TRANSMISSION MECHANISMS OF MONETARY POLICY IN INDONESIA

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Directorate of Economic Research and Monetary Policy
Bank Indonesia

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The mechanism by which monetary policy is transmitted to the real economy remains an important and central topic in monetary economics. It would almost be impossible for monetary authorities to formulate and implement monetary policy effectively without a clear understanding about the transmission mechanism.

For Indonesia, understanding transmission mechanism is also paramount for enhancing the role of monetary policy in maintaining the stability of Rupiah needed for nurturing economic recovery. Nevertheless, the effectiveness of monetary policy depends on the functioning of transmission channels through which the policy affects the real economy and prices. This is particularly an important issue as the financial intermediation problems as a result of the restructuring process of the overall banking system has weakened the efficacy of monetary policy. Looking forward, the smooth-functioning of monetary transmission mechanism will also be an important consideration for the authorities in their consideration to implement an inflation targeting framework of monetary policy.

This book documents the studies on transmission mechanisms of monetary policy in Indonesia. They comprise the results of strategic research projects as a part of the Bank Indonesia's effort to improve monetary policy framework. The aim is to provide empirical evidences on the working mechanism of various channels - particularly interest rates, credits (bank lending and balance sheet), exchange rates, asset prices, and expectation—in transmitting the monetary policy into real economy and prices.

The results of these studies are monumental not only for enhancing the effectiveness of Indonesian monetary policy but also as an integral part of Bank Indonesia's efforts in its preparation for implementation of inflation targeting in the future. The studies documented in this book is also intended to add to the already vast literature on monetary policy transmission mechanism. This book will be invaluable to policy makers, academic and students interested in monetary economics, particularly, those who needs to understand how the monetary policy influences the Indonesian economy.Σ

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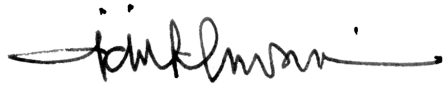
Foreword

Recently, Bank Indonesia is seriously considering implemention of a full-fledged inflation targeting. The framework of monetary policy is characterized by the public announcement of the official inflation target over a time horizon and monetary policy is conducted by independent central bank to achieve the target with high degree of transparency and accountability. For the implementation of the full-pledged inflation targeting, Bank Indonesia has been speeding up its serious preparation efforts over the past three years, including the institutional framework as well as operational issues.

The study on monetary transmission mechanisms documented in this book is one of attempts to prepare the implementation of inflation targeting. This is particularly important since the framework is forward looking in nature, in the sense that monetary policy is directed to respond deviation between the future development of inflation and inflation target. Thus, understanding the mechanisms through which a monetary action affects the future inflation and the lag between the actions and the final target is very crucial. In Addition, the various structural changes in the Indonesian economy since the wake of the crisis have altered the transmission mechanism of monetary policy. Hence, understanding the mechanisms could help the central bank to redesign an appropriate monetary operating procedures in order to enhance the monetary policy effectiveness.

I wish to express my greatest appreciation to the publication of the collection of studies on monetary transmission mechanism which is a part of *Strategic Reseach Projects* of the Directorate of Economic Research and Monetary Policy. The efforts of the research staffs are highly appreciated. Hopefully the study brings benefit for all of us.

Jakarta, July 2002
Directorate of Economic Reseach
and Monetary Policy



Hartadi A. Sarwono
Director

Preface

This study is a part of Strategic Research Program of the Directorate of Economic Research and Monetary Policy – Bank Indonesia for year 2001. The objective of the study is to provide empirical evidence on the working mechanism of various channels – particularly interest rates, credit, exchange rates, asset prices and expectation – in transmitting the monetary policy into the real economy and prices. The results of these studies are expected not only to enhance the efficacy of monetary policy but also to prepare the implementation of full pledged inflation targeting.

We would like to thank to those who have helped us in realizing this study. In particular, we thank to banks, firms and housholds as the respondents of our survey. We also thank Dr. Hartadi A. Sarwono, Mr. Sjamsul Arifin, Mr. Triono Widodo, Mr. Wibisono, Mr. Rizal A. Djaafara, Mr. Johanes Said, Mrs. Sri Liani Suselo, and other members of Divisions of SSR, SPPK, and SEI in the Directorate of Economic Research and Monetary Policy for providing comments and encouragements during the study. The study has benefited from advice of many colleagues, especially from Prof. Tsutomu Watanabe from Hitotsubashi University, Prof. Ben Dennis from Pacific University, and comments and suggestions from Dr. Tubagus Feridanusetiawan, Mr. Mirza Adityaswara, and participants of the Seminar on "Monetary Transmission in Indonesia" conducted in Jakarta, September 2001.

We realize that there are some limitations in these studies. Hence, comments and suggestions from readers to improve these studies will be appreciated. We hope that the study provides benefit for policy makers, bankers, academics and students interested in monetary economics.

Jakarta, July 2002

Monetary Transmission
Research Team

Chapter 1

Monetary Policy Transmission in Indonesia: An Overview

Perry Warjiyo and Juda Agung[1]

INTRODUCTION

Does monetary policy affect the real economy? If so, what is the transmission mechanism by which these occur? These two questions, are among the most important and controversial in macroeconomics. As such, monetary policy transmission has always been a topic of great interest to economists and monetary policy authorities. On the practical ground, it would almost be impossible for monetary authorities to formulate and implement monetary policy effectively without a clear understanding about the transmission mechanism. Monetary policy affects the economy and prices with relatively long and variable lag. It works through various channels —interest rates, monetary aggregates, credits, exchange rates, asset prices, and expectation. Thus, understanding the transmission mechanism is a key to be able to direct the present monetary policy for affecting the future course of real economy and prices.

1 Deputy Director and Economist, respectively, at the Directorate of Economic Research and Monetary Policy, Bank Indonesia. The views expressed in this paper are those of the authors, and do not necessarily represent the views of Bank Indonesia.

On the theoritical ground, a vast literature have been devoted in recent years to revive the various transmission channels and their implications on the effectivenes of monetary policy.[2] Most of the study attempt to revisit the traditional approach of transmission mechanism, known as the money view, which assumes that financial markets were homogeneous and perfect, and thus monetary disturbances have real effects if there are nominal rigidities. This is because once financial market imperfections are allowed for, monetary transmission becomes more complex. For instance, imperfections in financial market will lead to an approach known as the credit view. Although both approaches share a common element of interest rate as one of the transmission variable, the credit view also puts the importance of bank lending and firms' financial structure in transmitting monetary policy. On the other instances, imperfections and asymmetric information in other financial markets may add to the channels through which monetary policy works, e.g. through exchange rates, asset prices and expectation. The relative strength of those channels may vary from one economy to another, and from one regime to another, depending on the exisiting structure and arangements of their respective economies and financial markets. It is therefore no wonder that monetary transmission is often referred to as "black box" in the theory of monetary policy.

For Indonesia, understanding transmission mechanism is also paramount for enhancing the role of monetary policy in maintaining the stability of currency needed for nurturing economic recovery. The issue is increasingly pressing particularly since the economic crisis erupted in mid-1997, when the country experiences unprecedented pressures on exchange rates and inflation. The rupiah exchange rate has been weak and volatile because of large exposures on external debts exucerbates by herding behaviour in the part of international creditors coupled with domestic social and political instability. Pressures on inflation has also been increasing emanated from a combination of weakening exchange rate, adjustments on administered prices, and increasing inflation expectation. To mitigate the pressures on both inflation and exchange rate, the monetary policy has been directed toward controlling the excess liquidity in the economy through attaining the target of base money set forth under the IMF program. Nevertheless, the effectiveness of monetary policy depends on the functioning of transmission channels through which the policy affects the real economy and prices. This is particularly an important issue as the financial intermediation problems as a result of the restructuring process of the overall banking system has weakened the efficacy of monetary policy. Looking forward, the smooth-functioning of monetary transmission mechanism will also be an important consideration for the authorities in their consideration to implement an inflation targeting framework of monetary policy with interest rate as its operational target.

2 For a review of literature, see, a collection of papers in the Symposium on Monetary Transmission Mechanism, Journal of Economic Prespective, Fall 1995

This book documents the studies on transmission mechanisms of monetary policy in Indonesia. They comprise the results of strategic research projects as a part of the Bank's effort to improve monetary policy framework.[3] The aim is to provide empirical evidences on the working mechanism of various channels - particularly interest rates, credits (bank lending and balance sheet), exchange rates, asset prices, and expectation—in transmitting the monetary policy into real economy and prices. The results of these studies are monumental not only for enhancing the effectiveness of Indonesian monetary policy but also as an integral part of Bank Indonesia's efforts in its preparation for implementation of inflation targeting in the future. The studies documented in this book is also intended to add to the already vast literature on monetary policy transmission mechanism.

MONETARY POLICY IN INDONESIA

Before presenting the details of the study, to set the stage on the importance of understanding the monetary transmission mechanism, we shall proceed with a brief overview of Indonesian monetary policy at present and preparations undertaken by Bank Indonesia for the implementation of inflation targeting in the future. Over the past-three years Bank Indonesia has made a number of serious efforts to enhance the quality and credibility of its monetary policy. This is crucial not only for the needs of Bank Indonesia to enhance its accountability to meet the mandate of the new Central Bank Act of 1999, but also to support its role for nurturing the economic recovery for Indonesia. The efforts encompass a wide range of areas for enhancing both the capacity and institutional buildings for conducting better monetary policy making.

As enacted in 1999, the new Central Bank Act provides a clear mandate to Bank Indonesia for conducting its monetary policy. First, the objective of the central bank focuses on achieving and maintaining the stability of the rupiah (currency) value, meaning inflation and exchange rate.[4] Second, the central bank has been given independence in both setting the inflation target (goal independence) and in conducting its monetary policy (instrument independent).[5] Third, the decision on monetary policy rests on the Bank Indonesia's Board of Governors, without

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3 The studies are carried out by economists and under direction of the management in the Directorate of Economic Research & Monetary Policy. They benefit from periodical workshops and discussions with other economists in the Directorate. Technical assistances from Tsutomu Watanabe from Hitotsubashi University under funding of Japan International Coorperation Agency (JICA) and Benjamin Dennis from University of the Pacific under funding of USAID. Early versions of the papers have been presented before a national seminar on "Monetary Policy Transmission Mechanism in Indonesia" conducted in Jakarta on August, 2001. Comments and suggestions by Mirza Adityaswara and Tubagus Feridhanusetiawan as discussants and all participants in the Seminar are greatly acknowledged.

4 However, the single objective has been focused on inflation since, under the flexible exchange rate system adopted in Indonesia, the exchange rate is determined in the market.

5 As a note, a process of ammending the Act is now undergoing in which, among others, the inflation target will be set by the Government upon taking into account recommendation from Bank Indonesia.

any intervention from the Government and other parties. And fourth, a clear mechanism for accountability and transparency of monetary policy is outlined in the Act, among others by requiring Bank Indonesia to announce its inflation target and plan of monetary policy in the beginning of the year and to provide a quarterly report to the Parliament for its conducts of monetary policy.

With the mandate of the new Act, Bank Indonesia started to announce its annual inflation target and monetary policy plan since the beginning of 2000. A monthly Board of Governors meeting has also been conducted to review and set the monetary policy stance and direction.[6] To support the decision making, the research staffs have been charged to provide better analysis and forecast of inflation, economic, and financial trends as well as policy scenarios for the monetary policy. The results of the meetings have been widely communicated to the public through various media, including press release, press conference, seminars with academicians and other stakeholders, as well as in the website. For meeting its accountability to the Parliament, quarterly reports have been provided to include not only on review of monetary policy, but also other tasks of Bank Indonesia on banking and payment systems.

The central bank inflation target is based on the CPI. For 2000 and 2001, the target is set for the CPI inflation excluding the impacts of government administered prices and income policy. For example, the targets were 3-5% for 2000 and 4-6% for 2001. In addition, Bank Indonesia forecasted the impacts of administered prices and income policy on inflation, which for 2000 and 2001 were 2% and 2-2.5% respectively. Thus, adding the two constitute the forecast of Bank Indonesia for the total CPI inflation, which for 2000 and 2001 are 5-7% and 6-8.5%, respectively. For 2002, in light of difficulty in communication with the public, the target is set for the total CPI inflation of 9-10% while the central bank uses the core inflation as a basis for formulating its monetary policy. In addition to the annual target, started in 2002 the central bank also announces its commitment to bring down the CPI inflation to 6-7% within five years as a medium-term inflation target.

The current framework for conducting monetary policy is based on monetary programming using base money as the operational target. This is in conjunction with the existing arrangement under the IMF program. Thus, based on the inflation target, the target growth of base money is set annually, and from there the level of base money targets are set for every month. For 2000, based on the targeted inflation of 3-5% and on the assumptions of 3-4% economic growth and average exchange rate of Rp7,000 per US dollar, the targeted annual growth of base money for end of 2000 was set at 8.3%. Similarly, under the targeted inflation of

6 The coverage of the meetings would annual review for January's meeting, quarterly review for the months of April, July, October's meeting, and monthly review for the other months.

4-6% and assuming economic growth of 5% and average exchange rate of Rp8,000 per US dollar, the annual growth of base money for 2001 was targeted at 11-12%. For 2002, the central bank aims at an annual growth of base money at 12-14% with assumptions of economic growth of 3.5% and average exchange rate of Rp9,000 per US dollar. Under the IMF program, these base money targets are used as indicative targets or as performance criteria, together with the other monetary targets set for the Net International Reserves (NIR) and the Net Domestic Assets (NDA).

Operationally, the base money targets are used for the anchor of open market operations conducted by Bank Indonesia, through the weekly auction of Bank Indonesia's certificates (SBIs) every Wednesday. The interests on SBIs are determined through the auction market mechanisms, resulting in highest bid-rate (stop-out rate) and weighted average of SBIs for the winners of the auction. This monetary instrument is complemented by direct operation in the money market, to help manage liquidity, called as "rupiah intervention", whereby Bank Indonesia accepts and/or offers inter-bank borrowing using a policy "rupiah intervention rate".[7] In addition, if deemed necessary, Bank Indonesia also intervenes in the foreign exchange market, called as "foreign exchange sterilization", to help open market operation in absorbing liquidity as well as to stabilize the exchange rate. The magnitude and timing of the foreign exchange sterilization will depend, of course, on the liquidity conditions in the market and the development of exchange rate.

As pointed earlier, the new Act stipulates that Bank Indonesia set a target of inflation rate every year, and directs its monetary policy to achieve such a target. Thus, although it is not explicitly pronounced by the act, the framework of Bank Indonesia's monetary policy contains key features of the well-known **inflation target framework**. By definition, the inflation targeting is a framework for monetary policy characterized by the public announcement of official inflation targets over one or more time horizons, and by an independence of the central bank to direct its monetary policy to achieve the inflation target. Nevertheless, some preparations are still needed before the central bank commits to a full-pledged inflation targeting. As explained earlier, the existing practice of monetary policy is a base money programming aims at achieving the inflation target.

For the implementation of a full-pledged inflation targeting framework in the future, Bank Indonesia has speeded-up its serious preparation efforts over the past-three years (see, Warjiyo, 2002; Alamsyah, et.al., 2000; and Sitorus, 2001). These include the institutional

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7 In essence, the rupiah intervention rate acts as a floor for the Bank Indonesia policy rate. For the ceiling, Bank Indonesia provides SBIs repos and lenders of last resort facilities on which their interest rates are determined by some margin above the SBIs rate.

framework, operational issues, and organizational implications to the central bank.[8] On the institutional framework, the new Central Bank Act of 1999 lays a strong legal basis for central bank independence needed for the implementation of inflation targeting. The central bank also already set its inflation target design whereby the target is set for the CPI inflation, with a range of 2%, and for a time horizon of annual target and a commitment to five-years target. Meanwhile, accountability and transparency in monetary policy making have been enhanced through, among others, quarterly reports to the Parliament and regular communication of monetary policy via various media, including press release, press conference, seminars with academicians and other stakeholders, as well as in the website.

On the operational issues, the central bank has been conducting a number of research needed to enhance its capacity of monetary policy making. A new framework of monetary policy with interest rate as the operational target is being designed at present as one of the key works, in the views of, among others: (i) the compatibility of interest rate as the operational target for the inflation targeting framework, and (ii) uncertainty and difficulties surrounding the current base money programming. The details for the new monetary policy framework will include: (i) the optimal and time horizon for the inflation target, (ii) the policy information variables and monetary transmission mechanism, including the forecasts for inflation, exchange rate, and macroeconomic variables, (iii) monetary policy operations, including the definition of operating interest rate target, monetary policy rules, instrument mix, and signaling of monetary policy. The efforts over the past-three years and the focus of recent works on these areas can be elaborated in more details as follows:

1. **Inflation forecasting.** Under inflation targeting framework, monetary policy actively reacts to development of future inflation. For the framework to be operational, at least two requirements are needed: (i) the ability to set the optimal inflation target and to forecast the inflation trends, and (ii) a forward looking monetary reaction function or a feed back rule such as Taylor-type rule. Bank Indonesia has so far developed a small-scale macroeconomic model with about seven equations for inflation forecast.[9] The model as an input for setting the annual inflation target and for periodical monitoring of the recent inflation forecast, including the use of inflation fan-chart. In addition to the improvement of the model, the recent works focus on developing the optimal and time horizon of the medium-term inflation target, and on designing a monetary policy rule for achieving the

8 Implementation of inflation targeting requires both institutional framework and operational issues (Schaechter, Stone and Zelmer, 2000). Institutional framework encompasses central bank legal independence, inflation target design, and accountability and transparency. Meanwhile, the operational issues include the ability of central bank in dealing with inflation forecasting, policy transmission channels, monetary policy operations, and (for countries under the IMF program) with the IMF conditionality. Organizational implications for the central bank include internal decision making, monetary policy committee, and internal resource requirements.

9 For the description of the model, see Appendix-3 entitled "The Inflation Forecasting Model" in Alamsyah (2000).

target.[10] Furthermore, works also being done for enhancing the leading indicators of inflation and for developing the information variables for monetary policy making.

2. **Exchange rate forecasting.** In a small open economy, exchange rate behaviour significantly influences the economy and inflation. This is even crucial for Indonesia which has been experiencing weakening and volatile exchange rate, and large exchange rate pass-through effects on inflation. For forecasting short-term exchange rate, currently Bank Indonesia employs a partial model of behaviour effective exchange rate (BEER) which includes variables for fundamental factors (interest rate differential, terms of trade, and productivity) as well as technical factors (risk premium). However, models for assessing risk premiums to better forecast short-term exchange rate should be developed. This can be done in a number of ways, including through analysis on micro-structure of foreign exchange behaviour, surveys of an expert panel on various risk assessment influencing exchange rate, and by econometric modelling techniques.
3. **Macroeconomic modelling.** Analysis and forecast of macroeconomic variables are also keys for monetary policy making. This is particularly important for assessing the interactions between inflation behaviour and various macroeconomic variables, and better understanding on how monetary policy is being transmitted into various macroeconomic variables and finally to inflation. So far, the central bank is developing a quarterly macroeconomic model for analysis and forecasting technique (called the Short-term Forecasting model for Indonesian Economy or SOFIE) and a stochastic-dynamic macroeconomic model for policy scenarios (called the General Equilibrium Model for Indonesia or GEMBI).[11] The first versions of the models are being used to help formalize the macroeconomic analysis and forecast for monetary policy making. Nevertheless, more improvements are needed for enhancing the models, especially for incorporating monetary policy transmission mechanism and policy rule.
4. **Monetary policy transmission.** Monetary policy affects inflation and economy with lags and through different channels, i.e. money, interest rates, credits, asset prices, and expectation. This is the area that crucial but the most difficult to assess precisely in the monetary policy making (the area known as "black box"). As an integral part for enhancing the effectiveness of its monetary policy and its preparation toward inflation targeting framework, Bank Indonesia conducted comprehensive research works in 2001 to study the transmission mechanism through different channels of monetary policy (interest rate, credit, exchange rate, expectation, and asset price). The results of these research projects are documented in

11 The quarterly macroeconomic model is documented in Bank Indonesia (2001a), Short-term Forecast Model for the Indonesian Economy (SOFIE), while the first version of the dynamic model is documented in Bank Indonesia (2000a), the Stochastic Dynamic General Equilibrium Model of Bank Indonesia (GEMBI).

this book, of which we shall present their overview in the later part of this chapter. Further works are now being continued especially for incorporating the monetary policy transmission mechanism into the existing macroeconomic models.

5. **Policy information variables.** As indicated before, understanding about the behaviour of inflation and other macroeconomic variables are keys for monetary policy making. Thus, developing key policy information variables are important for the board to better formulate monetary policy. Those variables basically encompass indicators that reflect the economic trends and monetary policy transmission channels that are crucial for achieving the inflation target (e.g. inflation forecast and expectation, exchange rate forecast, real economic activity, monetary aggregates, credits, interest rates, and others). These can be developed through formal models of inflation forecast, exchange rate forecast, and structural macroeconomic model. The results of various survey need also be explored as valuable sources of information in developing the policy information variables. These are the area that Bank Indonesia is now developing.
6. **Monetary operating procedures.** Improvement on monetary operations is another area should be addressed, particularly because for implementing the inflation targeting framework, Bank Indonesia needs to respond actively in designing the present monetary policy to future path of inflation. In this case, as in other central banks, Bank Indonesia is designing a new monetary operating procedure with interest rate as the operating target (as compared to the present setting of base money programming). This is another crucial area that needs to be addressed seriously, not only because it is a new framework for Bank Indonesia, but also because the smooth-function of monetary operations will be a key for the successful implementation of monetary policy. Once monetary policy rule for setting the interest rate is completed, the first question for the monetary operating procedures is then which interest rate (money market or central bank's certificate, level versus corridor, policy versus target rate, etc) should be used as the operating target? Then, how instrument mix need to be designed and how open market operation should be conducted in order to achieve the interest rate target? Also, how signalling of monetary policy needs to be done so that the operating interest target can be understood by the market and better transmitted into other arrays of interest rates and other channels in influencing the inflation and the economy. In addition, understanding about the microstructure of money market is also important for the implementation of monetary operations.

Organizational implications for the central bank in implementing inflation targeting framework have also being dealt with by Bank Indonesia. One of them is the importance of enhancing decision making process for monetary policy. Since the new Act of 1999, monthly board meetings, as the highest monetary policy decision making forum, have been regularly

organized to set out monetary policy direction. To support the board's monetary policy making, analysis and forecast of inflation and preparation of scenarios and recommendations for monetary policy decision need to be regularly prepared. Continuous efforts are being conducted to improve the process to make it more efficient and effective with high quality of materials and decision. To do so, the materials for board's meeting are being refocused on the information variables that are keys for monetary policy decisions and are to be based on rigorous research and analysis. The materials need to be made available in advance within a sufficient time for the board to assess and formulate their opinions. These are needed for better quality of monetary policy making. Furthermore, communication strategy and transparency to the public at large need to be improved, so that the monetary policy can be understood by economic agents and better transmitted to inflation and the economy.

These are some major areas that are being studied and developed within Bank Indonesia for the successful full-pledged inflation targeting in the future. While these studies are underway or being planned for next year, current framework of base money targeting may provide as a temporary suitable venue for disciplining the conduct of monetary policy.

EVIDENCES OF TRANSMISSION MECHANISMS IN INDONESIA

By now, it should be clear how strategic is the research on monetary transmission mechanism, particularly in relation to the efforts of building capacity in monetary policy within Bank Indonesia. As alluded to earlier, clear understanding about monetary policy transmission mechanism is crucial for inflation targeting. Under an inflation-targeting framework, the current stance of monetary policy must aim at achieving the inflation target in the future. Thus, taking into account that monetary policy has considerable lag, targeting inflation requires setting the policy framework in a pre-emptive way. The problem, however, arises at the level of monetary policy implementation. Monetary policy has a very imperfect control over inflation. As Milton Friedman put it, monetary policy works only with long and variable lags. The channels through which a monetary policy instrument influences the inflation rate, known as the monetary transmission mechanism, are often unclear, and some economists have dubbed it as a "black box." They may works through several ways, e.g. direct monetary channel (through base money and money supply), interest rate channel (through real interest rate), asset price channel (through exchange rate and asset price), credit channel (bank lending and firm's balance sheet), and expectation channel.[12] For designing a monetary policy framework, understanding those transmission channels are inevitable.

12 See for example Kakes (2000) and de Bondt (2000).

Study on monetary transmission is also important to understand the relative important of each channel in influencing inflation. This will be useful for developing information variables that can be used as a reference for assessing the current state of monetary policy related to the attainment of the inflation target. While the use of intermediate targets (other than the forecast of future inflation itself, as emphasized by Svenson (1997)) does not fit comfortably with inflation targeting, many inflation-targeting central banks have emphasize particular macroeconomic indicators as information variables, i.e., variables that contain information about future course of the economy but which are not themselves targeted. Examples include the monetary condition index in New Zealand and Canada and the broad money aggregate in Spain. Although the targeting countries differ in the degree to which they emphasize particular indicators of inflation, all rely on varieties of sources of information when deciding policy. The result is a policy regime that exhibits what we called "constrained discretion".[13]

Earlier studies on this issue in Indonesia for the pre-crisis period have shown that interest rate channel is very important for Indonesian economy, and recommended the use of interest rate as operational target for monetary policy (Boediono (1998), Sarwono and Warjiyo (1998), Warjiyo and Zulverdi (1998)). Meanwhile, Agung (1998) found that, as an impact of financial deregulation, bank lending channel worked only for smaller banks but not for state banks which constitutes a larger portion of the banking system. For the post-crisis period, Agung (2000) found an evidence of firm's balance sheet channel, in which the response of the real sector to a monetary shock depends upon the financial structure of the firms, the segmentation of the financial market between large and small firms, and the degree of financial/credit friction in the capital/credit market. Furthermore, Agung, et. al. (2001b) shows a credit-crunch phenomenon in Indonesia for the post-crisis period, explaining that the existence of non-price rationing has significantly reduced the effectiveness of monetary policy in influencing the supply of credit.

Nevertheless, studies that comprehensively map all of the channels of monetary transmission have not been done previously for Indonesia. Bank Indonesia has, therefore, been studying extensively those channels of monetary policy transmission mechanisms, focusing on interest rate channel, bank lending and firm's balance sheet channels, exchange rate channel, and expectation channel. The purpose is to further document the existence, especially in terms of magnitude and lag structure, of different channels of monetary policy.

All of the studies presented in this book employ a structural vector autoregressive (VAR) approach to time-series data for the period both pre and post-crisis. This follows most of the current empirical literature on monetary transmission. The approach is often classified as data-

13 Fur further discussion on this issue, see for example Bernanke, et.al. (1999).

oriented, as opposed to more theory-oriented or structural approach. This means that it carries an important characteristic that statistical rather than economic criteria are taken as a starting point to construct econometric models, imposing as little economic structure on the estimation as possible. One of the advantages is that this approach is able to provide lag structure and magnitude on how monetary policy affects output and prices through the respective channels, an information that is a key for mapping monetary policy transmission mechanism. For some studies, however, formal structural economic models with more disaggregated data are also employed to enrich the economic interpretation of the findings and to capture the empirical evidences that might not be uncovered through the VAR methods. Moreover, the studies are also complemented by the results of the surveys to a sample of banks, corporations, and household.

Overall, the preliminary results of these studies provide valuable information of the transmission mechanism of monetary policy, both for the pre-crisis and post-crisis periods. In particular, not only they provide evidences on the behavior of each channel, but also they indicate some changes on relative strength of the transmission for the two periods. We shall summarize the underpinning economic reasoning, methodology, and findings of the respective channels of monetary transmission mechanisms in Indonesia documented in the remainder chapters of this book as follows.

Interest Rate Channel

The monetary transmission mechanism through interest rate channel starts from a change in short-term interest rate which will then be transmitted to all arrays of medium and long-term interest rates through the balancing mechanism of supply and demand in the financial markets. The change in short-term nominal interest rate set by the central bank can induce changes in real short and long-term interest rates with the existence of sticky price notion. This means that, with such price stickiness, an expansive monetary policy will drive down short-term real interest rate. Subsequently, with expectation hypothesis of term structure which states that long-run real interest rate is the average of expectation of future short-term interest rates, the lower short-term real interest rate will cause a decrease in long-term real interest rate. All these movements are expected to influence price variables in the financial market, real sector variables, and finally, inflation.

Chapter 2 of this book presents some evidences of the interest channel of monetary transmission in Indonesia (Kusmiarso, et al, 2001). To do so, they conduct analysis to see how cost of capital, substitution effects and income effect transmit the change in interest rate as a result of monetary policy adopted. The relationship of policy rate and real sector variables is

investigated using Granger test and VAR analysis. Furthermore, to have a deeper understanding on bank behavior in responding to policy rate, several structural equations are also introduced, involving several micro factors on banks, i.e. inter-bank overnight rate, deposit rate, and credit rate. The study employs monthly data for the period of January 1989 to December 2000 with a structural break in June 1997 to depict the economic crisis in Indonesia.

Empirical evidences from the VAR analysis reveal that before the crisis, real deposit rate and real investment credit rate were strongly influenced by inter-bank rate. Investment growth, however, was more influenced by the high access to foreign borrowing compared to real investment credit rate. Similarly, consumption growth was not significantly affected by changes in real deposit rate, as real deposit rate was relatively stable and low. After crisis, real deposit rate and real investment credit rate response to inter-bank rate is weaker as compared to the pre-crisis period. Real investment credit rate, however, does not correspond proportionately to changes in real deposit rate because banks concern that high interest rate will lead to higher debtor's default and non-performing loans. Investment growth is significantly influenced by real investment credit rate. Likewise, consumption growth is significantly driven by real deposit rate.

The structural models provide further evidences on the behaviour of bank interest rates, especially of inter-bank rate, time deposit rate, and working capital credit rate. For the inter-bank interest rate, the central bank certificate (SBI) rate and bank liquidity have been the dominant factors in both pre- and post-crisis period, with a stronger impact of SBI rate in the post-crisis period. Bank liquidity condition becomes a relevant variable in determining inter-bank interest rate for private national foreign exchange banks, private national non-foreign exchange banks, and regional development banks. However, liquidity is not a significant factor for state-owned banks, foreign and joint-venture banks, as they have more access of funding. Inter-bank rate, liquidity and its lag all together determine bank behavior of time-deposit rate. Time deposit rate responds to the movements of inter-bank rate and the role of inter-bank rate increases after crisis. Since the crisis, bank are relatively liquid, so that loan to deposit ratio as a proxy for liquidity does not significantly influence deposit rate, as all groups of bank are unwilling to lend money.

Time deposit rate and the liquidity condition are two determinants of bank behavior in determining working capital credit rate. During the pre-crisis period, banks had more access of funds from offshore, central bank and inter bank; thus liquidity was not a relevant factor for the loan rate. Unlike in pre-crisis period, liquidity condition becomes a relevant factor for loan rate in post-crisis period as banks have limited access of funding. For non-foreign exchange domestic private banks, however, liquidity condition is significant in all period, since their limited access to foreign funds and their relatively smaller size of assets. On the other hand,

liquidity never becomes a problem for foreign and joint-venture bank in determination of loan rate as they have perfect capital mobility.

The findings are confirmed by the results of survey conducted to banks, households, and companies. In particular, the results during the post-crisis period show that change in policy rates is being transmitted to various retail-banking rates and to the real sectors. The loan rate is determined by deposit rate, borrowers' risk and SBI rate. Banks respond to changes in policy rates significantly. When SBI rate declines, banks will reduce their deposit rate and portfolio holding of SBI, and then increase their loan portfolio especially for working capital loans. In addition, banks tend to raise their loan rates and reduce their loan portfolio in the case of tight liquidity or significant increase in SBI rate.

The survey also reveals that household decision to save is influenced by interest rate. However, slightly different from the empirical finding, households maintain their saving even though there is a decline in deposit interest rate, because of the presence of government guarantee scheme on deposits. Similarly, households maintain their saving when interest rate rises as they prefer to keep and to add their deposit instead of spending for consumption.
Finally, survey on firm level confirms the empirical findings in that the growth of investment is not strongly related to the movements of credit rate. In the event of rising policy rate, most companies choose to place their funds into their deposits with banks and reduce their loan demand. This is explicable by the fact that most respondents will turn into own funds for financing their business activities whilst others postpone their plan for expansion. The response becomes more pronounce if the companies perceive business prospect has become bleak and unprofitable.

Bank Lending Channel

For the last decade, there have been voluminous studies on the effects of imperfection in financial markets to the real economy and business cycles (see e.g. Gertler, 1988; Bernanke and Gertler, 1989). The understanding of the role of the financial market imperfection has also generated theories on monetary transmission mechanism which emphasize the importance of this imperfection, especially asymmetric information problem in credit market, in explaining the effects of a monetary policy. These theories can be categorized as the 'asymmetric information based transmission mechanism' or credit channel. There are two strands of literature on the credit channel. First, the bank lending channel which emphasizes the effects of monetary policy on bank balance sheet, especially in the asset side of banks. Second, the balance sheet channel which emphasizes the effects of monetary policy on firm balance sheet and thereby access to banks' credit.

According to the bank lending channel, banks participate in the transmission of monetary policy not only via their liabilities side but also through their assets. For example, in a monetary contraction, banks reserves decrease and owing to reserve requirements, bank deposits fall. Should the decrease in bank deposits not be offset by other funds which are free from reserve requirements, or by a decrease in securities, the consequence would be a fall in bank loans. If bank loans also fall and bank dependent borrowers are dominant in the economy, the restrictive monetary policy results in a fall in investment and economic activity. Hence, monetary policy not only directly influences the real interest rate but also directly affects the supply of bank loans.

Thus, two necessary conditions for the existence of this channel are: (1) bank loans and securities must be imperfect substitutes for some borrowers, or some borrowers are bank dependent; (2) the central bank must be able to constrain the supply of bank loans. While the first condition is likely to be satisfied as the bank lending is still the dominant source of funds for firms' financing, the second condition is subject to empirical investigation. Using sample data from 1985-1995, Agung (1998) proved that a monetary policy was able to influence the bank supply of credit, in particular, of small banks, not large banks which were able to shield their bank loan supply by finding the cheaper source of funds from abroad.

The second paper (Agung, et al., 2001b) presented in Chapter 3 of this book further investigates the bank lending channel of monetary transmission phenomenon in Indonesia using the sample data including the period after the crisis and using various tools to analyse. This is stimulating, at least for two grounds. First, the evidence of ability of large banks to protect the lending supply by accessing non-deposit funds from abroad may be questioned recently as the access to foreign funds has been very limited since the economic crisis. Second, the existence of credit crunch (Agung, et al., 2001a) supports the bank lending channel, i.e., the credit market is more supply-determined, rather than demand-determined as suggested by the money/interest-rate channel. However, the existence of credit crunch in which the non-price rationing exist, simultaneously shows that the effectiveness of monetary in influencing the supply of credit has also been reduced.

The study utilizes a battery of tests to analyse the bank lending channel. First, it employs VAR approach as Bernanke and Blinder (1992) using aggregate data to see effects of monetary policy on bank balance sheets. However, the empirical studies using aggregate data suffer from identification problem, i.e. the inability to establish whether the decline in credit as a result of a monetary contraction stems from a decline in loan supply or driven by the fall in demand for loans as a result of the high long term interest rate as predicted by the interest rate channel. Accordingly, following Kashyap and Stein (1995) the study also uses disaggregated data to deal with this identification issue. The use of the disaggregated data, hypothesis underlying the

bank lending channel can be analysed. That is, following a monetary contraction, smaller banks which do not have access to other source of funds will decrease their loan supply more than that of large banks. On the borrower side, small borrowers which presumably are characterized by stronger informational asymmetries and lower access to alternative source of funds should be more sensitive to monetary contraction (Gertler and Gilchrist, 1993, 1994). As complementary to the VAR analysis, long-run demand and supply equation of the Indonesian credit market are estimated, derived from vector error correction model (VECM) following Kakes (2000) in order to identify whether adjustment toward the equilibrium in the credit market is dominated by supply as suggested by lending channel. Finally, disaggregated evidence is analysed using bank level panel data to examine whether a monetary shock generates differential effects across banks according to their net worth (capital) position.

Overall, the study provides a comprehensive investigation on the existence of bank lending channel of monetary transmission in Indonesia before and after crisis. Given existence of 'bank dependent borrowers' as the secondary condition of bank lending channel clearly satisfied, the study particularly focuses on the first condition of the bank lending channel to exist; that is, whether a monetary policy affects the quantity of bank lending. Three different methods are used to achieve robust conclusions. First, using Bernanke-Blinder type of VAR it examines the responses of banks' balance sheet (deposits, lending and securities holdings) to a monetary shock measured by SBI rate and interbank rates. Second, supply of and demand for credit are identified using the restricted version of VECM to examine whether the short run adjustment toward equilibrium is dominated by the supply of loans as suggested by the credit channel hypothesis. Third, bank-level panel data is used to investigate in detail differential behaviour of bank lending, especially with regard to their capital strength and asset size.

Aggregate evidence show that a monetary policy is able to affect bank lending with a lag due to ability of banks to insulate the decrease in deposits by liquidating their securities holdings. This is conducted by bank to serve the commitment loans that have been made prior to the monetary shock. Empirical results with disaggregate data across bank categories indicate that after a monetary shock, in particular in the period of post crisis, there is a flight to quality of deposits especially from private domestic banks to foreign banks and state banks. Accordingly, lending of these categories of banks is less sensitive to a monetary shock compared with that of private banks.

A disaggregation of total bank loans into corporate and individual lending demonstrates that the response of aggregate lending to firms is less sensitive to a monetary policy. By contrast, the loans for individuals drop significantly in the aftermath of monetary shock. This may be explained by what so-called the 'flight to quality' phenomenon. That is, in a monetary contraction, to compensate the decline in cash flow, the creditworthy borrowers have access

to short-term loans, while loans to the less creditworthy borrowers, such as individuals, will be rationed.

