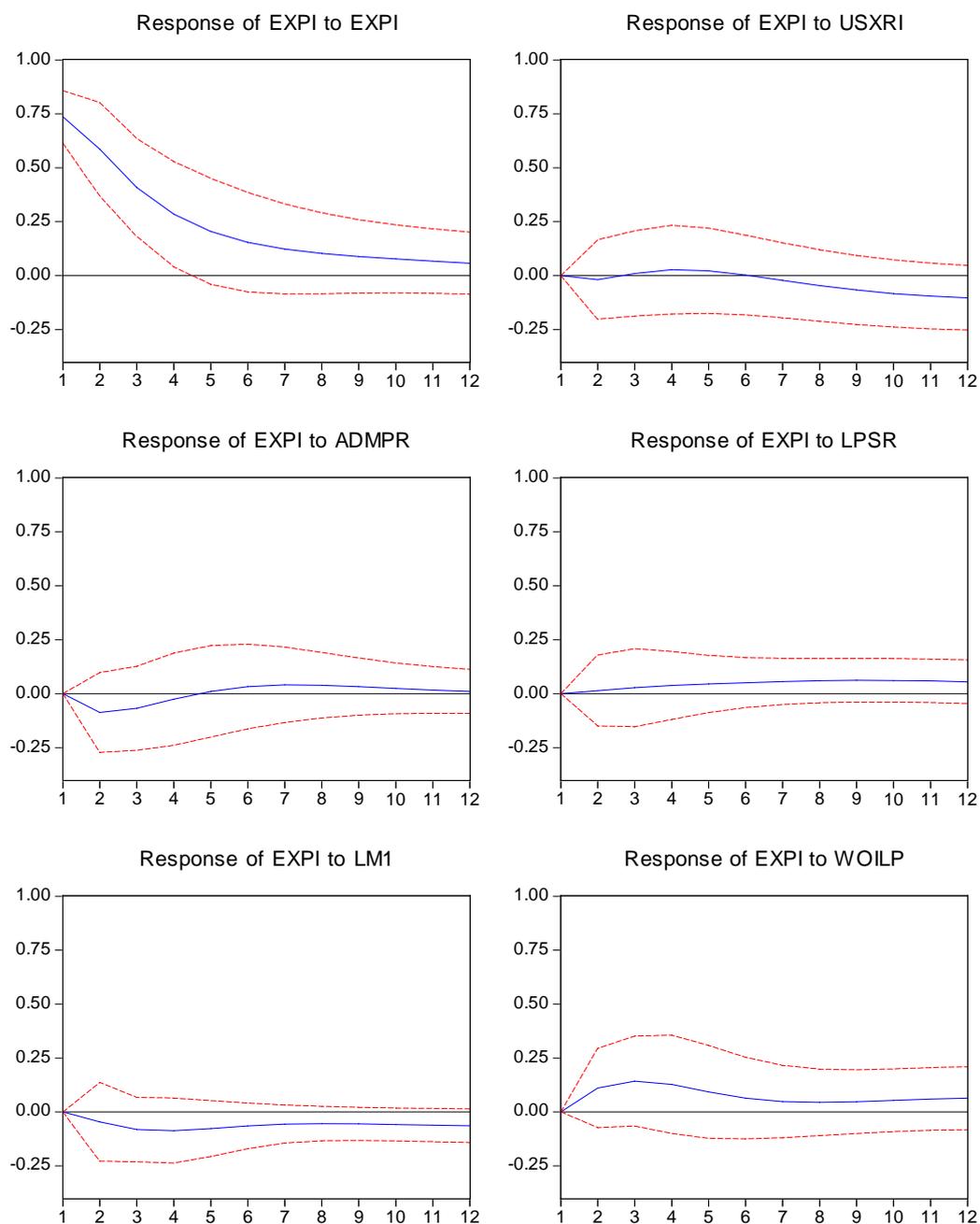
5.5 Economic shocks and changes of expectations

In this section, we investigate the responses of public inflation expectations to different shocks in the economy. Based on the above estimations, we focus our analysis on administered prices, deposit interest rates, and nominal exchange rates. In addition, we also include the effects of oil shocks to show the effect of global oil price hikes on expected domestic inflation. We also include the money supply to see whether it influences public expectations once the Bank changes its policy on money.

Figure 5.2 shows the effects of individual, one-time surprise increases in administered prices, deposit interest rates, nominal exchange rates and money supply M1 on survey-based expected inflation. In this figure, the solid line indicates the point estimate. In response to itself, the expected inflation became stable after a 12-month period. The shocks of ADMPR led to a one-month decrease of EXPI but then it increases for 4 months to a maximum before it stabilized at zero after a total of 12 months. What this tells us is that the effect of administered prices policy imposed by the government decreased the inflation expectations formed by households in the first quarter, but then it increased in response to the changes of certain commodities prices, before it became stable after a one-year period.

Meanwhile, the shocks in LPSR and USXRI had significant and permanent effects on EXPI. Since the expectations formed over the next 6 months, this explains the immediate impact of exchange rates on public expectations of inflation in Indonesia. On the other hand, a sudden increase in LPSR meant the imposition of tight monetary policy, which affected investments, and had a negative effect on market prices. As expected, people think an increase in the interest rates will result in the prices permanently increasing in a longer term period.

Figure 5.2 The responses of inflation expectations to various shocks.



On the other hand, EXPI's response to LM1's shocks was not significant. This could be explained by the fact that since Bank Indonesia adopted an inflation targeting framework as the ultimate objective of its monetary policy, the instrument of money supply has not been as important as interest rates and exchange rates. People see this as a sign that an increase in money supply is aimed at accommodating the pressures

on interest rates and exchange rates rather than achieving the target of money supply itself.

We also look at the response of public expectations to global oil price shocks (WOILP). As could be predicted, oil price hikes caused an immediate impact on expectations. People anticipated that the global oil price shocks would put the government under pressures, and they believed that the government would eventually increase the domestic oil prices by lifting certain percentages of current subsidies. As a result, the effect became permanent and increased along the longer periods of time as the oil prices affected other important commodities, such as electricity and transportation.

Table 5.7 Variance decomposition of inflation expectations

Period	S.E.	EXPI	ADMPR	LPSR	USXRI	LM1	WOILP
1	0.726	100.000	0.000	0.000	0.000	0.000	0.000
2	0.919	98.335	0.402	0.029	0.327	0.017	0.887
3	0.979	97.300	0.365	0.191	0.445	0.024	1.672
4	1.001	95.997	0.574	0.675	0.436	0.028	2.286
5	1.018	94.057	1.139	1.567	0.426	0.027	2.780
6	1.036	91.674	1.690	2.815	0.476	0.034	3.308
7	1.057	88.928	2.007	4.270	0.756	0.053	3.984
8	1.081	85.800	2.108	5.747	1.385	0.084	4.874
9	1.108	82.398	2.087	7.094	2.328	0.125	5.966
10	1.137	78.941	2.018	8.224	3.457	0.172	7.186
11	1.165	75.646	1.939	9.112	4.642	0.219	8.440
12	1.191	72.661	1.865	9.774	5.786	0.261	9.650

Note: Cholesky ordering (EXPI ADMPR LPSR USXRI LM1 WOILP).

How important are different shocks in accounting for the variability of inflation expectations? Table 5.7 presents the variance decomposition of the inflation expectations for a 12 month period. Since the survey data of inflation expectations used in this study are those conducted for the 6-month ahead period, we look at the variance of the sixth period forecast error, which corresponds to the next 6 months. As clearly shown, shocks to ADMPR, LPSR, USXRI, and even EXPI itself together accounted for approximately 96 per cent of the variability of inflation expectations. Interestingly, the contribution of each variable is different. Both LPSR and USXRI had increasing contributions, while in the fourth quarter, ADMPR showed a

decreasing contribution to the variability of inflation expectations. Accordingly, if we focus on the 12-month period forecast error, we clearly see that LPSR and USXRI contributed 9.77 per cent and 5.78 percent to the variability, respectively. In the meantime, the overall contribution of ADMPR, LPSR, USXRI and EXPI to the variability for the 12-month period decreased to approximately 90%.

Furthermore, if we look at the WOILP, it had an increasing trend in its contribution to the variability of inflation expectations. Overall, WOILP had the second highest contribution to the variability after LPSR. This means that the effect of global oil price hikes on the movements of inflation expectations is significant and will become stronger as the time passes. This phenomenon explains the government policy on energy, where the prices of gasoline and gas are continuously administered. When the prices of those commodities increase, they significantly impact other important commodities. Accordingly, in anticipation of future government policy on domestic energy prices, the public refer to the global oil prices and reflect this in their formation of future inflation expectations.

5.6 Anchoring inflation expectations

Having had the above estimations on the sources of movements of inflation expectations in Indonesia, we can argue that there are several monetary instruments that influence the inflation expectations which Bank Indonesia can use to anchor expectations. First, the Bank can utilize interest rates as the main variable to anchor the public expectations as it has a significant influence on their formation. This could be conducted through strengthening its policy on interest rates even further. The effect of deposit interest rates on future inflation expectations provides evidence that the Bank has taken the appropriate step to conduct its monetary policy through managing market interest rates, as it is more responsive to the changes of the policy rates.

Also important is the policy on exchange rates as exchange rate stability is needed to achieve domestic price stability. The movement of rupiah exchange rates, particularly against the US dollar, has been significant in influencing the movement of the public expectations. This in turn could be utilised by the Bank to persuade the public to follow the Bank's objectives. While the exchange rate regime in Indonesia is a

managed floating one, the Bank can still continue playing a significant role in the exchange rate market in order to reduce the volatility of the rupiah in the short term. The best way to conduct this market intervention is by allowing the rupiah to flow around the target band set up by the Bank. This policy will provide a signal to the domestic market that while the Bank has adopted the free floating exchange rate regime, it is ready to protect the interest of the public should the exchange rates vary wildly.

In addition to the above endogenous variables in which the Bank could have an important role to play with, the Bank should also look at the movement of the global oil prices. Although domestic energy prices are regulated by the government, the global oil market shocks will put pressures on the government to make necessary adjustments. Government action in this matter is needed to avoid increasing pressure on its annual budget, since most of the domestic energy prices are still subsidised by the budget. Therefore, it is important for the Bank to have strategic policy on future oil prices and reflect this in their policy towards domestic interest rates.

5.7 Conclusion

Using VAR, we estimated the movements of inflation expectations in Indonesia, and found that there are several variables which significantly influence the expectations. By estimating the response of the expectations to different shocks, we found that deposit interest rates, exchange rates and global oil prices have significant influence on the expectations. The administered prices, the prices of certain commodities regulated by the government, also influence expectations, but their role decreases as time passes. This phenomenon provides evidence that monetary policy could influence the expectations in the short and medium terms, while government policy has lesser effects on the long term.

Exogenous shocks to inflation expectations remain a significant source of movements in the expectations. They have long lasting effects and still account for more than 10 per cent of the variability of inflation expectations after a period of one year. This result suggests that the Bank should increase its effort in monitoring this external

variable to avoid an increase in the public expectations which would eventually end up generating a persistent increase in actual inflation.

Finally, the Bank can utilize these findings for anchoring the inflation expectations. One approach is to improve the mechanism of policy interest rates decision-making, taking into account the above influential variables.