By disaggregating banks according to their capital strength, the study reveals that the effect of monetary policy on bank lending is stronger for banks with low capital. Furthermore, from time series and panel data estimations, the efficacy of a monetary policy in influencing the bank lending and thus investment are stronger in the aftermath of the crisis, especially in the case of monetary contraction. Ineffectiveness of monetary policy in affecting bank lending prior to the crisis was due to banks' ability to access funds from international sources. In the wake of the crisis, given deterioration of bank capital and high credit risk, an increase in interest rate as a result of a monetary tightening raises the probability of loan default; hence banks become reluctant to extend credits. This findings lend support the existence of asymmetric effect of monetary policy; stronger in the recession than in the boom periods

Balance-Sheet Channel

In the empirical study on the balance sheet channel of monetary transmission, two empirical questions should be addressed. First, whether firms' balance sheet position plays important role in influencing firm's investment decision. Second, how does a monetary policy influence the firms' balance sheet and thus their investment decisions. While the empirical research on the role of balance sheet position on firms' investment has been abundant[14] and generally confirms the hypothesis, empirical study on the second hypothesis and thus explicitly on the balance sheet channel is relatively few. Oliner and Rudebusch (1996) for US, and Minguez (1997) for Spain and Germany are among the notable exceptions.

Empirical studies on the importance of balance sheet in firm investment have been conducted for Indonesian case in the context of testing financial constraint. Harris, et al. (1994) and Goeltom (1995) employ the accelerator models of investment using panel of manufacturing firms over period 1983-1989 to investigate whether financial liberalisation has relaxed the financial constraint of the firms. In a rather different context, using panel data of listed firms over period 1992-1997, Agung (2000) investigates the role of cash flow and leverage in firm investment to test indirectly whether the balance sheet channel operates in Indonesia. In spite of supporting the balance sheet hypothesis, the latter does not explicitly test whether the firm balance sheet magnifies the adverse effect of a monetary contraction.

The third paper (Agung, et.a.l. 2001) presented in Chapter 4 of this book investigates explicitly the balance sheet channel of monetary transmission in Indonesia by extending the

14 See a comprehensive survey by Hubbard (1998).

data used by Agung (2000) to include the crisis period, i.e., the data covers 1992-1999. By including the crisis period when interest rates substantially increased, the study can test whether the notable monetary shock indeed influences the investment through its effect on firms' balance sheet.

The empirical evidence suggests that firm balance sheet variables (cash flow and leverage) are very important determinant in the firm investment and the investments of small firms are more sensitive to their balance sheet changes than those of larger firms. The most important finding is that the sensitivity of investment with respect to a change in balance sheet variables increases during period of monetary contraction. This evidence provides support for the existence of balance sheet channel in Indonesia. However, there is no evidence that the investments of smaller firms more badly suffered than larger firms during the contraction period, perhaps due to large exposure of the larger firms to domestic currency depreciation that concurrently occur during period of monetary contraction.

While a contractionary monetary policy generates the adverse effects on the real investment through firms balance sheet are supported, the question whether the easing monetary condition improves the firm balance sheet, thus investment, is not answered yet in this study. Under condition of weak balance sheet, an asymmetric effect of monetary policy, i.e., stronger negative effect in the case of contraction but less positive effect in the case of expansion, become possible. This is a challenging area for future research.

Exchange Rate Channel

In the small open economies, exchange rate becomes a very important channel in transmitting monetary policy, in that exchange rate movements significantly influence the development of aggregate demand and aggregate supply, and thus output and prices. Its relative strength of course depends on the exchange rate arrangement of the country. Under floating exchange rate system, for example, an easing monetary policy will depreciate domestic currency, and increase prices of imported goods, thus raise the domestic prices even when there is no expansion in aggregate demand. Meanwhile, in some countries which adopt managed floating regime, the impact of monetary policy will work relatively stronger through other channels than exchange rate in affecting real output and prices. Nevertheless, there are cases where exchange rate has a room to fluctuate, especially when there is a relatively wide band of managed exchange rate system or if there is an imperfect substitution between domestic and foreign asset, and thus the exchange rate channel of monetary policy still has its influence on output and prices even with a smaller effect and longer time lag. Considering the possible changes in the effectiveness of monetary policy under different

regimes, it is important to examine the relative strength of the exchange rate channel during the two regimes.

Chapter 5 of this book presents the study (Siswanto, et al, 2001) on exchange rate channel of monetary transmission in Indonesia. The channel is illustrated into two blocks. The first block is directed to measure whether a monetary policy shock had dominant influence on exchange rate movement compared to risk factor. Dominancy of policy variable shock determines whether the monetary policy could be transmitted to the inflation through exchange rate channel. The second block is aimed at detecting the transmission of exchange rate changes to inflation rate both directly through the prices (direct pass-through effect) and indirectly through outputs (indirect pass-through effect).

The study is carried out by using SVAR approach, with variance decomposition to measure the strength of monetary policy impacts on exchange rate and inflation, and impulse response function to analyse lag structures. The study is furthered confirmed by conducting survey to banks, companies and households. Monthly data for the period between 1990.1 to 2001.4 are employed, with the omission of period 1997.9 to 1998.9 to avoid the structural break due to the economic crisis. Thus, the two periods depict the underlying different regimes of exchange rate, i.e. managed floating regime for the pre-crisis period and floating exchange rate regime for the post-crisis period.

The findings from SVAR analysis reveal that during the pre-crisis period, monetary policy transmission mechanism through the exchange rate channel worked very weak. Monetary authorities' action to maintain the exchange rate variability within a certain band had kept the exchange rate relatively stable and predictable. Under of such condition, interest rate on SBI instrument did not have significant impact on exchange rate, and the exchange rate was not an important determinant of inflation. It is worth noting, however, that during pre-crisis period, a rise is interest rate diferential as a result of tight monetary policy which caused a rise in interest rate differential was effective in attracting foreign capital inflows.

On the contrary, during the implementation of free-floating system in the post-crisis period, monetary policy transmission mechanism seems work better. Unfortunately, banking system in Indonesia has not fully recovered yet and country risk is still high, causing market mechanism in free-floating system could not work efficiently. Therefore, although variance decomposition indicated that SBI rate changes contribute a significant role to exchange rate variability, exchange rate response to the shock of SBI rate is still not conclusive. An increase in domestic interest rate fails to attract capital inflows as Indonesia's country risk is still high. Furthermore, risk premium also plays significant role in that the behavior of exchange rate is influenced more by non-economic factors stemming from among others transition in the domestic social and political developments.

Nevertheless, under free-floating system since the economic crisis, the role of exchange rate in the economy becomes increasingly important. Both direct and indirect pass-through effects of exchange rate to inflation are very strong as exchange rate changes dominantly contribute to variability of inflation. The finding also reveals that direct pass-through effect of exchange rate is stronger than indirect pass-through. The direct pass-through effect to inflation works instantaneously since the first month, while the indirect pass-through effect started with two months lag.

The findings from SVAR estimation are confirmed by the results of survey to the three sectors of economic agents, i.e. banks, companies and households. The survey to banks indicates that non-economic factors, interaction between supply and demand of foreign exchanges, and regional development of exchange rate are the most important factors that determine the movements of rupiah exchange rate. Most banks view that foreign exchange intervention is the most powerful monetary policy in influencing the exchange rate in the market. Only few banks consider that SBI rate policy could affect the exchange rate. This condition implies that in the current period, Bank Indonesia can not rely solely on open market operation instruments, including SBI rate, to affect exchange rate. High interest rate would not attract the foreign capital inflow because of persisting high risk premium of Indonesian economy as indicated by high swap premium.

Almost all companies are very concerned with the movements of rupiah exchange rate for setting their output price, regardless of the extent of import contents in their production. Exchange rate has a significant negative impact on the output price and the companies will react more to the exchange rate depreciation than to the exchange rate appreciation. Moreover, the households have the same expectation as the behavior of companies in setting output prices due to exchange rate changes. This result confirms the empirical finding on the strength of pass-though effect of the exchange rate to inflation.

The result of this study on exchange rate channel implies that Bank Indonesia may not rely only on SBI rate to influence exchange rate, especially under abnormal condition of financial market. It seems that during the crisis period the exchange rate movements should not be left to the market mechanism without intervention. Monetary authorities, to some extent, need to "control" the market until all market function normally.

Expectation Channel

As one of the channel in monetary transmission mechanism, expected inflation plays a crucial role in increasing market appreciation of the current and future inflation. Expected inflation has been developed in line with the dynamics of the economy and availability of

information. Monetary policy and economic development can influence the formation of expected inflation, which in turn will affect the behavior of economic agents. Theoretically, the change in behavior will be reflected in investment and consumption decisions and thus will influence change in aggregate demand and inflation, as well as on price and wage setting. Considering that an economic crisis has changed inflation expectation behavior in Indonesia, the fifth paper (Wuryandani, et al., 2001) presented in Chapter 6 of this book focuses its studies on the period after the crisis. Problem in data availability urges the authors for the appropriate expected inflation proxy. Several candidates for measuring inflation expectation are tested; they include inflation assumption in the government budget, VAR estimation through Fisher equation, OLS and interpolated expected inflation from the business survey (SKDU) data. By using some statistical methods such as correlation and Granger causality, the test on those candidates showed that the business survey (SKDU) data is the best proxy for expected inflation despite its limitation as an interpolated data.

The VAR analysis in the study concludes that in general there is a monetary transmission through expected inflation channel. The expected inflation itself is mainly determined by exchange rate, past inflation (inertia), and interest rate. The result confirms that expected inflation plays a role in inflation formation. However, it is considered not as strong as other variables such as inertia (past inflation). The significant effect of past inflation argued that monetary authority credibility is a very important factor. People observe the credibility of central bank and forms expectation based on what they have learned. In turn, credibility of central bank will determine the effectiveness of inflation targeting.

The survey also proves that expected inflation and inflation formations are determined predominantly by exchange rate, past inflation (inertia) and interest rate. Nonetheless, the market response to those factors is not always asymmetric. There is a downward rigidity in the firms' price setting, regardless of depreciation or appreciation in the exchange rate. On the contrary, household reacts asymmetrically to the movement of exchange rate. An interesting result from the survey is that market will expect inflation to increase as interest rate increase. The explanation of this result is that market learns when interest rate increased, inflation also increased in the same period in 1998, and the other way around in 1999. In this case, market did not take into account the time lag of monetary policy. In projecting future inflation, market uses past inflation as benchmark.

Asset Price Channel

As openly known, asset price movement contents some information about future economic condition as well as future path of inflation. While these properties are true for some

countries, they do not necessarily holds for other countries. For countries such as Japan, the UK and some Nordic countries, the large swing of asset price has created fluctuations in real economy, caused by a mix of ease monetary policy, real business cycle, and financial liberalization. Moreover, monetary conditions were a common background factor behind assets prices inflation (Hoffmaister and Schinasi, 1994) and some assets price show a power to predict future inflation (Filardo, 2000). In other countries, however, the role of asset price in the transmission mechanism is not really strong or clear. In fact, there could be no relationship between asset price and the economy. Gluck and Mader (1998) showed that term spreads in Austria had little predictive power for future industrial production and inflation. Jaillet and Sicsic (1998) pointed out that there is no link between equity price and growth of consumption in France. Nevertheless, the growing querry about the role of asset price in monetary policy transmission mechanism still takes place.

The final paper (Idris, et al., 2001) presented in Chapter 7 of this book examines the asset price channel of monetary policy transmission in Indonesia. The aim is to investigate whether the asset price channel exists in Indonesia, what information content it possess, and the role of asset price in designing monetary policy. The study also employs structural/identified VAR models, with some structural restrictions derived from economic theory. Housing price or land price should have been the best proxy for asset price. Yet, the data availability restrains present research of doing so. Alternatively, Jakarta Composite Stock Price Index (JSX) is used. In general, the study concludes that there is no strong evidence on the existence of asset price channel of monetary transmission in Indonesia. Even though monetary policy could alter financial asset portfolio, yet it fails to be transmitted further to inflation. The absence of asset price channel owes to some weaknesses that still impinged in this study. It is suspected that JSX index could not properly reflect the wealth of the economy. Survey result later verifies the insignificant portion of stocks in household's portfolio, i.e. less than 5%. Moreover, the limited number of observation, particularly for the post-crisis period, to some extent restrains the system to fully grab the long-run relationship. Therefore, to explore the asset price channel of monetary transmission, generating reliable data series on housing or land prices may be more appropriate in reflecting the wealth, and possess closer link with monetary policy. Other agenda includes applying other approaches to illustrate asset price channel more appropriately.

FINAL REMARKS

As shown, the studies presented in this book attempt to shed some important findings for the working of each channel in transmitting monetary policy in Indonesia for both the period before and after the economic crisis of 1997. In general, the results show that transmission

of monetary policy has been, to some extent, altered by changes in the existing structure and policy affecting the economy and financial system. For the period before the crisis, the Indonesian economy was in the "boom" period with ample foreign capital flows. Under such a circumstance, the interest rate channel worked quite well in transmitting monetary policy into interest rates for deposits and lending. Nevertheless, its effectiveness in influencing the real economy was inhibited by the fact that both consumption and investment were not responsive to changes in interest rates because of the booming economy and ample foreign funds. The findings are also confirmed by the bank lending channel which indicated that ineffectiveness of monetary policy in affecting bank lending prior to the crisis was due to banks' ability to access funds from international sources. In the meantime, the exchange rate channel was not strongly relevant before the crisis since the underlying exchange rate system was managed floating. As such, exchange rate movement was stable within the band with quite predictable rate of depreciation, and thus it did not induce significant pass-through effects to the real economy and prices.

After the crisis, however, the economy and financial system have undergone structural changes and the country has moved to the floating exchange rate system. This undoubtedly has fundamental implications to the working of monetary transmission mechanism. Exchange rate movements become more pronounced in affecting real economy and prices, while the effectiveness of monetary policy to influence exchange rate has been undermined by the fact that exchange rate movements have been driven more by non-economic factors. Likewise, expectation becomes more important factors in affecting inflation, but the behaviour of inflation expectation has been driven mostly by price inertia and exchange rate. The interest rate channel still works quite well in transmitting monetary policy, even though its magnitude have been affected by conditions in the banking system and the overall higher uncertainty and risk factors. As such, ample liquidity, market segmentation and higher risk factors in the financial markets necessitate higher policy interest rate changes to affect market interest rates. Once the market interest rates move, however, the impacts to real economy have been more pronounced. The finding is also confirmed from the bank lending channel, in that aggregate data show a monetary shock is able to affect bank lending with a lag due to ability of banks to insulate the decrease in deposits by liquidating their securities holdings. Furthermore, empirical findings from disaggregated data indicate that bank lending is more sensitive to monetary shocks for private domestic banks, banks with low capital, and for individual lending.

These are some key findings from the study on monetary transmission mechanism in Indonesia. Finally, these studies will provide strong evidences for further research works to analyse the relative strength of these channels for a complete mapping of monetary policy transmission mechanism in Indonesia. These become the area of researches that Bank Indonesia

is now focusing, particularly by incorporating the monetary policy transmission mechanism more rigorously into its economic models, in conjunction with its attempts to enhance the effectiveness of monetary policy and the preparations towards inflation targeting framework in the future.

References

Agung, Juda (1998). Financial Deregulation and Bank Lending Channel of Monetary Policy in Developing Countries: The case of Indonesia, *Asian Economic Journal,* Vol. 12, No.3,pp 273-294.

Agung, Juda (2000). Financial Constraints, Firm's Investment and Channel of Monetary Policy for Indonesia, *Applied Economics,* Vol 32,pp 1637-1646.

Agung, Juda, Bambang Kusmiarso, Bambang Pramono, Erwin G. Hutapea, Andry Prasmuko, and Nugroho Joko Prastowo (2001a), *Credit Crunch in Indonesia in the Aftermath of the Crisis*, Bank Indonesia: Directorate of Economic Research and Monetary Policy, Jakarta, March 2001.

Agung, Juda, Rita Morena, Bambang Pramono, and Nugroho Joko Prastowo (2001b) Bank Lending Channel of Monetary Transmission in Indonesia, paper presented at a seminar Monetary Policy Transmission in Indonesia, Bank Indonesia, Jakarta, November 2001.

Agung, Juda, Rita Morena, Bambang Pramono, and Nugroho Joko Prastowo (2001c) Monetary Policy and Firm Investment: Evidence for Balance Sheet Channel in Indonesia, paper presented at a seminar Monetary Policy Transmission in Indonesia, Bank Indonesia, Jakarta, November 2001

Alamsyah, Halim, Charles Joseph, Juda Agung, and Doddy Zulverdy (2001). Towards Implementation of Inflation Targeting in Indonesia, *Bulletin of Indonesian Economic Studies,* Vol 37, No. 3, pp: 309-24.

Bank Indonesia (2000). The General Equilibrium Model of Bank Indonesia (GEMBI) . Division of Macroeconomic Studies, Directorate of Economic Research and Monetary Policy.

Bank Indonesia (2001a). Short-term Forecast Model of Indonesian Economy (SOFIE) . Division of Macroeconomic Studies, Directorate of Economic Research and Monetary Policy.

Bank Indonesia (2001d). *Annual Report of 2000 and 2001.* Bank Indonesia, Jakarta.

Bernanke, B. and Blinder, A.S. (1992) The Federal Funds Rate and the Channel of Monetary Transmission, *The American Economic Review* September 1992, pp. 901-21.

Bernanke, B. and Gertler, M. (1989), Agency Cost, Net Worth and Business Fluctuations, *The American Economic Review,* March 1989, pp. 14-31.

Bernanke, Ben S., Thomas Laubach, Frederic S. Mishkin, and Adam Posen (1999). *Inflation Targeting: Lessons from the International Experience.* Pricenton University Press.

Blejer, Mario, Alain Ize, Alfredo M. Leone, and Sergio Werlang (2000). Inflation Targeting in Practice. International Monetary Fund, Washington.

Boediono (1998). Merenungkan Kembali Mekanisme Transmisi Moneter di Indonesi (Revisiting

Monetary Transmission Mechanism in Indonesia). *Buletin Ekonomi Moneter dan Perbankan*, Vol. 1, No. 1, pp. 1-4.

Boediono (2000). Comments on Inflation Targeting in Indonesia Charles Joseph and Anton Gunawan (eds.) *Monetary Policy and Inflation Targeting in Emergin Economies. Bank Indonesia, Jakarta.*

Filardo, Andrew J (2000). Monetary Policy and Asset Prices, Federal Reserve Bank of Kansas City, *Economic Review,* Third Quarter-2000, pp 11-37.

Gertler, M (1988). Financial Structure and Aggregate Economic Activity: An Overview. *Journal of Money Credit and Banking.* Aug., part 2, pp.559-88.

Gertler, M and Gilchrist, S. (1993), The Role of Credit Market Imperfections in the Monetary Trasmission Mechanism: Arguments and evidence*, Scandinavian Journal of Economics,* 951, pp. 43-64.

Gertler, M and Gilchrist, S. (1994), Monetary Policy, Business Cycles and theBehaviour of Small Manufacturing Firms, *Quarterly Journal of Economics,* May 1994, pp. 309-40.

Gluck Heinz and Richard Mader (1998). Information Content and Wealth Effects of Asset Prices – The Austrian Case, in Bank for International Settlements Conference Papers on *The Role of Asset Prices in the Formulation of Monetary Policy,* March 1998, pp 196-209.

Goeltom, M.S. (1995). *Indonesia's Financial Liberalization: An Empirical Analysis of 1981-1988 Panel Data.* Institute of Southeast Asian Studies. Singapore.

Harris, J.R., Schiantarelli, F., and Siregar, M.G. (1994). The Effect of Financial Liberalisation on the Capital Structure and Investment Decisions of Indonesian Manufacturing Establishments, *The World Bank Economic Review,* 8, pp.17-47.

Hoffmaister, Alexander W., and Garry J. Schinasi (1994). Asset Prices, Financial Liberalization and the Process of Inflation in Japan, *IMF Working Paper 94-153,* December 1994.

Idris, Rendra Z., Tri Yanuarti, Clarita L. Iskandar, and Darsono (2001), Asset Price Channel of Monetary Policy Transmission Mechanism in Indonesia. Division of Real Sector Studies, Directorate of Economic Research and Monetary Policy, Bank Indonesia, 2001.

Joseph, Charles and Anton Gunawan, eds. (2000). Monetary Policy and Inflation Targeting in Emergin Economies. Bank Indonesia, Jakarta.

Kakes, Janes (2000). Monetary Transmission in Europe: The Role of Financial Markets and Credit. Edward Elgar: Cheltenham.

Kashyap, A.K. and Stein, J.C., (1995), Impact of Monetary Policy on Bank Balance Sheets. *Carnegie-Rochester Series on Public Policy,* June 1995, pp. 151-95.

Kusmiarso, Bambang, Elizabeth Sukowati, Andry Prasmuko, Sudiro Pambudi, Dadal Angkoro, Iss Savitri Hafid (2001). Interest Rate Channel of Monetary Transmission in Indonesia paper presented at a seminar Monetary Policy Transmission in Indonesia, Bank Indonesia,

Jakarta, November 2001.

Minguez, J.M.G. (1997). The Balance Sheet Transmission Channel of Monetary Policy: the cases of Germany and Spain, *Working Paper*, Banco de Espana.

Oliner, S.D. and Rudebusch. G.D. (1996). Is there a Broad Credit Channel for Monetary Policy?" *Federal Reserve Bank of San Francisco Economic Review,* 1, pp. 3-13.

Sarwono, Hartadi.A. and Perry Warjiyo (1998). Mencari Paradigma Baru Manajemen Moneter Dalam Sistem Nilai Tukar Fleksibel: Suatu Pemikiran Untuk Penerapannya di Indonesia. (Searching for New Paradigm for Monetary Management under Flexible Exchange Rate System) *in Buletin Ekonomi Moneter dan Perbankan,* Vol. 1, No. 1, pp. 5-23.

Schaechter, Andrea, Mark R. Stone, and Mark Zelmer (2000). Adopting Inflation Targeting: Practical Issues for Emerging Market Countries. *IMF Occasional Paper* No. 202.

Siswanto, Benny, Yati Kurniati, Gunawan, and Sari H. Binhadi (2001). Exchange Rate Channel of Monetary Transmission in Indonesia paper presented at a seminar Monetary Policy Transmission in Indonesia, Bank Indonesia, Jakarta, November 2001.

Sitorus, Tarmiden (2000). Towards the Implementation of Inflation Targeting in Indonesia: A Review of Operational Issues in Charles Joseph and Anton Gunawan (eds.) *Monetary Policy and Inflation Targeting in Emergin Economies. Bank Indonesia*, Jakarta.

Svensson, Lars (1997), Open Economy Inflation Targeting, Working Paper, Stockholm University.

Warjiyo, Perry and Doddy Zulverdi (1998). The Use of Interest Rate as Operational Target of Monetary Policy in Indonesia, *Buletin Ekonomi Monter dan Perbankan,* Vol. 1, No.1, 1998 (in Bahasa Indonesia).

Warjiyo, Perry (2002). Towards Inflation Targeting: The Case of Indonesia in *Inflation Targeting: Theories, Empirical Models and Implementation in Pacific Basin Countries.* Bank of Korea: Seoul, January 2002.

Wuryandani, Gantiah, Abdul M. Ikram, and Tri Handayani (2001). Monetary Policy Transmission through Inflation Expectation Channel. *Division of Real Sector, Directorate of Economic Research and Monetary Policy, Bank Indonesia.*

Chapter 2

Interest Rate Channel of Monetary Transmission in Indonesia

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INTRODUCTION

There has been a long debate whether Bank Indonesia needs to change the conduct of its monetary policy management from "quantity" targeting to "price" targeting. To date, the monetary management is still based on the "quantity" money channel of transmission mechanism. This means that the impacts of monetary policy to real economy and prices are assumed to work through its effects on monetary aggregates (M1 and M2). In its monetary operations, therefore, Bank Indonesia uses base money as its operating target set in accordance with the inflation target and the level of economic activity. However, the swift changes in domestic and international economy have brought the monetary aggregates targeting less relevant. Most of the money creation process takes place beyond the control of monetary authority, thus diminishing the effectiveness of monetary policy implementation.

The recommendation for Bank Indonesia to shift to "price" targeting by using interest rate as its operating target of monetary policy has emerged even before the crisis. For example, previous studies by Hartadi (1996) and Warjiyo (1997) concluded that monetary transmission through interest rate and exchange rate channels are more viable to be applied in Indonesia. Such conclusion was based on several arguments. Those are: (1) the integration of domestic financial market with international market as a consequence of globalization; (2) the rapid development of financial instruments as a consequence of financial and banking sector

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reformation; (3) the decoupling of monetary sector and real sector (turn over of money in the financial market exceeds the needs in the real sector); (4) the relatively large amounts of short term capital inflows which are vulnerable to rumor and speculation, and; (5) the shift of exchange rate regime from crawling to floating exchange rate.

In reality, nonetheless, the prolonged economic crisis has prevented the willingness to quickly shift from the money channel of monetary management to the new operational target using interest rate. The crisis has gone deep rooted and has been strongly installed into the whole economy, causing some disruptions on the transmission of monetary policy. In addition, there has been a huge liquidity leakage resulting from the central bank's liquidity support needed to back up the government blanket guarantee program on banks' deposits.[1] In such circumstances, the monetary management through managing monetary aggregates is considered more appropriate. This is in line with the IMF program whereby the base money targeting is one of performance criteria for monetary management. Moreover, although various empirical studies generally indicated a strong relation between interest rate as intermediate target and output as ultimate target, the transmission mechanism from interest rate to the real economy and inflation is still unknown.

There are three ways by which interest rate transmits monetary policy into output and inflation, i.e. through cost of capital, substitution, income effects. This paper intends to assess these three channels of interest rate and investigate which effects are more significant. To investigate how these three effects are working, this study employs Granger Causality test and Vector Autoregression (VAR) analysis. Furthermore, to have a deeper understanding on bank behaviour in responding to policy rate, several structural equations are estimated. The study employs monthly data for the period of January 1989 to December 2000.

THEORETICAL FRAMEWORK

According to Warjiyo (1998), the essence of price targeting in monetary management is the price of money, i.e. interest rate. The monetary transmission mechanism through interest rate channel is conducted by managing the short-term interest rate to stay at the targeted level. Change in short-term interest rate will then be transmitted to all medium and long-term interest rate through the balancing mechanism of supply and demand.

The change in short term nominal rate as established by the central bank can induce changes in real short and long term interest rates with the existence of sticky price notion. The price

1 The program is an integral part of government's efforts to restructure the banking system from the crisis. Under the program, the government provides full guarantee for paying all of banks liabilities in the event of banks closure. The central bank is asked by the government to provide the funds for supporting the programs, known as Bank Indonesia's Liquidity Support (BLBI), for a return of promissory notes issued by the government.

stickiness causes the expansive monetary policy to drive down the short-term real interest rate. Expectation hypothesis of term-structure, which states that the long-run real interest rate is the average of expectation of future short-term interest rates, indicates that the lower short-term real interest rate causes a decrease in long-term real interest rate. All of these movements are expected to influence price variables in the financial market, real sector variables, and finally, inflation.

In general the interest rate channel of monetary transmission can be described as follow:

Based on Keynesian (Nualtaranee, 2001), the monetary policy through cost of capital channel is transmitted to the real economy as characterized by a schematic diagram as below:

A tight monetary policy leads to a rise in real interest rate, which in turn raises the cost of capital, thereby causing a decline in investment spending, and subsequently drives a decline in aggregate demand and a fall in output.

Interest rate plays crucial role in determining how the monetary policy is transmitted to the economy where interest rate has strong relation with firm and household expenditures (Mishkin, 1999). Monetary contraction will increase short-term nominal rate. Combined with sticky price and rational expectation, long-term interest rate will rise following an increase of short term interest rate. Although in the early stages this mechanism only works for firms' investment expenditure decision (business sector), research also showed that household spending on durable goods is also affected, and these spending are considered investment.

Nualtaranee (2001) supports the above notion by pointing out that the strong relation between real interest rate and assets is the main factor in monetary transmission mechanism. A change in real interest rate will have impact on cost of capital, which will then influence the asset value and investment decision. Starting from the banking sector, the tight bias monetary policy through contraction of liquidity in the economy limits banks' ability to obtain funds. This will give pressure to interest rate to rise and thus increase in the cost of capital as reflected by the cost of borrowing charged by the banks. The increases will lead to lower expenditure for investment goods and durable goods and to the decrease of aggregate demand, and thus output.

The tight monetary policy is supposed to reduce the value of assets at least temporarily and to slow down investment activity. This impact is generally stronger and is easier to detect

from the change in property and construction prices as compared to stocks and non-construction investment prices. However, interest rate is only one factor that influences investment variables, and it is difficult to isolate the effect from interest rate change to the effects from other changes resulting from the monetary shocks. This so called asset price channel will specifically be discussed in Chapter 7 at this book.

In addition to business sector and household decisions on investment and durable goods consumption, the monetary policy affects consumers' expenditure on non-durable as described in the income and substitution effects (Favero, 2001). The substitution effect predicts unequivocally a reduction in consumption on non-durable goods when real interest rate increases because the returns to saving increase. By postponing consumption, economic agents benefit from interest income. Under normal circumstances, higher interest rate implies that consumption in the future costs less. The higher is the interest rate, the bigger probability that consumption will post positive trend, increasing at slow pace in the early stages before it accelerates.

Study by Mahadeva and Sinclair (2001) indicates that there are two main transmission channels taken from the change in monetary policy to change in consumption.

The third channel through interest rate is income effect. If consumers' decisions are based on current and discounted future income, then higher interest rate will have a contraction impact on consumption as they reduce future discounted income. Such effect, however, can be compensated by a higher return on wealth; if consumers are net creditors, a rise in interest rates increases their wealth (Favero, 2001). On the other hand, if consumers are net debtors with floating rate linked to short-term rates, they will see their cash flows reduced by the rise in short-term rates, and will thus cut net debtors spending. Such effect will be weaker where additional finance is readily available. In addition, impact of changes in short-term interest rate to household cash flow depends on household debt maturity. Accordingly, firms and household debt maturity are factors that determine the asymmetry in monetary transmission through interest rate channel.

The asymmetry feature of income effects is also pointed by Mojon (2000). It is highlighted that potential source of asymmetry is the structure of non-financial firms' balance sheet and how the sensitivity of the said balance sheet structure gives impact to interest income and payment as well as wealth stemmed from changes in money market interest rate. There are three factors that determine the income effect of changes in monetary policy; those are: (1) Composition and size of balance sheet (2) Deposits and credit maturity (3) Price response to shock from monetary policy.

For instance, a household that has little debts but holds considerable securities will find an increase in their disposable incomes when the monetary policy is tight bias.

On the other hand, the firms issuing those securities will find their earnings drop. Theoretically, household will increase its consumption and firms will lower their investment only if they lack of liquidity or when their income is affected.

METHODOLOGY AND DATA

In line with the objective of our research, that is to picture monetary transmission mechanism, in our initial stage of study we observe the stylized fact of variables that are considered as proxy for indicators of transmission mechanism. In addition, we adopt Granger tests to assess the causality relation among those variables. The variables, ranging from those represent central bank policy to those represent economic performance, are one-month central bank's certificate (SBI) interest rate, overnight interbank call money market rate, one-month time deposits real rate, three-month time deposit real rate, investment loan real rate, working capital loan real rate, consumption growth, investment growth, investment deflator, consumption deflator, GDP deflator, and inflation.

Samples used in the research are monthly series data of period January 1989 to December 2000 with 144 observations. All variables are in form of logarithm data except for interest rate and inflation rate, which are in annual data. We used interest rate in real term (except for one-month SBI and PUAB rates) because economic agents make their decision taking expected inflation into their account. Expected inflation variables are 3-month moving average year-on-year inflation. Exception are applied to one-month SBI rate and PUAB rate which use nominal variables as PUAB and SBI rates are assumed as policy rate.

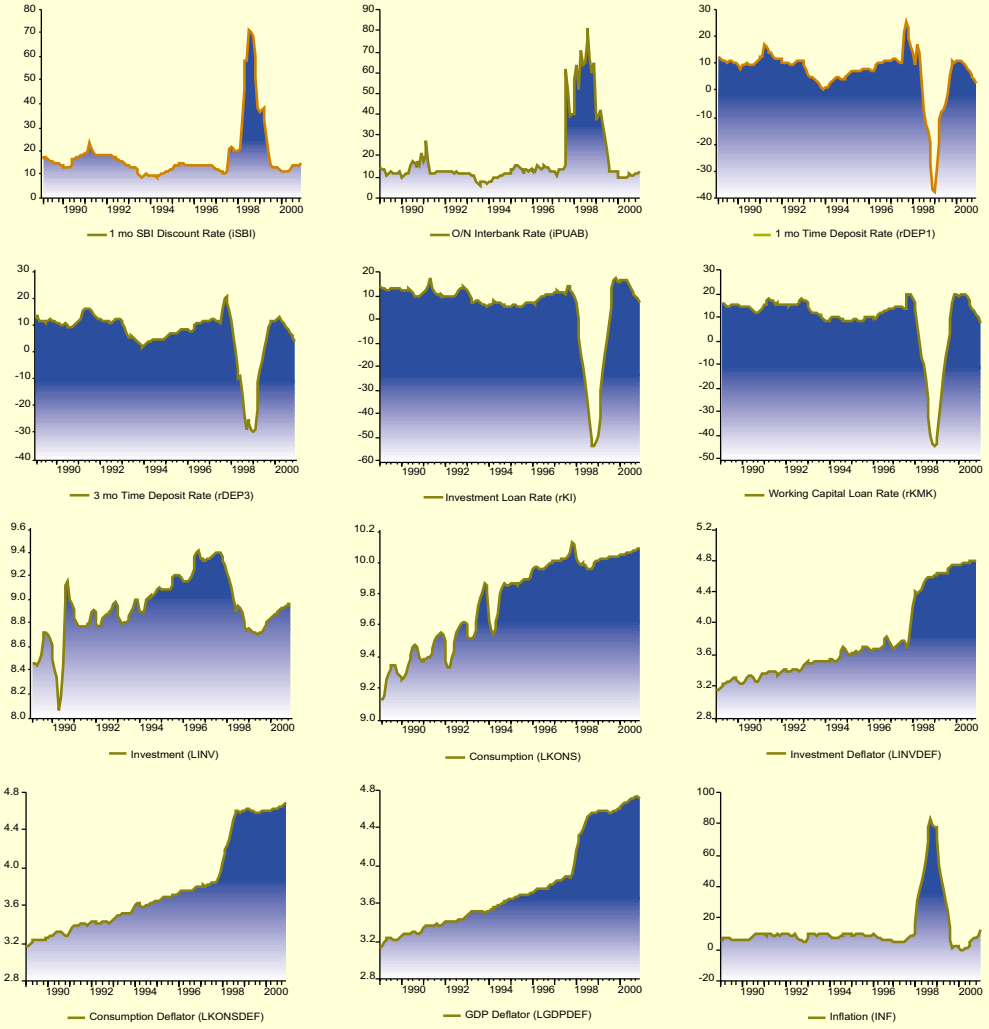
EMPIRICAL RESULTS

The graphic analysis shows a broad picture that the movement pattern of all variable are similar during the observed period except between period 1997 and end of 1999. Based on that picture, we categorize the observed period into two, i.e., pre-crisis period (January 1989 - July 1997) and post-crisis period (August 1997 - December 2000).

Stylized Facts

During the pre-crisis period, movement of policy rate is followed by movement of other interest rate variable in the same direction. However, the movement of interest rate and that of variable representing real sector do not show a particular pattern of relationship among the variables. Investment and consumption variables during the pre-crisis tend to increase although SBI interest rate was relatively stable. One possible explanation for this is the relatively stable SBI rate that economic agents foresee stable inflation; hence they tend to make investment.

Graph 2.1
Analysis on All Variables



In the post-crisis period, movement of deposit rate as well as loan rates show an opposite direction as compared to that of SBI interest rate as policy factor. It was the high inflation rate at that time that brought the movement in opposing direction that the real interest rate tends to be negative. Subsequently, real sector variable movement shows no particular pattern when related to interest rate variable.

Granger Causality Test

To further assess the relation among variables, we use Granger test. Before proceeding to the Granger test, we conduct stationarity test of each variable. As presented in Table 2.1., all variables are stationary at level except for interest and inflation rate variables. The stationarity test will affect model estimation. Should the said variables are integrated; then there is possibility of having co-integration equation, which can improve estimation of the model used.

Our Granger analysis is divided into three observation period; those are: (1) January 1989 - December 2000, (2) January 1989 - July 1997, and (3) August 1997 - December 2000. Such division is established because the economic condition-taking place since August 1997 is considered to cause different behavior of economic agents.

Table 2.1 Result of Stationarity Tests

Result of ADF Test

No.	Variable	Level		First Difference	
		Lags	ADF Test	Lags	ADF Test
1	iSBI	11	-3.420553**	11	-3.956996*
2	iPUAB	1	-2.298123	1	-10.80576*
3	rDEP1	5	-4.237313*	7	-4.747156*
4	rDEP3	9	-3.424206**	10	-4.844854*
5	rKI	1	-4.480257*	6	-5.192266**
6	rKMK	10	-2.292081	9	-5.200986*
7	LINV	10	-1.941268	12	-2.932598**
8	LKONS	12	-2.244811	12	-3.407796**
9	LINVDEF	11	0.156028	10	-2831525***
10	LKONSDEF	8	0.570099	7	-3.846745*
11	LGDPDEF	7	0.264989	6	-3.622560*
12	INF	7	-2.833641***	12	-3.018623**

Note :
* 1% significance level
** 5% significance level
*** 10 significance level

On the observation period between January 1989 to December 2000 (see Appendix A), Granger analysis (Table 2.2) result shows that the interest rate channel can only transmit the monetary policy from the policy rate to the banking sector. Transmission mechanism from

the banking sector to the real sector is not found as reflected in low F-Statistic between banking sector interest rate variable and investment and consumption variable. Meanwhile, real sector variable is found to have significant impact to inflation variable.

The break between banking sector variable to the real sector variable could be caused by the low expected inflation in pre-crisis. In this setting, investment behavior is not affected by movement in loan rate as interest rate increase is followed by investment increase too.

Table 2.2. Results of Granger Test for the Whole Period (January 1989 - December 2000)

No.	Causality (X → Y)		Obs	Lag	F-Statistic	Probability
	X	Y				
1	iSBI	iPUAB	154	2	8,55865	0,00030
	iPUAB	iSBI			8,08657	0,00046
2	iPUAB	rDEP1	152	2	12,90450	6,9E-06
	rDEP1	iPUAB			2,65373	0,07376
3	rDEP1	rDEP3	152	2	31,93360	3,0E-12
	rDEP3	rDEP1			29,99480	1,2E-11
4	rDEP1	rKI	153	1	109,12800	0,00000
	rKI	rDEP1			52,99190	1,7E-11
5	rDEP3	rKI	153	1	14,03640	0,00026
	rKI	rDEP3			19,89450	1,6E-05
6	rDEP1	rKMK	153	1	97,84640	0,00000
	rKMK	rDEP1			54,89680	8,6E-12
7	rDEP3	rKMK	153	1	6,42121	0,01230
	rKMK	rDEP3			13,71590	0,00030
8	rKI	LINV	142	12	1,63456	0,09118
	LINV	rKI			2,28964	0,01181
9	rDEP1	LKONS	147	7	0,68517	0,68440
	LKONS	rDEP1			0,96107	0,46243
10	rDEP3	LKONS	143	11	0,41409	0,94749
	LKONS	rDEP3			1,28355	0,24198
11	LKONS	LKONSDEF	141	3	2,36038	0,07430
	LKONSDEF	LKONS			2,69576	0,04852
12	LINV	LINVDEF	141	3	2,23004	0,08761
	LINVDEF	LINV			0,08821	0,96640
13	LGDPDEF	INF	141	3	9,74787	7,3E-06
	INF	LGDPDEF			4,93303	0,00279
14	LINVDEF	LGDPDEF	141	3	4,77107	0,00342
	LGDPDEF	LINVDEF			6,83819	0,00025
15	LKONSDEF	LGDPDEF	142	2	4,44155	0,01352
	LGDPDEF	LKONSDEF			2,40786	0,09381
16	LGDPDEF	rPUAB	138	6	3,12613	0,00689
	rPUAB	LGDPDEF			9,99086	5,3E-09

Granger analysis for observation period of January 1989 to July 1997 (see Appendix B) as shown in Table 2.3, shows a similar result to that of period January 1989 to December 2000. Transmission mechanism from banking sector to the real sector do not show significant F statistic, implying no impact of changes in credit and deposit rates to consumption variable. As elaborated above, the low inflation expectation can drive up investment although interest rate is increasing. Another factor that causes the break of channel between banking sector and the real sector is the high access to external borrowing, leaving investment unaffected to high loan rate.

Table 2.3 Results of Granger Test - Pre Crisis
(January 1989 - July 1997)

No.	Causality (X → Y)		Obs	Lag	F-Statistic	Probability
	X	Y				
1	iSBI	iPUAB	105	10	3,36995	0,00098
	iPUAB	iSBI			2,53456	0,01014
2	iPUAB	rDEP1	112	1	26,15000	1,4E-06
	rDEP1	iPUAB			0,16116	0,68888
3	rDEP1	rDEP3	112	1	32,92630	8,7E-08
	rDEP3	rDEP1			7,91951	0,00580
4	rDEP1	rKI	107	6	16,32110	8,6E-13
	rKI	rDEP1			3,63960	0,00272
5	rDEP3	rKI	107	6	5,46190	7,0E-05
	rKI	rDEP3			1,90524	0,08795
6	rDEP1	rKMK	101	12	3,82571	0,00015
	rKMK	rDEP1			2,27370	0,01587
7	rDEP3	rKMK	102	11	2,74382	0,00466
	rKMK	rDEP3			2,38271	0,01327
8	rKI	LINV	101	12	0,94071	0,51191
	LINV	RKIr			4,48706	2,1E-05
9	rDEP1	LKONS	101	12	0,78294	0,66609
	LKONS	rDEP1			0,33938	0,97906
10	rDEP3	LKONS	101	12	0,58021	0,85157
	LKONS	rDEP3			0,43471	0,94444
11	LKONS	LKONSDEF	97	6	4,48475	0,00055
	LKONSDEF	LKONS			5,05395	0,00018
12	LINV	LINVDEF	97	6	2,40178	0,03431
	LINVDEF	LINV			4,17333	0,00102
13	LGDPDEF	INF	100	3	0,58869	0,09666
	INF	LGDPDEF			2,17114	0,62393
14	LINVDEF	LGDPPI	100	3	1,88002	0,13835
	LGDPDEF	LINVDEF			4,04413	0,00946
15	LKONSDEF	LGDPDEF	95	7	2,06813	0,04902
	LGDPDEF	LKONSDEF			2,64700	0,01271
16	LGDPDEF	rPUAB	97	6	0,64505	0,69388
	rPUAB	LGDPDEF			2,35297	0,03775

On the other hand, GDP deflator has no significant impact to inflation. Further analysis shows that investment influence to investment deflator is stronger as compared to consumption influence to consumption deflator. Therefore, we can conclude that in pre-crisis period, GDP deflator is more affected by investment than consumption. In the case where investment increases at time of high interest rate, we can expect that substitution effect, whereby economic agents postpone their consumption to put investment, took place during pre-crisis period. This conclusion will be further confirmed through VAR analysis in the next section.

Table 2.4 Results of Granger Test Post Crisis
(August 1997 - December 2000)

No.	Causality (X → Y)		Obs	Lag	F-Statistic	Probability
	X	Y				
1	iSBI	iPUAB	41	2	2,53509	0,09332
	iPUAB	iSBI			1,92903	0,16001
2	iPUAB	rDEP1	41	1	7,86586	0,00789
	rDEP1	iPUAB			1,46387	0,23379
3	rDEP1	rDEP3	41	3	7,49400	0,00056
	rDEP3	rDEP1			6,91763	0,00093
4	rDEP1	rKI	41	1	50,34450	1,8E-08
	rKI	rDEP1			18,59470	0,00011
5	rDEP3	rKI	41	1	9,77170	0,00339
	rKI	rDEP3			11,75820	0,00147
6	rDEP1	rKMK	41	1	42,15130	1,2E-07
	rKMK	rDEP1			20,05390	6,7E-05
7	rDEP3	rKMK	41	1	5,37367	0,02592
	rKMK	rDEP3			10,22640	0,00279
8	rKI	LINV	41	12	5,04202	0,00170
	LINV	rKI			2,06227	0,08837
9	rDEP1	LKONS	41	5	3,33393	0,01637
	LKONS	rDEP1			2,52899	0,05033
10	rDEP3	LKONS	41	3	2,08888	0,11998
	LKONS	rDEP3			0,44399	0,72309
11	LKONS	LKONSDEF	41	3	4,08845	0,01396
	LKONSDEF	LKONS			6,76632	0,00106
12	LINV	LINVDEF	41	3	3,85209	0,01782
	LINVDEF	LINV			2,68229	0,06222
13	LGDPDEF	INF	41	3	2,85198	0,05169
	INF	LGDPDEF			1,43100	0,25077
14	LINVDEF	LGDPDEF	41	7	4,84448	0,00134
	LGDPDEF	LINVDEF			3,87988	0,00509
15	LKONSDEF	LGDPDEF	41	2	17,51090	4,9E-06
	LGDPDEF	LKONSDEF			14,86700	2,0E-05
16	LGDPDEF	rPUAB	41	6	1,63591	0,17431
	rPUAB	LGDPDEF			2,68756	0,03456

In observation period of August 1997 to December 2000 (see Appendix C), Granger analysis shows that policy rate can significantly influence other variables all the way to real sector and inflation. An interesting thing to consider is that the test shows a significant F-test of 5.04202 and 3.33393 for loan rate to investment and deposit rate to consumption respectively. It implies that investment and consumption levels are still high in spite of higher loan and deposit rate.

The above condition can be foreseen if we take into consideration of income effect. In the income effect notion, economic agents increase their consumption as they anticipate higher wealth due to relatively higher deposits interest rate. On the other hand, investment does not accordingly fall since investor use self-financing with relatively small amount of fund.

Passthrough Effect

Numbers of studies have put forward to measure the passthrough effect of change in policy variables - in this case is (Interbank Call Money Market) PUAB - to other variables. Among those measures is the Error Correction Mechanism (ECM) employed by Mojon (2000) to find out passthrough effect from money market rate to retail bank rate. The study covers various credit and deposit rates in several European countries. The estimation equation is as follow:

whereas r_t is money market rate and i is retail bank rate, and Δ is the first difference operator. Number of lag is chosen using general to specific approach. This specification can be applied as long as the two rates are integrated, shown by the significance of γ coefficient. Significance and the correct sign of this coefficient will be the determinant of presence and size of passthrough effect from money market rate to retail bank rate. Meanwhile, the β coefficient is used to assess elasticity bank retail rate to change of money market rate.

Table 2.5 Passthrough Effect of Some Variables to Money Market Rate

Before Crisis (1988:01 - 1997:07)				After Crisis (1997:08 - 2000:12)			
Variable	β	γ	β lags	Variable	β	γ	β lags
iDEP1	0.1260	-0.1143	3	iDEP 1	0.1203	-0.2019	7
iDEP3	0.0494	-0.0685	3	iDEP 3	0.0819	-0.0599	2
iKMK	0.0766	-0.0541	3	iKMK	ns	ns	-
iKI	0.2169	-0.0600		iKI	ns	-0.0152	-
LKONS	ns	ns	-	LKONS	-0.0009	ns	5
LINV	ns	ns	-	LINV	0.0009	0.0003	11
LKONSDEF	ns	ns	-	LKONSDEF	ns	0.0006	-
LINVDEF	ns	ns	-	LINVDEF	-0.0012	ns	2
LGDPDEF	ns	ns	-	LGDPDEF	-0.0006	-0.0003	2

In this paper, we adopt the Error Correction Mechanism used by Mojon with addition of passthrough effect and elasticity of PUAB rate to real sector variables. As seen from the table, the passthrough effect of PUAB rate before the crisis only occurred to financial sector variables while it did not happen to the real sector variable. From the table above, it is seen that the coefficient γ of deposit rate (1 and 3 month) is bigger than the coefficient γ of the working capital and investment loan rate. This shows that the banks adjust its deposits interest rate faster than the loan rate as a response to the PUAB rate change. During the crisis period, the passthrough effects to financial sector variables have a similar pattern to that of pre-crisis period except that there is working capital loan rate that is not significant. Meanwhile, only GDP deflator inflation has correct sign and significant influence to the real sector variables although with very low coefficient, i.e., 0.0003.

The result obtained from the two periods of observation shows that the passthrough effect from the change in PUAB rate presents well in financial sector variables while it is vaguely seen in the real sector variables.

Table 2.6 Passthrough Effect of Some Variables to Money Market Real Rate

Before Crisis (1988:01 - 1997:07)				After Crisis (1997:08 - 2000:12)			
Variable	β	γ	β lags	Variable	β	γ	β lags
rDEP1	0.081	-0.068	3	rDEP1	0.141	ns	1
rKI	0.190	-0.053	2	rKI	-0.066	ns	1
LKONS	ns	ns	-	LKONS	-0.001	ns	5
LINV	ns	ns	-	LINV	-0.001	ns	8
GDPG_GR	ns	ns	-	GDPG_GR	-13.702	-0.958	11
INF	ns	ns	-	INF	-0.098	-0.046	3

VAR Analysis

After understanding how one variable is affecting the other through Granger causality and passthrough effect, the next stage in our study is to see the direction and magnitude of each variables response to the shock of any policy variables. We employ VAR as it can explain each variable's response to shock error term of policy variables through the use of Impulse Response Function. In addition, the information on the impact magnitude contributed by each variable to the other variable through the use of variance decomposition.

As with Granger analysis, we conduct our analysis each for pre-crisis (1988:01 - 1997:07) and post-crisis (1997:08 - 2000:12). Nonetheless, such division limits the degree of freedom that can be used to establish a VAR system for each observation period. To address the issues of degree

of freedom, we will not apply all variables of the monetary transmission mechanism within the interest rate channel into the VAR system. In choosing variables, we consider the variables order within the transmission mechanism based on our hypothesis and best statistic test of each VAR model including unrestricted co-integration rank test, stability test, residual normality test, and residual serial correlation LM Test. Our VAR analysis is divided into three sections following the general path in the monetary policy transmission to the real sector using interest rate; those are (1) cost of capital, (2) substitution effect and (3) income effect.

Before further discussion, note that the data constraints have caused limitation for interpreting and explaining the outcomes and eventually influence the conclusions. Due to the limited of availability of supporting (detailed) data, in certain cases, the explanation and the analysis of the outcomes, particularly when it does not comply with the theory employed, was enhanced with the relevant information and facts gained from the empirical facts within the corresponding period.

Evidence on transmission in pre-crisis period

Cost of Capital

There are four variables in the VAR system for the pre-crisis period (see Appendix D); those are overnight interbank rate (iPUAB), three-month deposit real rate (rDEP3), investment loan real interest rate (rKI), and investment growth (LINV). The framework of monetary transmission mechanism can be depicted as follow:

$$iPUAB \rightarrow rDEP3 \rightarrow rKI \rightarrow LINV.$$

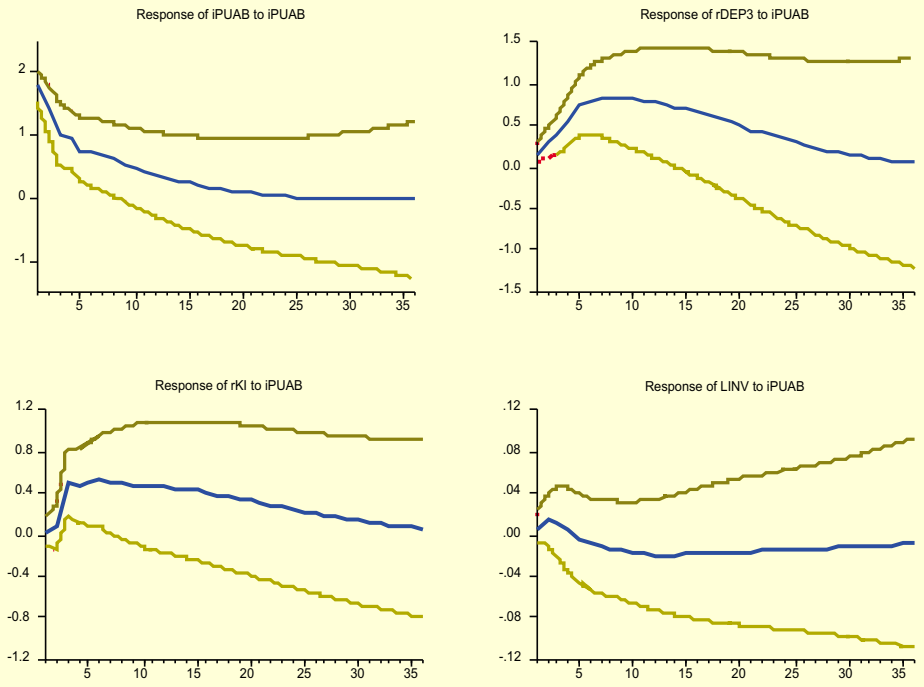
We use the forecast error variance decomposition analysis to find the contribution magnitude of each variable in influencing the others. Based on the variance decomposition, it is found that PUAB rate strongly influences the three-month deposit real rate variation in the longer term. Then, still in the longer run, the three-month deposits real interest rate and PUAB rate strongly influence variations in investment loan real rate. The real investment loan rate becomes the strongest variable to influence the investment growth. Accordingly, if we look at the magnitude of influence from each variable within the systems, the notion of cost of capital is evidenced in the pre- crisis period, transmitting the monetary policy through interest rate from the financial sector to the real sector.

We then use one standard deviation of policy variable shock (i.e., iPUAB) to find the direction of relationship among variables (positive or negative) besides the magnitude of the

response. By incorporating the four variables above, we find the VAR model optimized at lag three.

Responses given by each variable in the pre-crisis period are still in line with our hypothesis. Graph 2.2 shows that shock of PUAB rate to the PUAB rate itself which instantaneously increase interest rate before it then gradually converge to the previous balance. The increase of PUAB rate leads to an increase in three-month deposit real rate with a smaller percentage. Unlike the PUAB rate which will then decrease until it reaches its initial balance, the three-month deposits real interest rate still increase until it reaches its top until about six months before it returns to its initial balance. This finding demonstrates the lag in bank response to monetary policy. Similar response is also found in investment loan real interest rate which instantaneously rises and reaches its top on the third month before it slides down again to the initial balance. Next, although real investment loan rate rises, investment growth variable will instantaneously increase until the fourth month and then slide down to negative growth.

Graph 2.2.
Impulse Response through Cost of Capital Channel Pre Crisis



From the response given by each variable, it is clear that when the central bank raises the policy rate, banking sector tends to promptly increase its loan rate (within three months) as compared to its deposit rate (within 6 months). The behavior is related to the fact that deposit rate is banks' cost whilst loan rate is banks' revenue. The increase in investment loan rate has a negative effect to the investment growth with four-month lag.

The response and its direction of each variable in the VAR system show that during pre-crisis period, the cost of capital works well in transmitting monetary policy using interest rate. This is explainable as during that period the banking and real sector are still in normal circumstance; hence they can give proportional response to the central banks' monetary policy.

Substitution / Income Effect

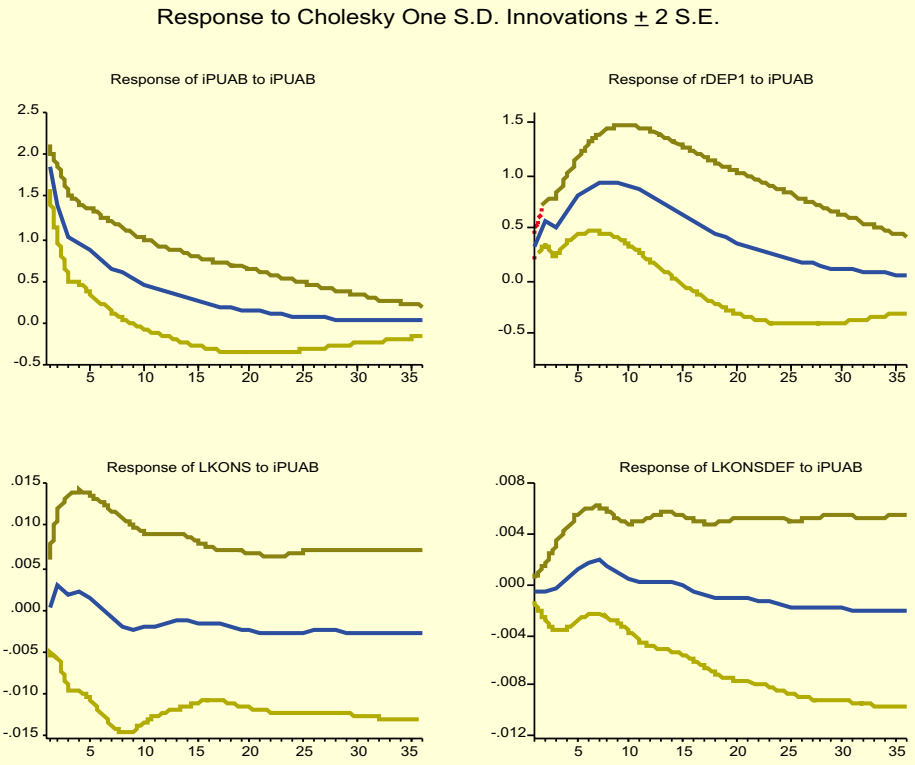
On the inter-temporal substitution/income effect VAR model for the pre-crisis period (see Appendix E), variables used are overnight inter-bank rate (iPUAB), one-month deposits real interest rate (rDEP1), consumption growth (LKONS), inflation variable consumption deflator (LKONSDEF). The framework can be depicted as follow:

iPUAB → rDEP1 → LKONS → LKONSDEF

Variance decomposition shows that the PUAB rate, both short and long-term, is mostly influenced by PUAB rate itself because the PUAB rate is the policy rate. Change in PUAB rate in long-term strongly influences the one-month deposits real interest rate. However, the one-month deposits real interest rate is not strong enough in influencing consumption growth. The consumption growth during the pre-crises period is rather strongly influenced by itself both in short term and long-term. Consumption deflator inflation also has significant influence in the long-term, contrary to the hypothesis that it is influenced by consumption growth. This phenomenon provides evidence that in the pre-crisis period change, it is the consumption goods price that will mostly determine consumers' behavior than the one-month deposits interest rate. The reason is that during the pre-crisis period, the one-month deposits interest rate was relatively stable and low that depositors perceive the return is unattractive in real term.

The graph below shows the variance decomposition of each variable's response to the shock given to PUAB rate. The rise of PUAB rate following a monetary shock is promptly responded by un-proportional rise in the one-month deposit rate until the eight month. The slow and smaller proportion of such response is related to banks behavior before the crisis. In those days, bank can accumulate funding easily from customer, being attracted to the banks'

Graph 2.3
Impulse Response through Substitution/Income Effects Pre-Crisis



bonus and prizes, and from Bank Indonesia's open market operation with relatively low cost SBPU (money market promissory notes) selling, having rather expansive stance.

The consumption growth, which remains positive, indicates a lag in consumers' behavior. This lag is mostly affected by substitution effect from the change in deposits interest rate. This is seen from the negative consumption growth since the sixth month onward inline with the return of deposits interest rate to the initial balance. The effect from negative consumption growth in long term is also seen from the negative consumption deflator inflation.

Based on the above findings, it is evidenced that although there is substitution effect between change of one-month deposits interest rate and consumption growth, the relationship between the said two variables is not strong, particularly in the short-term. The weak relation is caused by the rigidity of deposit rate in the pre-crisis period because the loose monetary policy stance.

Evidence on transmission in post-crisis period

Cost of Capital

On post-crisis period of observation (see Appendix F), we use variables, in rank order, overnight interbank rate (iPUAB), investment loan real interest rate (rKI), investment growth (LINV), and investment deflator inflation (LINVDEF). By incorporating those four variables, we obtain the VAR optimal at lag 2. The framework of the monetary transmission mechanism involving those four variables can be depicted as follow:

iPUAB → rKI → LINV → LINVDEF

Based on variance decomposition of each of the above variables, it is found that PUAB rate as policy variable has the most significant influence in determining variation in investment loan real interest rate. However, the investment loan real interest rate has strong influence to investment growth only in short term while in the long term, the investment growth is influenced by investment deflator inflation. The investment deflator inflation is much affected by PUAB rate in the short run and by investment growth in the long run.

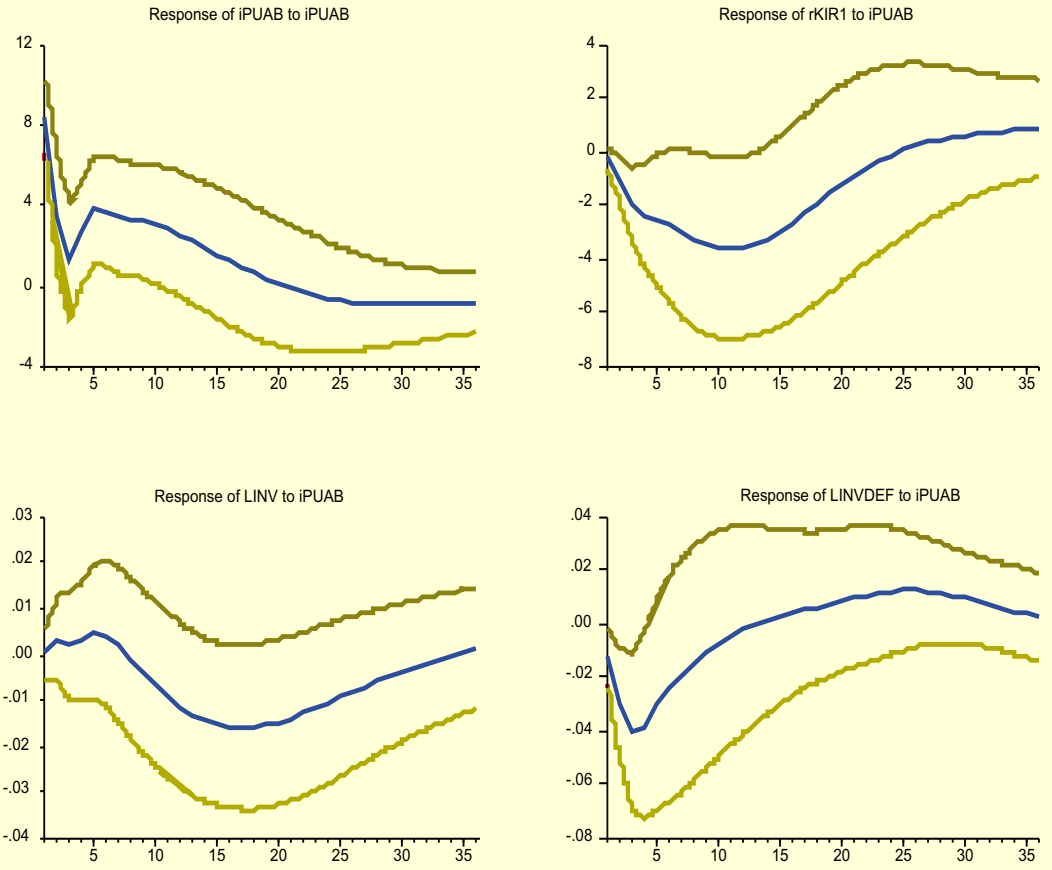
The response from each variable tends to depart from our hypothesis. When the PUAB rate increases, the investment loan real interest rate decreases. The lower rates turn out to bring down the investment growth although it responds differently at the beginning. This initial expansion in investment is suspected to be simply the remaining lag response from previous shock. Of all variable observed, only the inflation variable that is still in line with theory.

Nonetheless, the above finding actually shows that interest rate monetary policy transmission through cost of capital is still present although in contrary sense. The investment loan rate responds on opposing direction from the PUAB rate increase. This could be caused by high and rapid increase of SBI (Bank Indonesia Cetificate) nominal rate for quite a long period (1998-1999) which then leads to proportionate increase in bank interest rate. Meanwhile, credit investment nominal rate can not be raised too high as it may drag debtors into default. Such circumstance will, then, cause inflation (investment deflator) prompted by low inflation.

Substitution / Income Effect

The VAR model of monetary transmission mechanism based on inter-temporal substitution/income effect for the post-crisis period of observation (see Appendix G) use

Graph 2.4
Impulse Response through Cost of Capital Channel Post Crisis



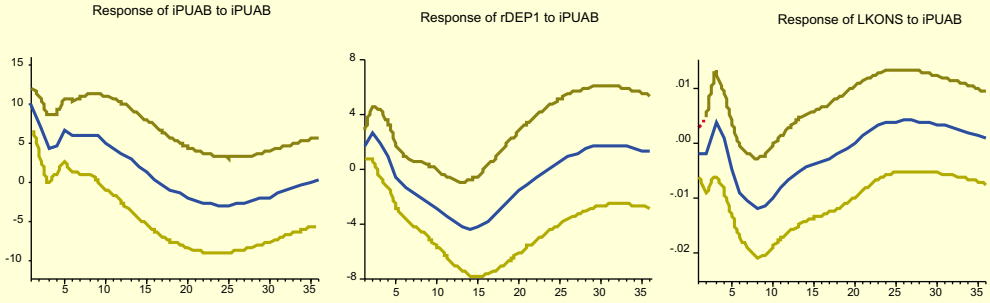
variables: overnight interbank rate (iPUAB), one-month deposits real interest rate (rDEP1), consumption growth (LKONS). The framework can be depicted as follow:

iPUAB → rDEP1 → LKONS

Based on variance decomposition analysis of each variable, the one-month deposits real interest rate is strongly influenced by PUAB rate. The one-month deposits real interest rate, however, does not influence the consumption growth as significant as the PUAB rate. During crisis, the nominal rate was so high that the society takes into account the nominal rate rather

than the real rate in deciding their investment and consumption. In this setting, bank deposits interest rate is seen as the best and only possible choice to place their fund although in real term the placement actually produced negative return.

Graph 2.5
Impulse Response through Substitution/Income Effects Post-Crisis



The increase of PUAB rate following the monetary shock is responded by an increase in one-month deposits real interest rate with a smaller magnitude until the 2nd month. Meanwhile, the increase of PUAB rate is initially responded by a negative growth of consumption for approximately two months. However, when the deposit real rate starts to decrease, household consumption follows to decrease with a lag of one month. This behavior persists over the coming months, leaving the deposit real rate and consumption growth to move toward the same direction.

Such initial response of consumption is presumed as a reflection of consumption behavior carried from pre-crisis period, which is much affected by substitution effect. The subsequent consumption response, which tends to move toward the same direction to that of deposit real rate, indicates the presence of income effect. The change in consumption behavior is explicable by the fact that deposit nominal rate has once reach 70% before it drop to 10%-11%, allowing fund owner to spend their assets when the interest rate return to normal level.

Banking Structural Model

There are various forms of interest rate that are involved with the banking operation. Nevertheless, this study focuses on bank short-term interest rate since it is the main form of

instrument, which is being used in some countries by central bank. On the other hand Mahadeva and Sinclair (2001) implied that the short-term interest rates which influence firms and households' spending are loans and deposits rates set by commercial banks.

In addition to using VAR as a test tool to the transmission mechanism through interest rate, a structural model test (Least Square Method) is also applied to find out determinant factors of bank interest rate. The short-term interest rates that are considered in this study are focused on 3 interest rates, which are overnight inter bank call money market rate (iPUAB), one-month deposit rate (iDEP1), and Loan Rate (iKMK). The investigation followed with examining interest rates in each group of banks, which are Commercial Banks, State Banks (Persero), Private National Foreign Exchange Banks (BUSD), Private National Non Foreign Exchange Banks (BUSND), Joint Venture and Foreign Bank (BAC), Regional Government Banks (BPD). To capture real economic condition, we used data from Monthly Bank Reports during 1991-2000 and grouped in to 3 period as follow: the period, pre-crisis, and post-crisis.

Inter-Bank Rate Determination

PUAB rate is suggested to be influenced by several factors, those are monetary policy factors, its lag and bank liquidity. The monetary policy factor in the short term is one-month rate, which is provided as an official central bank interest rate. According to survey on interest rate determination structure on banking side (SPPK-DKM, 2000), there are several variables both micro and macro, in interest rate determination, both on funding side and placement side. Bank lending to other bank in PUAB is determined by PUAB liquidity as reflected in previous PUAB rate, banks' own liquidity variables, counterpart bank liquidity and credit line limit. Accordingly, the structural model for PUAB rate is as follow:

$$iPUAB_t = \alpha_1 iSBI_t + \alpha_2 iPUAB_{t-1} + \alpha_3 log\ (\Delta Liq)_t$$

where *t* referring to period t; *iPUAB* denotes inter bank call money market nominal rates; *iSBI* denotes SBI nominal rates (central bank rates); log (ΔLiq) denotes banks' liquidity condition.

We can expect that α_1 and α_2 each > 0, the changing of PUAB rate has the same direction with the changing of SBI rate and lag PUAB rate. When banks have lack of liquidity, they will try to find from inter bank money market, and it causes increase of PUAB rate, $\alpha_3 < 0$.

The estimation result is seen in Table 2.7 below. For all period, an increase in SBI rate and lag PUAB rate caused PUAB rate grew up, the significance level of positive α_1 and α_2 are examined. The outcome in principle depicts that increase in SBI rate will drive up PUAB rate as policy

Table 2.7 Regression Result of Commercial Bank PUAB Rate

	Whole Sample (1991.01 - 2000.12)	Before Crisis (1991.01 - 1997.12)	After Crisis (1998.01 - 2000.12)
$i_{SBI\ t}$	0.25	0.12	0.32
	(2.87)	(2.48)	(2.10)
$i_{PUAB\ t-1}$	0.77	0.80	0.73
	(10.83)	(23.01)	(5.98)
Log (Liq_t - Liq_{t-1})	0.18	-0.60	0.07
	(0.39)	(-2.15)	(0.06)
R^2	0.93	0.93	0.90
DW-stat	2.31	2.31	2.43

factor influence the short-term money market interest rate. The role is increasing during the crisis period as during that time the monetary authority tended to be expansive that bank use the short-term funding interest rate as their reference. Meanwhile, SBI rate influencing role in bank funding rates is not considerable because the discount is big. On the post-crisis period, the role of SBI is increasing as a result of contractionary monetary policy. This has made the SBI rate as an alternative for placement.

On the other side, banks' liquidity only influenced PUAB rate before crisis, and the significance level of α_3 is negative. When bank liquidity shrink, bank will look for fund in PUAB that demand will increase, lead to rise in PUAB rate. Likewise, when liquidity is high, supply of fund will multiply that PUAB rate will decline. After the crisis, banks have plenty of fund and over liquid than before, this condition was depicted by no significance level of a positive α_3.

Bank Liquidity is relevant factor to determine PUAB rate for Private National Foreign Exchange Bank, Private National Non Foreign Exchange Bank and Regional Government Bank, with negative estimated α_3 in all period. Meanwhile in State Bank and Joint Venture and Foreign Bank, bank liquidity is not relevant factor because they have more access for funding (Appendix J).

Time Deposit Rate

In time deposit rate determination, the micro variable considered are the needed fund, target loan rate, which indirectly reflects profit target and bank strategy in the future. On macro variables, inflation (for pre-crisis period) and exchange rate and social and political condition (for post-crisis period) are considered influential. The time lag response to external factor such as liquidity tightening, change in interest rate by market leaders and competitors and exchange rate fluctuation, become shorter (1 week) as compared to pre-crisis period. Furthermore the guarantee deposits interest rate is now determined on monthly basis.

Bank considers future short-term interest rate, in this case it is PUAB, and its need for fund in its interest rate determination. In this case, one-month time deposit rate reflects short-term interest rate and serves as reference for long-term interest rate. To assess the impact of change in PUAB rate and funding need to time deposits rate, we establish an equation data as follow:

$$iDEPI_t = \alpha_1 iPUAB_t + \alpha_2 LDR_{+} \alpha_3 iPUAB_{t-1}$$

with t referring to period t; *iDEP* denotes bank time deposit rates; *iPUAB* denotes inter bank money market rates; LDR denotes bank needed for fund.
We can expect that α_1, α_2 and $\alpha_3 > 0$, the increase of inter bank money market rate, LDR and lag time deposit rate will cause time deposit rate going up.

The bank time deposit rate moves in the same direction as market interest rate, i.e., PUAB

Table 2.8. Regression Result of Commercial Bank Time Deposit Rate

	Whole Sample (1991.01 - 2000.12)	Before Crisis (1991.01 - 1997.12)	After Crisis (1998.01 - 2000.12)
$i_{PUAB\ t}$	0.21	0.18	0.25
	(10.20)	(13.02)	(3.49)
LDR_t	0.02	0.02	0.02
	(5.66)	(6.19)	(0.41)
$i_{Dep\ t-1}$	0.70	0.69	0.67
	(24.12)	(22.61)	(10.46)
R^2	0.97	0.96	0.96
DW-stat	1.40	0.69	1.62

rate. Hence, during 1991 - 2000, rise in PUAB rate caused rise of deposit rate. This finding highlights the prompt response of bank deposit rate to PUAB rate, and the role of PUAB rate going up after crisis.

On the other hand, when bank experience liquidity problem before crisis, bank will accommodate their needs by increasing their deposit rate. After crisis banks relatively does not have liquidity problem, that why LDR does not significantly influence time deposit rate. The banking over-liquidity condition occurs because the banking sector unwilling to lend its fund, meanwhile the growth of deposit is still higher than that of banking credit. These circumstances are not only for commercial bank, but also for all group banks (Appendix K).

Loan Rate

In loan rate determination, variable influencing liquidity conditions are profit margin target, risk margin, Non Performing Loan (NPL) and competitors' interest rate. Meanwhile, there is a long time lag between the decrease funding and loan rate. The loan rate rigidity is caused by high credit risk, huge NPL, amortization of losses, overhead cost and high funding cost.

Loan rate is determined by funding rate (SPPK 2000), operational cost, profit margin target and credit risk. The term funding rate here refers to one-month time deposit rate as the movement of the one-month time deposit is strongly related to that of money market interest rate, which is represented by PUAB rate. NPL percentage of bad loan to total loans, pictures bank credit condition and is used as proxy for credit risk. A loan to Deposit Ratio, ratio of bank credit to third party funds, is used to obtain picture bank credit extension. The ratio of Net Interest Margin(NIM) over total productive assets is used to obtain picture of profit expected by banks. Using data series from January 1991 to 2000, we employ equation as follow:

$$iKMK_t = \alpha_1 iDEP1_t + \alpha_2 Liq_t + \alpha_3 iKMK_{t-1}$$

with *t* referring to period t; *iKMK* denotes working capital loan rate; *iDEP1* denotes time deposit rate; *Liq* denotes banks' liquidity condition.

We can expect that α_1 and α_3 each > 0, the changing of time deposit rate has the same direction with the changing of loan rate and lag of loan rate. When banks have lack of liquidity to lend credit, it causes loan rate growing up, $\alpha_2 < 0$.

The results of estimation are in line with our expectation previously. For the whole period and after crisis, all coefficients are significant. The significance level of an estimated negative α_2, positive α_1 and α_3 are examined. Increasing time deposit rate and the last one-month loan

Table 2.9 Regression Result of Commercial Bank Loan Rate

	Whole Sample (1991.01 - 2000.12)	Before Crisis (1991.01 - 1997.12)	After Crisis (1998.01 - 2000.12)
$i_{Dep\ t}$	0.08	0.14	0.07
	(9.47)	(5.76)	(9.21)
Liq_t	-0.49	-0.26	-1.00
	(-6.69)	(-1.72)	(-5.55)
$i_{KMK\ t-1}$	0.87	0.85	0.85
	(67.21)	(33.69)	(55.71)
R^2	0.98	0.95	0.99
DW-stat	1.59	1.70	1.70

rate will be followed by current loan rate. Beside that, bank liquidity condition relevantly influencing loan rate, except before crisis period. The exception occurred because banks had more access to get fund, such as foreign loan, central bank loan and inter bank loan. In loan rate determination, bank will use deposit rate as a base rate that increases in time deposit rate will instantaneously influence loan rate, and also reviewing the last loan rate as a comparison for the new loan rate.