CHAPTER 6
INFLATION EXPECTATIONS AND MONETARY POLICY RULES
IN INDONESIA¹⁵

6.1 Introduction

It has been widely accepted in the literature that interest rates are the main instrument of inflation targeting central banks. They set up this transmission mechanism for their monetary policy in such a way that public are well informed as to where the central bank is heading with regard to future inflation targets, and interest rates are the most readily observable variable in the market.

Central banks also use this monetary instrument as a way to gain feedback from the public. A well accepted response by the public is a good indication to the bank that it should continue its current policy. On the other hand, when public sentiment changes, it may be time for the bank to find an alternative approach that reflects the change in public reaction.

As identified in previous chapters, a central bank that adopts inflation targeting is more concerned with measures to contain domestic inflationary pressures, rather than reacting to short-term deviations in inflation (Seyfried and Bremmer, 2003). This means that the bank should pay more attention to isolating shocks that might impact negatively on the achievement of its long-run inflation targets. That is also why many central banks around the world do not react excessively to short-term fluctuations in the market, as they tend to focus on longer-term outcomes (Bernanke and Mishkin, 1997). However, banks do use short-term interest rates as a way to influence long-term price levels in order to achieve their predetermined targets.

In the meantime, inflation expectations play a very important role in the monetary policy-making process and provide central banks with critical information regarding the public's expectations of future price movements. Accordingly, understanding the relationship between inflation expectations and interest rate policy is very important,

¹⁵ An earlier version of this chapter has been accepted and published at *IUJ Journal of Monetary Economics*. Vol. VIII No. 1&2 (Feb & May 2010)

especially as both variables are directly related to the achievement of the ultimate objective of monetary policy, a low and stable inflation rate in the long run.

It is important for Bank Indonesia as one of the central banks adopting inflation targeting to be forward looking in its conduct of monetary policy. Being forward looking means, in part, that the Bank should always consider the attitudes revealed by the public about future rates of inflation (Rossouw and Joubert, 2005), and inflation expectations data reflect the public's perception of future price movements. This means that the Bank should take into consideration the public's inflation expectations as one key variable in the process of interest rate determination.

This chapter will analyse the conduct of monetary policy in Indonesia, particularly regarding Bank Indonesia's ability to fulfil its task of achieving its monetary objectives. There are three specific issues raised here: (i) how well can inflation expectations fit into a monetary policy rule to describe the movements of Bank Indonesia's policy interest rates; (ii) what is the best measure of inflation that Bank Indonesia should consider for its ultimate monetary policy objectives; (iii) whether Bank Indonesia can perform better under a rule-based monetary policy approach than the current discretionary approach.

This chapter is divided into six sections. Section 6.2 reviews the operational instruments of monetary policy that have been used by Bank Indonesia in its conduct of monetary policy, and their relationship to overall interest rate and inflation outcomes. Section 6.3 discusses the econometric formulation of a simple rule of monetary policy. Section 6.4 uses a Taylor-rule model to analyse the process of interest rate setting in Indonesia analyses and interprets the results. Section 6.5 analyses policy implications and section 6.6 draws the main conclusions.

This chapter is divided into six sections. Section 6.2 reviews the current interest rate policy maintained by Bank Indonesia. Section 6.3 discusses the econometric formulation of a simple rule of monetary policy. Section 6.4 analyses and interprets the results. Section 6.5 analyses policy implications, and section 6.6 draws the main conclusions.

6.2 Bank Indonesia's interest rate policy

Bank Indonesia as one of the inflation targeting central banks does not follow many other central banks in the way it conducts monetary policy. Although the Bank uses interest rates as its policy instrument, the framework that is currently implemented in Indonesia does not really follow strict inflation targeting principles (Widyasanti, 2004, Goeltom, 2007). Instead, Bank Indonesia implements a softer regime, which means the Bank can make adjustment to fit the current economic policy imposed by the government.

The Bank's policy on interest rates has changed dramatically over recent years, as a result of the new Central Bank Act of 1999, later amended in 2004. The law gives a strong mandate to the Bank to pursue inflation targeting and to use interest rates as its policy instrument to achieve the targets. Accordingly, the Bank no longer focuses its policy on other monetary instruments, such as money supply. However, ever since the Bank adopted inflation targeting domestic interest rates have been volatile, ranging from 6 per cent to 13 per cent, with short-term interest rates particularly so. Market players understand that volatile interest rates can lead to tight monetary policy in the future learned on the fact that there was interference made on many occasions in the past. Therefore, the volatility of short-term interest rates may lead to a negative in the market, in the form of an upward trend in adjustment to prices. This volatility can also fuel short-term speculation and create confusion in the market.

Indrawati (2002) argued that the high volatility of Indonesian interest rates was caused by at least two central issues. First, there were coordination problems between the government and Bank Indonesia in the past, particularly in the sense of fiscal deficit management (fiscal game) that led to forced borrowings and rapid expansion in money supply. The enactment of the new central bank legislation gave it some autonomous power and independent status; however, there has still been interference on many occasions. On the other hand, the Bank's independent status is also claimed to have raised other problems, including policy scandals and mismanagement resulting in a loss of public confidence in the credibility of the Bank. Second, Bank Indonesia has remained the central target of political pressures, and in the early years

politicians were keen to propose amendments to the new Bank Indonesia Act to accommodate their short-term political interests. Indrawati (2002) also claimed that the tight monetary policy imposed by Bank Indonesia in the past had not been fully effective.

As required by the law, Bank Indonesia currently pursues its future monetary policy through interest rates. The Bank's board of governors meets regularly to evaluate recent economic developments and to make decisions on whether it should increase, decrease, or leave unchanged the current policy interest rate for the next one period. The result of the board meetings is announced to the public through press releases and monetary policy reviews (MPR) which are published both in English and Indonesian.

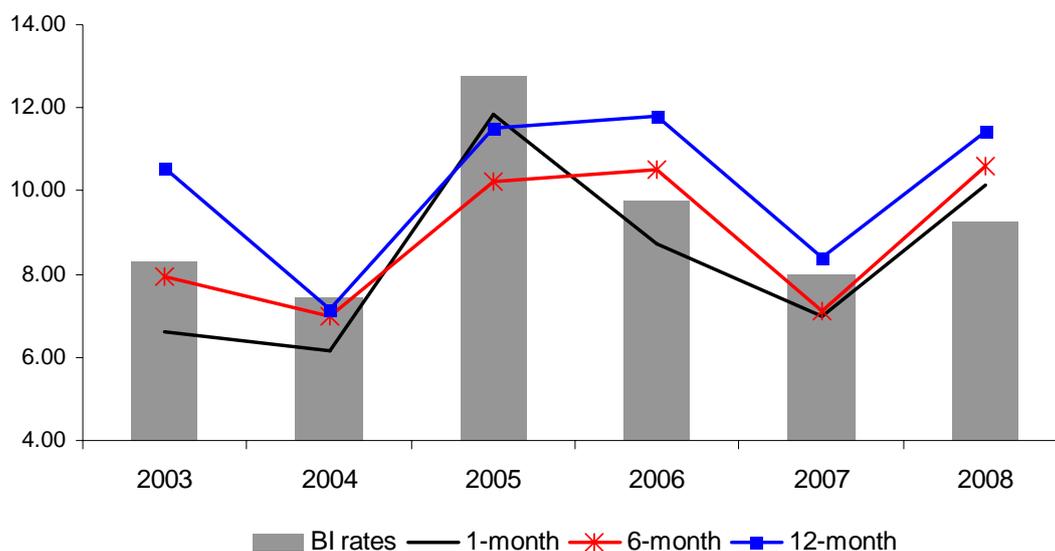
The MPR covers a wide range of information about recent monetary policy issues, both domestic and international. Although the MPR explains the policy that Bank Indonesia adopts in dealing with those monetary policy matters, it does not clearly discuss how policy decision-making is done by the Bank's board. The mechanism for policy determination in the board's meetings is not announced and the decisions made are based on a discretionary basis (Goeltom, 2007). The problem with discretionary policy is that it often poses a potential problem known as time inconsistency. This problem arises when a monetary policy authority changes its policy by giving priority to short-term inflationary conditions over long-run objectives (Goeltom, 2007). Therefore, in many circumstances monetary policy would be more effective if it is based on a rule-based approach (Kydland and Prescott, 1977, Barro and Gordon, 1986).

6.2.1 Operational instruments of monetary policy

In this section we will analyse the operational instruments of monetary policy that have been used by Bank Indonesia in its conduct of monetary policy, and their relationship to overall interest rate and inflation outcomes. Although the bank currently uses interest rates as its monetary instrument, different types of interest rates have been adopted over time. The latest interest rate instrument adopted by the Bank is claimed to reflect the latest developments in the global economy, particularly in the financial markets (Bank Indonesia, 2008).

We start our analysis by observing the movements in short-term deposit interest rates compared with the Bank policy interest rate. Figure 6.1 shows that the BI rate was reduced sharply between 2005 and 2007, before being increased significantly in 2008, in advance of the global economic slowdown. Domestic deposit interest rates have fluctuated around the policy rate.¹⁶ Bank Indonesia (2006) found that deposit interest rates had actually been more responsive to the movement of the policy rate than several other rates, such as credit interest rates. However Figure 6.1 also demonstrates that during the period of 2006, only the one-month deposit interest rate closely followed the BI rate movement. The other two rates, namely the 6-month rate and 12-month rate, moved in the opposite direction before they decreased to about the level of the BI rate in the following year. This suggests that short-term interest rates will immediately follow the changes in the Bank's policy rate while the longer-term interest rates will fluctuate in the short run before they level off.

Figure 6.1 BI rates and interest rates on time deposit in rupiah



Source: Bank Indonesia.

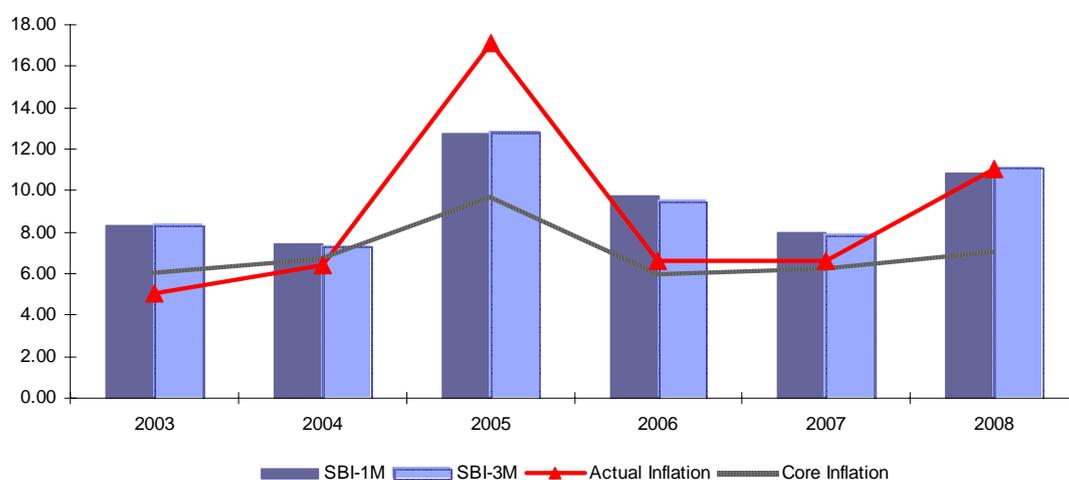
From 1999 to 2008 Bank Indonesia used the Bank's one-month certificate rate (SBI) as its monetary policy instrument to achieve its low inflation objective. Initially, the

¹⁶ BI rate refers to Bank Indonesia policy rate (also referred to as BIPR in some places): for details see the discussion below.