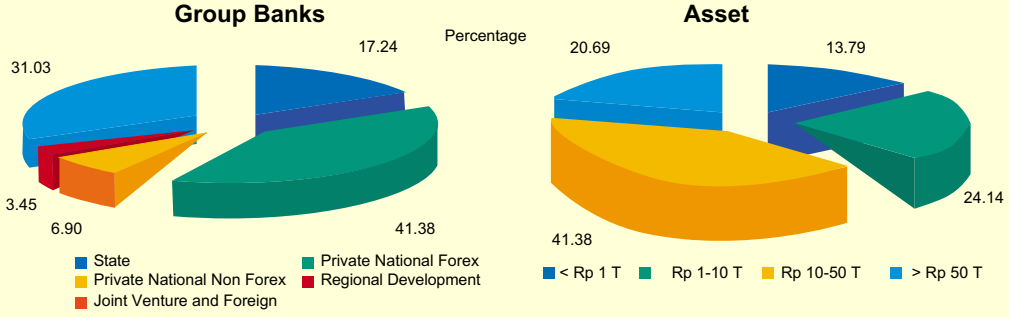
The interesting finding is the behavior of private national non-foreign exchange banks, in which their liquidity condition are significant factor before and after crisis. It is because of their limitation access to search of funds. Meanwhile the liquidity of joint venture and foreign bank is not a significant factor for determining loan rate, as previously found.

EVIDENCES FROM SURVEY

One of the objectives of a survey is to draw a conclusion of a certain condition that applies in a system. Whereas an empirical result has been obtained, the survey could be used to confirm empirical results. Accordingly, our survey was conducted to investigate response of banking and real sector to the changes of interest rate. The banking is divided into two categories according to: ownership (and license to transact in foreign exchange) and business scale.

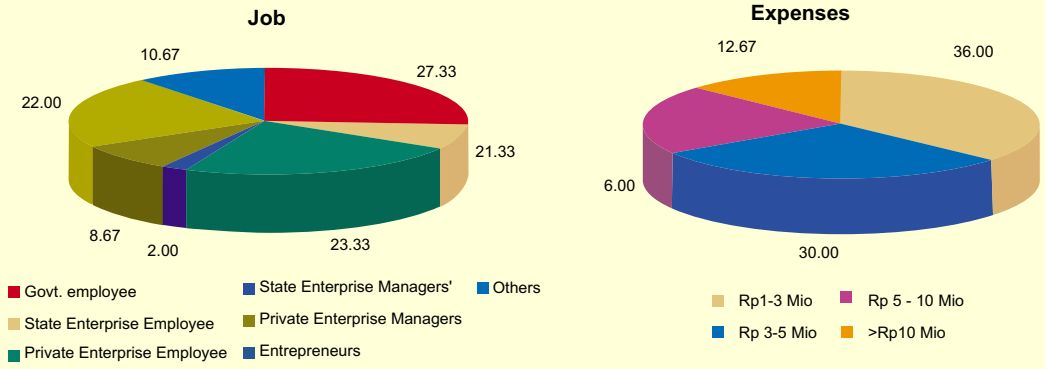
Banking respondents then are further classified: state bank, private national foreign exchange bank, private non-foreign exchange bank, joint venture and foreign bank, and regional development bank. Those respondents were being asked regarding their source and

Graph 2.6
Bank Respondent Characteristic (Percentage)

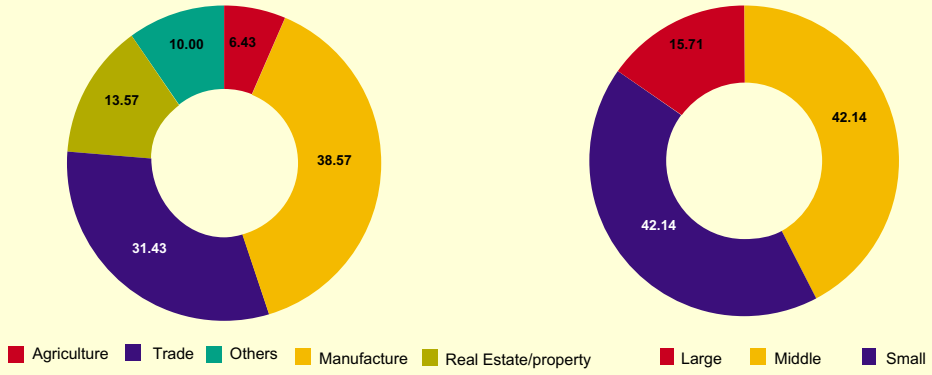


management of fund, liquidity condition, and interest rate formulation policy. The amount of respondent is 29 banks that consist of 5 state banks, 12 private national foreign exchange banks, 2 private national non foreign exchange banks, 1 regional development bank and 9 joint venture and foreign banks.

Graph 2.7
Household Respondent Characteristic by Occupation and Expenditure
(Percentage)



Graph 2.8
Corporate Respondent Characteristic by Sector and Business Scale
(Percentage)



The respondents for the real sector are households and firms. The survey on households aimed to compile information about consumption behavior such as asset saving preferential, and response to the changes of interest rate and goods prices. The survey on company is aimed to get investment behavior such as source of company fund, response to the interest rate changes and company investment policy. The numbers of respondent for these categories are 150

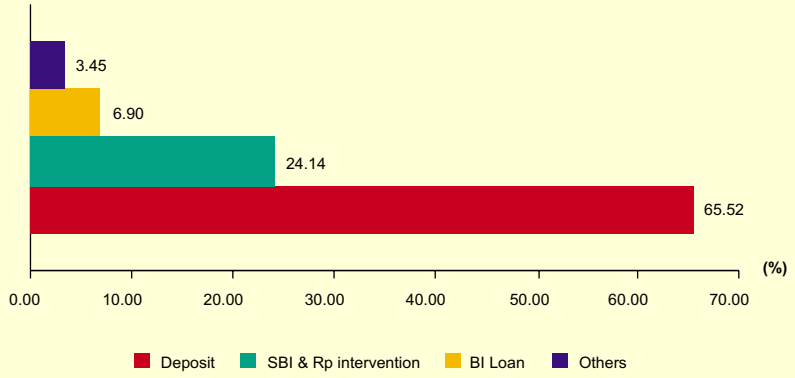
households and 138 corporates. Employees represented the household respondents came from government institution, state enterprise, private company, state enterprise and private company managers, entrepreneurs and others. Meanwhile, companies represented the corporate respondents from agriculture, manufacture, trade, real estate/property and others.

Banking Sector

Source of Fund

Confirming our empirical results, banking sector significantly response the policy rate changes through the changes in the PUAB rates, deposit rates and loan rates. The survey confirmed that deposit is the main source of fund for short-term liquidity with maturity less than 1 month in bank daily operation. The subsequent source of fund are SBI, Rupiah Intervention (IRK) and Bank Indonesia's liquidity facility.

Graph 2.9
Banks' Source of Fund



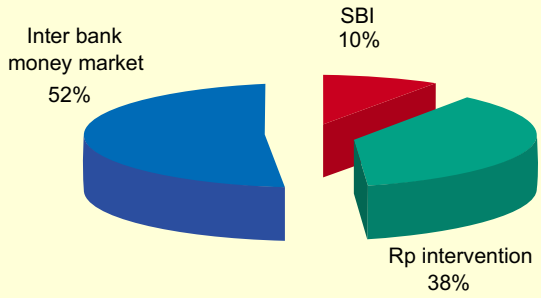
Meanwhile, inter bank money market is the main source of emergency liquidity, then followed by mature rupiah intervention. Out of 29 respondents, 28 banks choose PUAB and IRK due to their accessibility.

Interest Rate Determination

In determining interest rates, banks usually refer to policy rate such as SBI rate, PUAB rate and government guarantee rate. The survey found that PUAB rate is the main reference in

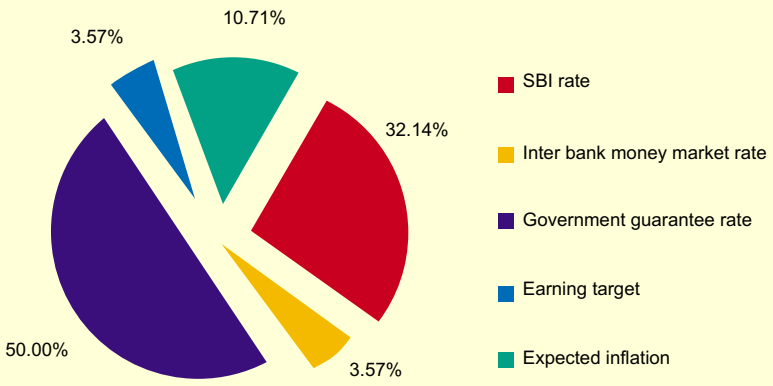
determining inter-bank loan rate. In this sense, PUAB rate can be used as a proxy for the inter-bank market liquidity. Meanwhile the Rupiah Intervention rate (IRK rate), which is announced daily in the morning, is the second reference. The market views IRK rate as the floor rate since at the end of the day banks will place the rest of their excess liquidity to IRK. IRK rate also functions as a signal of monetary policy stance toward interest rate movement. There is a great possibility if Bank Indonesia cut IRK rate then PUAB rate would fall immediately.

Graph 2.10
Inter Bank Loan Benchmark



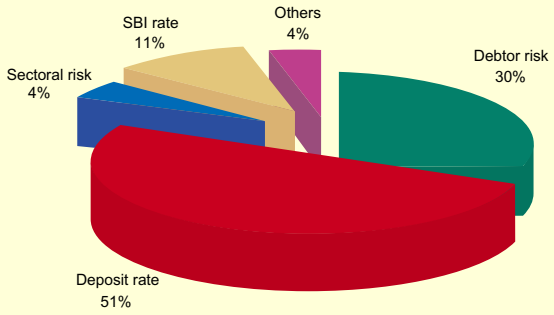
Based on our empirical results, policy rate (iPUAB) is transmitted to banking sector through deposit rate. This result is not strongly confirmed by the survey, as now the main reference to formulate deposit rate is government guarantee and SBI rates. This phenomenon correct for most of the banks, but probably not for banks that have high low cost deposits and high liquid assets. The government guarantee scheme rate is newly introduced in 1998, so the data are not sufficient to run a quantitative model. However, the use of SBI rate is consistent with the quantitative result as SBI rate determines the PUAB rate.

Graph 2.11
Bank Deposit Rate Benchmark



The transmission of policy rate through the banking sector continues from deposit rate to loan rate. This empirical finding is confirmed by the survey result that loan rate is determined by deposit rate, debtor risk and SBI rate. The banks concern on debtor risk reflects their concern on NPL as supported by the fact that after crisis real investment loan rate does not respond proportionately to changes in real deposit rate.

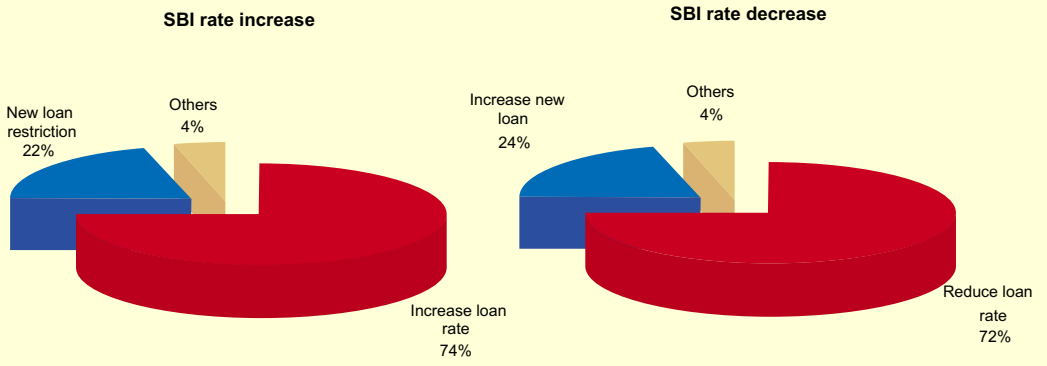
Graph 2.12
Loan Rate Benchmark



Banking Response

Other finding from the bank survey convinced empirical result that the changes of policy rate would be followed significantly by the changes of bank interest rate. In the event that SBI rate increases, 74% respondents would also increase their loan rate. On the other hand, when SBI rate declines, 72% respondents would also reduce their loan rate. In addition, 24% respondents would enhance new loan.

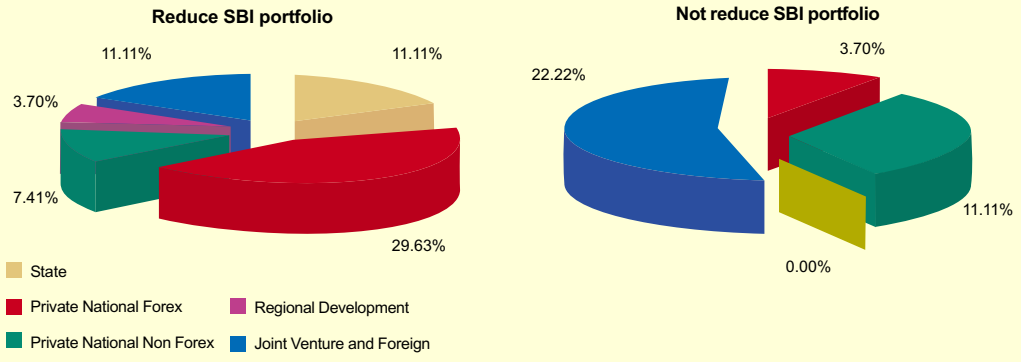
Graph 2.13
Banking Response to SBI Rate



The impact of rate changes on the portfolio shows that when SBI rate declines significantly, 58.62% banks will reduce their SBI portfolio. 75.0% out of those banks that reduce their SBI portfolio have a plan to increase their loan portfolio especially for working capital loans.

On the other hand, in a tight liquidity condition, banks will reduce their loan portfolio particularly for big company exposure. These circumstances forced banks to enhance their liquidity by selling SBI and borrowing from inter bank money market.

Graph 2.14
Portfolio Response toward SBI Rate



Households

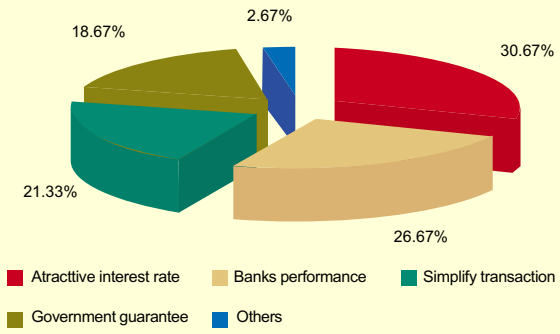
Saving Decision

There are various factors that influence households saving decision. The main factor is interest rate, and second is the banks' performance. This result supports our empirical findings that substitution effect is taking place in the early period of crisis.

Response to interest rate changes

Most of households restraint to interest rate fluctuation mainly when interest rate declines. In the event of interest rate decline, 82.76% households would not withdraw their deposit. In average, 84.91% of respondents from each expenditure categories will not withdraw their deposits, except respondents with expenditure more than Rp10 million show lower percentage (72.22%).

Graph 2.15
Factors Influencing Household Saving Decision



Furthermore, in the event of interest rate reduction, 44.04% of household respondents will not withdraw their deposit because of the presence of government guarantee scheme. This finding shows the importance of government guarantee scheme for deposit is still important. Another 34.86% of households choose a reason that they could easily withdraw their deposit at any time.

Table 2.10 Response of Interest Rate Declining

Expenditure	With draw fund from banks		Total
	Yes	No	
Rp 1-3 million	8	45	53
Rp 3-5 million	7	36	43
Rp 5-10 million	5	26	31
> Rp 10 million	5	13	18
Total	25	120	145

Looking at the magnitude of interest rate decrease, 59.43% households answered that 10% decline is sufficient to influence households decision whether to deposit or to withdraw their money from bank. A number of 85.71% households with more than Rp10 millions expenditure would change their decision if interest rate decrease by 10%.

In addition, when households withdraw some of their deposit, they usually use it for buying investment goods (37.04%) such as land/houses, for holding cash (24.07%) and

Graph 2.16
Reasons to Keep Deposit

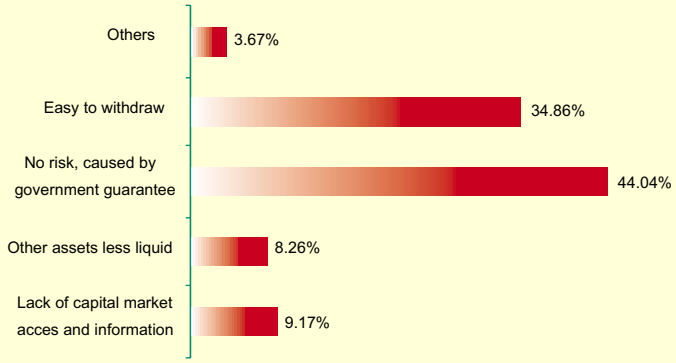
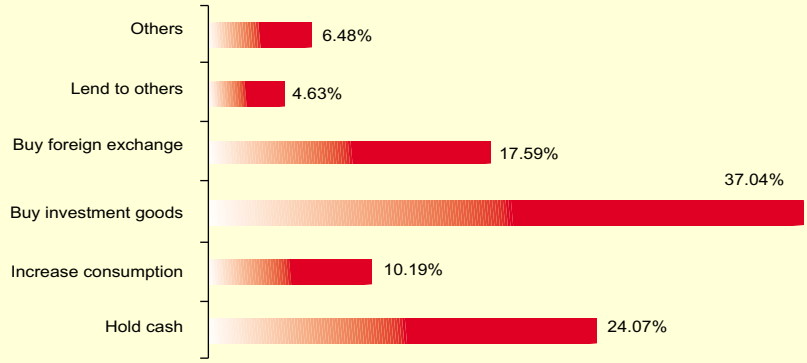


Table 2.11 Magnitude of Interest Rate Reduction

Expenditure	Percentage of interest rate reduction					Total
	≤ 14%	≤ 13%	≤ 12%	≤ 11%	≤ 10%	
Rp 1-3 million	8	0	6	3	22	39
Rp 3-5 million	3	2	6	2	15	28
Rp 5-10 million	2	0	4	0	11	17
> Rp 10 million	1	0	0	0	6	7
Total	14	2	16	5	54	91

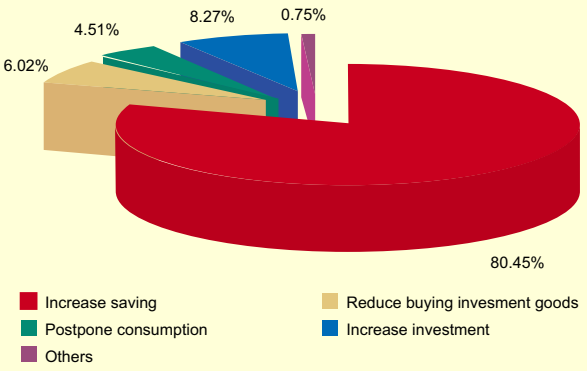
Graph 2.17 The Usage of Withdrawn Deposit



also for buying foreign exchange (17.59%). This evidence indicates that household's intention to keep their own wealth safely. This survey does not specify the purposes of buying foreign exchange whether for speculative motive or for storing the value of money.

Another support for the presence of substitution effects is the reluctant response of households when interest rate raise, a number of 80.45% of the household prefer keeping their deposit in the bank to spending their money for consumption (4.51%).

Graph 2.18 Response of Raising Interest Rate



Based on their expenditure, 94.44% of 18 households with expenditure more than Rp10 million respond significantly by increasing their deposit. However, only 4.51% of household will postpone consumption.

Table 2.12 Rising Interest Rate Response by Household Categories

Expenditure	Increase bank saving	Increase investment	Reduce investment goods buying	Postpone consumption	Others	Total
Rp 1-3 million	36	3	4	2	0	45
Rp 3-5 million	33	2	2	2	1	40
Rp 5-10 million	21	6	2	1	0	30
> Rp 10 million	17	0	0	1	0	18
Total	107	11	8	6	1	133

Based on the magnitude of interest rate changes, a number of 50.50% respondents will add their deposit if deposit rates raised by at least 6%. Moreover, this respond mostly (66.67%) come from household with more than Rp10 million expenditure and (60.61%) from household with expenditure ranging from Rp1 million to 3 million. Whilst the increase of deposit rate caused households to enhance their deposits in accordance with their marginal income.

Table 2.13 Magnitude of Rising Interest Rate

Expenditure	Interest rate changes				Total
	0 - 2%	2 - 4%	4 - 6%	> 6%	
Rp 1-3 million	1	3	9	20	33
Rp 3-5 million	3	4	10	15	32
Rp 5-10 million	2	5	8	6	21
> Rp 10 million	2	2	1	10	15
Total	8	14	28	51	101

Companies

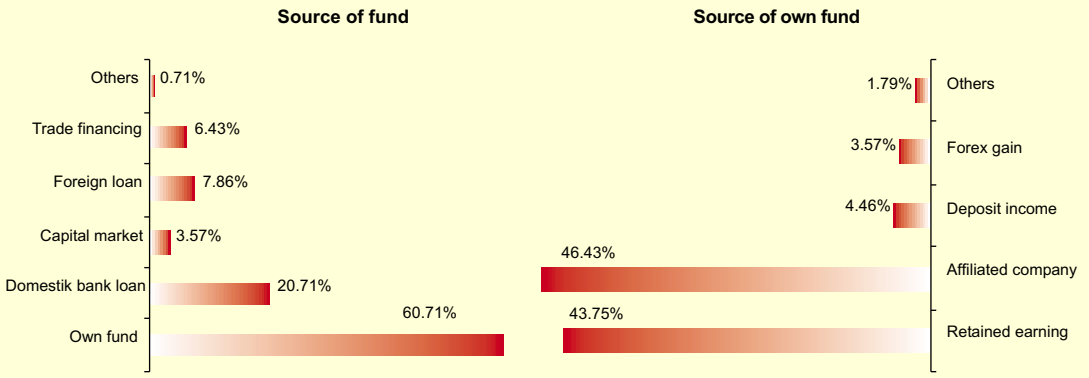
The objective of company survey is to unveil the behavior of companies in relation to their response to the monetary transmission through interest rate. Some questions asked to the respondents comprised source of fund, response to policy interest rate, and the factors influencing company investment.

Source of Funds

The survey showed that approximately 60.71% companies acquire funding from their own pool of funds, and as much as 20.71% get their fund from bank loans. It is interesting to observe on how the companies generate funds from their own pool of funds. This finding showed that banks do not want to lend to companies, indicating a credit crunch phenomenon has taken place. the result is rather indecisive because most repondents chosed two main sources of fund, namely from affiliated companies (46.43%) and from retained earning (43.75%).

The companies' sources of fund profile does correspond with the outcome of earlier empirical results, informing the growth of investments are less related to the movement of loan rates as the companies' source of fund is mainly from their own fund. Nevertheless, the survey also attempts to capture the behavior of companies in regard to

Graph 2.19
Corporate Source of Fund



the movement of policy rate, which in turn affects the deposit and loan rates, also, their pricing policy.

Response to Policy Rate

The survey also asked respondent behavior to the pricing policy when there is a raise in interest rate. Sum 79.69% respondents tend to increase their product pricing policy in a bid to earn more profit and thus increased companies retained earning. Moreover, bankable firms that have loan application or loan from bank accounted for 44.12% of respondents, which in turn, sum 70.0% of them will increase their product pricing if there is a raise in interest rate.

Graph 2.20
Corporate Pricing Policy toward Increasing Interest Rate

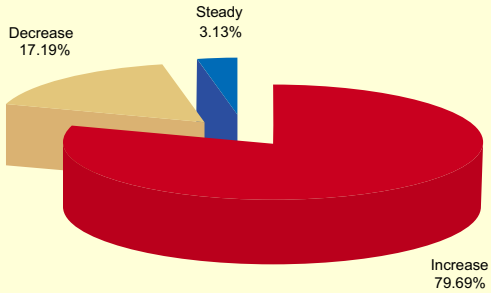
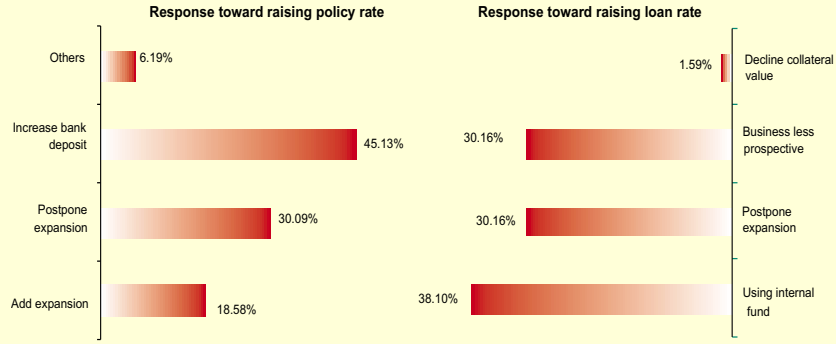


Table 2.14 Bankable Firms Response to Interest Rate Raise

Submit bank loan proposal	Pricing Policy			Total
	Increase	Decrease	Steady	
Yes	21	4	5	30
No	27	6	5	38
Total	48	10	10	68

When deposit rates hike, almost 45.13% companies choose to add their deposit with banks and 30.09% of respondents are postponing expansion. Consequently as the result of increasing loan interest rate, most respondent will reduce loan demand due to the following reasons; 38.10% would use its own internal source of funds; 30.16% would postpone expansion, and 30.16% thought that business prospective become bleak.

Graph 2.21
Corporate Response in Direction of Changes Interest Rate



On the other hand, when deposit rate is declining, sum 72.92% of respondents will change their pricing policy. The respond of 72.92% answers is 46% decrease the product price, 37% increase product price. In addition, 41.67% firms that has loan or loan applications, in which 55.0% of them keep their current price if there is a decline in deposit rate.

The respondents respond in the same direction as the rising of interest rate toward the product pricing policy. However, firms would not respond in the same direction when interest rate is declining, most of the firms will keep the existing price. It also explains why the transmission mechanism through cost of capital channel does work. Furthermore,

Graph 2.22
Corporate Pricing Policy toward Decreasing Deposit Rate

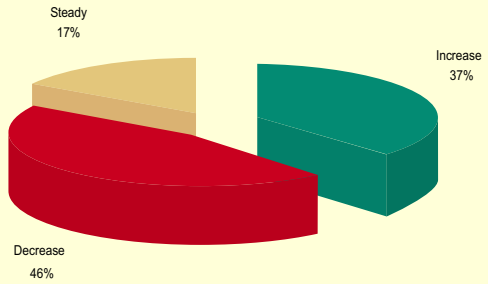


Table 2.15 Bankable Firms Response to Deposit Rate Decline

Submit bank loan proposal	Pricing Policy			Total
	Increase	Decrease	Steady	
Yes	1	8	11	20
No	12	8	8	28
Total	13	16	19	48

most respondents revealed that in the past 3 years the investment has been increased and cash flow is the main financial factor that influences investment policy.

SUMMARY AND CONCLUSION

This study explores the evidences of monetary transmission mechanism through interest rate channel in Indonesia. Empirical analysis reveals that before the crisis, real deposit rate and real investment loan rate were strongly influenced by policy rate (inter-bank rate). Investment growth, however, was more influenced by the high access to foreign borrowing compare to real investment loan rate. Similarly, consumption growth was not significantly affected by change in real deposit rate, as real deposit rate was relatively stable and low. Consumption growth was more affected by change in price level, thus substitution effect was not pronounced.

After crisis, real deposit rate and real investment loan rate response to policy rate is weaker as compared to pre-crisis period. Real investment loan rate, however, does not respond proportionately to change in real deposit rate because banks concern the high interest rate will lead to debtor default and on increasing non-performing loans. Investment

growth is significantly influenced by real investment loan rate. Likewise, consumption growth is significantly driven by real deposit rate.

Change in policy rate was transmitted strongly to real retail banking interest rate during pre-crisis period. The change in inter-bank rate was significantly responded by the changes in real deposit rate. As the economy was in the booming stage, more liquidity was needed by the banking sector. The main domestic source of fund was deposit and the second source was the sale of the money market promissory notes (SBPU) to other bank and central bank. Thus, the rate that formed in the inter-bank market significantly influences the determination of deposit rate. In addition, the relatively stable inflation had enhanced the stability of nominal deposit rate.

Real investment loan rate was also responsive during the pre-crisis period as the economy was booming more fund was needed by the business sector. The weaker response of real investment loan rate after the crisis was caused by the negative return as inflation jumping to much higher level, and the banks' concerns on the debtor default Those factors brings the non-price factors become stronger in influencing bank in extending loan.

Real sector responds significantly to banking interest rate after crisis period. Investment growth responds stronger as compared to pre-crisis to real investment loan rate because investor has limited access to other source of financing from domestic financing i.e. credit from banks, and from offshore borrowing and from any other sources such as issuing papers as the high risk. The negative return leads to the banking sector reluctance to disburse new credit. The existing credit is disbursed on the consideration of long-term relationship, because after crisis most sectors bear higher risk. Meanwhile, in pre-crisis period, investors had high access to offshore borrowing. Consequently, investment growth was weakly influenced by the change in the real investment loan rate.

Consumption growth is influenced significantly by change of inter-bank interest rate in post-crisis. The increase of inter-bank interest rate is initially responded by a negative growth of consumption, showing the presence of substitution effect. However, when the deposit real rate starting to decrease, household consumption follows to decrease, indicating the presence of income effect.

The bank interest rate structural model analysis consist of inter bank rate, time deposit rate and working capital loan rate. SBI and the bank liquidity determine the inter-bank rate in pre-crisis period. SBI rate influence to inter-bank rate is stronger in post-crisis. The bank liquidity becomes a relevant variable for private national foreign exchange banks, private national non-foreign exchange banks, and regional development banks. However, liquidity is not a variable for state-owned banks, foreign and joint venture banks, as they have more access of funding.

Inter-bank rate, liquidity and its lag determine time deposit rate. Time deposit rate responds the movement of inter-bank rate and the role of inter-bank rate increase after crisis. Since the crisis, bank are relatively liquid, so that loan to deposit ratio as a proxy for liquidity does not significantly influence deposit rate, as all groups of bank are unwilling to lend money.

Time deposit rate and the loan rate determine working capital loan rate. Liquidity factor relevantly influence loan rate in post-crisis period as banks have limited access of funding. Unlike in pre-crisis period, banks had more access of fund from offshore, central bank and inter bank; thus liquidity was not a relevant factor in pre-crisis period. For non-foreign exchange domestic private banks, however, liquidity condition is significant in all period, since their limited access associated with the lack of confidence and their relatively smaller size of assets. On the other hand, liquidity never becomes a problem for foreign and joint venture bank in loan rate determination as they have perfect capital mobility.

The survey results confirm the empirical results during post-crisis period in that change in policy rates is transmitted to various retail-banking rates and to the real sectors. The loan rate is determined by deposit rate, debtor risk and SBI rate. The banking response to changes in licy rates significantly. When SBI rate declines bank will reduce their loan rate and SBI portfolio, and then increase loan portfolio especially working capital loan. In addition, banks tend to a raise their loan rates and to reduce loan portfolio in the case of tight liquidity or SBI rate rises significantly.

There are two departures from our empirical result. First, the inter-bank rate is the main priority in determining inter-bank loan rate. In determining deposit rates, banks use government guarantee and SBI rate. The use of SBI is consistent with our findings as SBI rate determines the inter-bank rate. However, the use of government guarantee was not incorporated into our empirical analysis because the phenomenon of government guarantee scheme rate is newly established in 1998 so that there is no sufficient data to run quantitative model. Second, household decision to save is influenced by the interest rate. However, slightly different from our empirical finding, households maintain their saving when there is a decline in deposit rate, because of security reason with the presence of government guarantee scheme. Similarly, households maintain their saving when interest rate rises as they prefer to keep and to add their deposit instead of spending for consumption.

Finally, survey on firm side corresponds to our empirical findings. The growth of investment is not strongly related to the movement of loan rate. In the event of rising policy rate, most companies choose to add their deposit with banks and reduce their loan demand. This is explicable by the fact that most respondents will turn into own fund whilst others postpone expansion and perceive business prospect has became bleak.

References

Bernanke, Ben S., and Blinder, Alan S. The Federal Funds rate and The Channels of Monetary Transmission. *The American Economic Review,* Volume 82, Issue 4, September 1992.

Brischetto, A. and Voss, G. A Structural Vector Autoregression Model of Monetary Policy in Australia. Research Discussion Paper 1999-11. *Economic Research Department, Reserve Bank of Australia.* December 1999.

Favero, C. A. and Giavazzi, F. (2001). Monetray Policy Transmission in the Euro Area. European Parliament Directorate Genaral for Research Working Paper - *Economic Affairs Series, ECON 110 EN/rev.1,* Januari 2001.

Hakim, Ridho, Bambang Kusmiarso, Gunawan, Erwin Gunawan H., Bambang Pramono, and Masagus Abdul Azis (2000). Struktur Pembentukan Suku Bunga dari Sisi Perbankan Untuk Menunjang Efektivitas Kebijakan Moneter, [Understanding of Interest Rate Structure in Banking Sector To Enhance Monetary Policy Effectiveness], Buletin Ekonomi Moneter dan Perbankan, Vol.3 No.2, September 2000, pp 1-75.

Mahadeva, L. and Sinclair, P. (2001) The Transmission Mechanism of Monetary Policy - 2001 Central Bank Governors Symposium on the Transmission Mechanism of Monetary Policy. *Centre for Central Banking Studies Bank of England,* 2001.

McCallum, B. T. (1999) Analysis of the Monetary Transmission Mechanism: Methodological Issues. *National Bureau of Economic Research - Working Paper* 7395, October 1999.

Mishkin, F. The Channels of Monetary Transmission : Lesson for Monetary Policy . *National Bureau of Economic Research - Working Paper* 5464, February 1996.

Mishkin, F.S. (1995) Symposium on the Monetary Transmission Mechanism. *Journal of Economic Perspectives,* Vol.9, No.4, Fall 1995, pp.3-10.

Mojon, B. (2000) Financial Structure and the Interest Rate Channel of ECB Monetary Policy. *European Central Bank Working Paper,* No. 40, November.

Nualtaranee, J. (2001) Transmission Mechanism of Monetary Policy: Literature Survey and Theoritical Discussion, http://wb-cu.car.chula.ac.th/papers/transmission.htm,

Sarwono, H. A. (1996) Mencari Paradigma Baru Mekanisme Transmisi Kebijakan Moneter. Suatu Studi Kemungkinan Penerapannya. [In Search of a New Paradigm of Monetary Transmission Mechanism]. Manuscript

Taylor, J. (1995) The Monetary Transmission Mechanism: An Empirical Framework. The Journal of Economic Perspectives, Volume 9, Issue 4, Autumn 1995.

Warjiyo, P. (1997) Manajemen Moneter dalam Sistem Nilai Tukar Fleksibel: Suatu pemikiran Untuk Penerapannya di Indonesia. [Monetary Management in Flexible Exchange Rate System]. Manuscript

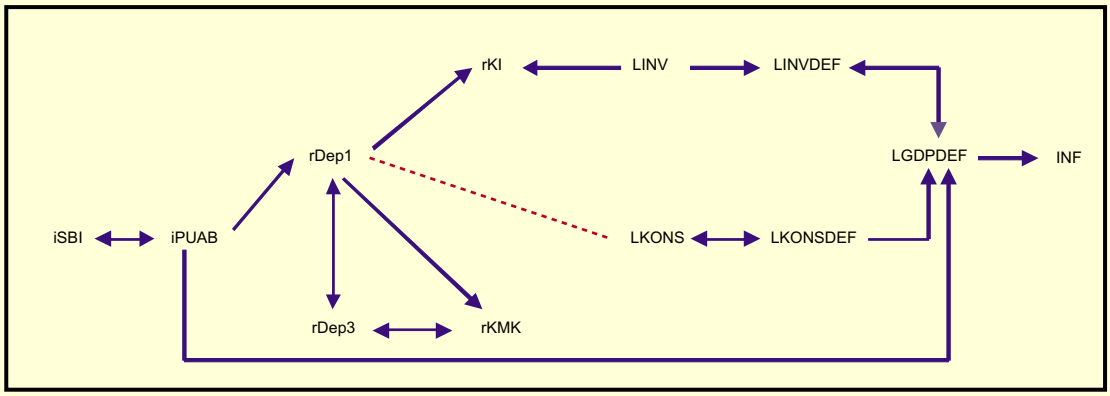
Warjiyo, P. and Zulverdi, D. (1998). Penggunaan Suku Bunga sebagai sasaran Operasional Kebijakan Moneter di Indonesia [The Use of the Interest Rate as an Operating Target of Monetary Policy in Indonesia]. *Buletin Ekonomi Moneter dan Perbankan,* Vol.1, No.1, July 1998, pp. 25-53.

Yoshioka, S. (2001) Relationship among Exchange Rate, Money Supply, Interest Rate and Prices Before and After Monetary Crisis in Indonesia - A vector Autoregression Model Analysis. June.