Bank used SBI as an instrument for its open market operation and as a medium to manage the excess liquidity of domestic commercial banks. Later, the Bank used this instrument as part of its inflation targeting in which the Bank determined that the changes of SBI were the sign of its future policy direction on inflation. It is also apparent from this figure that there is a high level of volatility in the BI rate.

Next, we observe the movements of SBI as the bank's policy instrument. From Figure 6.2, we find some interesting information regarding the practice of inflation targeting in Indonesia. Although Bank Indonesia targets actual inflation as its ultimate objective of monetary policy (Goeltom, 2007), the figure demonstrates that there has been a lot of variability in the movement of actual inflation, and SBI could not contain that variability well. During the examined period, SBI and core inflation was aligned closely with each other. Because of the oil price hike in 2005 which caused the actual inflation to increase dramatically, core inflation was relatively more steady than actual inflation.

Figure 6.2 SBI interest rates and inflation



Source: Bank Indonesia

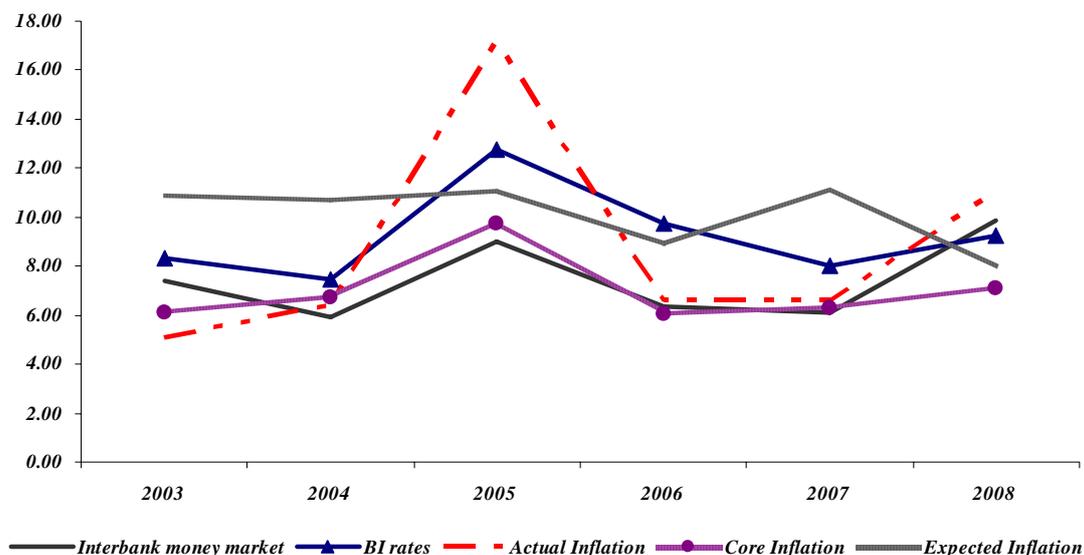
Goeltom (2007) claimed that core inflation has been used by the Bank as its operational target based on the premise of its suitability as an indicator in formulating monetary policy. Figure 6.2 appears to be consistent with the view that Bank Indonesia has used core inflation for the purpose of determining monetary policy, as controlling this measure of inflation is more achievable. This issue is investigated

further later in this chapter. However, this practice of using core inflation has not been specifically stated in the Central Bank Act of 2004. Instead, the Act indicates that the Bank should target inflation that reflects the actual Indonesian macroeconomic conditions.

In June 2008, Bank Indonesia started to use the interbank money market as its operational instrument for monetary policy to replace SBI (Bank Indonesia, 2008). The Bank argues that the decision to use this interbank rate is due to the recent global economic slowdown, which produced excess liquidity in most domestic banks. This excess liquidity is mostly invested in the Bank's financial instruments, rather than being invested in more productive business sectors. Consequently, it causes the domestic interbank rate to move with relatively high volatility, so that the Bank sought to reduce this volatility and create a more stable financial market by changing its interest rate focus from SBI to this shorter-term interest rate.

In addition, Bank Indonesia also claims that, during the period of the global turbulence, the effects of changes in the interest rate structure in the domestic financial market were enormous and left many commercial banks subject to vulnerability and liquidity risks. Therefore, the bank implemented a series of decisions to counter this liquidity issue and to improve its monetary policy operation, which resulted in using the domestic interbank rate as the Bank's monetary policy operational target. Bank Indonesia believes that if this effect had continued, it would have distorted the bank's monetary policy transmission mechanism process to achieve its ultimate objective (Bank Indonesia, 2008).

Figure 6.3 BI rates, interbank money market and inflation



Source: Bank Indonesia.

To understand the changes in the operational instrument made by the Bank, we look at the relationship between the interbank interest rates and inflation. Figure 6.3 above shows the recent development of interbank money market rates in Indonesia. As expected, the interbank rates have been moving broadly in line with the BI rate over the last six years, except in 2008. However, we find some interesting facts presented in the figure. While, the actual inflation has been volatile, the interbank money market and core inflation have been more stable and have moved closely together during all the examined period, except in 2008. One explanation for the deviation of the interbank money market from core inflation in 2008 might have been due to the period of global economic crisis, as the result of the sub-prime mortgage issues in the US, where several financial institutions collapsed and the domestic banks responded to the crisis by raising their interest rates.

We also observe reasonable similarity in movements of both the BI rate and expected inflation with the interbank money market and core inflation, except for the deviation of expected inflation from the others during the period of 2007. The figure demonstrates that monetary policy using the BI rates has been able to contain the movement of core inflation, including during the period of 2008, while it has not been able to control the variability of the actual inflation. The other interesting information

provided by Figure 6.3 is the fact that public inflation expectations increased in 2007, while the other variables were going down. This reverse phenomenon also occurred in 2008. It may be that the public responded to the recent global financial crisis by raising their expectations. But when the impact of the crisis on domestic economy was found to be limited, the public reversed their expectations. This observation suggests that the Bank's past monetary policy did not have significant impact on public expectations formation, particularly during the period of economic uncertainty.

Although the overnight interbank interest rate is the current monetary instrument used by Bank Indonesia, we will not use this interest rate for analysis in this study. Firstly, the Bank just started using interbank rates in June 2008 while the examined period of this study spanned from 2002 to 2008. Secondly, monetary policy is a long-term decision-making process which impact on long-term macroeconomic development. Accordingly, for the rest of the analysis, the Bank Indonesia policy rate (BIPR) or the BI rate is referred to as the one-month Bank Indonesia certificate (SBI).

6.2.2 Implication of the current conduct of monetary policy

Having discussed the above issues, there are at least three implications of the current conduct of monetary policy that we believe have impacted on inflation targeting in Indonesia. Firstly, there is a problem of the lack of credibility of Bank Indonesia. This can be seen from the persistent level of variability in the movements of actual inflation which has not been contained well by the Bank and consequently, the Bank has not been able to fulfil its objective of meeting the predetermined inflation targets. This problem has hindered the Bank's efforts to prove itself as a highly reputable institution. There is also an issue on how inflation targets are determined. The general public will find it difficult to understand inflation measures if they do not reflect sufficiently the spending pattern of average household (Rossouw and Joubert, 2005). As a result, unrealistic numerical inflation targets set by the government will affect the overall credibility of the inflation targeting regime (Paulin, 2006). If inflation targets are set too high, the authorities will not be viewed as serious about achieving a low inflation environment. On the other hand, if they are set too low, the targets may be seen as unrealistic and have a reduced impact on public expectations.

Secondly, the Act requires the Bank should target an inflation measure that reflects the actual condition of the country's macroeconomy. Although the Act does not explicitly state that the inflation target has to be actual inflation, Goeltom (2007) mentioned that the bank should assume actual inflation as its ultimate objective of monetary policy in the long run since it reflects the real condition of the movement of prices of goods and services. It has been suggested that the bank has used core inflation as its target while it claims that the ultimate target of its monetary policy is the actual (headline) inflation, and this claim is examined in the next section. This practice has created a dilemma for the bank, as actual inflation is the most widely known inflation series for the public, since it measures the cost of living for consumers. Goeltom (2007) argued that actual inflation in Indonesia has been associated with supply shocks and numerous price movements that are unrelated to monetary policy.

Thirdly, there is an issue of transparency associated with the current conduct of monetary policy by Bank Indonesia. The Bank does not announce to the public its decision-making process in the determination of future interest rates. This is related to the fact that the Bank currently conducts its monetary policy based on a discretionary basis. Although a discretionary monetary policy has been implemented by several other central banks (for example, the US Federal Reserve), this approach requires a high degree of confidence from the public. With its credibility problem, it may be difficult for Bank Indonesia to conduct monetary policy effectively if its policy decision-making is based on this discretionary approach. Therefore, we believe that it would be favourable for Bank Indonesia to consider a rule-based approach. In this regard, the Bank would conduct its policy using a standard principle that is already known to and followed by the public. This approach would help the Bank to improve the transparency of its processes and to encourage more accommodative public responses in terms of future expectations.

Although the Bank has, to some extent, performed relatively well with regard to macroeconomic stability, its core mandate to achieve low and stable inflation has not been fulfilled. Part of the failure to accomplish that task comes from the fact that Bank Indonesia seems to set out to control core inflation while it publicly announces that it targets low actual inflation. As a result, this creates confusion in the market

about which inflation series the Bank actually pursues. Therefore, we believe that the Bank should clearly state in its reports what measure of inflation it currently pursues and that statement should also be formally included in the Central Bank Act.

Furthermore, in the analysis below we find that since its adoption of inflation targeting, the Bank's monetary policy can be closely approximated by a rule-based approach. From our observation above, the Bank does not explicitly mention whether it follows a Taylor rule approach in designing its monetary policy, but the evidence shows that the Bank has actually determined its policy interest rates as suggested by a Taylor rule. Based on this evidence, we argue that it would be useful for the Bank to explicitly announce that its monetary policy decision-making process relies substantially on a rule-based approach, if this is indeed the case.

In the following section, we will analyse the possibility for the Bank to explicitly announce a different inflation measure as its long-term inflation objective. Based on our previous observation, we believe it will be more favourable if the Bank can complement that policy announcement with a more transparent policy making process through the implementation of a monetary policy rule. In the next section, we will provide evidence on the benefits of using a rule-based policy approach.

6.3 Simple rules for monetary policy

This study utilizes the Taylor rule for monetary policy. As previously described, the Taylor rule is a simple monetary policy rule designed by John Taylor (1993) and it has been widely used in empirical monetary modelling. According to Marzo (2003), the advantage of using the Taylor rule is that it sets nominal interest rates as a reaction to changes in inflation and output. As in Seyfried and Bremmer (2003) and Marzo (2003), a Taylor rule function is written as:

$$T^* = T'(i, \pi, y) \tag{6.1}$$

where T^* is a measure of the short-term nominal interest rate to be determined by the central bank according to the Taylor rule, i is the desired policy interest rate which is

defined as the long run real interest rate, π is the current inflation rate, and y is the current output gap.

In an extended mathematical form, one common specification of a Taylor rule model can be expressed as:

$$T_t^* = i^* + \pi_t + \phi_1(\pi_t - \pi_t^*) + \phi_2 y_t \quad (6.2)$$

where i^* is the long-term real interest rate and π^* is the inflation target. Taylor (1993) assumed that both the long-term interest rate and inflation target were both equal to 2 per cent, while the weights of y and π were both set equal to 0.5.¹⁷ However, as this study is conducted for an emerging economy, the above assumption will be adjusted to meet domestic economic considerations.

In this study, instead of using output gap data, we attempt to estimate the above Taylor rule model using public expectations data, which expressed in the following simple modified Taylor rule:

$$T_t^* = i^* + \pi_t + \phi_1(\pi_t - \pi_t^*) + \phi_2 \pi_t^e \quad (6.3)$$

There are several reasons why using public expectations data in our modification of the original Taylor rule can be justified and might offer a better result.¹⁸

Firstly, according to Bolt and Els (2000), output gaps may be an important determinant of expected inflation. The short-run trade-off between output and inflation could be constant over time and the change in inflation relative to expected inflation would be simply proportional to the deviation of output from potential output (Dupasquier and Ricketts, 1998). According to Clause (2000), the change in inflation depends on its inertia and the past realisations of the output gap, and the change of the output gap also depends on its past realizations and the past realisations of inflation.

¹⁷ Taylor (1993) made this assumption for the US economy as described in his paper.

¹⁸ Although this is the case, we will also compute the original Taylor rule using the output gap for comparative purposes. A brief discussion on this issue will be presented in the next section.

In other words, inflation expectations can be used to explain potential output and output gaps since it could help explain the dynamics of inflation (Clark et al., 1996). Therefore, we attempt to use the inflation expectations data to replace the output gaps without losing necessary information required by the original Taylor rule model.

Secondly, our justification for using public expectations data is based on a belief that employing more frequent time series data in the model will provide more information to central banks, particularly for use in the short term. With the information technology revolution and globalisation, more people are now spending time searching and using data and information than ever before. According to the OECD (2008), as the result of new information technology, new producers of statistical information have gradually entered in the market, producing radical changes in the technique used for gathering and disseminating information. Accordingly, more businesses have begun using data produced in real time, instead of official statistical data.

The need for more frequent data particularly occurs in financial markets. Financial instruments are constantly moving, as customers revise their expectations of future economic performance based on forecasts and actual economic reports. As a result, the more frequent the economic data, the more readily the market can incorporate new information into their expectations (Kettel, 2002). Consequently, central banks need to consider using more frequent data to respond to these economic changes. In addition, a monetary policy rule using output gap measured using quarterly data cannot incorporate unexpected economic shocks that occur during the examining periods. On the other hand, public expectations data calculated on monthly basis can better take into account various short-term changes in the economy.

Thirdly, as suggested by Seyfried and Bremmer (2003), in determining its interest rate policy the central bank needs to look at the adjustment mechanism which reflects the noises it creates in the markets due to changes in its current policy. This means that a central bank adopting a policy rule model using more frequent data can also measure feedbacks from its current policy on more frequently basis. It can accommodate changes in the market much faster to avoid any possible macroeconomic instability in near future.

Previous studies suggest that monetary authorities need to make changes as smooth as possible in order to avoid excessive disturbances in the markets (Seyfried and Bremmer, 2003). It is also in the public interest to have a forward looking policy since the private sector bases its decisions on expectations of the future (Rossouw and Joubert, 2005). Thus, a monetary policy will be more effective if it can persist over time. So, it is in the Bank's interest to engage in small but persistent changes in the interest rates, known as interest rate smoothing. By smoothing interest rates, the size of the changes in interest rates required to reduce fluctuations in the economy can be smaller than would otherwise be necessary (Amato and Laubach, 1999).

We start our econometric tests for the above modified Taylor rule model by looking at the adjustment mechanism of monetary policy conducted by central banks. This mechanism is important in order to assure the markets that the bank's policy will not create more macroeconomic instability. We write the adjustment mechanism of the central bank as:

$$\Delta M_t = \gamma(M_t^* - M_{t-1}) + \delta \Delta M_{t-1} \quad (6.4)$$

where ΔM represents the change of the current policy interest rate series of the central bank, M^* is the targets of monetary policy interest rates, γ describes the speed of adjustment of monetary policy, and δ measures the degree of persistence of monetary policy.

According to Seyfried and Bremmer (2003), the speed of adjustment explains how quickly the central bank reacts to changes in future price targets, estimated by the coefficient on the lagged interest rate. It also explains how long a policy will last before a new direction is proposed by the bank. On the other hand, persistence measures the way the central bank reacts to the changes, whether it will continue to adjust its interest rates until a desired level is achieved or whether the bank will hold the adjustment until further circumstances emerge. This persistence is estimated by the coefficient on the lagged change in interest rates. Hence, to have a more complete equation, we replace the modified Taylor rule rates as in equation (6.3) as follows:

$$M_t^* = i^* + \pi_t + \phi_1(\pi_t - \pi_t^*) + \phi_2\pi_t^e \quad (6.5)$$

Then, we substitute equation (6.5) into equation (6.4) which results in:

$$\Delta M_t = \gamma((1 + \phi_1)\pi_t + (i^* - \phi_1\pi_t^*) + \phi_2\pi_t^e - M_{t-1}) + \delta\Delta M_{t-1} + \eta_t \quad (6.6)$$

$$\Delta M_t = \gamma(1 + \phi_1)\pi_t + \gamma(i^* - \phi_1\pi_t^*) + \gamma\phi_2\pi_t^e - \gamma M_{t-1} + \delta\Delta M_{t-1} + \eta_t \quad (6.7)$$

$$\Delta M_t = \delta\Delta M_{t-1} - \gamma M_{t-1} + \gamma(1 + \phi_1)\pi_t + \gamma(i^* - \phi_1\pi_t^*) + \gamma\phi_2\pi_t^e + \eta_t \quad (6.8)$$

The above equation reflects the determination of short-term interest rates by the central bank based on the bank's past interest rates, but leaves the current inflation and public expectations unchanged. Since the bank is unlikely to have data on the latest price levels and the public expectations immediately, then we have to use the lags of each variable. A dynamic model is also more useful in explaining the movements of the variables along the examined period. Furthermore, as in Seyfried and Bremmer (2003), we treat the coefficients of actual inflation and public inflation expectations differently to reflect various weight changes of the two variables (ϕ_1 and ϕ_2). Accordingly, the monetary policy model now becomes:

$$\Delta M_t = \delta\Delta M_{t-1} - \gamma_1 M_{t-1} + \gamma_2(1 + \phi_1)\pi_{t-1} + \gamma_3(i^* - \phi_1\pi_t^*) + \gamma_4\phi_2\pi_{t-1}^e + \eta_t \quad (6.9)$$

Although the construction of our modified Taylor rule model follows closely that of Seyfried and Bremmer (2003), there are two differences between the two models. Firstly, Seyfried and Bremmer (2003) utilised quarterly time series data in the model which were the output gaps and inflation rates as originally proposed by Taylor (1993). However, this study employs monthly time series data in accordance with the practice of Statistics Indonesia and Bank Indonesia that publish economic data on monthly and yearly bases. Consequently, by using monthly data, the original Taylor rule has to be remodified to accommodate more frequent time series data as well as the missing output gaps. In doing this, we rely our judgment on the belief that more

frequent data can explain the current market interest rate dynamics better than less frequent ones. We also believe that more frequent data can capture and explain unexpected shocks more quickly. Secondly, our model attempts to use public inflation expectations to estimate the Taylor rule. This modified model can be useful for central banks adopting inflation targeting with a rule-based policy approach in incorporating expectations survey data in monetary policy decision-making.

Although adopting a rule-based approach may provide a more optimal monetary policy decision-making process, we recognise that monetary phenomena are not only influenced by changes in monetary instruments, but can also be influenced by many other factors, such as foreign markets, the current global economic situation, domestic political circumstances as well as changes in other real sectors. Accordingly, we share the view with some previous studies that a monetary policy rule should be not be used as a rigid formula for the policy implementation (Lucas, 1973, Taylor, 1993, Seyfried and Bremmer, 2003).

In the next section we will test whether an expectations augmented Taylor rule as described by equation 6.9 provides an effective description of the actual practice of monetary policy in Indonesia. Having done that, we also check the robustness of our model above. To do that, we will perform a test that can explain if the effect of changes in one variable on another will affect the overall model and changes the behaviour of the dependent variable. In this regard, we will use impulse response function. The impulse response function basically measures the response of a random variable (y_t) to one-time impulse (shock) in another variable while all other variables from the current and earlier periods held constant.

The procedure of the tests performed in this chapter follows closely Hamilton (1994) and Verbeek (2004), where a vector autoregression (VAR) model is written in vector moving average (MA) form of order q as:

$$y_t = \mu + \varepsilon_t + \alpha_1 \varepsilon_{t-1} + \alpha_2 \varepsilon_{t-2} + \alpha_3 \varepsilon_{t-3} + \dots + \alpha_q \varepsilon_{t-q} \quad (6.10)$$

where μ denotes a vector of constants, α_s is a matrix of autoregressive coefficients for $s = 1, 2, 3, \dots, q$. ε_t is a white noise process (shock). Therefore, the matrix of α_s has the representation:

$$\alpha_s = \frac{\partial y_{t+s}}{\partial \varepsilon_t'} \quad (6.11)$$

which describes that the row i , column j element of α_s identifies the consequences of a one-unit increase in the shock of j th variable at time t ($\varepsilon_{j,t}$) for the value of the i th variable at time $t + s$ ($y_{i,t+s}$), holding all other shocks at all times constant. Supposedly, we assume that the first element of ε_t changed by δ_1 at the same time the second element changed by δ_2, \dots , and the n th element by δ_n , then we can also estimate the combined effect of these changes on the value of the vector y_{t+s} as:

$$\Delta y_{t+s} = \frac{\partial y_{t+s}}{\partial \varepsilon_{1t}} \delta_1 + \frac{\partial y_{t+s}}{\partial \varepsilon_{2t}} \delta_2 + \dots + \frac{\partial y_{t+s}}{\partial \varepsilon_{nt}} \delta_n = \alpha_s \delta \quad (6.12)$$

where $\delta = (\delta_1, \delta_2, \dots, \delta_n)'$.¹⁹

In this set up, the real variables considered in the above dynamic relationship will include Bank Indonesia policy interest rates, public inflation expectations, actual (headline) inflation, core inflation, rupiah exchange rates and world oil prices.

6.4. Empirical analyses

In this section, we will present and analyse the results of our modified Taylor rule model estimations. Two main matters are at issue. The first is the role of both inflation expectations and Taylor rules in the actual practice of monetary policy in Indonesia to date. We test both by using various Taylor rules to calculate the implied levels of policy interest rates, and by estimating Taylor rule equations in terms of actual policy instrument variables for Indonesia over 2002-08. The second relates to

¹⁹ For detailed explanation about vector MA representation, refer to Hamilton (1994).

the characteristics of monetary policy in Indonesia, particularly in relation to persistence and response functions to various variables, which we explore on the basis of our findings about the role of Taylor rules. These analyses will help us to consider whether the survey data of public inflation expectations can play a useful role in a rule-based approach to monetary policy.