Appendix A

Granger Chart in All Period : January 1989 - December 2000

Granger Chart in All Period: January 1989 - December 2000



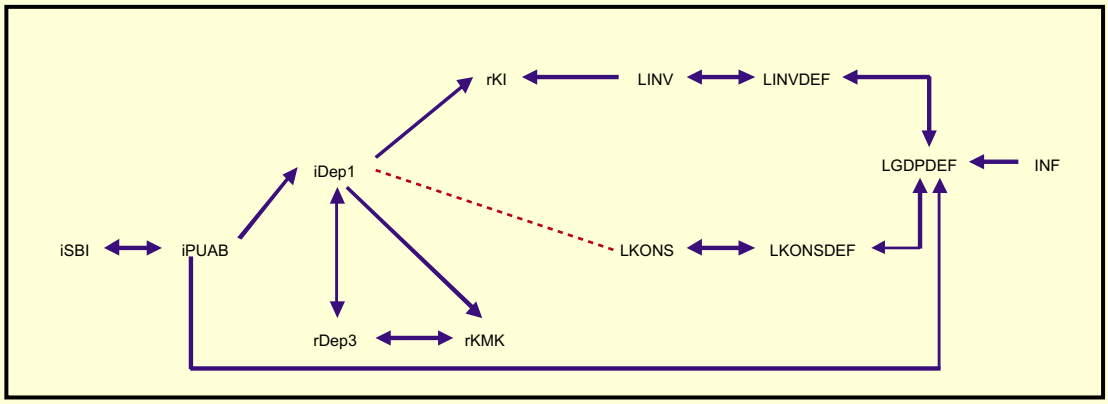
Note :

- One way induction
- Two ways induction
- No induction

Appendix B

Granger Chart in Pre-Crisis : January 1989 - July 1997

Granger Chart in Pre-Crisis : January 1989 - July 1997



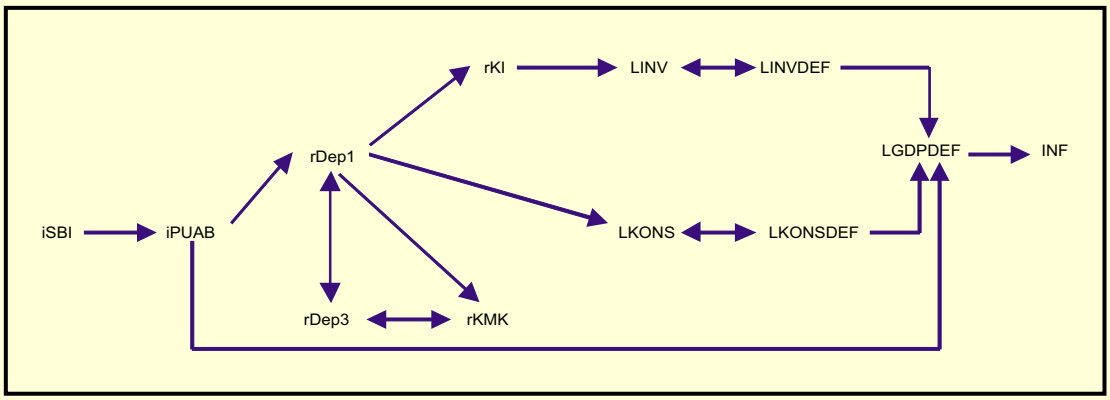
Note :

- One wayinduxction
- Two ways induction
- No induction

Appendix C

Granger Chart in Post-Crisis: August 1997 - December 2000

Granger Chart in Post-Crisis: August 1997 - December 2000



Note :

One way induction

Two ways induction

No induction

Appendix D

Results of VAR : Cost of Capital Channel in Pre-Crisis Period

Vector Autoregression Estimates
Date: 07/24/01 Time: 14:44
Sample(adjusted): 1988:06 1997:07
Included observations: 110 after adjusting endpoints
Standard errors in ( ) & t-statistics in [ ]

	iPUAB	rDEP3	rKI	LINV
iPUAB(-1)	0.783024	0.050911	-0.014790	0.003278
	(0.10559)	(0.02693)	(0.03921)	(0.00409)
	[7.41555]	[1.89049]	[-0.37719]	[0.80161]
iPUAB(-2)	-0.061366	-0.000959	0.222712	-0.007174
	(0.12945)	(0.03302)	(0.04807)	(0.00501)
	[-0.47405]	[-0.02903]	[4.63300]	[-1.43115]
iPUAB(-3)	0.159378	0.043295	-0.212503	-0.000630
	(0.10967)	(0.02797)	(0.04073)	(0.00425)
	[1.45326]	[1.54790]	[-5.21796]	[-0.14839]
rDEP3(-1)	-0.038709	1.361261	0.491784	0.003254
	(0.43994)	(0.11220)	(0.16337)	(0.01704)
	[-0.08799]	[12.1323]	[3.01028]	[0.19099]
rDEP3(-2)	0.162072	-0.594679	-0.514241	0.021581
	(0.66910)	(0.17065)	(0.24847)	(0.02591)
	[0.24222]	[-3.48483]	[-2.06965]	[0.83291]
rDEP3(-3)	-0.128649	0.177611	0.119184	-0.018113
	(0.40155)	(0.10241)	(0.14912)	(0.01555)
	[-0.32038]	[1.73427]	[0.79927]	[-1.16484]
rKI(-1)	-0.029085	0.111299	0.978265	-0.005120
	(0.26573)	(0.06777)	(0.09868)	(0.01029)
	[-0.10945]	[1.64228]	[9.91391]	[-0.49752]
rKI(-2)	-0.228380	-0.020251	0.036002	-0.001710
	(0.33815)	(0.08624)	(0.12557)	(0.01309)
	[-0.67539]	[-0.23482]	[0.28671]	[-0.13057]
rKI(-3)	0.231199	-0.126125	-0.170157	-0.002697
	(0.26740)	(0.06820)	(0.09930)	(0.01036)
	[0.86460]	[-1.84936]	[-1.71358]	[-0.26046]
LINV(-1)	4.366503	-1.110110	-2.315141	1.441821
	(2.61957)	(0.66810)	(0.97276)	(0.10144)
	[1.66688]	[-1.66160]	[-2.37996]	[14.2133]
LINV(-2)	-9.372251	1.697311	3.010350	-0.556458
	(4.35862)	(1.11162)	(1.61855)	(0.16879)
	[-2.15028]	[1.52687]	[1.85990]	[-3.29683]
LINV(-3)	5.315931	-0.739176	-1.111696	0.028644
	(2.61714)	(0.66748)	(0.97186)	(0.10135)
	[2.03120]	[-1.10742]	[-1.14388]	[0.28263]
C	-0.920332	1.040338	4.404855	0.858724
	(7.55740)	(1.92745)	(2.80640)	(0.29266)
	[-0.12178]	[0.53975]	[1.56957]	[2.93423]

R-squared	0.698242	0.983016	0.950020	0.949518
Adj. R-squared	0.660912	0.980915	0.943836	0.943273
Sum sq. resids	309.0724	20.10387	42.62023	0.463484
S.E. equation	1.785025	0.455254	0.662860	0.069124
F-statistic	18.70418	467.8600	153.6468	152.0408
Log likelihood	-212.9035	-62.60699	-103.9349	144.7373
Akaike AIC	4.107336	1.374673	2.126089	-2.395223
Schwarz SC	4.426484	1.693820	2.445237	-2.076075
Mean dependent	12.78873	9.399885	9.885157	8.911930
S.D. dependent	3.065405	3.295406	2.797015	0.290227
Determinant Residual Covariance		0.000869		
Log Likelihood (d.f. adjusted)		-236.7116		
Akaike Information Criteria		5.249302		
Schwarz Criteria		6.525893		

Roots of Characteristic Polynomial
Endogenous variables: iPUAB rDEP3 rKI LINV
Exogenous variables: C
Lag specification: 1 3
Date: 07/24/01 Time: 14:47

Root	Modulus
0.923658 - 0.057819i	0.925466
0.923658 + 0.057819i	0.925466
0.808074 - 0.103792i	0.814713
0.808074 + 0.103792i	0.814713
0.658869 - 0.205629i	0.690212
0.658869 + 0.205629i	0.690212
0.337855 + 0.504301i	0.607014
0.337855 - 0.504301i	0.607014
-0.345533 + 0.311515i	0.465225
-0.345533 - 0.311515i	0.465225
-0.100738 - 0.354845i	0.368867
-0.100738 + 0.354845i	0.368867

No root lies outside the unit circle.
VAR satisfies the stability condition.

VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
H0: residuals are multivariate normal
Date: 07/24/01 Time: 14:48
Sample: 1988:01 1997:07
Included observations: 110

Component	Skewness	Chi-sq	df	Prob.
1	0.331348	2.012840	1	0.1560
2	-0.672931	8.301997	1	0.0040
3	-0.127869	0.299760	1	0.5840
4	0.791116	11.47418	1	0.0007
Joint		22.08878	4	0.0002

VAR Residual Serial Correlation LM Tests
H0: no serial correlation at lag order h
Date: 07/24/01 Time: 14:48
Sample: 1988:01 1997:07
Included observations: 110

Lags	LM-Stat	Prob
1	47.18502	0.0001
2	71.07753	0.0000
3	44.87479	0.0001

Probs from chi-square with 16 df.

Date: 07/24/01 Time: 14:49
Sample(adjusted): 1988:07 1997:07
Included observations: 109 after adjusting endpoints
Trend assumption: Linear deterministic trend
Series: iPUAB rDEP3 rKI LINV
Lags interval (in first differences): 1 to 3

Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.324030	59.77745	47.21	54.46
At most 1	0.080890	17.09228	29.68	35.65
At most 2	0.047887	7.898219	15.41	20.04
At most 3	0.023118	2.549418	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels

Variance Decomposition of iPUAB

Period	S.E.	iPUAB	rDEP3	rKI	LINV
1	1.7850	100.0000	0.0000	0.0000	0.0000
2	2.2977	98.2297	0.0546	0.0176	1.6982
3	2.5180	97.9455	0.1394	0.4859	1.4292
4	2.6913	97.8118	0.1711	0.7173	1.2998
5	2.8021	97.6580	0.2727	0.8608	1.2085
6	2.8968	97.4872	0.4352	0.9466	1.1310
7	2.9793	97.2998	0.5950	0.9935	1.1117
8	3.0458	97.0874	0.7217	1.0297	1.1639
9	3.0983	96.8821	0.8054	1.0530	1.2595
10	3.1388	96.8821	0.8579	1.0657	1.3834
11	3.1704	96.5121	0.8914	1.0718	1.5247
12	3.1955	96.3327	0.9142	1.0752	1.6780

Variance Decomposition of rDEP3

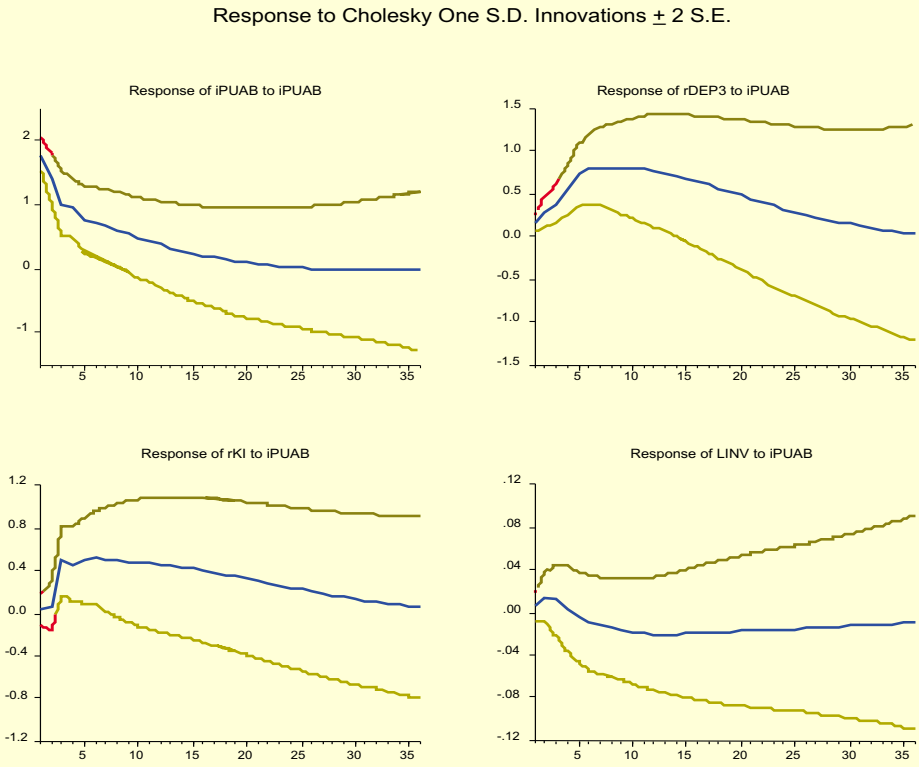
Period	S.E.	iPUAB	rDEP3	rKI	LINV
1	0.4553	10.5760	89.4240	0.0000	0.0000
2	0.8374	15.1275	83.4270	0.6192	0.8263
3	1.1432	19.0186	77.9187	1.8631	1.1997
4	1.4149	27.5315	68.9663	2.1093	1.3929
5	1.6757	38.2212	58.7205	1.7615	1.2969
6	1.9028	46.9304	50.5136	1.3712	1.1848
7	2.0982	53.5805	44.0879	1.1940	1.1376
8	2.2680	58.7002	38.9605	1.2368	1.1025
9	2.4186	62.7327	34.7926	1.4297	1.0450
10	2.5551	65.9689	31.3681	1.6992	0.9638
11	2.6799	68.5594	28.5697	1.9920	0.8789
12	2.7935	70.6145	26.3008	2.2734	0.8114

Variance Decomposition of rKI

Period	S.E.	iPUAB	rDEP3	rKI	LINV
1	0.6629	0.2324	28.5083	71.2594	0.0000
2	1.0508	0.4803	40.9891	56.2480	2.2826
3	1.4840	11.2470	40.6742	44.7439	3.3350
4	1.7784	14.5201	41.0709	40.9695	3.4395
5	1.9990	17.5041	40.6042	37.6223	4.2694
6	2.1705	20.5902	39.6392	34.7986	4.9720
7	2.2943	23.1406	38.6599	32.6222	5.5773
8	2.3895	25.5596	37.5633	30.8034	6.0737
9	2.4645	27.8447	36.4586	29.2986	6.3980
10	2.5258	29.9938	35.3889	28.0408	6.5766
11	2.5780	32.0136	34.3750	26.9754	6.6361
12	2.6235	33.8883	33.4349	26.0669	6.6099

Variance Decomposition of LINV

Period	S.E.	iPUAB	rDEP3	rKI	LINV
1	0.0691	0.5839	0.7838	0.2221	98.4102
2	0.1220	1.4640	0.8245	0.4554	97.2562
3	0.1626	1.4169	0.4838	0.8736	97.2257
4	0.1904	1.0936	0.4080	1.5630	96.9354
5	0.2093	0.9347	0.4374	2.3799	96.2481
6	0.2229	1.0078	0.4197	3.3779	95.1947
7	0.2333	1.1786	0.3844	4.6070	93.8300
8	0.2420	1.4044	0.4283	6.0630	92.1044
9	0.2496	1.6947	0.6135	7.6709	90.0210
10	0.2565	2.0493	0.9438	9.2966	87.7104
11	0.2628	2.4502	1.3869	10.8123	85.3506
12	0.2684	2.8661	1.8959	12.1354	83.1026


Response to Cholesky One S.D. Innovations ± 2 S.E.
Response of iPUAB to iPUAB
Response of rDEP3 to iPUAB
Response of rKI to iPUAB
Response of LINV to iPUAB

Appendix E

Results of VAR : Substitution/Income Effects in Pre-Crisis Period

Vector Autoregression Estimates
Date: 07/24/01 Time: 15:54
Sample(adjusted): 1989:04 1997:07
Included observations: 100 after adjusting endpoints
Standard errors in ( ) & t-statistics in [ ]

	iPUAB	rDEP1	LKONS	LKONSDEF
iPUAB(-1)	0.752074 (0.12343) [6.09316]	0.092591 (0.04313) [2.14676]	0.002114 (0.00183) [1.15820]	0.000355 (0.00029) [1.23639]
iPUAB(-2)	-0.051035 (0.14736) [-0.34632]	-0.113677 (0.05149) [-2.20762]	-0.001788 (0.00218) [-0.82029]	-0.000391 (0.00034) [-1.14254]
iPUAB(-3)	0.116658 (0.11815) [0.98736]	0.142048 (0.04129) [3.44055]	0.001079 (0.00175) [0.61776]	0.000274 (0.00027) [0.99670]
rDEP1(-1)	0.044869 (0.32868) [0.13651]	1.175529 (0.11485) [10.2353]	-0.003462 (0.00486) [-0.71233]	-0.000417 (0.00076) [-0.54585]
rDEP1(-2)	0.056116 (0.49324) [0.11377]	-0.170843 (0.17236) [-0.99123]	0.001859 (0.00729) [0.25489]	0.001008 (0.00115) [0.87864]
rDEP1(-3)	-0.070006 (0.30070) [-0.23281]	-0.118945 (0.10507) [-1.13200]	-0.000181 (0.00445) [-0.04066]	-0.000810 (0.00070) [-1.15878]
LKONS(-1)	0.526392 (6.85717) [0.07677]	-0.360928 (2.39613) [-0.15063]	1.220934 (0.10141) [12.0402]	0.018342 (0.01594) [1.15043]
LKONS(-2)	-2.416991 (11.0039) [-0.21965]	-1.152074 (3.84513) [-0.29962]	-0.252913 (0.16273) [-1.55421]	-0.031671 (0.02558) [-1.23789]
LKONS(-3)	4.413786 (6.81255) [0.64789]	1.454196 (2.38054) [0.61087]	-0.298817 (0.10075) [-2.96607]	0.026533 (0.01584) [1.67508]
LKONSDEF(-1)	11.96726 (24.7973) [0.48260]	-2.879552 (8.66502) [-0.33232]	0.174435 (0.36671) [0.47568]	2.223609 (0.05766) [38.5673]
LKONSDEF(-2)	-32.75314 (44.5842) [-0.73464]	4.623830 (15.5793) [0.29679]	-0.127177 (0.65932) [-0.19289]	-2.065573 (0.10366) [-19.9262]
LKONSDEF(-3)	17.74607 (25.0122) [0.70950]	-1.907420 (8.74013) [-0.21824]	0.373180 (0.36989) [1.00891]	0.823615 (0.05816) [14.1624]
C	-11.54565 (16.5439) [-0.69788]	0.629455 (5.78101) [0.10888]	1.716026 (0.24465) [7.01408]	-0.060069 (0.03847) [-1.56163]

R-squared	0.681024	0.968712	0.989488	0.999530
Adj. R-squared	0.637028	0.964396	0.988038	0.999466
Sum sq. resids	300.1436	36.64884	0.065639	0.001623
S.E. equation	1.857398	0.649039	0.027468	0.004319
F-statistic	15.47900	224.4682	682.4070	15428.65
Log likelihood	-196.8484	-91.70444	224.5443	409.5524
Akaike AIC	4.196968	2.094089	-4.230885	-7.931048
Schwarz SC	4.535640	2.432761	-3.892213	-7.592375
Mean dependent	12.55550	8.666474	9.648759	3.516556
S.D. dependent	3.082961	3.439724	0.251136	0.186801
Determinant Residual Covariance		1.49E-08		
Log Likelihood (d.f. adjusted)		333.5111		
Akaike Information Criteria		-5.630221		
Schwarz Criteria		-4.275533		

Roots of Characteristic Polynomial
Endogenous variables: iPUAB rDEP1 LKONS LKONSDEF
Exogenous variables: C
Lag specification: 1 3
Date: 07/24/01 Time: 16:01

Root	Modulus
0.998466	0.998466
0.623357 - 0.673521i	0.917717
0.623357 + 0.673521i	0.917717
0.781550 + 0.460686i	0.907222
0.781550 - 0.460686i	0.907222
0.888618	0.888618
0.675668 - 0.035490i	0.676599
0.675668 + 0.035490i	0.676599
-0.389872	0.389872
-0.067522 + 0.328591i	0.335457
-0.067522 - 0.328591i	0.335457
-0.151171	0.151171

No root lies outside the unit circle.
VAR satisfies the stability condition.

VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
H0: residuals are multivariate normal
Date: 07/24/01 Time: 16:01
Sample: 1988:01 1997:07
Included observations: 100

Component	Skewness	Chi-sq	df	Prob.
1	0.654619	7.142092	1	0.0075
2	-0.343327	1.964561	1	0.1610
3	-1.120299	20.91782	1	0.0000
4	-0.349603	2.037036	1	0.1535
Joint		32.06151	4	0.0000

VAR Residual Serial Correlation LM Tests
H0: no serial correlation at lag order h
Date: 07/24/01 Time: 16:02
Sample: 1988:01 1997:07
Included observations: 100

Lags	LM-Stat	Prob
1	36.73339	0.0023
2	34.95141	0.0040
3	67.84702	0.0000

Probs from chi-square with 16 df.

Variance Decomposition of iPUAB

Period	S.E.	iPUAB	rDEP1	LKONS	LKONSDEF
1	1.8574	100.0000	0.0000	0.0000	0.0000
2	2.3301	99.9410	0.0095	0.0015	0.0480
3	2.5434	99.8386	0.1003	0.0186	0.0425
4	2.7150	99.6303	0.2074	0.0310	0.1313
5	2.8541	99.1238	0.2879	0.1644	0.4238
6	2.9620	98.4604	0.3316	0.4725	0.7355
7	3.0450	97.9094	0.3443	0.8715	0.8747
8	3.1074	97.5665	0.3423	1.2214	0.8698
9	3.1541	97.3912	0.3370	1.4263	0.8454
10	3.1894	97.3335	0.3333	0.4925	0.8407
11	3.2164	97.3485	0.3329	0.4863	0.8424
12	3.2376	97.3750	0.3359	0.4669	0.8222

Variance Decomposition of rDEP1

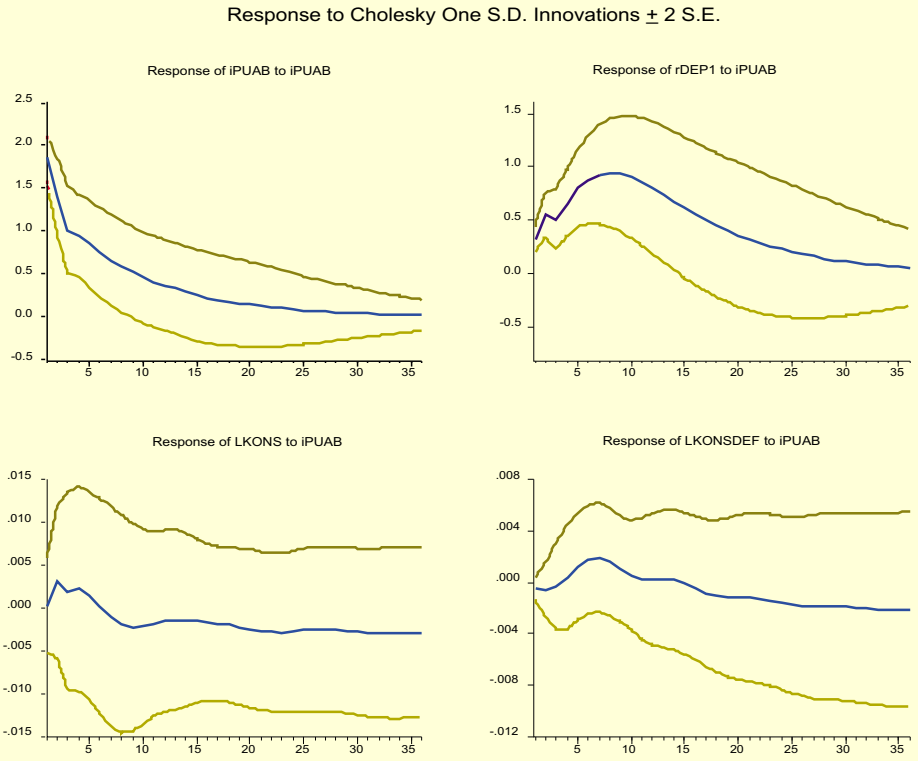
Period	S.E.	iPUAB	rDEP1	LKONS	LKONSDEF
1	0.6490	25.1112	74.8888	0.0000	0.0000
2	1.0804	35.5079	64.4729	0.0063	0.0129
3	1.3810	35.6128	64.2087	0.1545	0.0241
4	1.6614	40.6135	59.0262	0.3199	0.0386
5	1.9273	47.3487	52.2300	0.3781	0.0432
6	2.1719	53.6740	45.9323	0.3482	0.0454
7	2.3946	59.0827	40.5707	0.2871	0.0595
8	2.5958	63.4620	36.1549	0.2770	0.1060
9	2.7753	66.8460	32.5870	0.3688	0.1982
10	2.9354	69.3883	297,431	0.5522	0.3165
11	3.0667	71.2995	27.5136	0.7700	0.4169
12	3.1783	72.7752	25.7969	0.9574	0.4706

Variance Decomposition of LKONS

Period	S.E.	iPUAB	rDEP1	LKONS	LKONSDEF
1	0.0275	0.0108	0.1950	99.7943	0.0000
2	0.0435	0.5000	0.7072	98.7635	0.0292
3	0.0555	0.4335	1.3105	98.0850	0.1711
4	0.0613	0.4855	2.1454	96.5714	0.7977
5	0.0634	0.5047	3.0849	93.5820	2.8284
6	0.0651	0.4796	3.7536	88.7252	7.0417
7	0.0685	0.4556	3.8463	83.4698	12.2284
8	0.0726	0.4719	3.5817	79.8065	16.1400
9	0.0758	0.5209	3.3252	78.0199	18.1339
10	0.0772	0.5799	3.2106	77.3140	18.8955
11	0.0774	0.6320	3.1940	77.0145	19.1595
12	0.0776	0.6672	3.2030	76.9621	19.1677

Variance Decomposition of LKONSDEF

Period	S.E.	iPUAB	rDEP1	LKONS	LKONSDEF
1	0.0043	1.2598	0.1271	1.0985	97.5146
2	0.0105	0.4901	0.3493	0.4184	98.7422
3	0.0162	0.2404	0.3553	0.2465	99.1578
4	0.0198	0.2031	0.3342	0.1655	99.2972
5	0.0212	0.5228	0.3385	0.2661	98.8726
6	0.0216	1.2159	0.3945	0.8377	97.5519
7	0.0220	1.9543	0.5979	2.0294	95.4185
8	0.0224	2.3682	1.1192	3.4714	93.0411
9	0.0235	2.3560	1.9315	4.4027	91.3098
10	0.0252	2.0860	2.6809	4.4488	90.7843
11	0.0271	1.8101	3.1585	4.0570	90.9744
12	0.0286	1.6384	3.4717	3.7138	91.1761


Response to Cholesky One S.D. Innovations ± 2 S.E.
Response of iPUAB to iPUAB
Response of rDEP1 to iPUAB
Response of LKONS to iPUAB
Response of LKONSDEF to iPUAB

Appendix F

Results of VAR : Cost of Capital Channel in Post-Crisis Period

Vector Autoregression Estimates
Date: 07/24/01 Time: 08:37
Sample: 1997:08 2000:12
Included observations: 41
Standard errors in ( ) & t-statistics in [ ]

	iPUAB	rKI	LINV	LINVDEF
iPUAB(-1)	0.413764	-0.095486	0.000146	-0.001410
	(0.15335)	(0.02262)	(0.00033)	(0.00061)
	[2.69816]	[-4.22139]	[0.43639]	[-2.31331]
iPUAB(-2)	-0.171447	-0.055864	-0.000838	-8.36E-05
	(0.17962)	(0.02649)	(0.00039)	(0.00071)
	[-0.95450]	[-2.10854]	[-2.13841]	[-0.11712]
rKI(-1)	-1.854803	1.534338	-0.001309	-0.005008
	(0.60587)	(0.08937)	(0.00132)	(0.00241)
	[-3.06137]	[17.1688]	[-0.99063]	[-2.07877]
rKI(-2)	1.493833	-0.662370	0.001471	0.005047
	(0.57168)	(0.08432)	(0.00125)	(0.00227)
	[2.61305]	[-7.85502]	[1.17921]	[2.22022]
LINV(-1)	-26.06457	-12.71530	1.239069	-0.483469
	(65.2090)	(9.61847)	(0.14227)	(0.25927)
	[-0.39971]	[-1.32197]	[8.70947]	[-1.86469]
LINV(-2)	9.012565	10.47939	-0.395011	0.189118
	(58.0713)	(8.56565)	(0.12669)	(0.23090)
	[0.15520]	[1.22342]	[-3.11782]	[0.81906]
LINVDEF(-1)	34.58414	-12.47885	-0.140324	1.591473
	(27.3165)	(4.02924)	(0.05960)	(0.10861)
	[1.26606]	[-3.09707]	[-2.35457]	[14.6528]
LINVDEF(-2)	-69.92546	7.491421	0.072669	-0.818692
	(26.3797)	(3.89106)	(0.05755)	(0.10489)
	[-2.65073]	[1.92529]	[1.26264]	[-7.80545]
C	333.5224	46.95083	1.718394	3.707908
	(307.718)	(45.3891)	(0.67135)	(1.22350)
	[1.08386]	[1.03441]	[2.55961]	[3.03056]
R-squared	0.898134	0.997998	0.993420	0.991071
Adj. R-squared	0.872668	0.997497	0.991775	0.988839
Sum sq. resids	2253.758	49.03484	0.010728	0.035630
S.E. equation	8.392254	1.237877	0.018309	0.033368
F-statistic	35.26741	1993.915	603.8763	443.9788
Log likelihood	-140.3155	-61.84514	110.9180	86.31048
Akaike AIC	7.283684	3.455860	-4.971610	-3.771243

Schwarz SC	7.659834	3.832010	-4.595460	-3.395093
Mean dependent	34.15073	-5.553811	8.928659	4.527906
S.D. dependent	23.51851	24.74463	0.201882	0.315846
Determinant Residual Covariance		1.83E-05		
Log Likelihood (d.f. adjusted)		-9.035792		
Akaike Information Criteria		2.196868		
Schwarz Criteria		3.701468		

Roots of Characteristic Polynomial
Endogenous variables:iPUAB rKI LINV LINVDEF
Exogenous variables: C
Lag specification: 1 2
Date: 07/24/01 Time: 08:40

Root	Modulus
0.943601 - 0.113361i	0.950386
0.943601 + 0.113361i	0.950386
0.883985 - 0.299851i	0.933456
0.883985 + 0.299851i	0.933456
0.086322 - 0.511535i	0.518767
0.086322 + 0.511535i	0.518767
0.475414 - 0.141894i	0.496138
0.475414 + 0.141894i	0.496138

No root lies outside the unit circle.
VAR satisfies the stability condition.

VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
H0: residuals are multivariate normal
Date: 07/24/01 Time: 08:41
Sample: 1997:08 2000:12
Included observations: 41

Component	Skewness	Chi-sq	df	Prob.
1	0.251942	0.433743	1	0.5102
2	-0.089407	0.054623	1	0.8152
3	0.581682	2.312087	1	0.1284
4	0.042216	0.012178	1	0.9121
Joint		2.812631	4	0.5897

Date: 07/24/01 Time: 08:41
Sample: 1997:08 2000:12
Included observations: 41
Trend assumption: Linear deterministic trend
Series: iPUAB rKI LINV LINVDEF
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Trace Eigenvalue	5 Percent Statistic	1 Percent Critical Value	Critical Value
None **	0.777136	118.4110	47.21	54.46
At most 1 **	0.650120	56.86202	29.68	35.65
At most 2	0.273228	13.80524	15.41	20.04
At most 3	0.017417	0.720392	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 2 cointegrating equation(s) at both 5% and 1% levels

VAR Residual Serial Correlation LM Tests
H0: no serial correlation at lag order h
Date: 07/24/01 Time: 08:41
Sample: 1997:08 2000:12
Included observations: 41

Lags	LM-Stat	Prob
1	69.79759	0.0000
2	5.825275	0.9899

Probs from chi-square with 16 df.

Variance Decomposition of iPUAB

Period	S.E.	iPUAB	rKI	LINV	LINVDEF
1	8.3923	100.0000	0.0000	0.0000	0.0000
2	9.4519	92.5489	6.0984	0.2037	1.1490
3	9.9553	85.0332	12.9653	0.3700	1.6315
4	10.5151	82.7730	15.3371	0.4081	1.4818
5	11.2960	83.0695	15.2193	0.4018	1.3094
6	11.9801	83.5125	14.8261	0.3978	1.2636
7	12.5247	83.8495	14.3258	0.3840	1.4407
8	13.0175	84.0984	13.5809	0.3567	1.9641
9	13.4933	84.0375	12.7330	0.3419	2.8877
10	13.9452	83.4944	11.9370	0.3832	4.1855
11	14.3698	82.4431	11.2424	0.5315	5.7830
12	14.7691	80.9630.	10.6435	0.8337	7.5598

Variance Decomposition of rKI

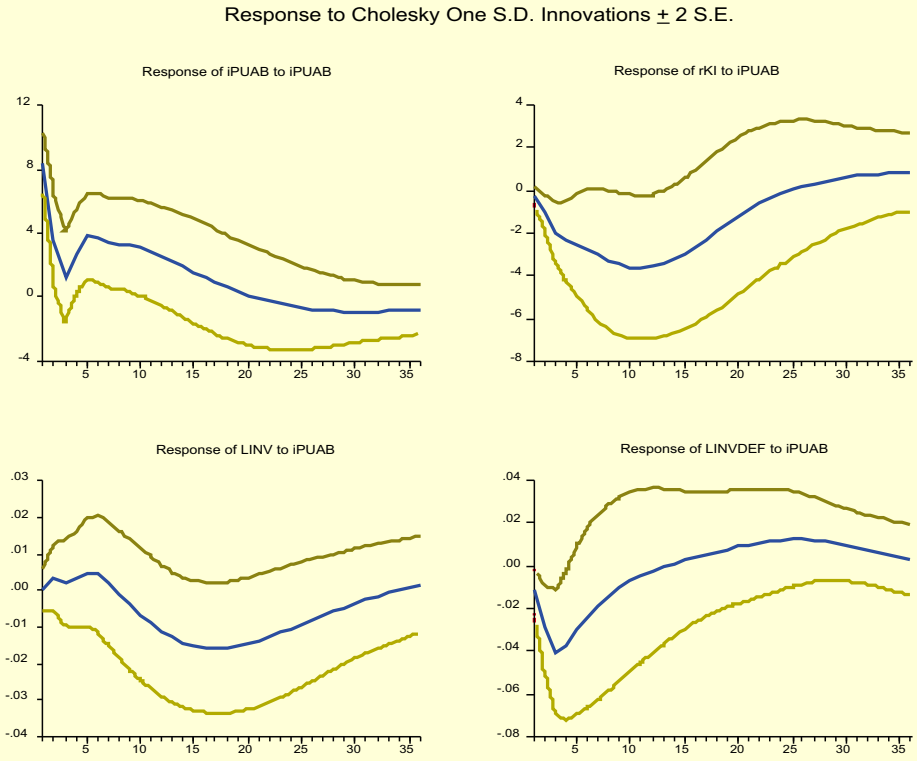
Period	S.E.	iPUAB	rKI	LINV	LINVDEF
1	1.2379	3.6104	96.3896	0.0000	0.0000
2	2.7101	14.9869	82.8342	0.3592	1.8197
3	4.5527	24.2251	70.3261	0.2857	5.1631
4	6.4328	25.8206	65.1858	0.1434	8.8502
5	8.1336	25.6942	62.1483	0'2681	11.8894
6	9.5727	26.6684	58.7332	0.7763	13.8222
7	10.7402	29.0981	54.6143	1.6730	14.6147
8	11.6651	32.5820	50.1414	2.8584	14.4183
9	12.4027	36.6380	45.7234	4.1242	13.5144
10	13.0244	40.7768	41.6895	5.1991	12.3346
11	13.5971	44.4850	38.2587	5.8501	11.4062
12	14.1643	47.3364	35.4851	5.9939	11.1846

Variance Decomposition of LINV

Period	S.E.	iPUAB	rKI	LINV	LINVDEF
1	0.0183	0.0348	38.9541	61.0111	0.0000
2	0.0298	1.4527	37.4332	59.2128	1.9013
3	0.0382	1.1694	34.0084	58.2440	6.5782
4	0.0449	1.2891	28.0306	57.0216	13.6587
5	0.0509	1.9004	22.2729	54.9593	20.8674
6	0.0564	2.1606	18.1699	53.0527	26.6168
7	0.0612	1.9406	15.4896	51.8562	30.7137
8	0.0653	1.7290	13.6885	51.2624	33.3201
9	0.0688	1.8771	12.4035	51.0784	34.6409
10	0.0719	2.5627	11.4263	51.1085	34.9025
11	0.0745	3.8659.	10.6476	51.1388	34.3477
12	0.0768	57,673	10.0160	50.9783	33.2384

Variance Decomposition of LINVDEF

Period	S.E.	iPUAB	rKI	LINV	LINVDEF
1	0.0334	11.9804	10.7189	0.2173	77.0834
2	0.0675	21.6757	9.7014	1.9908	66.6322
3	0.0977	27.4288	7.3843	4.4283	60.7586
4	0.1196	28.3992	5.3099	7.6316	58.6593
5	0.1354	27.2147	4.2023	11.4508	57.1323
6	0.1478	25.5181	4.2836	15.3645	54.8339
7	0.1578	23.8541	5.4434	18.8518	51.8507
8	0.1661	22.3489	7.3615	21.5979	48.6917
9	0.1726.	21.0741	9.5895	23.5166	45.8198
10	0.1775	20.0834	11.6908	24.7005	43.5254
11	0.1810	19.3841	13.3657	25.3383	41.9119
12	0.1831	18.9451	14.4899	25.6346	40.9304


Response to Cholesky One S.D. Innovations ± 2 S.E.
Response of iPUAB to iPUAB
Response of rKI to iPUAB
Response of LINV to iPUAB
Response of LINVDEF to iPUAB

Appendix G

Results of VAR : Substitution/Income Effects in Post-Crisis Period

Vector Autoregression Estimates
Date: 07/24/01 Time: 16:30
Sample: 1997:08 2000:12
Included observations: 41
Standard errors in ( ) & t-statistics in [ ]

	iPUAB	rDEP1	LKONS
iPUAB(-1)	0.552094	0.039819	-3.96E-05
	(0.17513)	(0.06354)	(0.00025)
	[3.15243]	[0.62669]	[-0.15746]
iPUAB(-2)	0.000213	-0.110235	0.000622
	(0.20030)	(0.07267)	(0.00029)
	[0.00106]	[-1.51691]	[2.16255]
iPUAB(-3)	0.377512	0.008363	-0.000948
	(0.18565)	(0.06735)	(0.00027)
	[2.03351]	[0.12417]	[-3.55658]
rDEP1(-1)	0.816365	1.333482	0.000365
	(0.46668)	(0.16931)	(0.00067)
	[1.74932]	[7.87591]	[0.54439]
rDEP1(-2)	-1.054110	-0.517884	-0.000508
	(0.72423)	(0.26275)	(0.00104)
	[-1.45550]	[-1.97100]	[-0.48871]
rDEP1(-3)	0.648047	0.021288	9.68E-05
	(0.41730)	(0.15140)	(0.00060)
	[1.55295]	[0.14061]	[0.16148]
LKONS(-1)	-208.3447	54.26705	1.262104
	(107.400)	(38.9649)	(0.15427)
	[-1.93990]	[1.39272]	[8.18103]
LKONS(-2)	213.7806	-128.5483	-0.354725
	(158.067)	(57.3472)	(0.22705)
	[1.35247]	[-2.24158]	[-1.56230]
LKONS(-3)	-73.29734	110.9162	-0.226608
	(103.866)	(37.6829)	(0.14920)
	[-0.70569]	[2.94341]	[-1.51885]
C	682.3328	-365.0573	3.215656
	(646.205)	(234.445)	(0.92823)
	[1.05591]	[-1.55711]	[3.46429]
R-squared	0.864372	0.961178	0.915390
Adj. R-squared	0.824996	0.949907	0.890825
Sum sq. resids	3000.753	394.9763	0.006192

S.E. equation	9.838622	3.569478	0.014132
F-statistic	21.95174	85.27975	37.26504
Log likelihood	-146.1839	-104.6142	122.1854
Akaike AIC	7.618728	5.590936	-5.472461
Schwarz SC	8.036673	6.008880	-5.054516
Mean dependent	34.15073	1.777653	10.03369
S.D. dependent	23.51851	15.94839	0.042772

Determinant Residual Covariance	0.180642
Log Likelihood (d.f. adjusted)	-139.4491
Akaike Information Criteria	8.265810
Schwarz Criteria	9.519643

Roots of Characteristic Polynomial
Endogenous variables: iPUAB rDEP1 LKONS
Exogenous variables: C
Lag specification: 1 3
Date: 07/24/01 Time: 16:34

Root	Modulus
0.940494 - 0.163132i	0.954537
0.940494 + 0.163132i	0.954537
0.723236 - 0.461275i	0.857814
0.723236 + 0.461275i	0.857814
-0.732093	0.732093
-0.134526 - 0.646992i	0.660829
-0.134526 + 0.646992i	0.660829
0.410683 - 0.422183i	0.588981
0.410683 + 0.422183i	0.588981

No root lies outside the unit circle.
VAR satisfies the stability condition.

VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
H0: residuals are multivariate normal
Date: 07/24/01 Time: 16:34
Sample: 1997:08 2000:12
Included observations: 41

Component	Skewness	Chi-sq	df	Prob.
1	1.695260	19.63836	1	0.0000
2	0.234302	0.375133	1	0.5402
3	-0.720371	3.546054	1	0.0597
Joint		23.55954	3	0.0000

VAR Residual Serial Correlation LM Tests
H0: no serial correlation at lag order h
Date: 07/24/01 Time: 16:34
Sample: 1997:08 2000:12
Included observations: 41

Lags	LM-Stat	Prob
1	40.26586	0.0000
2	13.57250	0.1384
3	21.08555	0.0123

Probs from chi-square with 9 df.

Date: 07/24/01 Time: 16:35
Sample: 1997:08 2000:12
Included observations: 41
Trend assumption: Linear deterministic trend
Series: iPUAB rDEP1 LKONS
Lags interval (in first differences): 1 to 3

Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Trace Eigenvalue	5 Percent Statistic	1 Percent Critical Value	Critical Value
None **	0.667932	64.98383	29.68	35.65
At most 1 *	0.345978	19.78483	15.41	20.04
At most 2	0.056296	2.375644	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 2 cointegrating equation(s) at the 5% level
Trace test indicates 1 cointegrating equation(s) at the 1% level

Variance Decomposition of iPUAB

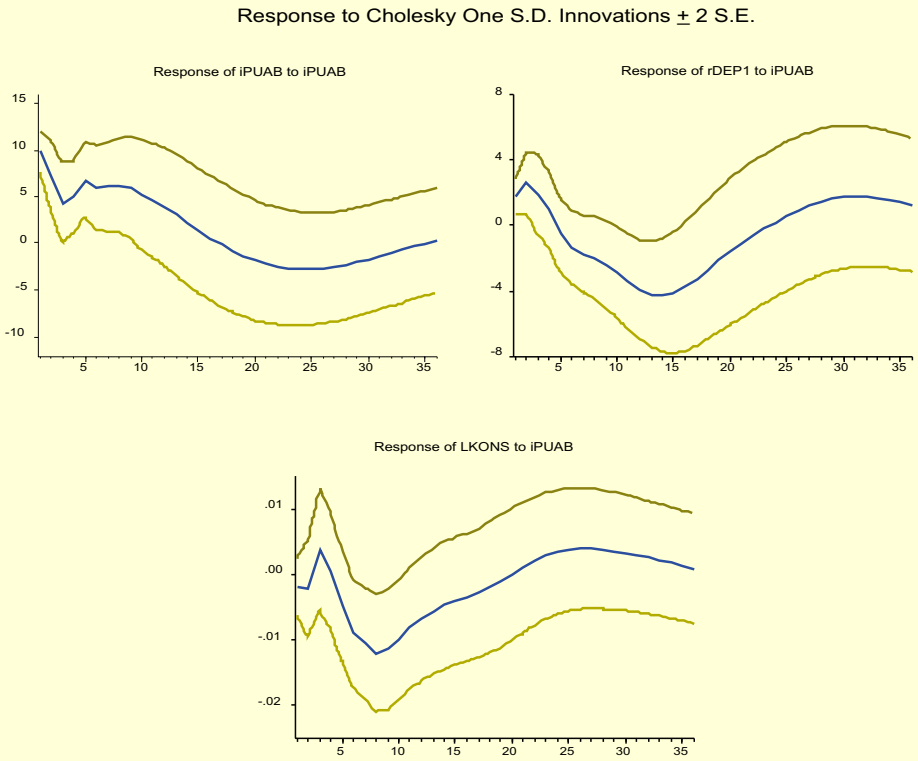
Period	S.E.	iPUAB	rDEP1	LKONS
1	9.8386	100.0000	0.0000	0.0000
2	12.7404	92.0597	2.8033	5.1369
3	13.6031	90.9596	3.0421	5.9984
4	14.7570	88.4513	3.3518	8.1969
5	16.4777	87.8726	4.4724	7.6560
6	17.8720	85.9512	6.9546	7.0942
7	19.1633	84.8254	8.9852	6.1894
8	20.4670	83.4716	11.1019	5.4264
9	21.6653	82.0047	13.0344	4.9609
10	22.6208	80.3768	14.8468	4.7765
11	23.4147	78.8625	16.2822	4.8553
12	24.0345	77.4183	17.5386	5.0431

Variance Decomposition of rDEP1

Period	S.E.	iPUAB	rDEP1	LKONS
1	3.5695	23.7511	76.2489	0.0000
2	6.1869	25.6552	728669	1.4778
3	7.6634	22.9250	76.1065	0.9685
4	8.3198	20.7891	78.3435	0.8674
5	8.6349	19.7407	79.0553	1.2040
6	9.0003	20.5060	74.8393	4.6574
7	9.5570	21.6759	67.0612	11.2629
8	10.2717	22.5411	58.1711	19.2879
9	10.9962	24.5574	50.7628	24.6798
10	11.6690	27.9539	45.3401	26.7059
11	12.3276	32.8481	41.4364	25.7155
12	13.0544	38.2675	38.4740	23.2585

Variance Decomposition of LOKNS

Period	S.E.	iPUAB	rDEP1	LKONS
1	0.0141	1.8712	1.9519	96.1769
2	0.0229	1.6335	3.2597	95.1086
3	0.0293	2.8673	3.6331	93.6796
4	0.0315	2.3677	4.7175	92.9148
5	0.0323	4.5130	4.5501	90.9369
6	0.0336	11.4069	4.5039	84.0893
7	0.0356	19.0267	5.1554	75.8180
8	0.0382	26.5067	6.0435	67.4508
9	0.0404	31.8015	7.2609	60.9376
10	0.0420	35.1033	8.4247	56.4720
11	0.0432	36.9304	9.5019	53.5676
12	0.0440	37.9614	10.4286	51.6100


Response to Cholesky One S.D. Innovations ± 2 S.E.
Response of iPUAB to iPUAB
Response of rDEP1 to iPUAB
Response of LKONS to iPUAB

Appendix H

Results of VAR : Passthrough in Pre-Crisis Period

Vector Autoregression Estimates
Date: 07/25/01 Time: 13:35
Sample(adjusted): 1988:05 1997:07
Included observations: 111 after adjusting endpoints
Standard errors in ( ) & t-statistics in [ ]

	rPUAB	INF
rPUAB(-1)	0.794617	0.027231
	(0.09605)	(0.03663)
	[8.27338]	[0.74349]
rPUAB(-2)	0.036377	-0.035497
	(0.09420)	(0.03592)
	[0.38615]	[-0.98810]
INF(-1)	-0.742134	1.295003
	(0.23427)	(0.08934)
	[-3.16785]	[14.4957]
INF(-2)	0.536573	-0.409694
	(0.24226)	(0.09238)
	[2.21488]	[-4.43473]
C	2.478490	0.934282
	(1.03642)	(0.39523)
	[2.39140]	[2.36390]
R-squared	0.755793	0.869056
Adj. R-squared	0.746578	0.864114
Sum sq. resids	331.8234	48.25427
S.E. equation	1.769296	0.674707
F-statistic	82.01463	175.8761
Log likelihood	-218.2787	-111.2681
Akaike AIC	4.023040	2.094921
Schwarz SC	4.145091	2.216972
Mean dependent	4.805250	7.975138
S.D. dependent	3.514620	1.830325
Determinant Residual Covariance		1.423081
Log Likelihood (d.f. adjusted)		-334.5861
Akaike Information Criteria		6.208759
Schwarz Criteria		6.452860

Roots of Characteristic Polynomial
Endogenous variables: rPUAB INF
Exogenous variables: C
Lag specification: 1 2
Date: 07/18/01 Time: 10:36

Root	Modulus
0.872618	0.872618
0.735577	0.735577
0.467622	0.467622
0.013803	0.013803

No root lies outside the unit circle.
VAR satisfies the stability condition.

VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
H0: residuals are multivariate normal
Date: 07/18/01 Time: 10:37
Sample: 1988:01 1997:07
Included observations: 111

Component	Skewness	Chi-sq	df	Prob.
1	0.492163	4.481145	1	0.0343
2	0.221835	0.910395	1	0.3400
Joint		5.391540	2	0.0675

Date: 07/18/01 Time: 10:37
Sample(adjusted): 1988:06 1997:07
Included observations: 110 after adjusting endpoints
Trend assumption: Linear deterministic trend
Series: rPUAB INF
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Trace Eigenvalue	5 Percent Statistic	1 Percent Critical Value	Critical Value
None	0.075585	12.81597	15.41	20.04
At most 1 *	0.037205	4.170613	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

VAR Residual Serial Correlation LM Tests
H0: no serial correlation at lag order h
Date: 07/18/01 Time: 10:38
Sample: 1988:01 1997:07
Included observations: 111

Lags	LM-Stat	Prob
1	4.095147	0.3933
2	4.386064	0.3563

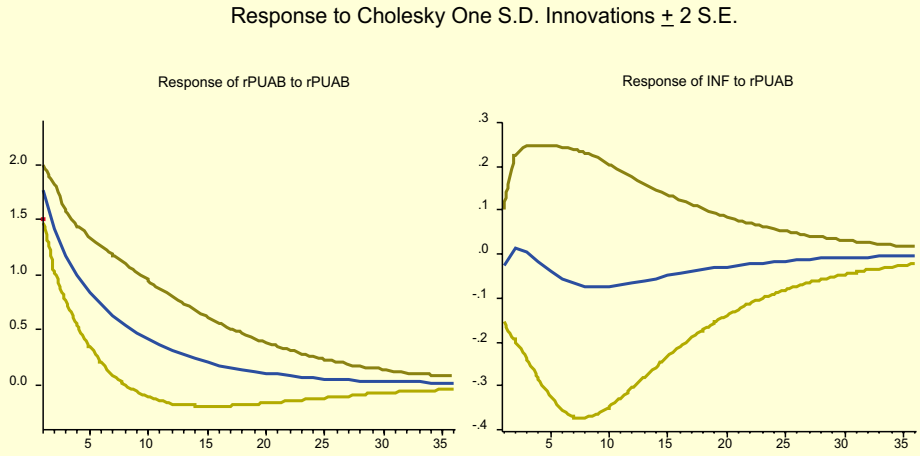
Probs from chi-square with 4 df.

Variance Decomposition of iPUAB

Period	S.E.	iPUAB	INF
1	1.7693	100.000	0.0000
2	2.3260	95.37.21	4.6279
3	2.6925	90.0961	9.9039
4	2.9557	85.8948	14.1052
5	3.1488	82.8321	17.1679
6	3.2917	80.6430	19.3570
7	3.3982	79.0747	20.9253
8	3.4778	77.9408	22.0592
9	3.5376	77.1123	22.8877
10	3.5827	76.5012	23.4988
11	3.6168	76.0468	23.9532
12	3.6426	75.7068	24.2932

Variance Decomposition of INF

Period	S.E.	iPUAB	INF
1	0.6747	0.21384	99.8616
2	1.1.36	0.0719	99.9281
3	1.3874	0.0477	99.9523
4	1.5680	0.0486	99.9514
5	1.6815	0.0957	99.9043
6	1.7530	0.1888	99.8112
7	1.7985	0.3152	99.6848
8	1.8279	0.4589	99.5411
9	1.8473	0.6060	99.3940
10	1.8604	0.7464	99.2537
11	1.8692	0.8738	99.1262
12	1.8754	0.9853	99.0147


Response to Cholesky One S.D. Innovations ± 2 S.E.
Response of rPUAB to rPUAB
Response of INF to rPUAB
2.0
1.5
1.0
0.5
0.0
.3
.2
.1
.0
-.1
-.2
-.3
-.4
5
10
15
20
25
30
35

Appendix I

Results of VAR : Passthrough in Post-Crisis Period

Vector Autoregression Estimates
Date: 07/19/01 Time: 17:10
Sample: 1997:08 2000:12
Included observations: 41
Standard errors in ( ) & t-statistics in [ ]

	rPUAB	INF
rPUAB(-1)	0.747369 (0.16502) [4.52908]	0.116690 (0.05308) [2.19849]
rPUAB(-2)	0.155260 (0.17463) [0.88908]	-0.013631 (0.05617) [-0.24268]
I NF(-1)	-0.694617 (0.43335) [-1.60290]	1.581557 (0.13939) [11.3465]
INF(-2)	0.558219 (0.46808) [1.19257]	-0.583020 (0.15056) [-3.87239]
C	4.198800 (3.26662) [1.28537]	-0.701382 (1.05070) [-0.66754]
R-squared	0.799728	0.988019
Adj. R-squared	0.777476	0.986688
Sum sq. resids	3679.823	380.7072
S.E. equation	10.11026	3.251953
F-statistic	35.93894	742.2040
Log likelihood	-150.3660	-103.8599
Akaike AIC	7.578827	5.310238
Schwarz SC	7.787799	5.519210
Mean dependent	8.113019	26.18236
S.D. dependent	21.43254	28.18534
Determinant Residual Covariance		1016.834
Log Likelihood (d.f. adjusted)		-258.3042
Akaike Information Criteria		13.08801
Schwarz Criteria		13.50595

Roots of Characteristic Polynomial
Endogenous variables: rPUAB INF
Exogenous variables: C
Lag specification: 1 2
Date: 07/19/01 Time: 17:10

Root	Modulus
0.900854 - 0.167727i	0.916336
0.900854 + 0.167727i	0.916336
0.673768	0.673768
-0.146551	0.146551

No root lies outside the unit circle.
VAR satisfies the stability condition.

VAR Residual Serial Correlation LM Tests
H0: no serial correlation at lag order h
Date: 07/19/01 Time: 17:10
Sample: 1997:08 2000:12
Included observations: 41

Lags	LM-Stat	Prob
1	1.920873	0.7503
2	3.720222	0.4452

Probs from chi-square with 4 df.

VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
H0: residuals are multivariate normal
Date: 07/19/01 Time: 17:11
Sample: 1997:08 2000:12
Included observations: 41

Component	Skewness	Chi-sq	df	Prob.
1	1.836245	23.04060	1	0.0000
2	-0.383470	1.004835	1	0.3161
Joint		24.04543	2	0.0000

Date: 07/19/01 Time: 17:11
Sample: 1997:08 2000:12
Included observations: 41
Trend assumption: Linear deterministic trend
Series: rPUAB INF
Lags interval (in first differences): 1 to 2
Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Trace Eigenvalue	5 Percent Statistic	1 Percent Critical Value	Critical Value
None	0.217146	14.14739	15.41	20.04
At most 1 *	0.095388	4.110214	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Variance Decomposition of INF

Period	S.E.	iPUAB	INF
1	10.110	100.000	0000
2	12.494	96.925	3.075
3	14.077	91.943	8.057
4	15.134	85.768	14.232
5	15.907	79.368	20.632
6	16.535	73.556	26.444
7	17.107	68.948	31.052
8	17.672	65.853	34.147
9	18.243	64.254	35.746
10	18.817	63.895	36.105
11	19.376	64.404	35.569
12	19.901	65.412	34.588

Variance Decomposition of INF

Period	S.E.	iPUAB	INF
1	3.252	5.933	94.067
2	6.432	15.818	84.182
3	9.564	25.218	74.782
4	12.538	34.368	65.632
5	15.291	42.854	57.146
6	17.785	50.395	49.605
7	19.996	56.852	43.148
8	21.912	62.196	37.804
9	23.531	66.474	33.526
10	24.862	69.768	30.232
11	25.924	72.184	27.816
12	26.746	73.837	26.163

Appendix J

Interbank Money Market Rate

1. Regression Result of State Bank PUAB Rate

	Whole Sample (1991.01 - 2000.12)	Before Crisis (1991.01 - 1997.12)	After Crisis (1998.01 - 2000.12)
$i_{SBI\ t}$	0.27	0.15	0.40
	(2.75)	(3.27)	(1.28)
$i_{PUAB\ t-1}$	0.72	0.78	0.61
	(0.07)	(21.62)	(2.44)
Log Liq $_t$	9.22	-0.34	1.74
	(0.95)	(-1.04)	(0.88)
R^2	0.92	0.95	0.86
DW-stat	2.28	1.78	1.76

2. Regression Result of Private National Foreign Exchange Bank PUAB Rate

	Whole Sample (1991.01 - 2000.12)	Before Crisis (1991.01 - 1997.12)	After Crisis (1998.01 - 2000.12)
$i_{SBI\ t}$	0.29	0.21	0.40
	(3.25)	(5.17)	(1.46)
$i_{PUAB\ t-1}$	0.74	0.72	0.70
	(9.65)	(21.59)	(2.96)
Log Liq $_t$	-0.60	-0.58	-2.33
	(-1.22)	(-1.16)	(-1.56)
R^2	0.94	0.95	0.89
DW-stat	2.41	0.90	2.61

3. Regression Result of Private National Non Foreign Exchange Bank PUAB Rate

	Whole Sample (1991.01 - 2000.12)	Before Crisis (1991.01 - 1997.12)	After Crisis (1998.01 - 2000.12)
$i_{SBI\ t}$	0.24	0.18	0.49
	(2.34)	(2.83)	(2.17)
$i_{PUAB\ t-1}$	0.775	0.75	0.66
	(9.04)	(14.27)	(3.81)
Log Liq $_t$	-0.64	-0.30	-3.15
	(-1.33)	(-1.01)	(-2.25)
R^2	0.90	0.90	0.87
DW-stat	2.88	0.55	2.07

4. Regression Result of Joint Venture and Foreign Bank PUAB Rate

	Whole Sample (1991.01 - 2000.12)	Before Crisis (1991.01 - 1997.12)	After Crisis (1998.01 - 2000.12)
$i_{SBI\ t}$	0.10	0.11	0.07
	(1.19)	(3.14)	(0.28)
$i_{PUAB\ t-1}$	0.86	0.87	0.83
	(12.75)	(28.67)	(4.35)
Log Liq $_t$	0.22	-0.18	0.96
	(0.45	(-0.87)	(0.64)
R^2	0.92	0.97	0.85
DW-stat	2.60	0.65	1.96

5. Regression Result of Regional Government Bank PUAB Rate

	Whole Sample (1991.01 - 2000.12)	Before Crisis (1991.01 - 1997.12)	After Crisis (1998.01 - 2000.12)
$i_{SBI\ t}$	0.44	0.24	0.74
	(4.37)	(4.61)	(3.55)
$i_{PUAB\ t-1}$	0.609	0.740	0.41
	(7.01)	(15.31)	(2.40)
Log Liq $_t$	-0.81	-0.38	-3.24
	(-.170)	(-1.73)	(-2.25)
R^2	0.93	0.94	0.92
DW-stat	1.69	1.82	1.07

Appendix K
Time Deposit Rate

1. Regression Result of State Bank Time Deposit Rate

	Whole Sample (1991.01 - 2000.12)	Before Crisis (1991.01 - 1997.12)	After Crisis (1998.01 - 2000.12)
$i_{PUAB\ t}$	0.22	0.18	0.26
	(10.26)	(14.09)	(4.00)
LDR_t	0.01	0.02	0.01
	(5.70)	(7.31)	(0.25)
$i_{Dep\ t-1}$	0.70	0.67	0.67
	(24.35)	(22.59)	(10.57)
R^2	0.97	0.97	0.96
DW-stat	1.40	0.67	1.64

2. Regression Result of Private National Foreign Exchange Bank Time Deposit Rate

	Whole Sample (1991.01 - 2000.12)	Before Crisis (1991.01 - 1997.12)	After Crisis (1998.01 - 2000.12)
$i_{PUAB\ t}$	0.21	0.17	0.24
	(9.94)	(11.90)	(2.57)
LDR_t	0.02	0.02	0.02
	(5.49)	(5.10)	(0.29)
$i_{Dep\ t-1}$	0.71	0.72	0.68
	(24.80)	(23.47)	(10.74)
R^2	0.97	0.96	0.96
DW-stat	1.39	0.74	1.62

3. Regression Result of Private National Non Foreign Exchange Bank Time Deposit Rate

	Whole Sample (1991.01 - 2000.12)	Before Crisis (1991.01 - 1997.12)	After Crisis (1998.01 - 2000.12)
$i_{PUAB\ t}$	0.20	0.15	0.25
	(9.48)	9.94)	(4.35)
LDR_t	0.02	0.01	0.01
	(4.92)	(2.70)	(0.62)
$i_{Dep\ t-1}$	0.72	0.79	0.67
	(25.26)	(25.50)	(10.62)
R^2	0.97	0.95	0.96
DW-stat	1.32	0.82	1.62

4. Regression Result of Joint Venture and Foreign Bank Time Deposit Rate

	Whole Sample (1991.01 - 2000.12)	Before Crisis (1991.01 - 1997.12)	After Crisis (1998.01 - 2000.12)
$i_{PUAB\ t}$	0.21	0.17	0.26
	(9.83)	(10.79)	(5.12)
LDR_t	0.01	0.01	0.02
	(4.98)	(3.38)	(0.92)
$i_{Dep\ t-1}$	0.71	0.80	0.64
	(24.18)	(33.37)	(8.42)
R^2	0.97	0.95	0.96
DW-stat	1.34	0.78	1.66

5. Regression Result of Regional Government Bank Time Deposit Rate

	Whole Sample (1991.01 - 2000.12)	Before Crisis (1991.01 - 1997.12)	After Crisis (1998.01 - 2000.12)
$i_{PUAB\ t}$	0.20	0.16	0.26
	(9.66)	(10.78)	(4.82)
LDR_t	0.03	0.03	0.02
	(5.18)	(4.09)	(0.78)
$i_{Dep\ t-1}$	0.70	0.74	0.66
	(22.83)	(22.53)	(9.90)
R^2	0.97	0.95	0.96
DW-stat	1.31	0.75	1.64

Appendix L
Time Deposit Rate

1. Regression Result of State Bank Loan Rate

	Whole Sample (1991.01 - 2000.12)	Before Crisis (1991.01 - 1997.12)	After Crisis (1998.01 - 2000.12)
$i_{Dep\ t}$	0.08	0.14	0.09
	(10.03)	(5.63)	(10.70)
Liq_t	-0.62	-0.25	-0.79
	(-7.19)	(-1.67)	(-5.96)
$i_{KMK\ t-1}$	0.85	0.85	0.83
	(56.32)	(34.50)	(47.26)
R^2	0.98	0.95	0.99
DW-stat	1.60	1.71	1.71

2. Regression Result of Private National Foreign Exchange Bank Loan Rate

	Whole Sample (1991.01 - 2000.12)	Before Crisis (1991.01 - 1997.12)	After Crisis (1998.01 - 2000.12)
$i_{Dep\ t}$	0.07	0.14	0.06
	(8.95)	(5.89)	(6.79)
Liq_t	-0.41	-0.26	-0.74
	(6.27)	(-1.66)	(-4.45)
$i_{KMK\ t-1}$	0.89	0.85	0.89
	(75.04)	(32.40)	(72.16)
R^2	0.98	0.95	0.99
DW-stat	1.59	1.69	1.51

3. Regression Result of Private National Non Foreign Exchange Bank Loan Rate

	Whole Sample (1991.01 - 2000.12)	Before Crisis (1991.01 - 1997.12)	After Crisis (1998.01 - 2000.12)
$i_{Dep\ t}$	0.07	0.16	0.05
	(8.73)	(6.69)	(5.10)
Liq_t	-0.28	-0.30	-0.67
	(-5.76)	(-2.55)	(-3.92)
$i_{KMK\ t-1}$	0.90	0.82	0.91
	(81.14)	(29.30)	(83.62)
R^2	0.98	0.95	0.99
DW-stat	1.57	1.71	1.38

4. Regression Result of Joint Venture and Foreign Bank Loan Rate

	Whole Sample (1991.01 - 2000.12)	Before Crisis (1991.01 - 1997.12)	After Crisis (1998.01 - 2000.12)
$i_{Dep\ t}$	0.07	0.15	0.06
	(7.87)	(5.73)	(4.85)
Liq_t	-0.24	-0.03	-0.52
	(-4.52)	(-0.37)	(-1.32)
$i_{KMK\ t-1}$	0.91	0.87	0.91
	(82.23)	(41.18)	(59.52)
R^2	0.98	0.95	0.99
DW-stat	1.47	1.72	1.10

5. Regression Result of Regional Government Bank Loan Rate

	Whole Sample (1991.01 - 2000.12)	Before Crisis (1991.01 - 1997.12)	After Crisis (1998.01 - 2000.12)
$i_{Dep\ t}$	0.08	0.15	0.07
	(9.44)	(6.09)	(7.97)
Liq_t	-0.787	-0.47	-0.67
	(-6.38)	(-1.42)	(-3.71)
$i_{KMK\ t-1}$	0.85	0.83	0.86
	(53.42)	(22.19)	(48.48)
R^2	0.98	0.94	0.99
DW-stat	1.59	1.65	1.36

List of Variables Used

iSBI	nominal interest rate of Bank Indonesia Certificate (SBI)
iPUAB	nominal interest rate of overnight interbank call money market
iKMK	nominal interest rate of working capital loan
rPUAB	real interest rate of overnight interbank call money market
rDEP1	real interest rate of one-month time deposit
rDEP3	real interest rate of three-month time deposit
rKI	real interest rate of investment loan
rKMK	real interest rate of working capital loan
LINV	logarithm of investment volume
LKONS	logarithm of consumption volume
LINDEF	logarithm of investment volume deflator
LKONSDEF	logarithm of consumption volume deflator
LGDDEF	logarithm of Gross Domestic Product (GDP) deflator
GDPG_GR	growth of GDP gap
INF	CPI inflation rate
Liq	banks' liquidity condition

Chapter 3

Bank Lending Channel of Monetary Transmission in Indonesia

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INTRODUCTION

Monetary policy in Indonesia is recently being faced with the most challenging time. The monetary policy to control high pressure of inflation and smooth out volatility of Rupiah exchange rate has been constrained by banks and firms' financial restructuring process. Under such circumstances when disintermediation of banking system takes place, efficacy of monetary policy has been declining and sometimes the policy is seen by many observers as costly.

The problems have been aggravated by the uncertainty regarding the way in which the monetary policy affects the real economy in the aftermath of the crisis. Attempts have been made to apprehend the monetary policy implications of current the banking crisis. A study by Agung, et al (2001) is one of the attempts to understand the existence of financial disintermediation in the banking sector in the aftermath of the crisis and its monetary policy implications. Thus, a broader agenda to understand the whole picture of monetary transmission mechanism needs to be done. This agenda is of paramount as the full implementation of the inflation targeting framework requires a deep understanding on the work of the monetary policy in the economy both in the short-run and long-run.

This paper is a part of the research agenda on the monetary transmission mechanism in Indonesia. In the recent years, a large body of literature has been developed on the efficacy of

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monetary policy and channels through which the policy affects the real economy. Traditionally, monetary policy is believed to influence the economy through money or short-term interest rate which in turn affects the long-term interest rate and cost of capital and thus investment. For example, in a monetary contraction, the banks reserves decrease and due to the reserve requirement the ability of banks to issue the deposits were constrained. As a result, the depositors hold less money (bank deposits) in their portfolios. If prices are sticky, real money balance will fall and both short-term interest rates and (through expectation effect) the long-term interest rates will rise. Accordingly, demand for loans, investments and interest-sensitive spending such as housing, all fall.

For the last decade, there have been growing voluminous studies of the effects of imperfection in financial markets on the real economy and business cycles (see e.g. Gertler, 1988; Bernanke and Gertler, 1989). The understanding of the role of the financial market imperfection has also generated theories on monetary transmission mechanism which emphasize the importance of this imperfection, especially asymmetric information problem in credit market, in explaining the effects of a monetary policy. These theories can be categorized as the 'asymmetric information based transmission mechanism' or credit channel. There are two strands of literature on the credit channel. First, the bank lending channel which emphasize the effects of monetary policy on bank balance sheet, especially in the asset side of banks. Second, the balance sheet channel which emphasize the effects of monetary policy on firm balance sheet and thereby access to banks' credit.

According to the bank lending channel, banks participate in the transmission of monetary policy not only via their liabilities side but also through their assets. For example, in a monetary contraction, banks reserves decrease and owing to reserve requirements, bank deposits fall. Should the decrease in bank deposits be not offset by other funds which are free from reserve requirements, or by a decrease in securities, the consequence would be a fall in bank loans. If bank loans also fall and bank dependent borrowers are dominant in the economy, the restrictive monetary policy results in a fall in investment and economic activity. Hence, monetary policy not only directly influences the real interest rate but also directly affects the supply of bank loans. Thus, two necessary conditions for the existence of this channel are: (1) bank loans and securities must be imperfect substitutes for some borrowers, or some borrowers are bank dependent; (2) the central bank must be able to constrain the supply of bank loans. While the first condition is likely to be satisfied as the bank lending is still the dominant source of funds for firms' financing, the second condition is subject to empirical investigation. Using sample data from 1985-1995, Agung (1998) proved that a monetary policy was able to influence the bank supply of credit, in particular, of small banks, not large banks which were able to shield their bank loan supply by finding the cheaper source of funds from abroad.

This paper investigates the bank lending channel of monetary transmission using the sample data including the period after the crisis and using various tools to analyse. This is stimulating, at least for two grounds. First, the evidence of ability of large banks to protect the lending supply by accessing non deposit funds from abroad may be questioned recently as the access to foreign funds has been very limited. Second, the existence of credit crunch (Agung, et al., 2001) supports the bank lending channel, i.e., the credit market is more supply-determined, rather than demand-determined as suggested by the money/interest-rate channel. However, the existence of credit crunch in which the non-price rationing exist, simultaneously shows that the effectiveness of monetary in influencing the supply of credit has also been reduced.

A battery of tests will be utilised to analyse the bank lending channel. First, we use VAR approach as Bernanke and Blinder (1992) using aggregate data to see effects of monetary policy on bank balance sheets. However, the empirical studies using aggregate data suffer from identification problem: the inability to establish whether the decline in credit as a result of a monetary contraction stems from a decline in loan supply or driven by the fall in demand for loans as a result of the high long term interest rate as predicted by the interest rate channel. Accordingly, following Kashyap and Stein (1995) we also use disaggregated data to deal with this identification issue. The use of the disaggregated data, hypothesis underlying the bank lending channel can be analysed. That is, following a monetary contraction, smaller banks which do not have access to other source of funds will decrease their loan supply more than that of large banks. On the borrower side, small borrowers which presumably are characterized by stronger informational asymmetries and lower access to alternative source of funds should be more sensitive to monetary contraction (Gertler and Gilchrist, 1993, 1994). As complementary to the VAR analysis, we estimate long-run demand and supply equation of the Indonesian credit market derived from vector error correction model (VECM) following Kakes (2000) in order to identify whether adjustment toward the equilibrium in the credit market is dominated by supply as suggested by lending channel. Finally, disaggregated evidence is analysed using bank level panel data to examine whether a monetary shock generates differential effects across banks according to their net worth (capital) position.

THE ROLE OF BANKS IN MONETARY TRANSMISSION

There is a widespread agreement among economists that banks or financial intermediaries have generally played an important role in transmitting monetary policy to the real economy. But the precise role of banks is still debated. In the standard view, known as

the money or interest rate channel, banks play a special role on the liabilities side, i.e., the banking system creates money (liquidity) by issuing deposits[1] and plays no role on the assets side. In a monetary contraction, banks reserves decrease and due to the reserve requirement the ability of banks to issue the deposits were constrained. As a result, the depositors hold less money (bank deposits) in their portfolios. If prices are sticky, real money balance will fall and both short-term interest rates and (through expectational effect) the long-term interest rates will rise. Accordingly, demand for loans, investments and interest-sensitive spending such as housing, all fall.[2] So, three crucial conditions must be satisfied for the existence of a money channel are: (1) prices are sticky so that monetary policy can affect real money balances, (2) short-term interest rates do influence long-term interest rates; and (3) the latter do influence real investment expenditure.

According to the "bank lending" (Bernanke and Blinder, 1988) monetary transmission mechanism, banks' assets as well as their liabilities play an important role. In a monetary contraction, banks' reserves decrease and given reserve requirements, banks' deposits fall. If the decrease in deposits is not offset by other funds which are not subject to reserve requirements, or by a decrease in securities, this will result in a decrease in bank loans. If bank loans fall and bank dependent borrowers are dominant in the economy, real investment expenditure will fall. Since bank loans in many countries, especially developing countries, remain the main source of external finance for business enterprises, a disrupting of bank loan supply can reduce the economic activity. The necessary conditions for the existence of this channel are: (1) the central bank must be able to constrain the supply of bank loans, (2) bank loans and securities must be imperfect substitute for some borrowers.

In regard to the second condition, since asymmetric information in financial markets in developing countries seems to be prevalent, some class of borrowers find it difficult to issue securities. Banks play an important role in overcoming the information problem in credit markets, consequently many borrowers are substantially bank dependent.[3] Thus the second condition seems to be satisfied. As pointed out by Bernanke and Gertler (1995), the first condition is questionable in empirical grounds, that is, whether monetary policy can significantly influence the supply of bank loans. As we discussed above, in order to limit the ability of banks to extend their loans after monetary contraction, banks must not easily issue another form of liabilities to replace lost deposits. In other words, all components of bank

1 By making loans or buying bonds.
2 Alternatively, some have described the money view as the standard IS-LM model, thus it does not require the role of banks. In the IS-LM, if banks did not exist, central banks could buy and sell bonds from public. This would influence interest rates and hence real investment expenditure.
3 Even in the countries like US where financial markets have been well established, the number of bank dependent borrowers are substantial (see Himmelberg and Morgan, 1995).

liabilities (except capital) must be subject to reserve requirement .[4] Of course, to some extent banks which have gone public can issue new equity to generate loanable funds.[5] However as argued by Kashyap and Stein (1995), as long as the banks do not face a perfectly elastic demand for their managed liabilities, a bank lending channel will operate. Some argue that the regulatory action of central banks can also significantly influence bank loan supply. For example, much research has focused on the effect of capital adequacy regulations on the banks' willingness to lend (see for example, Peek and Rosengren,1995a,b).

The third channel through which monetary policy might be transmitted to the real economy is known as the balance-sheet channel.[6] The basic idea of this theory is that monetary policy can affect borrower's financial position or collateralisable net worth, thereby influencing the costs of external finance, which in its turn affects a borrower's financial decision to engage investment expenditure. Suppose of central bank conducts a monetary tightening by raising market interest rates. It can directly influence the borrowers' financial position in two ways.[7] First, it can cause a deterioration of the assets prices of the borrowers, and hence reduce the value of the collateral the borrowers hold. Second, an increase in market interest rates raises the cost of servicing outstanding short-term or floating debt and so reduces net cash flow. Due to asymmetric information, moral hazard problem and bankruptcy law, borrowers with lower net worth are less creditworthy since the lender must bear higher costs in the event of the project fails. In contrast, the higher is a borrower's net worth, the greater is his collateral, hence the lower are the monitoring costs borne by the lenders. Consequently, the lenders impose a varying premium for external finance reflecting the cost of monitoring and evaluation. Thus, under information asymmetries, the internal finance of a new project is cheaper than external finance; and monetary policy influences the 'wedge' between the internal and external finance. A monetary contraction will increase the wedge and vice versa.

The second and third channels have similarities. Both theories suggest that monetary policy can influence borrowers who have a limited access to capital markets, and the bank dependent and the finance-constrained borrowers to some extent are identical. The differences between the two channels is that in the bank lending channel the condition that monetary policy must be able to affect bank loan supply is crucial. In contrast, in the balance sheet channel banks are not the central player, instead what matters is any

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4 However, even if the reserve requirement (RR) is equal over all class of liabilities, in practice, RR can not be flexibly applied. Hence, at least in the short run banks can escape from monetary tightening.
5 Since 1989 banks in Indonesia have been allowed to issue equity.
6 Some call it the "broad credit channel" or "net worth channel". For theoretical exposition of this channel, see Bernanke and Gertler (1989), Calomiris and Hubbard (1990), and Bernanke, Gertler and Gilchrist (1996).
7 See Bernanke and Gertler (1995) for detailed discussion.

disturbance which can influence the premium paid for external finance. Since the arguments of these two channels are primarily based on credit (capital) market imperfection, they two channels are often classified as the 'credit channel' or the 'capital market imperfections channel'.

EMPIRICAL EVIDENCE FROM VAR ANALYSIS

Data

We analyse monthly data over a sample that runs from 1991:01 to 2000:12. Most earlier studies of the bank lending channel employed aggregate data, comparing the relationship between total bank loans versus total deposits and the economic variables in the context of vector autoregressions (see Bernanke and Blinder, 1992) or the relative forecasting power of the two aggregates with respect to output fluctuations (Ramey, 1993, Kim, 1999, among others). However, it is now widely agreed that testing with aggregate data can generate a misleading conclusion. First, the use of aggregate time series cannot resolve the well-known identification problem, i.e. to distinguish whether the credit contraction which typically follows the monetary tightening is a result of the supply by banks, as argued by the bank lending channel, or the fall in demand for bank loans stemming from a recession. Second, testing the relative importance of the bank lending vs the money view by comparing the information content of these two aggregates with respect to output would be misleading (Bernanke, 1993). Due to bank balance sheet constraints, aggregate money supply (liability side of banks) and aggregate bank loans (assets side of banks) by construction, move together although they are not identical. Thus the relative forecasting power of these two aggregate variables does not provide any information about monetary transmissions.