6.4.1 Modified Taylor-rule interest rates

The data used to compute the Taylor rule interest rates in this study are the central bank interest rate (BI policy rate), inflation (actual inflation and core inflation series), the survey data of public inflation expectations and the output gap as the percentage of GDP. Their descriptive statistics are presented in Table 6.1. The period examined for all the variables, including the output gaps are from 2000 to 2008. Except for the output gap which is estimated on quarterly basis, all variables presented in the table are calculated on monthly basis. Both inflation series are calculated as annual change of customer price index from the same month of the previous year. Table 6.1 shows that on average all variables except for the output gap range between 7 per cent to 11 per cent. The average BI rate and the actual inflation are very close to each other. However the variability of actual inflation is much higher which we can see in Table 6.2. Meanwhile, the average core inflation is 7.74 per cent which is lower than both the BI rate and the actual inflation, while the mean of the expected inflation is higher than both the actual and core inflation. The output gap shows a much more volatile movement than the other variables.

Table 6.1 Descriptive statistics of tested economic variables

	BI rate	Actual inflation	Core inflation	Expected inflation	Output gap
Mean	9.82	9.84	7.74	10.50	0.15
Median	9.00	9.83	6.85	10.64	0.64
Std. Dev.	2.34	3.59	2.06	1.29	7.21
Skewness	0.92	0.62	1.02	-0.44	-0.11
Kurtosis	2.85	2.44	3.14	3.01	1.85
Jarque-Bera	11.66	6.27	14.16	2.68	2.04
Probability	0.0029	0.0433	0.0008	0.2615	0.3608
Observations	81	81	81	81	36

Note: the output gap used in this table is quarterly data and estimated using the Hodrick-Prescott filter.

Using equation (6.3) with a 2% long-term real interest rate as suggested by Taylor (1993), we present the policy interest rates implied by various Taylor ruled (TR) in Table 6.2. Although the 2% real interest rate was initially suggested for the case of the US economy, it has been seen as a suitable rate for emerging financial markets in the long run, since it is not too high to be harmful for the economy and not too low to offset the inflation rates. If we assume that the nominal inflation rate is zero, then the market interest rate is 2%. The test was also done using the inflation targets set by the government and the inflation expectations data derived from the household survey conducted by Bank Indonesia.

An interesting preliminary finding from Table 6.2 is regarding the deviation of the actual inflation from its predetermined target. Actual inflation has been much more volatile than both the inflation target and core inflation. Except in 2004 and 2007, along the examined period, actual inflation has been either much higher or much lower than target inflation. The table also demonstrates a similar finding for core inflation where its movements have not been in line with the inflation targets, although it performed better than the actual inflation. This fact provides evidence about the lack of credibility of Bank Indonesia in fulfilling its task to control inflation.

Table 6.2 Policy interest rates using the Taylor rule model (in per cent)

	2002	2003	2004	2005	2006	2007	2008
Targeted inflation	9.00	9.00	5.50	6.00	8.00	6.00	5.00
Actual inflation	10.03	5.06	6.40	17.11	6.60	6.59	11.06
Core inflation	11.30	6.08	6.72	9.75	6.03	6.29	7.11
Expected inflation	12.42	10.88	10.67	11.03	8.85	11.12	7.95
TR rate (actual)	12.70	7.41	8.98	20.22	8.97	9.18	13.76
TR rate (core)	14.04	8.48	9.14	12.34	8.32	8.71	9.42
TR rate (output gap)	7.02	10.87	11.45	27.27	12.89	8.94	13.67
BI policy rate	12.93	8.31	7.43	12.75	9.75	8.00	9.25

Notes: TR rate is the Taylor rule interest rates based on estimations using a 2% long-term interest rate as suggested by Taylor (1993). TR rate (actual) is the TR rate calculated using the actual inflation data, TR rate (core) is the TR rate calculated using the core inflation data, and TR rate (output) is calculated using the output gap data (this variable uses quarterly data running from 2000Q1 to 2008Q4). BI policy rate is the central bank's rates announced by Bank Indonesia every month as part of its inflation targeting.

Another possible explanation for the deviation of actual inflation from its target is due to the determination of future inflation targets. The inflation targets set by the government might have not reflected the real economic condition, and they rather appear as if they had been picked arbitrarily. On the other hand, the Bank, by not achieving its predetermined targets, causes the market to appear to doubt the seriousness of the Bank in implementing the inflation targeting. This market response is made evident by the expected inflation figures which at all times are above the targets and above actual inflation, except in 2005 and 2008. Based on this finding, one question that remains is how Bank Indonesia as well as the government determine future inflation targets, particularly the mechanism for inflation policy decision-making, as it has not been made clear to public.

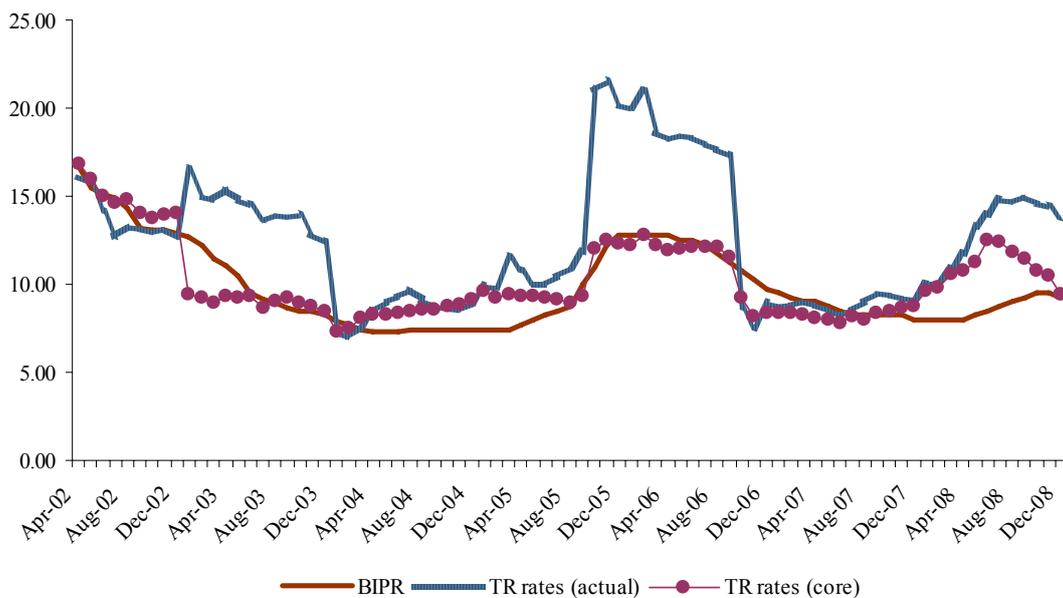
From Table 6.2, we can also observe two different estimated Taylor rule-based interest rate models using inflation expectations data. The first TR rate which is based on the actual inflation data showed a close relationship with the BI rates, except in 2005 and 2008. We observe that the TR rate (actual) will deviate from the BI rates when a crisis occurs. In the case of 2005, the government was facing significant global oil price hikes which jumped from around US\$30 per barrel to about US\$135 per barrel. At that time, the price of gasoline in Indonesia was heavily subsidized by the government. As a result, when the government increased the domestic oil price in order to catch up with the world oil price and to reduce pressures on the national budgets, the price of other commodities also went up very sharply resulting in a very high inflation rate.

The 2008 global economic recession which started from the subprime crisis in the US has impacted on most economies in the world including Indonesia. Although the magnitude of the global recession impact on Indonesian economy was not as strong as that occurred in other countries, the government released several policies including economic stimuli to back up decreasing domestic demands. In this regard, Indonesia applied a lesson learned from the 1997 financial crisis and insulated its domestic economy from external disturbances through increased government spendings.

However, the second TR rate (core) shows a more favourable relationship with the BI rates. Only in the early period did the TR rate (core) deviate substantially from the BI rate. As this TR rate is calculated based on core inflation, the deviation that occurred in 2002 might have been caused by the impact of the crisis that still remained in the economy, since the recovery process took several years to complete. In the later periods, the BI rate has moved very closely with the core inflation. Based on the above finding, it is suggested that our modified TR model using core inflation can replicate the actual BI interest rate quite well.

In Figure 6.4 we illustrate the movements of the TR rates (both actual and core) and BI rate along the sample period to provide a much clearer description of the relationship. From the figure, we can clearly identify that the TR rate (actual) can reproduce the BI rate only in normal years. The fact that the TR rate (actual) deviated from the BI rate in 2003 and 2005 have been due to changes in domestic circumstances as explained above. On the other hand, both the TR rate (core) and the BI rate has been aligned very closely with each other, except in 2008. This indicates the TR rate (core) has been able to replicate the future direction of the Bank interest rate policy reasonably well.

Figure 6.4 Modified Taylor rule (TR) rates and BI rates (BIPR)



We also conducted a test using the output gap as in the original Taylor rule. The result shows that the TR rate cannot reproduce actual BI rates as well as inflation expectations data. We believe that the failure of the Taylor rule with output gap to replicate Bank Indonesia's policy interest rate is due to high volatility of both actual inflation and output gaps. This can be seen from Table 6.1 above that in some years, the result from the output gap test resembled the movement of the actual inflation but at much higher rates. Thus, our finding confirmed and is consistent with the case in which the public inflation expectations data will perform better in explaining recent monetary policy, particularly if we use them together with core inflation.

6.4.2 Public inflation expectations in the Taylor-rule model

To justify our use of inflation expectations as a key variable in the calculation of the above TR rates, we tested our modified model using standard econometric procedures. The objective of the tests is to find evidence as to whether inflation expectations will be statistically significant if they are used to replace the output gaps, and whether an expectations augmented rule can best replicate the Bank's actual practice of monetary policy. The modified model includes the current and past BI rates, actual inflation and public inflation expectations. In developing the model, we use a dynamic system since the central bank is assumed to employ data of actual inflation and public expectations from previous periods, because the latest data are not available immediately. This practice has been suggested by Seyfried and Bremmer (2003). Furthermore, in estimating the model, we used the 0.5 weights as suggested by Taylor (1993) and an alternative weight in which we picked arbitrarily to show if different results would occur as the result of using different weights.

Table 6.3 shows the result of the tests. The estimations were performed using equation (6.9). From the estimation, we observed that the weights did not make much difference, indicating that the weights of each variable included in the model do not really influence the end results of our model estimations. It is the parameters of the variables that explain the behaviour of the monetary policy.

As presented in the table, the results show that in both inflation series, the changes of lags of BI rate (ΔM) were quite significant, as well as the lags of the BI rate (M). This

means, Bank Indonesia takes into consideration its own past interest rate changes to determine future BI rates. Furthermore, from all the estimations, the public inflation expectations show statistically significant in describing the movements of the future BI rates using both the actual inflation and core inflation. This finding suggests if we use a Taylor-rule model to replicate past interest rate determination by Bank Indonesia, public inflation expectations can be a useful variable since the model can explain reasonably well the movement of the actual BI rates.

Table 6.3 Variable estimations using different inflation series

	Actual inflation ($\phi_1=0.5,$ $\phi_2=0.5$)	Actual inflation ($\phi_1=0.7,$ $\phi_2=0.3$)	Core inflation ($\phi_1=0.5,$ $\phi_2=0.5$)	Core inflation ($\phi_1=0.7,$ $\phi_2=0.3$)	Output gap ($\phi_1=0.5,$ $\phi_2=0.5$)
ΔM_{t-1}	0.632**	0.652**	0.622**	0.631**	0.808**
M_{t-1}	0.039*	0.040*	0.069**	0.067**	0.138**
π_{t-1}	0.028	0.024	0.031*	0.027*	-0.058**
π_{t-1}^e	0.079*	0.131*	0.069*	0.116*	-
y_{t-1}	-	-	-	-	-0.078
R^2	0.571	0.597	0.633	0.612	0.667
\bar{R}^2	0.552	0.571	0.551	0.591	0.612
F-stat	25.161**	27.088**	29.184**	29.265**	11.649**
DW-stat	1.96	1.90	1.94	1.92	2.52

Notes: * and ** denote statistical significance at 10% and 5% levels, respectively. ϕ_1 is the weight for the inflation rates (π) and ϕ_2 is the weight for the inflation expectations (π^e), while the BI rates (M) are left unchanged. The various weights were chosen arbitrarily to show alternative estimations. The standard errors for all equations are not included, but available upon request. Output gap uses quarterly data from 2000Q1 to 2008Q4.

From the above table, we also find other important information. The estimation shows that actual inflation is not statistically significant, even at 10 per cent level. However, when we estimated the model using core inflation, we detected that core inflation did explain the movement of the policy interest rates. This analysis becomes more interesting due to the fact that if we estimate the model with core inflation, then both inflation and public inflation expectations are statistically significant.

For comparison purposes, we also estimated the model from equation (6.9) by replacing the public expectations data with its original variable, the output gap, while retaining the actual inflation as is. The result showed that the change of lags of BI rate and the lags of BI rate remain the same in which they are statistically significant at 5 per

cent level. Surprisingly, actual inflation becomes statistically significant, but the output gap is not significant even at 10 per cent level. Since our tests were conducted with the objective to find evidence whether inflationary pressures exist and responded well by the Bank using different monetary variables and the output gap, our finding demonstrates while the public inflation expectations show the result as expected, the output gap cannot support this objective.

Based on this finding, we conclude that the expectations augmented Taylor rule with core inflation provides a good representation of actual Bank Indonesia policy over 2002-08, and that such a rule is superior to ones using either actual inflation or the output gap.

6.4.3 Interest rate smoothing

Williams (2003) claimed that a key characteristic of successful policies is a strong degree of persistence in movements of the policy interest rates. This would be achieved through having an efficient rule of monetary policy that is able to smooth the interest rate response to shocks and even use public feedback concerning anticipated policy actions to stabilize inflation and output.

We measure the degree of persistence and the speed of adjustment of monetary policy in order to understand the interest rate smoothing currently engaged by Bank Indonesia. As in Seyfried and Bremmer (2003), we estimated equation (6.4) to measure the degree of persistence and the speed of adjustment of the current monetary policy in Indonesia. The high values of the coefficient δ (the degree of persistence) and the low value of the coefficient γ (the speed of adjustment) would suggest efforts to engage in interest-rate smoothing.

Table 6.4 Degree of persistence and speed of adjustment

	Actual inflation	Core inflation
Degree of persistence	0.73** [10.11]	0,65** [8.51]
Speed of adjustment	-0.003 [0.47]	0.034** [2.32]
R^2	0.55	0.58
\bar{R}^2	0.54	0.57
DW-statistic	1.94	1.86

Notes: ** denotes statistically significance at 5% level. Numbers in [] represent the t-statistics.

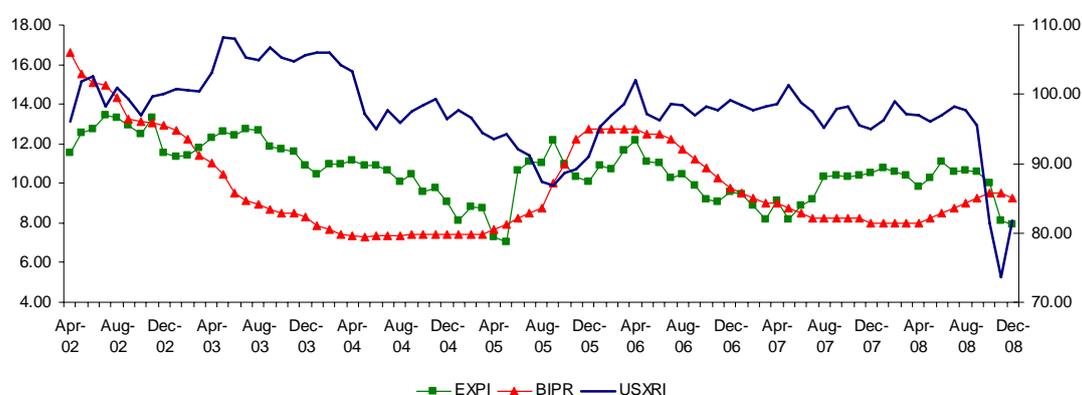
As we can observe from Table 6.4, the degree of persistence of monetary policy in Indonesia has been very high in responding to both the variability of actual inflation and core inflation. Having a high degree of persistence means that the central bank continuously makes changes to its policy in order to affect the market interest rates until the interest rates reach their steady state or a target rate level determined by the bank, while at the same time the bank can avoid excessive and unnecessary impact on the market (Lendvai, 2004). Our finding implies that Bank Indonesia will continue to adjust its policy interest rate (BI rate) to the level that can accommodate the movement of domestic market prices.

Meanwhile, the above table also shows that in term of its speed of adjustment, the response of the bank to changes in the actual inflation has been slow. This means that Bank Indonesia has not been able to engage fully in controlling the actual inflation although the efforts put forward to overcome its variability has been high. However, Bank Indonesia responds more aggressively to changes in core inflation. In other words, Bank Indonesia will make quick adjustment only to the movement of prices in certain commodities. The finding suggests that the issue of interest rate smoothing is taken seriously by Bank Indonesia, although it is only able to respond partially to the variability of domestic aggregate inflation. Since the Bank has only one instrument to be used for its monetary policy, we can also argue that the Bank engage more in controlling core inflation, rather than actual inflation, even though the law does not explicitly specify that the Bank should target actual inflation as opposed to core inflation.

6.4.4 Analysis of economic shocks

Having looked at the role of public expectations in the monetary policy decision-making process, we now turn to the analysis of unexpected shocks that can influence future monetary policy. As we mentioned previously, the ultimate objective of Bank Indonesia as prescribed in its 2004 Central Bank Act is to stabilize the value of the rupiah, both in terms of its market price stability and exchange rate value against other currencies.

Figure 6.5 BI rates, inflation expectations and rupiah exchange rates



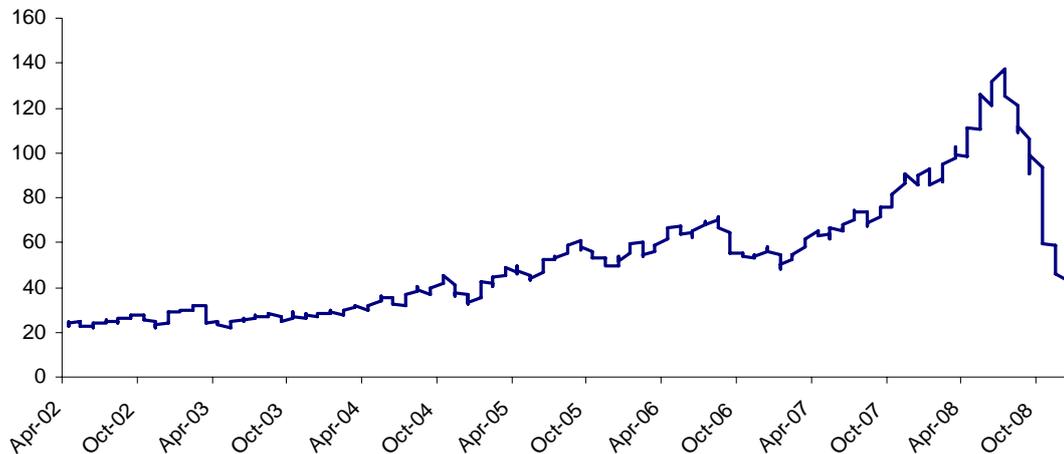
Source: Bank Indonesia

Figure 6.5 shows the movements of the rupiah exchange rates (USXRI) in the last several years (right axis). It is seen that the rupiah exchange rates were closely aligned with the inflation expectations (EXPI), except in 2005 where the government announced the increase in domestic oil prices through reducing subsidies. In that period, Bank Indonesia responded to the rupiah depreciation by raising its BI rates. As expected, since this had been anticipated by the public through their expectations, we observe smooth adjustment of the exchange rate in the following periods.

The figure confirms that there is a close long-run relationship between the public inflation expectations and the rupiah exchange rate. In Chapter 5, we estimated the movements of inflation expectations in Indonesia, and found that there are several variables that significantly influence expectations, including the rupiah exchange rates and global oil prices. Administered prices (the prices of certain commodities

regulated by the government) also has influence on expectations, but its role decreases as time passes.

Figure 6.6 World crude oil prices

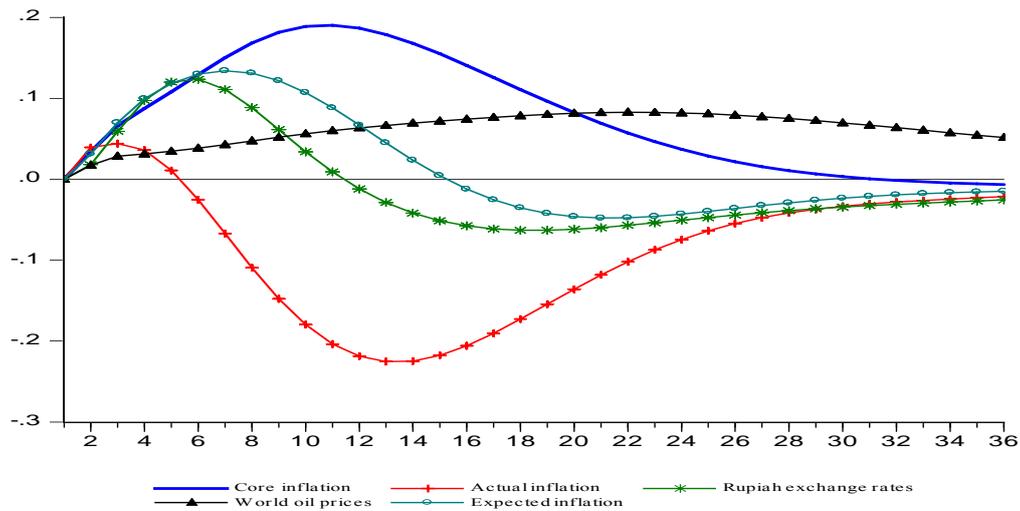


Source: US Energy Department

If we look at the world oil prices during those periods, as presented in Figure 6.6, it is clearly shown that oil prices were increasing sharply from 2004 until they reached their peak in the middle of 2008, right after the crisis of subprime mortgages occurred in the United States. In other words, the public feared the increasing prices and adjusted their expectations. In response, Bank Indonesia also increased its BI rate as a way to smooth the movement of the rupiah exchange rate within its target bands.

To understand how Bank Indonesia responded to various economic shocks, we performed impulse response tests. An impulse response function basically measures the response of a random variable (y_t) to one-time impulse (shock) in another variable while all other changes from the current and earlier periods held constant. Given the specification mentioned under equation (6.11), we will perform impulse response analysis. This test is conducted for the purpose of examining the soundness and the robustness of our previous findings.