To identify the channel of monetary policy, recent studies (Kashyap and Stein, 1995, 2000; Dale and Haldane, 1995, Kakes, 2000, for example) have tended to use cross sectional data to determine whether there are distributional effects of monetary policy across lenders and borrowers, as predicted by the bank lending channel argument. On the lenders side, the lending view suggests that a monetary policy shock should constrain bank loan supply since banks cannot frictionlessly raise non-deposit funds to make up for a shortfall in their deposits. But this will depend on the ability of banks to insulate themselves from the shock. Small banks which have relatively limited access to non-deposit funds such as securities issues or foreign borrowings are expected to be more affected by the monetary shock and to tend to cut their loan supplies immediately following the shock. On the borrower side, small firms that have

limited access to external finance should be more sensitive to a monetary shock (Gertler and Gilchrist, 1994). The use of cross sectional data, furthermore, eliminates the banks' balance sheet constraints.

This study follows Kashyap and Stein (1995) by disaggregating banks into different classes, reflecting their size and accessibility to non-deposit funds: state banks which are large and foreign exchange licensed banks, private banks and foreign and joint venture banks. The source of data is from Banking Statistics Monthly Report. The data for each class of banks include bank loans, deposits, non-deposit funds and securities holdings. The loans are also disaggregated into class of borrowers, i.e. loans to individual and private enterprises and disaggregated into different types of use, i.e., investment and working capital (Appedix A provides detailed definition of data used).

VAR specification

The effects of monetary policy shock on bank balance sheets and economic variables are examined using the vector autoregression (VAR) approach. Specifically, we use the standard semi-structural VAR approach as suggested by Bernanke and Blinder (1992) instead of structural VAR since we do not explicitly use a theoretical framework to identify the innovations, but impose a causal ordering. A structural model is a linear dynamic system of the following form:

$$\mathbf{B}y_t = \mathbf{C}(\mathbf{L})y_t + \varepsilon_t \quad (1)$$

or in MA form:

$$y_t = \Phi(\mathbf{L})\varepsilon_t \quad (2)$$

where $\Phi(\mathbf{L})=[\mathbf{B}-\mathbf{C}(\mathbf{L})]^{-1}$. y is nx1 vector of endogenous variables in the system including one policy variable and some non-policy variables. $\boldsymbol{\varepsilon_t}$ is a vector of structural shocks, including the monetary policy shock. **B** represents the structural parameters of contemporaneous endogenous variables and **C(L)** is k^{th} degree matrix polynomial in the lag operator, i.e. $\mathbf{C(L)} = \mathbf{C_1L+C_2L^2+...+C_kL^k}$. ε_t is an nx1 vector of structural shocks with zero mean, orthogonal and variance-covariance matrix $E(\varepsilon_t\varepsilon_t') = I$.

Equation (1) can be written in a reduced form which can be estimated by OLS as:

$$y_t = \mathbf{A}(\mathbf{L})y_t + \mathbf{u}t \quad (3)$$

with $\mathbf{E(utut')} = \Omega$. By noting $\mathbf{A(0) = B^{-1}}$, from the structural model (1) and the reduced form model (3) we obtain:

$$\mathbf{A(L)=A(0)C(L)} \quad (4)$$

and,

$$\mathbf{u_t = A(0)\varepsilon_t} \quad (5)$$

Accordingly,

$$E(u_t u_t') = \Omega = A(0)A(0)^T \quad (6)$$

From (2) we can obtain impulse-response functions, Φ(L), to structural shocks, ε_t and Φ(L) can be calculated from (3) and (5):

$$\Phi(L) = [I-A(L)]^1 A(0) \quad (7)$$

In order to identify the structural model and structural shock, ε_t we have to determine the *nxn* elements of matrix A(0). As Ω is known from OLS estimates of (3) we can solve (6) for **A(0)** and then deduce ε_t from (5). However system (6) only provides n(n+1)/2, hence we need n(n-1)/2 additional restrictions for the identification. A convenient way to add the n(n-1)/2 restrictions is to assuming **A(0)** is lower triangular and use the Cholesky decomposition of the variance-covariance matrix Ω (Sims, 1980). This restriction is equivalent to assuming that the residuals u_t form a recursive system. The ordering of the variables in the system, therefore, affects the recursive chain of causality among the shocks in any given period. The policy variable is placed first (for example, Sims, 1992) if we assume that there is no contemporaneous feedback from non-policy variables onto the policy variables. Thus, this equivalently assumes that the monetary decisions are made without considering the simultaneous evolution of economic variables. This assumption is plausible if data of non-policy variables are not readily available. If we assume that the policy variable responds to contemporaneous feedback from non-policy variables but there is one period lag of feedback of the policy shock on non-policy variables, the policy variable should be placed last. Given the high frequency data (monthly) that we use in constructing VARs, hence the existence of information lag from non-policy variables,[8] we prefer the former identifying restriction. Nevertheless, as the correlations across residuals (ε_t) are very small, the ordering is actually not significant. [9]

In contrast to Agung (1998), in examining the effects of monetary policy on the bank balance sheet, we include all bank balance sheet components in a VAR, so that the interrelationship between the balance sheet components can be evaluated. This approach follows McMillin (1996). Since such specification involves a VAR with many variables, while our data is rather limited, we use only lag of 3. The systems we developed are six-variable VARs with the following ordering: monetary policy indicator, bank deposits, loans, output and prices. We use real GDP and deflator GDP for output and prices, respectively, when aggregate loans are used. In the VAR using disaggregated data, for loans to individual, we use real consumption and consumer price index as the output and prices, while for loans to private enterprises, we

8 For example, interest rate data (the policy variable) is readily available, while non-policy variables such as real output and price were available with a lag.

9 A rule of thumb is that if $|\rho_{ij}| < 0.2$ for $i \neq j$, the ordering of variables in a VAR is not relevant (Enders, 1995, pp.309).

Table 3.1 Unit Root Tests

Variabel	Level		First Diff.	
	Lag	ADF Test	Lag	ADF Test
SBI Rates	6	-2.851 ***	11	-3.771 *
Interbank Rates	1	-2.196	1	-10.361 ***
Base Money	11	-1.549	11	3.347 **
Exchange rate	9	-1.982	8	-3.783 ***
Real GDP	10	-2.018	12	-2.035
GDP Deflator	9	-1.896	6	-3.622 ***
Consumer PI	8	-1.603	7	-4.022 ***
Real Consumption	12	-0.841	11	-3.427 **
Deflator Consumption	8	-1.489	7	-3.847 ***
Production Index	9	-1.319	8	-3.103 **
Real Investment	7	-1.352	6	-7.295 ***
Deflator Investment	11	-1.746	10	-2.831 ***
Deposit - Comercial Banks	12	-2.501	1	-7.283 *
Deposit - State Banks	2	-1.300	1	-6.285 *
Deposit - Private Banks	1	-1.182	10	-3.529 **
Deposit - FX Banks	11	0.361	10	-3.147 ***
Deposit - Foreign Banks	1	-3.067	1	-10.122 *
Lending - Comercial Banks [a]	1	-1.269	12	-2.532
Lending - State Banks [a]	8	-1.011	9	-2.095
Lending - Private Banks	2	-0.888	9	-3.256 **
Lending - FX Banks [a]	8	-3.062	1	-5.840 *
Lending - Foreign Banks	10	-0.488	9	-2.825
Total Lending To Private Enterprises	8	-3.193 *	8	-2.090
Lending To Individuals	3	-1.671	2	-3.528 ***
Inv.Lending Rates - Commercial.Banks	1	-1.646	1	-10.516 ***
Inv.Lending Rates - State Banks	7	-2.352	1	-9.583 ***
Inv. Lending Rates - Private Banks	8	-3.091 **	11	-2.933 **
Inv.Lending Rates - Foreign Banks	9	-3.162 **	7	-3.288 **
Invest. Lending - Commerc.Banks	8	-3.594 **	12	-3.231 **
Invest. Lending - State Banks	8	-3.266 *	9	-2.951 **
Invest. Lending - Private Banks	8	-2.701	8	-2.497
Invest. Lending - Foreign Banks	2	-3.163 *	4	-4.325 ***
WC.Lending Rates - Commercial.Banks	10	-2.839 *	9	-2.977 **
WC.Lending Rates - state banks	7	-2.738 *	9	-3.228 **
WC.Lending Rates - Private Banks	7	-2.826 *	9	-2.484 *
WC.Lending Rates - Foreign Banks	4	-2.488	9	-3.211 **
Work. Cap. Lending - Commerc.Banks	8	-2.791	4	-3.036 **
Work. Cap. Lending - State Banks	5	-1.711	1	-8.660 ***
Work. Cap. Lending - Private Banks	1	-1.577	1	-6.253 ***
Work. Cap. Lending - Foreign Banks	8	-3.685 **	12	-3.941 ***

Notes :
- For levels, time trend and constant were included in the tests, while for first-difference, only constant was included.
- Critical values: levels: 5 % (*) = -3.44, 1%(**)=-4.02; first-differences: 5%(*)=-2.88, 1%(**)=-3.47. A first difference of these variables are significant at 10% without trend and constant

use the production index and the wholesale price index. In the disaggregation based on the bank categories, the balance sheet variables are deposits and loans of the relevant banks.

All variables are in log levels except for interest rates and were tested for stationarity by Augmented Dickey Fuller (ADF) tests (see Table 3.1). In general, the results indicate that all were found to be I(1). In spite of non-stationarity of data, Sims (1980) and Doan (1992) do not recommend differencing the data prior to VAR estimation even if they contain unit roots. Their argument is that differencing in order to assure stationarity will 'throw away' valuable information concerning the interrelationships of the variables in the system such as the possibility of cointegrating relationship. It should be noted that the emphasis of VAR analysis is to trace the dynamic relationships among a set of interested variables, not the parameter estimates. Therefore, the VARs were estimated with all variables in levels. Tests of cointegration using Johansen maximum likelihood suggest that all systems are cointegrated (Appendix B).

Measuring the monetary policy variable

The crucial part of the studies on transmission mechanism is how to measure the monetary policy indicator. The literature on the identification of monetary policy indicator suggests that there are some alternatives to measure the indicators: the interest rate used by the central bank to influence the money market such as the Federal Funds rate in US (Bernanke and Blinder, 1992), Romers's dates of monetary tightness (Romer and Romer, 1990), or some aggregates such as base money, total reserves, non-borrowed reserves (Strongin, 1995 and Christiano, Eichenbaum and Evans, 1996).

Agung (1998) uses the money market interest rate (interbank money market) as the monetary policy variable by arguing that Bank Indonesia often indirectly targets the interbank interest rates. An alternative is the SBI rates which have been widely used as the benchmark by the market, in particular since the banks' holding of SBIs increased dramatically. The problem of using the SBI rates are the auction system has been changed three times. Before 1993, Bank Indonesia targeted the quantity of SBI in the auction (cut-off rate), but since 1993 the system was changed to stop-out rate in which the monetary authority set the interest rates on SBIs and market determines the quantity of SBIs. The stop-out rate system was changed again into cut-off rate in 1998. In practice, however, a mix of price and quantity targets has been frequently executed. Another alternative is base money, which has formally been used by Bank Indonesia as the operating target since 1998.

In order to choose the appropriate measure of monetary policy we follow a simple approach suggested by Bernanke and Blinder (1992). In this approach, the selection is based on the information content of the policy variables in the reduced forms of various real variables

such as real GDP, consumer price index, production index, consumption and investment. In addition to lags of the real variables and the policy variables, the reduced form also incorporates other monetary aggregates such as M1. We use lag of 12 for all independent variables in the reduced form. Since the variables are I(1), an alternative specification is the models are specified in the ECM model in which the variables are specified in first differenced and lag of cointegrating relationship is included in the model. Using this approach we can select the policy variables based on the short run information content (significance of the first differenced) and the long run information content (significance of the ECM coefficient). The results suggest that in general SBI rates and PUAB rates perform better than base money. However, it is difficult to select the best policy indicator between the two interest rates. With regard to the short run information content, PUAB rates perform better than SBI rates, while in the ECM specification, the long-run information content of SBI is superior to the PUAB rates. Hence we use the two policy indicators and compare the results in the VARs.

Table 3.2 Information content of the monetary policy variables

Variables	Base Money			SBI Rates			Interbank Rates		
	Level Spec.	ECM Spec.		Level Spec.	ECM Spec.		Level Spec.	ECM Spec.	
		First Diff.	ECM		First Diff.	ECM		First Diff.	ECM
GDP	0.151	0.389	-0.010 (2.027)	0.016	0.009	-0.104 (3.394)	0.042	0.025	-0.034 (3.964)
Production Index	0.319	0.248	-0.053 (2.143)	0.298	0.229	-0.005 (1.267)	0.000	0.000	0.002 (1.569)
CPI	0.742	0.564	0.001 (0.032)	0.004	0.004	-0.053 (1.351)	0.030	0.009	0.018 (0.724)

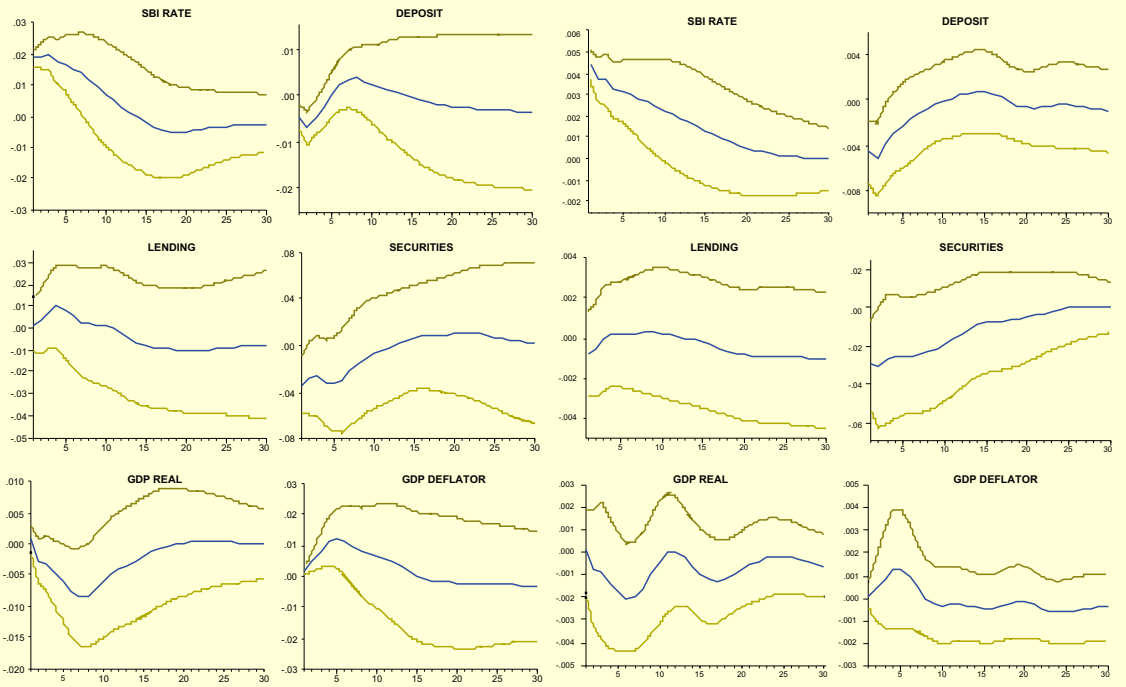
Innovation Analysis

Graph 3.1 and 3.2 reports the impulse responses of variables in the VAR to a monetary shock measured by the SBI rates for the whole period and period before the crisis. Generally speaking, the adverse effects of a monetary tightening on the banks' balance sheet and macroeconomic variables are much stronger than those before crisis.

Before the crisis, bank lending is almost not affected by a tight monetary policy. This result is consistent with findings by Agung (1998) who also use pre-crisis data. One of a reasonable explanation of low sensitivity of lending to a monetary shock is that before the crisis, especially since the beginning of 1990s, the access of domestic commercial banks to

international source of funds was relatively easy. Hence, in spite of tight money, banks can still provide loans to their borrowers. A survey conducted by Hadad (1996) also found similar phenomenon. During the tight money period (e.g. in the aftermath of what so called-*Gebrakan Sumarlin*), the loan growth of state banks and large private banks were higher than their deposit growth. In fact, domestic banks have been major issuers of bonds into international markets during the period (World Bank, 1996). Large banks obviously have better credit ratings than smaller banks and are thus able to raise funds less expensively. This differential behaviour of state banks and private banks is clearly reflected in Graph 3.1 Loans of state banks are completely insensitive to a monetary shock, while that of private banks are more sensitive to the shock.

Graph 3.1. Effects of a Monetary Shock (SBI rate)

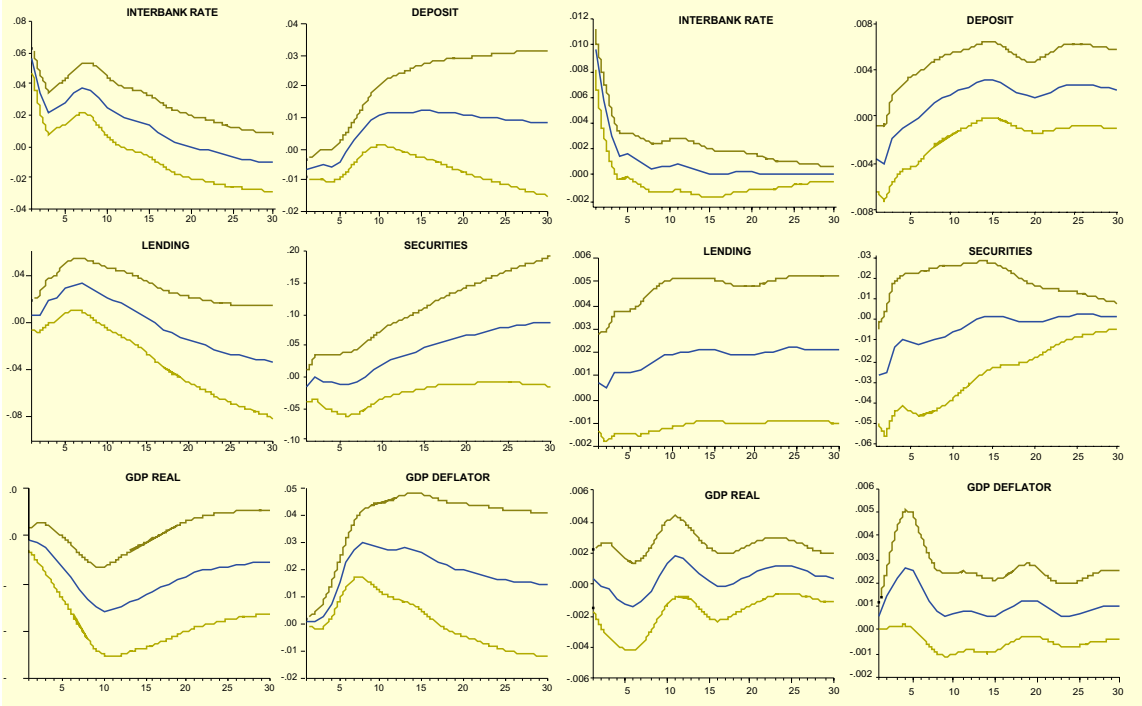


The relatively high sensitivity of commercial bank lending for the whole sample is partly influenced by behaviour of bank lending during and after the crisis. Given weakening of firms' balance sheet amidst low economic prospect, a monetary tightening worsens the firms' financial position and raises the probability of default and hence reduces the willingness of bank to lend. This is consistent with a recent study by (Agung et al., 2001) who found the existence of 'credit crunch' in the aftermath of the crisis. Under such situation, they argue, a

tight money exacerbates the unwillingness of banks to lend. This is also confirmed by a corresponding study on balance sheet channel that concludes the existence of financial accelerator effect of monetary policy, especially after the crisis. Similar impulse responses is obtained if we use the PUAB rate as the policy variable, although the effect of a change in SBI rate seems to be more pronounced than a change on PUAB rate.

For the whole period sample, although the bank lending is responsive to a monetary shock, its response is rather slow, i.e. about 10 months for bank lending to decline after a shock occurs. Another bank asset portfolio, the securities holdings of commercial banks, immediately fall after a shock and take about 10 months to return back. This behaviour can be interpreted as an indication that banks prefer to use their securities holdings as a buffer stock to offset monetary shocks. This behaviour is consistent across different types of banks, except for the foreign and joint-venture banks (Graph 3.3). This is not surprising that after a monetary contraction there is an indication of flight to quality of deposits, especially from private domestic banks to foreign banks. While deposits of private banks fall immediately after a shock, deposits of foreign banks increases. Accordingly, the foreign banks have an ample deposit funds to maintain the credit line without liquidating their securities holdings.

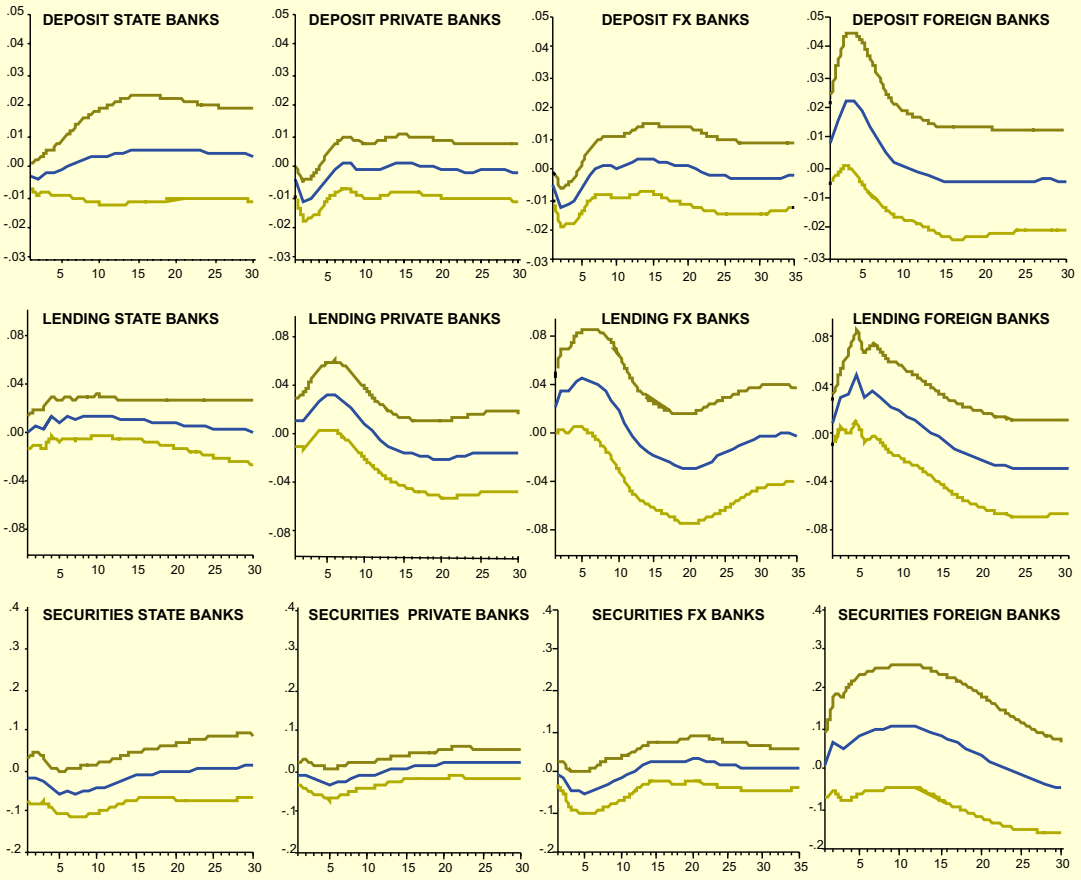
Graph 3.2 Effects of a Monetary Shock (PUAB rate)



The lag of bank lending to respond a shock can be attributed to the fact that bank lending practices, especially investment loans, are mostly conducted on a loan commitment basis, instead of on a project or fixed-term basis. Under such a commitment, banks allow borrowers to draw down a line of credit at their discretion; and borrowers pay a fee for the credit line and pay interest on actual loans that have been drawn. As a result of this system, banks cannot prevent the borrowers from drawing the credit even when the monetary condition is tightened. Banks can only reduce the supply of new loans, which presumably does not immediately lead to a substantial fall in aggregate loans.

A disaggregation of total bank loans into corporate lending and individual (household) lending (Graph 3.4), however, suggests that the insignificant response of aggregate lending stems

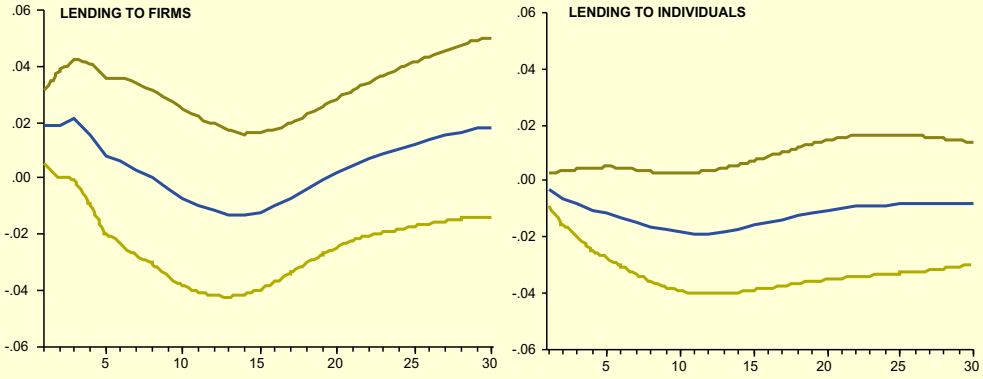
Graph 3.3
Effects of a monetary shock to balance sheet of different types of banks: the whole sample



from the loan to firms. By contrast, the loans for individuals drop significantly in the aftermath of monetary shock. This may be explained by what so-called the 'flight to quality' phenomenon as suggested by Bernanke, et al. (1996). That is, in a monetary contraction, to compensate the decline in cash flow, the creditworthy borrowers have access to short-term loans, while loans to the less creditworthy borrowers such as individuals or small firms will be rationed.

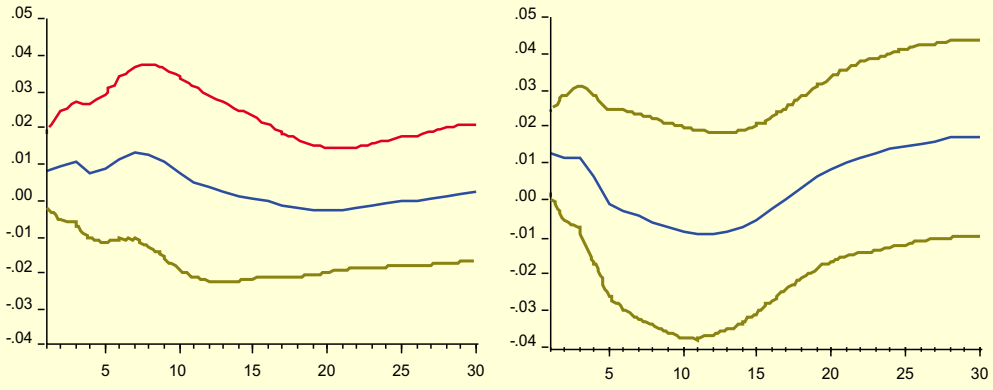
Graph 3.4
Effects of a Monetary Shock (SBI rate): Corporate vs Individual Loans

A. Lending to Corporate **B. Lending to Individuals**



Graph 3.5
Effects of a Monetary Shock (SBI rate): Working capital vs Investment Loans

A. Investment Loans **B. Working capital Loans**



EVIDENCE FROM ADJUSTMENT IN THE CREDIT MARKET

Methodology

The hypothesis of the bank lending channel is that a monetary policy affects the supply of bank lending which in turn influence the investment by bank-dependent borrowers. The crucial assumption underlying the hypothesis, thus, the credit market is supply-determined. Following the approach conducted by Kakes (2000), we utilize the Johansen's cointegration framework and impose the restrictions on the cointegrating parameters representing the long run supply of and demand for credit and to examine whether the short run adjustment toward equilibrium is dominated by the demand or supply determined. If the system is dominated by supply, one would expect that initially the adjustment mainly takes place in the direction of the supply equation, while eventually both relationships are satisfied.

The model of credit market is developed in a four-variable VECM. The supply of bank lending is a function of the spread between the bank' lending rate and bank' funding costs proxied by the deposits rate, and the level of economic activity. Whereas, the demand for loans is a function of the lending rate and the level of economic activity. Thus, the VECM includes the following variables: bank lending, level of economic activity, loan rate and deposit rate. We analyse a VECM of the working capital credit and investment credit markets as well as the disaggregation according to bank categories.

In testing the Johansen's cointegration framework, we use the so-called Pantula principle (Johansen, 1991) to select the deterministic components and the rank of the cointegration

Table 3.3 Selection of the cointegration model: joint test of deterministic specification and rank of long run matrix

Variables	λ trace		
	Model 1	Model 2	Model 3
Working Capital			
r = 0	51,37 **	49,52 **	55,82 **
r ≤ 1	33,33 **	32,55 **	34,80 **
r ≤ 2	9,567	9,083	23,37 *
r ≤ 3	2,392	0,495	9,074
Investment			
r = 0	40,51 **	38,55 **	44,39 **
r ≤ 1	31,05 **	24,93 *	26,39 *
r ≤ 2	12,360	11,67	11,74
r ≤ 3	6,955	5,94 *	7,419

matrix P. The results suggest that the rank of r = 2 which implies that we have to find two long-run relationship in order to identify the cointegration space. Table 3.3 also shows that we use model 1, i.e., include a constant in the cointegration relationship and allow for a trend in the levels of variables.

Results

Table 3.4 provides the unrestricted cointegrating relationship, given rank r = 2. The first cointegrating equation likely represents the supply function, while the second cointegrating equation represent the demand function. Table 3.4 also report the outcome of restriction. We impose two restrictions: equality restriction in the supply equation, i.e., coefficients on il equals to (-) coefficients on id and exclusion restriction, coefficient on id is zero in the demand equation. After normalizing with respect to L_t, the following long-run supply and demand relationship, respectively:

Market of working capital credit:

$$L_t^S = 2.166 y_t + 0.046 (i_t^l - i_t^d) \quad (11)$$

$$L_t^D = 1.792 y_t - 0.016 i_t^l \quad (12)$$

Market of investment credit:

$$L_t^S = 2.567 y_t + 0.008 (i_t^l - i_t^d) \quad (13)$$

$$L_t^D = 2.473 y_t - 0.011 i_t^l \quad (14)$$

The credit demand equation shows long-run income elasticities of 1.8 and 2.5 for working capital and investment loans, respectively, which are comparable to studies in other countries (e.g. Kakes, 2000, Fase, 1995). The interest elasticities are -0.36 (-0.016 x 22.5, i.e. product of semi-elasticity of loan rate and sample mean of loan rate) and -0.20 (-0.011 x 18.18) for working capital and investment loans, respectively. These results are very intuitive that the demand for working capital loans (short term loans) is more sensitive to a change in the loan interest rates. Similarly, the elasticity of interest rate for working capital loans in the supply function is higher than that for investment loans.

Table 3.4 shows the adjustment coefficients, α, which indicate the speed towards the long run equilibrium. Compare α coefficient for supply and demand equation for working capital loans, it appears that bank loans adjust significantly in the direction of the long-run supply of credit (α = - 0.10), while the adjustment to the demand equation is insignificant with speed of adjustment coefficient 0.04. The same conclusion is also found for investment loans, i.e., coefficient of speed of adjustment for supply equation is - 0.28, while that for demand equation is 0.19. This suggest that in the short run the market for working capital and investment credit is dominated by supply rather than demand.

Table 3.4 Results for cointegration and restricted cointegration

A. Working Capital Loans

[1] Test for the number of cointegrating vector				
	L	Y	i L	i D
Eigenvalues	0,424407	0,301216	0,0977544	0,025388
Hypothesis	r = 0	r ≤ 1	r ≤ 2	R ≤ 3
λ_{trace}	96,66**	45,29**	11,96	2,39
λ_{max}	51,37**	33,33**	9,57	2,39
[2] Standardized eigenvectors, β'				
	L	Y	i L	i D
Vector1	1,000	-6,079	-0,698	0,528
Vector2	-1,285	1,000	-0,238	0,161
[3] Standardized adjustment coefficient, α				
	L	Y	i L	i D
Vector 1	-0,016	0,002	0,134	0,004
Vector2	0,026	0,004	-0,001	-1,084
[4] Restricted eigenvectors				
	L	Y	i L	i D
Supply (α=-0.10)	1	-2.17	-0.05	0.05
Demand (α=0.04)	1	-1.79	0.02	0.00

B. Investment Loans

[1] Test for the number of cointegrating vector				
	L	Y	i L	i D
Eigenvalues	0,254408	0,201477	0,0857003	0,0491518
Hypothesis	r = 0	r ≤ 1	r ≤ 2	R ≤ 3
λ_{trace}	90,88**	50,37**	19,32	6,955
λ_{max}	40,51**	31,05**	12,36	6,955
[2] Standardized eigenvectors, β'				
	L	Y	i L	i D
Vector1	1,000	-2,677	-0,022	0,013
Vector2	0,116	1,000	0,161	-0,066
[3] Standardized adjustment coefficient, α				
	L	Y	i L	i D
Vector1	-0,100	-0,009	0,313	0,172
Vector2	0,013	-0,011	-0,472	1,472
[4] Restricted eigenvector				
	L	Y	i L	i D
Supply (α=-0.28)	1	-2.57	-0.01	-0.01
Demand (α=0.19)	1	-2.41	-0.01	0.00

EVIDENCE FROM BANK LEVEL PANEL DATA

As aforementioned previously, the existence of bank lending channel should be tested using disaggregated bank data. In section 3 using VAR approach we have shown differential lending behaviour across banks according to their accessability to non deposits funds and their

securities holdings to maintain their lending activities. While many studies have used such VAR approach to investigate differential effects, empirical evidence about the existence of bank lending channels using bank-level data is scarce. Kashyap and Stein (2000) and Kishan and Opiela (2000) for US and Bondt (1999) for European countries are the notable exceptions. Using bank level data, Kashyap and Stein (2000) found that sensitivity of bank lending to a monetary policy is determined by buffer stock owned by banks. Lending of banks that have lower ratios of cash and securities to assets are more sensitive to a monetary tightening. Using similar approach, Bondt (1999) employs bank level data with different size and liquidity to examine impact of monetary policy through bank lending channel. Kishan and Opiela (2000) separate banks according to their capital leverage ratio by arguing that capital's role in absorbing shock to assets makes it an indicator of bank health and a good indicator of bank's ability to raise funds during tight money policy.

In the following empirical approach, we combine both capital (capital to asset ratio) and size (assets). We test empirically whether the effects of monetary policy on bank lending are more pronounced for small and low capital banks.

Methodology and Data

The empirical framework is as follows:

$$\Delta L_{it} = \alpha_i + \beta_1 r_t + \beta_2 (r_t * LCAP_{it}) + \beta_3 \Delta DEP_{it} + \beta_4 (\Delta DEP_{it} * LCAP_{it}) + \beta_5 \Delta Y_{it} + \beta_6 (\Delta Y_t * A_{it})$$

with index i referring to bank i and t to period t; L denotes log loans, r denotes SBI or interbank (PUAB) rates, LCAP denotes low capital indicator (1 for banks with Capital to Asset ratio below the sample first quartile and 0 otherwise), DEP denotes log deposits, Y denotes log real GDP, and A denotes log total assets as a proxy of bank size.

We can expect that $\beta_1 < 0$, that is, the an increase in interest rate on SBI or PUAB, as the monetary policy indicator, will lead to a fall in bank lending. The impact may differ across banks according to their capital strength. The response of lending of low capital banks is expected to be more sensitive to a change in interest rate, $\beta_2 < 0$. Similarly, using deposits as the proxy of the bank lending capacity (loanable funds), we can expect that a higher the loanable funds the higher loan growth, $\beta_3 > 0$. The sensitivity of loan with respect to the loanable funds should be more higher for low capital banks that may more difficult to find other sources of funds, $\beta_4 > 0$. Loan demand effects are assumed to be captured by the growth rate of real GDP; higher economic activity will leas to a rise in bank lending, $\beta_5 > 0$. Assuming that bank and borrower size are positively correlated, we can expect that the impact of loan demand to a monetary shock may be stronger for small banks (Bondt, 1999) and hence $\beta_6 < 0$.

Bank-level data are obtained from Monthly Bank Report, over period 1994-1999. The sample size is 140 banks, all still exist until the end of 1999. In estimation, we split the sample estimation into before crisis, after crisis and the whole sample to capture possible different behaviour. Table 3.5 summarizes the characteristics of data.

Table 3.5 Sample characteristics of banks data

		Asset	Capital	Loan	Deposit	C/A
Before Crisis	Mean	7,818,206	177,667	1,388,371	1,779,192	0.123
	Median	446,002	41,013	220,792	140,900	0.101
	1st quartile	149,001	15,815	81,088	51,403	0.063
After Crisis	Mean	15,820,693	853,297	2,567,427	5,590,698	0.089
	Median	1,131,292	61,182	420,213	301,733	0.071
	1st quartile	299,345	22,947	82,115	94,578	0.033
Whole Period	Mean	10,485,702	402,877	1,781,390	3,049,694	0.112
	Median	575,147	51,009	248,567	187,872	0.092
	1st quartile	180,021	17,410	81,421	61,322	0.051

Empirical Results

The results of estimation are presented in Table 3.6 and 3.7, for SBI and PUAB rates as policy variables, respectively. Generally speaking, the results are in line with our prior expectation. For the whole period, all coefficients are significant. To test our hypothesis regarding the existence of a bank lending channel, the significance level of a negative estimated β_2, positiveβ_4 is examined. The results support the hypothesis, that is, an increase in interest of SBI or PUAB reduces the bank lending supply and their effects are more pronounced for low capital banks. Furthermore, it can be seen that bank lending supply is sensitive to lending capacity available. What is more interesting result is that the sensitivity of bank lending is higher for banks wit low capital. A significant negative estimated β_6 support the hypothesis that lending of small banks is more sensitive to demand effect.