Figure 6.7 Response of BI rates to several economic shocks.



The impulse response tests performed here use the Cholesky decomposition with one standard deviation. Figure 6.7 demonstrates how the BI rate responded to several shocks in the economy. The time frame considered here is up to 36 periods on the basis that monetary policy will not have an effect in the immediate short run. One unit period in this analysis is equivalent to one month period. From the figure we observe the following facts. Firstly, a one-time shock in actual inflation will initially cause monetary policy to react positively but then turns negative and the reaction will last up to 24 periods. Literature suggests that in responding to any increase in actual inflation the central banks should increase its interest rates in order to contain the prices (tight monetary policy); however our test demonstrates the opposite, thus we argue that Bank Indonesia does not respond appropriately to the movement of the actual inflation.

As expected, the monetary policy reaction to a one-time shock in core inflation is positive. This means that monetary policy has been more responsive to changes in core inflation than to changes in the actual inflation. The monetary policy response takes more than one year which is in line with monetary policy theory and several empirical studies that it needs between six months to eighteen months for monetary policy to be able to influence the future path of inflation (Bank of England, 1999, Sellon, 2004, Ragan, 2006). Furthermore, we also argue that the better monetary policy response to the movement of core inflation, as shown above, can be attributed to the fact that many components of core inflation are within the control of Bank

Indonesia, i.e. demand shocks, so it can react to any shock in core inflation through increasing BI rate as to attract more savings and influence future spending.

On the other hand, a one-time shock in inflation expectations and exchange rates will need about 12 periods for monetary policy to respond before interest rates return to their steady state. This finding demonstrates that monetary policy will react more aggressively to the movements of exchange rates and, to the lesser extent, inflation expectations. Any significant depreciation or appreciation of the rupiah beyond its predetermined ranges would be anticipated by the bank through controlling the supply and demand of foreign currencies (Bank Indonesia, 2008). The evidence provided in this analysis confirms our previous findings, i.e Bank Indonesia will be more responsive to changes in exchange rates, but less responsive to actual inflation, and the Bank's response to the changes in core inflation is much better than that for the actual inflation.

Figure 6.7 also shows how monetary policy responds to shocks in world oil prices. As expected, the response of monetary policy to the world oil price hikes becomes permanent. This is due to the fact that the domestic oil price has been highly subsidized by the government, and accordingly, Bank Indonesia seemed to respond more to domestic oil prices, instead of global oil markets. In doing so, the bank anticipated or even coordinated with the government in avoiding further domestic price increases as the result of increasing prices of import goods.

Another interesting finding from the above figure is that public inflation expectations seemed to be closely related to the exchange rates. The response of Bank Indonesia to shocks in inflation expectations was not quite clear. However, we suspect that the response of monetary policy to shocks in the exchange rates has a significant effect on public expectations. In addition, the BI rate's responses to the expectations shocks is seen to move at a slower pace, but very closely following that of the exchange rates. Based on the above finding, we argue that public expectations have been significantly influenced by the movement of the rupiah exchange rates.

6.4.5 Empirical conclusions

The conclusions of the empirical analyses reported above are quite striking, and can be summarised as follows:

- An expectations augmented Taylor rule model with core inflation provides a powerful replication of the Bank's policy decision process, with good statistical properties. This model is superior to others using actual inflation or the output gap, as judged by the properties of the estimated equations and by predictions of the Bank's policy interest rate.
- In terms of such models the Bank shows a rapid speed of adjustment to changes in core inflation but little adjustment to changes in actual inflation, and generally shows a high degree of persistence in monetary policy.
- Estimated impulse functions show that the Bank responds positively and substantially to changes in core inflation and to inflation expectations, but mainly responds negatively (if it responds at all) to changes in actual inflation.

Our overall conclusion from this analysis is that, as Goeltom (2007) suggests, the Bank does indeed target core inflation as its operational variable, does take account of inflation expectations data and sets policy in a reasonably systematic basis in relation to such variables. These findings are quite at variance with the standard description and perception of Bank Indonesia's policy.

6.5 Policy implications

In this section, we attempt to highlight the implications of the above findings on the current and future conduct of monetary policy in Indonesia. We would like to assess it in two important aspects. Firstly, the impact of our findings on the current central bank law and secondly, how it would affect the future conduct of monetary policy in Indonesia as a whole.

6.5.1 Consequences on the Central Bank Act

According to Act No. 23 of 1999 as later amended to the Act No. 03 of 2004, the Bank has been given a full mandate to pursue its goal to achieve and maintain the stable value of the rupiah. In this regard, Bank Indonesia conducts monetary policy on a sustained, consistent, and transparent basis, taking into account the general economic policies of the government. Alamsyah, Joseph et al. (2001) claimed that the objective of Bank Indonesia as stipulated in the law is to achieve a stable and low value of the rupiah in terms of prices of goods and services. In other words, Bank Indonesia shall target actual inflation as its ultimate monetary objective.

Meanwhile, the above Act does not specify the mechanism and procedure that the government and Bank Indonesia should follow in determining future inflation targets. This means that public will not be able to replicate predetermined inflation targets that have been set by the government, since they are not well informed how the government makes its decision about inflation policy.

Given our findings above, we argue that the central bank law that is currently in place should be considered for amendment to accommodate the Bank's interest in pursuing its objective. This amendment should consider two important issues. Firstly, the future amended Central Bank Act should clearly specify what inflation measure Bank Indonesia pursues as its monetary policy objective, whether it is actual inflation or core inflation. Secondly, the Act should also require the government and Bank Indonesia to be more transparent regarding the decision-making process about the determination of future inflation targets, so that the public is fully aware and can follow what future economy would look like by learning the government decision about future inflation policy.

6.5.2 Implications for future monetary policy

Our main objective of this chapter is to understand how Bank Indonesia has conducted its monetary policy as part of the implementation of inflation targeting. We are interested in examining the approach Bank Indonesia takes in responding to different changes in economic variables as they influence the achievements of the

Bank's predetermined inflation targets. Based on evidence examined previously, we can draw several policy implications that may be useful for Bank Indonesia in its future conduct of monetary policy.

Firstly, in the first several years of implementing inflation targeting, Bank Indonesia used SBI as a benchmark. This decision was made based on the fact that SBI has functioned as one of the primary instruments of the Bank in open market operation and money demand can be controlled through changing SBI interest rates. In June 2008, the Bank switched its operational monetary instrument to overnight interbank interest rates. The Bank claimed that the overnight rates are more responsive and reflect the liquidity conditions of domestic commercial banks.

However, the evidence shows that there is a problem of lack of transparency and credibility of Bank Indonesia. This can be seen from the evidence that the variability of actual inflation has not been much influenced by the Bank through its policy rates. The Bank has not even been able to meet all predetermined inflation targets. In addition, the mechanism of determining inflation targets has not also been clear to public. Therefore, we believe that the Bank has not performed to the level as expected by the Central Bank Act and the public if both transparency and credibility issues are used as indicators. The evidence also shows that the Bank's lack of transparency and credibility has been partly due to discretionary monetary policy decision-making, instead of rule-based policy approach. These factors have impacted on the public perception of the central bank, and the public appears to doubt its seriousness in pursuing policy objective as set out in the regulation.

Accordingly, it is important for the Bank to improve its credibility, among other ways, through making its decision-making process more transparent. The bank's board of governors would be able to enhance its transparency if they make information about its monetary decision-making mechanism available on regular basis. More importantly, both the Bank and the government should announce publicly the process they consider in determining future inflation targets, so that the public can replicate the official inflation targets and learn whether such targets are realistic. By providing all this information, the public would be able to form their future price expectations better and closer to the expectations made by the Bank. This is due to the fact that the

Bank's commitment to pursue inflation targeting is influenced by future expectations formed by the public.

Secondly, our findings suggest that Bank Indonesia has used core inflation as its operational target while the legal framework states that it should target actual (headline) inflation on the basis that it is the inflation measure that the public is more familiar with. Since the BI rate has a more positive effect on core inflation, but less on the actual inflation, the government should consider the current central bank legislation to be amended to explicitly specify the core inflation measure to be targeted for the purpose of monetary policy since it is the one whose components can be better controlled by the Bank. Based on evidence, if the current practice of determining future targets continues, it will be very difficult for the Bank to fulfil its mandate as to achieve predetermined inflation targets. Our finding is supported by Goeltom (2007) who argued that actual inflation in Indonesia has been associated with supply shocks and numerous price movements are unrelated to monetary policy. Regarding her claim that the use of core inflation may raise questions about fairness to public, we can argue that the government and Bank Indonesia can improve their communication to the public through a more transparent mechanism and by making available the core inflation series along with the actual (headline) inflation.

Thirdly, we note that the Bank currently conducts its monetary policy based on a discretionary approach. Although discretionary monetary policy has also been practiced by several other central banks, but with the problem of limited credibility, it might be favourable for Bank Indonesia to consider a rule-based approach. Applying a rule-based policy approach means that the Bank conducts monetary policy responses in two simultaneous ways. The Bank would be able to be persistent in responding to market interest rate changes. Until the market rates return to its steady state, the Bank can continue adjusting its interest rates, taking into account the current economic circumstances. By pursuing this, the Bank can instil public confidence that it is determined to conduct its monetary policy according to the best practice of inflation targeting.

The Bank can also consider its monetary policy regarding the speed of adjustments and later influences on the market changes. A high speed of adjustment is not

necessarily better, while a slow adjustment would be seen as less responsive by the public. In other words, the Bank could just perform a quick action to solve the market rate fluctuation by imposing, for example, a tight monetary policy through drastic changes in BI rates. However, this way would result in excessive response by the public as an anticipation of the possibility of future macroeconomic instability.

Instead, the Bank could determine its speed of adjustment for its monetary policy response by looking closely at the market responses of every policy it has pursued in the past. Despite the fact that the outcome of the policy action is highly influenced by constantly changing economic condition. Through anchoring public expectations, the Bank will be able to measure how quickly it would take for the public to react to changes in the current monetary policy. The Bank will also be able to determine how urgent it should respond to unexpected changes in market interest rates and for how long its policy will last. Although, the Bank has been able to respond partially to the reaction of the public for its policy in the past, in general, the result of the estimations confirms that the speed of adjustment of monetary policy in Indonesia is slow. This means that the Bank has not had a clear timeline when its policy should completely respond fluctuations in the market. Having clear timeline would allow the public to anticipate what their future price expectations would look like.

Furthermore, through implementing a rule-based approach, the Bank can determine its monetary policy that accommodates unexpected future shocks. Although in a discretionary policy approach, the Bank has more freedom to make adjustment in anticipating future uncertainties, the public has to be assured that the central bankers are reliable and responsive. This means the Bank has to develop high credibility for it to be able to produce reliable policy. In contrast by implementing a rule-based policy approach, the public are well informed of the future direction that the Bank will pursue in response to possible shocks on the economy.

Our discussion provided in the earlier sections together with the empirical examination provided here seem to offer a complement to the standard procedure of monetary policy decision-making process. The emphasis presented here is on the ability to make sound judgment regarding the risks arising from unexpected shocks, rather than the durability of the shocks itself. Bank Indonesia as an inflation targeting

central bank needs to develop its ability and credibility by understanding the nature of the shocks and how the public perceive them. Responding to the shocks by solely relying on discretionary decision-making process would hinder the Bank's objective of forward looking policy as one prerequisite to having a forward looking policy is by anchoring the public expectations of inflation.

6.6 Conclusions

This study analysed the current practice of Indonesian monetary policy in terms of a modified simple monetary rule based on the seminal work of Taylor (1993) which is widely known as the Taylor rule. A strand of literature has suggested that the use of a rule-based (time-consistent) monetary policy over discretionary policy, as currently practiced by Bank Indonesia will improve the credibility and transparency issues of the Bank, particularly since Bank Indonesia is also an inflation targeting central bank.

Our analysis finds that public inflation expectations data can be used to complement the traditionally used output gap data in monetary policy modelling using the Taylor rule. The evidence provided in this study shows that the Taylor rule can perform relatively well using different monetary variables and higher frequency data. The results for Indonesia reveal that in addition to other key monetary variables, future interest rates could also be traced by looking at past interest rates and past inflation expectations. Our findings suggest that public inflation expectations can also be used in rule-based monetary policy for inflation targeting.

We also find that Bank Indonesia will perform better in terms of improving its credibility and transparency when utilizing core inflation as its monetary policy objective, despite the fact that Bank Indonesia claims to have actual inflation as its ultimate monetary objective in the long run. Our finding confirms that the Bank can only partially control the components of inflation and these components fall within the range of core inflation. Based on the estimation, we also find that the Taylor-based monetary policy rule does indeed perform reasonably well to capture most of the current policy interest rate movements. Therefore, we suggest that a policy rule focused on core inflation and utilizing inflation expectations will be able to improve the conduct of monetary policy in Indonesia.

CHAPTER 7

CONCLUSION

This thesis examined the conduct of monetary policy in relation to the implementation of inflation targeting in Indonesia. Specifically, this study focuses on the utilization of survey-based data of public inflation expectations in the monetary policy decision-making process. Our review of the previous literature has provided evidence on the importance of inflation expectations in monetary policy. We also found that monetary policy decision-making has been widely associated with two major regimes, discretionary policy and policy rules. Most previous studies claim that policy rules have a better performance in the monetary policy decision making than the discretionary monetary policy, particularly in an environment where the central bank's credibility is limited and its transparency in the conduct of monetary policy is low.

There are at least two main components that we address in our study. The first issue is about the relationship of survey-based data of public inflation expectations and other key monetary variables. We consider this issue important, particularly for emerging market economies, where regular surveys are conducted by relevant institutions including the central banks, but the data have not been optimally utilized as part of monetary policy decision-making process. This is due to the fact that in inflation targeting, central banks need to determine monetary policy based on future inflation expectations formed by the public. This proposition is supported by Daianu and Lungu (2005) and Fraga, Goldfajn and Minella (2003), who argue that emerging economies are found to face more difficulties in the implementation of inflation targeting than more advanced economies.

The second issue is about the use of monetary policy rules. As suggested in the literature, inflation targeting economies may achieve better outcomes by adopting a rule-based monetary policy approach rather than using discretionary policy. This comes from the fact that several countries whose central banks have relatively limited credibility have not been successful in meeting their predetermined targets. In other words, they have not been able to achieve their ultimate objective of low and stable inflation in the long run. In this regard, it would be favourable for the central bank to

consider using policy rule approaches to improve its transparency and credibility and to clearly inform the public on future directions of its monetary policy.

Bank Indonesia is currently one of the inflation targeting central banks. The Bank adopted this inflation targeting framework in 1999 as the result of the promulgation of its new central bank act, but officially announced interest rates as its policy instrument for inflation targeting in 2005. The decision to come into inflation targeting is based on the long experience of implementing various monetary policy approaches. The amended Bank Indonesia Act of 2004 specifies that the Bank's objective is to achieve the stable value of the rupiah, which is interpreted by the Bank as stability in terms of prices of goods and services.

In the first several years of implementing inflation targeting, the Bank used SBI as a benchmark, but later it switched its operational monetary instrument to guide overnight interbank interest rates. The Bank claimed that the overnight rates are more responsive and reflect the liquidity conditions of domestic commercial banks. Over the examined periods, we found that the Bank's effort to control inflation has not been successful. This weakness has caused problems for the Bank in term of low transparency and credibility, and we argue that the Bank has not performed as expected by the central bank law if both issues are used as the indicators. The evidence shows that the Bank's lack of transparency and credibility has been partly due to its more discretionary monetary policy decision-making, instead of a rule-based policy approach.

As a low and stable rate of inflation in the long-run has been determined as its single overriding objective, Bank Indonesia is considered as a full-fledge inflation targeting central bank. But the Bank still considers domestic output growth and exchange rate stability as part of its tasks. In this regard, the Bank is seen to have ambiguous objectives; notwithstanding the evidence that the Bank has never met its inflation targets. Interestingly, among the fundamental elements of Indonesia's inflation, as suspected by the Bank, is the high contribution of public expectations to inflation.

The Bank believes that public expectations, which are estimated through the monthly survey conducted by the Bank, are adaptive, which means that the influence of past inflations on the expected inflation is still very significant. While the literature suggests that public inflation expectations should be rational, the findings of this adaptive phenomenon on the expectations survey data by the Bank have raised several important issues on the reliability of the survey, the methodology, and the formation of the expectations.

In this study, we analysed inflation expectations based on the household survey data provided by Bank Indonesia. From our examination, we found that both the actual inflation and the inflation expectations are non-stationary, which means that in the short-run they might drift apart since they exhibit random walk individually. However, we also found that there exists a long-run equilibrium relationship between actual inflation and inflation expectations in Indonesia. This finding provides evidence that public inflation expectations in Indonesia are reliable and rational, which means the household survey data can be utilized as one of key monetary variables in the policy decision-making process.

We also found that the relationship has not been very strong between public inflation expectations and aggregate inflation, but it has been strong between expectations and core inflation. Inflation expectation survey data in Indonesia might also overestimate actual inflation, as in many of the periods examined expected inflation on average has been above actual inflation. In the meantime, the unavailability of longer-period expectations, e.g. 12-monthly survey, might also hinder further investigations of the relationship.

Using VAR, we estimated the movements of inflation expectations in Indonesia, and found that there are several variables that significantly influence expectations. By estimating the response of the expectations to different shocks, we found that deposit interest rates, exchange rates and global oil prices have significant influence on expectations. Administered prices, the prices of certain commodities regulated by the government, also has influence on expectations, but its role decreases as the time passes. This phenomenon shows evidence that monetary policy could influence

expectations in the short and medium terms, while the influence of government policy will have decreasing effects as time passes.

Exogenous shocks to inflation expectations remain a significant source of movements in inflation expectations. They have long lasting effects and still account for more than a 10 per cent contribution to the variability of inflation expectations after the period of one year. This result suggest that the Bank should increase its effort in monitoring this external variable, to avoid an increase in public expectations which eventually end up generating a persistent increase in the actual inflation.

This study analysed and proposed the utilization of a modified simple monetary rule based on the seminal work of Taylor (1993) which is widely known as the Taylor rule. A strand of literature has suggested that the use of a rule-based monetary policy over discretionary policy as currently practised by Bank Indonesia would improve the credibility and transparency of the Bank, particularly since Bank Indonesia is also an inflation targeting central bank.

Applying a rule-based policy approach means that the Bank conducts the monetary policy responses in two simultaneous ways. Firstly, the Bank would be able to measure the degree of persistence of its monetary policy in responding to market interest rate changes. In monetary policy, being persistent means that the Bank continues adjusting its interest rates until it achieves the market rate's steady state. Until the market rates return to its steady state, the Bank can continue adjusting its interest rates, taking into account the current economic circumstances. By pursuing this course, the Bank can demonstrate to the public that it is determined to conduct its monetary policy according to the best practice of inflation targeting.

Secondly, the Bank can also conduct its monetary policy by taking into consideration the speed of adjustments that its policy makes to the market changes. A high speed of adjustment is not necessarily better, while a slow adjustment would be seen as less responsive by the public. In other words, the Bank might just perform a quick action to offset a market rate fluctuation by imposing, for example, a tight monetary policy through drastic changes in BI rates. However, this approach could result in an

excessive response by the public in anticipation of the possibility of future macroeconomic instability.

Our analysis also found that inflation expectations can be a complement to the operation of Taylor rule. The evidence examined in this study shows that the Taylor rule can perform relatively well in emerging countries using different monetary variables. However, the results for Indonesia show that in addition to other key monetary variables, the future interest rates could also be traced by looking at past interest rates and past inflation expectations. This finding suggests that public inflation expectations can play a useful role in the rule-based conduct of inflation targeting.

Furthermore, through implementing a rule-based approach, the Bank can determine a monetary policy that addresses unexpected future shocks. Although in a discretionary policy approach, the Bank has more freedom to make adjustment in anticipating future uncertainties, the public has to be assured that the central bankers are reliable and responsive. This means the Bank has to develop high credibility for it to be able to produce reliable policy. Otherwise, by implementing a rule-based policy approach, the public are well informed of the future direction that the Bank will pursue in response to possible shocks on the economy.

One other important issue is that we also found that Bank Indonesia has targeted core inflation for its monetary policy objective, while the public are only aware that actual (headline) inflation is the ultimate objective of inflation targeting currently pursued by the Bank. In our analysis, we found that Bank Indonesia performs better in controlling core inflation than if it does to the actual inflation. Accordingly, we claim that in order to improve its transparency and credibility as an inflation targeting central bank, the government needs to consider amending the current central bank law to give more opportunities for Bank Indonesia to control core inflation as its single objective, and to set the inflation targets in terms of core inflation.

The main implications from our findings in the previous chapters are to offer some complementary proposals to the standard procedure of monetary policy decision-making process. The emphasis presented here is on the ability to make sound

judgment regarding the risks arising from unexpected shocks, rather than the durability of the shocks itself. Bank Indonesia as an inflation targeting central bank needs to develop its ability and credibility by understanding the nature of the shocks and how the public perceive them. Responding to the shocks by solely relying on discretionary decision-making process could hinder the Bank's objective of forward looking policy, as one prerequisite to having an effective forward looking policy is to anchor the public expectations of inflation.

Although our findings provide important evidence about the household survey data of inflation expectations in Indonesia and about its use in the monetary policy decision-making process, there are several limitations of this study which we consider worthy of further investigations in the future. Firstly, the examined periods of the survey data of inflation expectations are relatively short. Therefore, it gives very limited options to explore the data further using different analysis technique, since they require that the time series data for examination be long enough in order to achieve reliable results. Secondly, Bank Indonesia only conducts the household surveys of inflation expectations for the next three months and six months periods. The three-month period question was just introduced a few years ago. In this regard, we only have the six-month survey data for our analysis and this leaves us no other option to investigate further with shorter and longer expectations periods. Finally, during our investigation, we have faced difficulties in obtaining reliable sources of previous research on inflation expectations in Indonesia. Hence, we do not have many options to confirm and check the robustness of our estimation results with other previous research on similar issues.

Based on the above mentioned issues, we believe there are many issues about the household survey data of inflation expectations and the use of monetary policy rules in Indonesia that are worth it for further investigations and future research. In summary, we hope our findings in this study will be useful in complementing the current practice of Bank Indonesia, and to contribute to a more effective monetary policy in Indonesia.

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