The next interesting findings are that there is differential behaviour of bank lending before and after the crisis. Before the crisis, the interest rate of SBI and PUAB do not significantly influence the bank lending. This confirm to our VAR analysis above. However, during that period, lending of banks with low capital is negatively affected by the monetary tightening. Again, this result suggests that the bank lending channel is operative through banks with low capital. This can also be interpreted as a fact that bank lending channel is strongly working when the capital of commercial banks is weak. After the crisis, the bank lending is sensitive to

a monetary shock though only significant at 10%. The sensitivities are also higher for banks with low capital in spite of insignificant.

Table 3.6 Panel data results: SBI rate as the policy variable

	Whole Sample	Before Crisis	After Crisis
Constant	0.01	0.01	-0.01
	(11.97)	(5.12)	(-2.80)
$r\text{-}sbi_{t-1}$	-0.04	0.002	-0.01
	(-11.84)	(0.20)	(-1.65)
$r\text{-}sbi_{t-1}$ * *lowcap*	-0.01	-0.03	-0.01
	(-3.14)	(-4.18)	(-1.20)
Δ *dep*	0.12	0.07	0.19
	(37.19)	(18.80)	(30.62)
Δ *dep * lowcap*	0.09	0.03	0.07
	(12.12)	(3.096)	(5.67)
Δy_t	1.24	1.15	0.89
	(5.87)	(4.31)	(2.51)
Δy_t * *Size*	-0.08	-0.08	-0.05
	(-5.09)	(-4.01)	(-2.06)

Notes: Values in parentheses are t-statistics

Teble 3.7 Panel data results: PUAB rate as the policy variable

	Whole Sample (1994.01 – 1999.12)	Before Crisis (1994.01 – 1997.12)	After Crisis (1998.01 – 1999.12)
Constant	0.01	0.01	-0.01
	(10.14)	(8.73)	(-3.29)
$r\text{-}puab_{t-1}$	-0.03	0.01	-0.01
	(-9.89)	(1.57)	(-1.07)
$r\text{-}puab_{t-1}$ * *lowcap*	-0.01	-0.01	-0.01
	(-2.81)	(-2.50)	(-1.18)
Δ *dep*	0.13	0.07	0.195
	(37.40)	(18.95)	(30.68)
Δ *dep * lowcap*	0.09	0.03	0.07
	(12.09)	(2.75)	(5.68)
Δy_t	1.27	1.30	0.89
	(5.95)	(4.89)	(2.48)
Δy_t * *Size*	-0.08	-0.09	-0.05
	(-5.54)	(-4.54)	(-2.14)

Notes: Values in parentheses are t-statistics

EVIDENCE FROM SURVEY

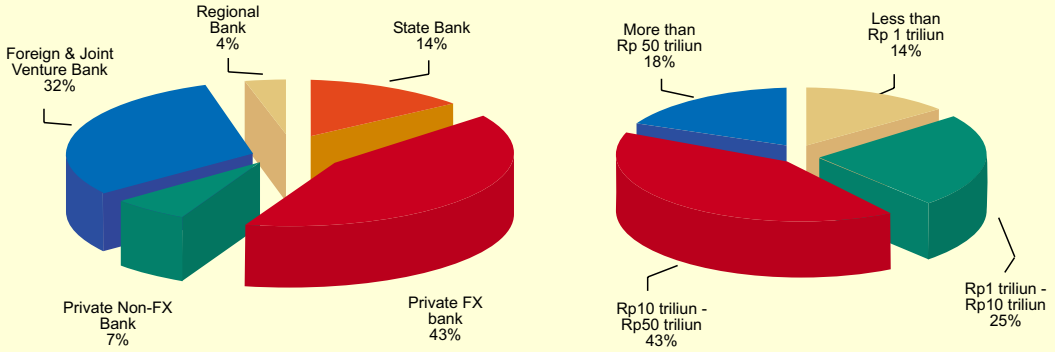
This section presents an analysis based on a survey on banks and firms. The survey is designed to generate answers to some important questions on behaviour banks and firms in

the aftermath of a monetary shock. From the banking survey, the main issue examined is whether banks reduce their lending supply after a monetary shock, as expected by the bank lending channel hypothesis. How do they reduce the lending supply, by price or non-price mechanism? If they reduce their loan supply with a lag, how do they maintain their lending supply? From the firm survey, the issues examined are: what are sources of funds, how is the sensitivity of demand for bank lending after a monetary tightening? Are they rationed during a tight money periods?

Sample characteristics

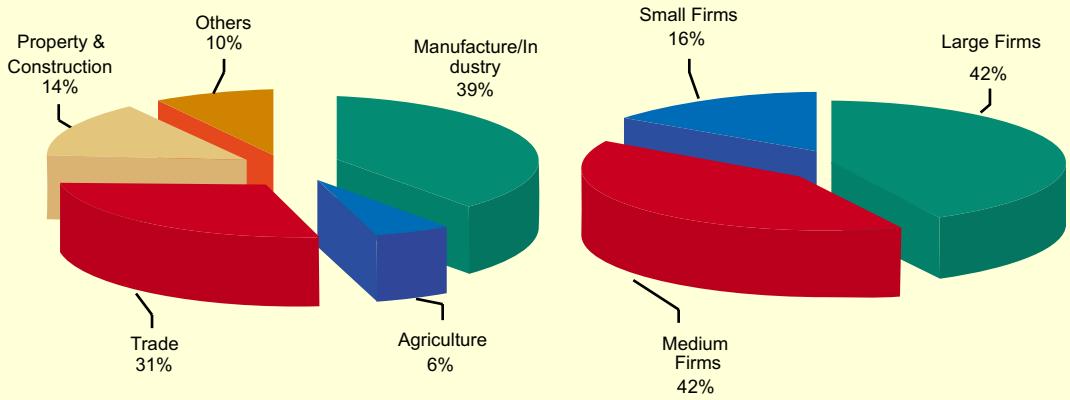
The characteristics of the banks participating in the survey are summarized in Graph 3.6 The number of banks interviewed was 28, which can be categorized as follows: State Bank 14%, Private FX Bank 48%, Private Non-FX Bank 7%, foreign & joint Venture Bank 32% and Regional Bank 4%. According to asset size, the most respondents are relatively large banks with around 65% of banks having more than Rp10 triliuns. Examining whether a bank is recapitalized after the crisis is important for analysing their behaviour. Accodingly, we split the sample into recapitalised banks (57%) and non-recapitalised bank (43%).

Graph 3.6 Characteristic of Bank Sample



For the firm survey, we interviewed 141 companies, categorized according to business sector and scale. According to business sectors, the sample can be categorized into manufaturing sector (39%), trade (31%), property and construction (14%), agriculture (6%) and other sector (10%) (Graph 3.7). Meanwhile classified according to the size of turnover, both large and medium firms have same portion 42%, but for small firm just 16% of total respondent. The majority of firms (63%) sell their product in domestic market, and only 37% of firms have export orientation.

Graph 3.7 Characteristic of Firm Sample



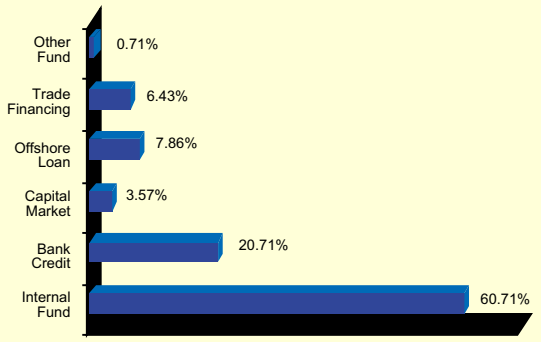
Are firms bank-dependent?

As outlined previously, the existence of the bank lending channel of monetary transmission depends on whether the bank lending is a dominant source of external funds. The survey indicates that in conducting their business activities, the firms use internal fund as the main source of financing (60,71%) (Graph 3.8). Meanwhile, as the source of external financing, bank credit still serves as the main source of funds. About 20,71% of firms use bank credits as the main sources of funds. This finding is in line with a 'credit crunch' survey conducted by Agung, et al. (2001) and substantially different from results from surveys before the crisis (e.g. Ang, Fatemi and Tourani-Rad, 1997). As found in many studies using pre-crisis data, the banks are the main sources of funds or at least 40% of firms' source of financing.

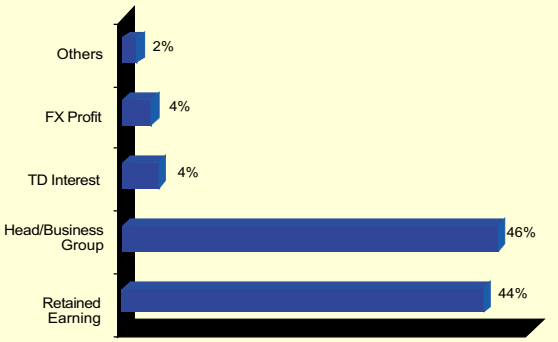
Firms using internal funds as the main sources consider funds from head/business group (46%) and retained earnings (44%) as the main sources. The incomes from deposit interest and foreign exchange profit are only around 4%. Referring to credit crunch survey, the main reasons of using internal fund are the relatively high loan rate, under utilized of their own capital, tightness of credit procedures and the existence of banks credit rationing.

Firms using bank loans as main source of financing come from manufacturing sector 37,9%, while trade and property/construction have the same portion about 20,7%, and agriculture sector only 13,8%. Classified according to business scale, large firm 55,2%, medium firm 41,4% and small firm only 3,4%. Small portion for agriculture sector and small scale business because the respondent from those categories experiencing difficulty to obtain credit bank. Obstacles in obtaining bank credit are tightness of collateral condition, declining cash flow, and credit rationing.

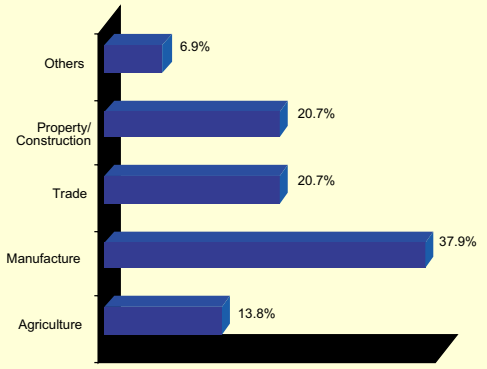
Graph 3.8
Sources of Funds

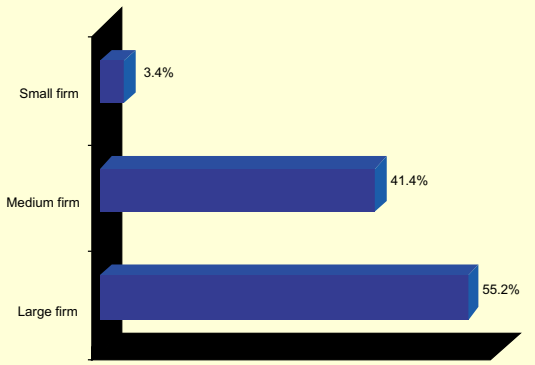


Graph 3.9
Sources of Internal Funds



Graph 3.10
Banks Loan as the main source of external fund





Lending behaviour after a monetary shock

The necessary condition of the existence of bank lending channel is whether or not a monetary policy influences the loans supply. The survey indicates that in the case of tight money, the majority of banks (77%) will reduce their loan supply and 23% of banks will not. As indicated by the quantitative study, the foreign and joint-venture banks are less influenced by the tight money than their domestic counterparts. The survey suggests that 50% of foreign and joint-venture banks will reduce their loans in the aftermath of the tight money policy. Meanwhile, all private non-foreign exchange banks and regional banks reduce their lending supply. This supports previous empirical findings (e.g. Agung, 1998) that small banks' reliance on the deposits as the source of funds makes their lending is more sensitive to a monetary tightening. By contrast, foreign banks and larger banks such as state banks and private foreign exchange banks that have access to non-deposit funds (e.g. foreign funds) are able to shield

their lending supply from the shock. Furthermore, the banks' holdings of securities enable them to protect their lending, at least in the short run.

Graph 3.11
Reducing loan supply in the aftermath of monetary shock?

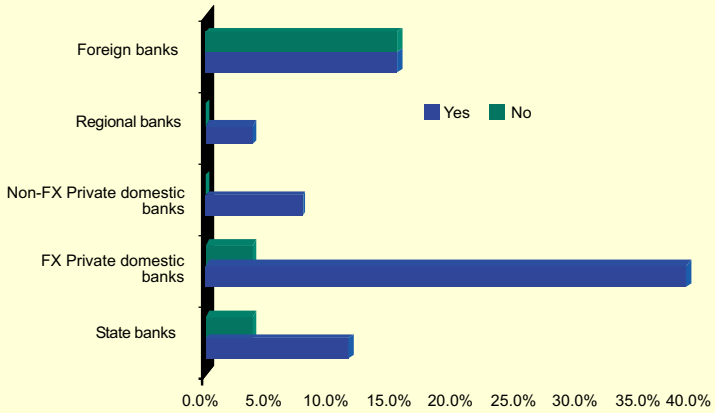


Table 3.8 Effects of monetary policy shock

Banks	Reduce in SBI rate				Rise in SBI rate			
	Reducing loan rates	Raising new loans	Other	Total	Reducing loan rates	Reducing new loans	Other	Total
State banks	2	1	1	4	3	1	1	5
	50.0%	25.0%	25.0%	100.0%	60.0%	20.0%	20.0%	100.0%
Private FX banks	8	3	0	11	6	5	0	11
	72.7%	27.3%	0.0%	100.0%	54.5%	45.5%		100.0%
Private Non-FX banks	1	1	0	2	2	0	0	2
	50.0%	50.0%	0.0%	100.0%	100.0%			100.0%
Regional banks	0	1	0	1	0	1	0	1
	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%		100.0%
Foreign and joint-ven.	7	0	1	8	9	0	0	9
	87.5%	0.0%	12.5%	100.0%	100.0%	0.0%	0.0%	100.0%
Total	18	5	2	25	20	6	1	28
	72.0%	20.0%	8.0%	100.0%	71.4%	21.4%	3.6%	100.0%

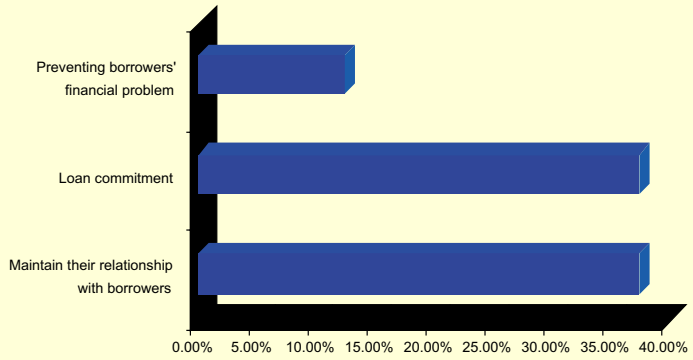
In the case of monetary tightening reflected in an increase in the SBI rate, banks reduce bank lending supply either by price mechanism, through increasing the loan rate or tightening the credit conditions, and non-price mechanism, through reducing new loans. Majority of banks (71%) raise the loan rate in the aftermath of tight money and around 21.4% of banks reduce the loan supply. A more interesting result is that banks that reduce the lending by rationing credit rather than by raising the loan interest rates coming from the private banks

and regional banks. Meanwhile, state banks and foreign banks raising the interest rate in order to reduce loan. The similar result is found in the case of monetary loosening (a fall in SBI rate), that is, around 72% of banks reduce loan rates and around 20% of banks raise the lending supply.

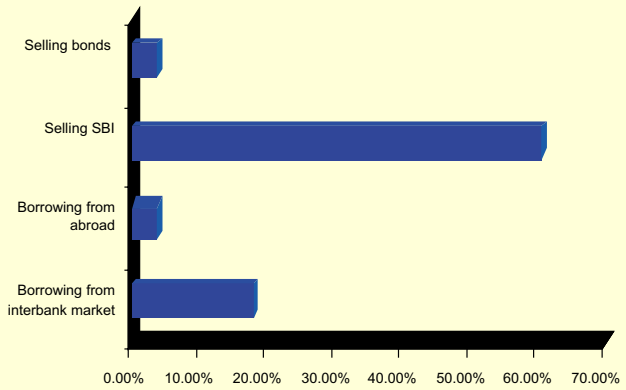
Lag in responses to a monetary tightening

As found previously that some banks do not reduce the loan supply after a monetary tightening. This confirms the quantitative results that suggest that the response of bank lending to a tightening of monetary policy needs time lag. There are three possible reasons for the apparently insensitive lending supply: (1) to maintain their relationship with their borrowers; (2) to honour the loan commitments that have been made; (3) to prevent the borrower's financial problem if the banks discontinue the lending supply. The survey indicates that the main reason is to maintain their relationship with borrowers and to honour loan commitments.

Graph 3.12
The reasons of not to reducing the lending suply after a monetary shock



Graph 3.13
Source of funds to finance lendings after a monetary shock



To finance the lending activities in the case of tight money, the majority of banks liquidate their SBIs. This supports the empirical findings that the banks' securities fall in the aftermath of the monetary tightening. The second resort is borrowing from interbank market and selling their bonds holdings.

SUMMARY AND CONCLUSIONS

We have investigated the existence of bank lending channel of monetary transmission in Indonesia before and after crisis. Given existence of 'bank dependent borrowers' as the secondary condition of bank lending channel clearly satisfied, our study particularly focuses on the first condition of the bank lending channel to exist; that is, whether a monetary policy affects the quantity of bank lending. We use three different methods to achieve robust conclusions. First, using Bernanke-Blinder type of VAR we examine responses of banks' balance sheet (deposits, lending and securities holdings) to a monetary shock measured by SBI rate and interbank rates. Second, using the restricted version of VECM to identify supply of and demand for credit and examine whether the short run adjustment toward equilibrium is dominated by the supply determined as suggested by the credit channel hypothesis. Third, we use bank-level panel data to investigate in detail differential behaviour of bank lending, especially with regard to their capital strength and asset size.

Aggregate evidence show that a monetary policy is able to affect bank lending with a lag due to ability of banks to insulate the decrease in deposits by liquidating their securities holdings. This is conducted by bank to serve the commitment loans that have been made prior to the monetary shock. Empirical results with disaggregate data across bank categories indicate that after a monetary shock, in particular in the period of post crisis, there is a flight to quality of deposits especially from private domestic banks to foreign banks and state banks. Accordingly, lending of these categories of banks is less sensitive to a monetary shock compared with that of private banks.

A disaggregation of total bank loans into corporate and individual lending demonstrates that the response of aggregate lending to firms is less sensitive to a monetary policy. By contrast, the loans for individuals drop significantly in the aftermath of monetary shock. This may be explained by what so-called the 'flight to quality' phenomenon. That is, in a monetary contraction, to compensate the decline in cash flow, the creditworthy borrowers have access to short-term loans, while loans to the less creditworthy borrowers, such as individuals, will be rationed. Disaggregation of banks according to their capital strength, we found that the effect of monetary policy on bank lending is stronger for banks with low capital. From time series and panel data estimations, the study found that efficacy of a monetary policy in influencing

the bank lending and thus investment is stronger in the aftermath of the crisis, especially in the case of monetary contraction. Ineffectiveness of monetary policy in affecting the bank lending prior to the crisis was due to banks' ability to access funds from international sources. In the wake of the crisis, given deterioration of bank capital and high credit risk, an increase in interest rate as a result of a monetary tightening raises the probability of loan default, hence banks become reluctant to extend credits. This findings lend support the existence of asymmetric effect of monetary policy; stronger in the recession than in the boom periods.

References

Agung, J., Bambang Kusmiarso, Bambang Pramono, Erwin G Hutapea, Andry Pasmuko, Nugroho J Prastowo (2001). *Credit Crunch in Indonesia in the Aftermath of the Crisis: Facts, Causes and Policy Implications.* Bank Indonesia, Directorate of Economic Research and Monetary Policy.

Agung, Juda (1998). Financial deregulation and bank lending channel of monetary policy in developing countries: The case of Indonesia, *Asian Economic Journal*, Vol. 12, No.3, 273-294.

Ang, J. S., Fatemi, A. and Tourani-Rad, R., 1997, Capital structure and dividend policies of Indonesian firms, *Pacific-Basin Finance Journal*, Vol 5, 87-103.

Bernanke, B and Gertler, M., 1995, Inside the black box: credit channel of monetary transmission mechanism, *Journal of Economic Perspective*, Fall 1995, pp. 27-48.

Bernanke, B. and Blinder, A.S., 1988, Credit, Money and Aggregate Demand, *The American Economic Review* , June 1983, pp. 257-76.

Bernanke, B. and Blinder, A.S., 1992, The federal funds rate and the channel of monetary transmission, *The American Economic Review* September 1992, pp. 901-21.

Bernanke, B. and Gertler, M., 1989, Agency cost, net worth and business fluctuations, *The American Economic Review* March 1989, pp. 14-31.

Bernanke, B., 1993a, Credit in the macroeconomy. *Fed Res Bank of New York Quarterly Review*, Spring 1993, pp. 50-70.

Bernanke, B., 1993b, How important is the credit channel in the transmission of monetary policy? A comment, *Carnegie-Rochester Series on Public Policy*, December 1993, pp. 47-52.

Bernanke, B., 1995, What do we know about how monetary policy affects the economy, *Fed Res Bank of St Louis Economics Review*, May/June 1995, pp. 127-42.

Bernanke, B., Gertler M., and Gilchrist, S., 1996, The financial accelerator and the flight to quality. *Review of Economics and Statistics* February 1996, pp. 1-15.

Callen, T. and Reynolds, P., 1996, Capital market development and financial deregulation in Thailand and Malaysia: implications for financial structure and the monetary transmission mechanism, *Paper presented in the Conference on Macroeconomic Issues Facing ASEAN Countries*, Jakarta.

Calomiris, C.W and Hubard, G., 1990, Firm heterogeneity, internal finance and credit rationing. *Economic Journal*, 100, pp. 90-104.

Cecchetti, S.G., 1995, Distinguishing theories of the monetary transmission mechanism, *Fed Res Bank of St Louis Economic Review*, May/June 1995, pp. 83-100.

Christiano, L.J., Eichenbaum, M., and Evans, C.L. (1996). The effects of monetary policy shocks: Evidence from the flow of funds, *Review of Economics and Statistics*, 78, pp.16-34.

Cole, D. and Slade, B.S., 1990, *Indonesian Financial Development: A different sequencing?* Harvard Institute for International Development HIID, Harvard University, Cambridge, Massachusetts unpublished.

Cole, D. and Slade, B.S., 1996, *Building a modern financial system: The Indonesian experience*, Cambridge University Press.

Dale, S and Haldane, H., 1994, Interest rates and the channel of monetary transmission: Some sectoral estimates, *European Economic Review* 39, pp. 1611-25.

Doan, T. (1992). *RATS Users's Manual*. Estima, Evanston, Illinois.

Enders, W., 1995, *Applied Econometric Time Series*, John Wiley and Sons, Inc.

Gertler, M and Gilchrist, S., 1993, The role of credit market imperfections in the monetary trasmission mechanism: Arguments and evidence, *Scandinavian Journal of Economics*, 951, pp. 43-64.

Gertler, M and Gilchrist, S., 1994, Monetary policy, business cycles and the behaviour of small manufacturing firms, *Quarterly Journal of Economics*, May 1994, pp. 309-40.

Hadad, M.D., (1996). Bank Behaviour in A Changing Regulatory Environment: Study of Indonesia, 1983-1993, unpublished thesis, University of Monash.

Himmelberg, C.P., and Morgan, D.P., 1995, Is bank lending special?, in Peek, J., and Rosengren, E.S. (eds), *Is bank lending important for the transmission of monetary policy?*, Federal Reserve Bank of Boston, Conference Series No. 39, June 1995.

International Monetary Fund, 1995, *Capital Flows to the Asia Pacific Region*, Occasional Paper No. 122. March 1995.

Johansen, S. (1992). Testing weak exogeneity and the order of cointegration in the UK money demand. *Journal of Policy Modelling*, 14, pp. 313-34.

Johansen, S. and Juselius, K (1990). Maximum likelihood estimation and inference on cointegration with application to the demand for money, *Oxford Bulletin of Economics and Statistics*, 52, pp.169-210.

Kakes, J. (2000). Monetary Transmission in Europe. The Role of Financial Markets and Credit. Edward Elgar: Cheltenham.

Kashyap, A.K. and Stein, J.C., (2000), What do a million banks have to say about the transmission of monetary policy?, *American Economic Review*.

Kashyap, A.K. and Stein, J.C., 1995, Impact of monetary policy on bank balance sheets. *Carnegie-Rochester Series on Public Policy*, June 1995, pp. 151-95.

Kashyap, A.K. and Stein, J.C., 1996, What do a million banks have to say about the transmission of monetary policy?, *NBER Working Paper* No. 6056.

Kishan, R and Opiela, T (2000). Bank size, Bank Capital and The Bank Lending Channel, *Journal of Money Credit and Banking*.

Peek, J and Rosengren, E. ,1995, The capital crunch: neither a borrower nor a lender be, *Journal of Money Credit and Banking*, August 1995, pp. 625-38.

Ramey, V, 1993, How important is the credit channel in the transmission of monetary policy?, *Carnegie-Rochester Conference Series on Public Policy*, Dec 1993, pp. 1-45.

Romer, C.D. and Romer,D. ,1990, New evidence on the monetary transmission mechanism, *Brooking Papers on Economic Activity* 1990:1, pp. 149-213.

Sims, C.A (1980). Macroecomics and reality, *Econometrica*, 48(1), pp.1-48.

Sims, C.A. (1992). Interpreting the macroeconomic time-series facts: the effects of monetary policy, *European Economic Review*, 36, pp. 975-1011.

Spiegel, M, 1995, Sterilisation of capital inflows through the banking sector: evidence from Asia, *Federal Reserve Bank of San Fransisco Economic Review*, Vol 1995, No. 3, pp. 17-34.

Strongin, S. (1995). The identification of monetary policy disturbances: explaining the liquidity puzzle, *Journal of Monetary Economics*

Appendix A. Data: sources and definition

Data are monthly from January 1991 - December 2000.

1. Macroeconomic data:

- SBI interest rate: It is the end-of-period 1-month SBI rates published in Weekly Report of Bank Indonesia.
- Money market (PUAB) interest rate: It is the end-of-period 1-month interbank call money rates published in Weekly Report of Bank Indonesia.
- Real GDP: Monthly data of the real GDP is interpolated from quarterly real GDP published in Indonesian Financial Statistics, Bank Indonesia. The interpolation was performed by the piece-wise cubic spline method. For early periods when the quarterly data were not published officially, the data were obtained directly from Indonesian Central Bureau of Statistics.
- Production Index: Monthly data of the production index is interpolated from quarterly production index published by Central Bureau of Statistics. The interpolation was performed by the piece-wise cubic spline method.
- Prices: Consumer price index published in the Indonesian Financial Statistics, Bank Indonesia.

2. Banks' balance sheet data:

Banks' balance sheet data is obtained from Monthly Commercial Bank Report.

- Deposits: Consist of demand deposits, savings deposits and time deposits both in Rupiah and foreign currency, excluded certificate deposits.
- Total loans: total loans extended by commercial banks both in Rupiah and foreign currency.
- Working capital loans: loans extended for firms' working capital both in Rupiah and foreign currency.
- Investment loans: loans extended for firms' investment both in Rupiah and foreign currency.
- Loans to individuals: loans extended to households mainly for durable goods, real estate and credit cards.
- Loans to firms: loans extended to private enterprises, in the form of either working capital or investment loans.

Appendix B. Results for cointegration tests

AGGREGATE

	1991:01 - 2000:12				1991:01 - 1997:07			
	RPUAB		RSBI		RPUAB		RSBI	
Rank p	Trace Stat	Max-Eigen Stat						
1	137,63 **	57,42 **	136,93 **	54,60 **	155,40 **	58,02 **	182,58 **	67,75 **
2	80,21 **	34,84 *	82,33 **	38,13 *	97,38 **	35,89 *	114,84 **	44,23 **
3	45,37	23,36	44,20	19,07	61,49 **	27,63 *	70,61 **	36,50 **
4	22,00	11,90	25,13	17,53	33,86 *	19,67	34,11 *	18,43
5	10,11	10,01	7,60	6,67	14,19	9,88	15,68 *	11,08
6	0,09	0,09	0,93	0,93	4,31 *	4,31 *	4,59 *	4,59 *

STATE BANKS

	1991:01 - 2000:12				1991:01 - 1997:07			
	RPUAB		RSBI		RPUAB		RSBI	
Rank p	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat
1	165,96 **	65,94 **	183,98 **	67,45 **	109,83 **	44,24 *	128,99 **	49,69 **
2	100,02 **	39,73 **	116,54 **	51,09 **	65,59	23,35	79,30 **	35,15 *
3	60,29 **	30,35 *	65,45 **	35,45 **	42,24	21,12	44,15	20,94
4	29,93 *	21,96 *	30,00 *	23,85 *	21,12	11,54	23,21	13,57
5	7,98	7,92	6,16	5,27	9,58	5,82	9,64	6,31
6	0,057	0,06	0,88	0,88	3,76 *	3,76 *	3,33	3,33

PRIVATE BANKS

	1991:01 - 2000:12				1991:01 - 1997:07			
	RPUAB		RSBI1M		RPUAB		RSBI1M	
Rank p	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat
1	166,30 **	84,91 **	153,93 **	64,18 **	154,09 **	52,83 **	154,55 **	48,76 **
2	81,39 **	36,11 *	89,75 **	59,07 **	101,26 **	39,84 **	105,79 **	40,25 **
3	45,28	22,43	30,68	18,49	61,42 **	27,77 *	65,53 **	34,44 **
4	22,86	14,89	12,19	6,99	33,65 *	22,15 *	31,10 *	17,99
5	7,96	7,93	5,19	5,11	11,50	8,34	13,11	7,56
6	0,03	0,03	0,08	0,08	3,16	3,16	5,54 *	5,54 *

FX-BANKS

	1991:01 - 2000:12				1991:01 - 1997:07			
	RPUAB		RSBI1M		RPUAB		RSBI1M	
Rank p	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat
1	163,25 **	82,01 **	147,51 **	70,14 **	146,21 **	45,17 **	147,78 **	41,25 *
2	81,24 **	33,92 *	77,37 **	49,14 **	101,04 **	36,19 *	106,53 **	37,80 *
3	47,32 *	24,33	28,23	13,38	64,86 **	28,07 *	68,73 **	32,34 **
4	22,98	16,39	14,85	9,66	36,79 **	23,05 *	36,39 **	21,37 *
5	6,59	6,52	5,19	4,91	13,73	11,69	15,02	11,43
6	0,07	0,07	0,28	0,28	2,05	2,05	3,59	3,59

FOREIGN-BANKS

	1991:01 - 2000:12				1991:01 - 1997:07			
	RPUAB		RSBI1M		RPUAB		RSBI1M	
Rank p	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat
1	122,64 **	54,41 **	131,23 **	57,07 **	148,73 **	64,96 **	147,66 **	64,74 **
2	68,23	29,46	74,16 *	37,53 *	83,77 **	37,21 *	82,91 **	37,00 *
3	38,77	17,93	36,64	18,21	46,56	27,83 *	45,91	25,94
4	20,84	14,42	18,42	12,10	18,73	12,66	19,97	11,73
5	6,42	6,28	6,33	5,46	6,07	4,83	8,24	8,04
6	0,14	0,14	0,87	0,87	1,24	1,24	0,19	0,19

LOANS TO INDIVIDUALS

	1991:01 - 2000:12				1991:01 - 1997:07			
	RPUAB		RSBI1M		RPUAB		RSBI1M	
Rank p	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat
1	242,54 **	110,94 **	203,52 **	66,96 *	136,44 **	50,09 **	153,03 **	46,44 **
2	131,59 **	57,24 **	136,56 **	63,29 **	86,35 **	35,77 *	106,58 **	41,62 **
3	74,35 **	38,33 **	73,27 **	39,70 **	50,59 *	25,53	64,95 **	36,32 **
4	36,02 **	18,63	33,56 *	18,69	25,05	18,31	28,63	22,10 *
5	17,39 *	16,83 *	14,87	14,79 *	6,74	6,55	6,52	6,52
6	0,57	0,57	0,07	0,07	0,19	0,19	0,00	0,00

LOAN TO PRIVATE ENTERPRISES

	1991:01 - 2000:12				1991:01 - 1997:07			
	RPUAB		RSBI1M		RPUAB		RSBI1M	
Rank p	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat
1	265,79 **	109,59 **	232,07 **	89,59 **			138,39 **	42,63 *
2	156,19 **	76,11 **	142,48 **	78,46 **			95,76 **	40,34 **
3	80,09 **	50,18 **	64,02 **	32,36 **			55,42 **	27,64 *
4	29,91 *	20,37	31,66 *	23,96 *			27,78	18,06
5	9,55	9,47	0,07	7,66			9,72	8,28
6	0,08	0,08	0,00	0,05			1,44	1,44

INVESTMENT LOANS

	1991:01 - 2000:12				1991:01 - 1997:07			
	RPUAB		RSBI1M		RPUAB		RSBI1M	
Rank p	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat
1	147,75 **	54,86 **	191,32 **	73,13 **	135,24 **	59,84 **	141,77 **	63,61 **
2	92,89 **	36,37 *	118,19 **	43,00 **	75,39 *	33,33	78,15 **	29,21
3	56,52 **	23,77	75,19 **	35,50 **	42,06	19,31	48,94 *	27,29 *
4	32,75 *	20,61	39,69 **	21,27 *	22,75	17,15	21,65	11,81
5	12,14	10,78	18,42 *	13,26	5,59	4,65	9,84	5,65
6	1,36	1,36	5,15 *	5,15 *	0,94	0,94	4,19 *	4,19 *

WORKING CAPITAL LOANS

	1991:01 - 2000:12				1991:01 - 1997:07			
	RPUAB		RSBI1M		RPUAB		RSBI1M	
Rank p	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat	Trace Stat	Max-Eigen Stat
1	272,01 **	132,95 **	222,94 **	90,08 **	196,10 **	78,15 **	190,79 **	76,19 **
2	139,06 **	60,07 **	132,86 **	64,35 *	117,95 **	54,98 **	114,59 **	42,84 **
3	78,98	49,89 **	68,51 **	36,25 **	62,97 **	36,31 **	71,74 **	39,27
4	29,09	20,63	32,26 *	25,04 *	26,67	16,89	32,47 *	20,51
5	8,46	8,45	7,22	7,15	9,77	6,99	11,96	8,23
6	0,00	0,00	0,07	0,07	2,78	2,78	3,73	3,73

Chapter 4

Monetary Policy and Firm Investment: Evidence for Balance Sheet Channel in Indonesia

Juda Agung, Rita Morena*
Bambang Pramono, Nugroho Joko Prastowo

INTRODUCTION

In the last decade, the question on how a monetary policy affects the real economy has been a hot topic in the literature. In particular, along the lines of the growing literature on the macroeconomic consequences of information imperfection in financial market (Gertler, 1988), what so called 'imperfect information based' monetary transmission has been put forward in the literature.[1] One of variants of this type of monetary transmission is the balance sheet channel which emphasizes the impact of monetary policy changes on the balance sheet of borrowers. The essence of this theory is that, due to information asymmetries, moral hazard and bankruptcy costs, borrower's net worth is the important determinant of their ability to raise external funds. A monetary policy shock such as an increase in the interest rate reduces the borrowers' net worth by reducing expected future sales and increasing the real value of debt. The borrowers become less creditworthy and the external funds become more costly, hence lowering investment.

Many authors have argued that this phenomenon is widespread in the East Asian countries in the aftermath of financial crisis that has been provoked by a dramatic increase in

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1 See Bernanke and Gertler (1995) and Hubbard (1998) for the survey.

domestic interest rates and large-scale depreciation. The 'third-generation' model of currency crisis, proposed by Krugman (1999) clearly highlights this phenomenon:

"...[the] third-generation crisis .. emphasises two factors that have been omitted from formal models to date: the role of companies' balance sheets in determining their ability to invest, and that of capital flows affecting the real exchange rate' (pp.3).

For countries experiencing dramatic changes in financial structure such as Indonesia since the wake of the Asian crisis, understanding the effects of monetary policy on the firm financial structure and thus their investment behaviour is very important. We can expect that under weakening firms' financial condition after the crisis, the effects of monetary contraction on the investment through the balance sheet channel will be amplified. The monetary contraction reflected from the high interest rate not only increases the cost of capital for investment but also worsens the quality of firms' assets. This in turn amplifies the impact of monetary policy on the real sector, a phenomenon the so called as "financial accelerator". By contrast, the expansionary monetary policy would be ineffective as a lower interest rate does not necessarily increase their investment. Firms tend to use this opportunity to take various measures to restructure their financial condition such as deleveraging.

In the empirical studies on the balance sheet channel of monetary transmission, two empirical questions should be addressed. First, whether balance sheet position plays important role in influencing firm's investment decision. Second, how does a monetary policy influence the firm's balance sheet and thus their investment decision. While the empirical research on the role of balance sheet position on firms' investment has been abundant[2] and generally confirms the hypothesis, empirical study on the second hypothesis and thus explicitly on the balance sheet channel is relatively few. Oliner and Rudebusch (1996) for US, and Minguez (1997) for Spain and Germany are among the notable exceptions.

Empirical studies on the importance of balance sheet in firm investment have been conducted for Indonesian case in the context of testing financial constraint. Harris, et al. (1994) and Goeltom (1995) employ the accelerator models of investment using panel of manufacturing firms over period 1983-1989 to investigate whether financial liberalisation has relaxed the financial constraint of the firms. In a rather different context, using panel data of listed firms over period 1992-1997, Agung (2000) investigates the role of cash flow and leverage in firm investment to test indirectly whether the balance sheet channel operates in Indonesia. In spite

2 See a comprehensive survey by Hubbard (1998).

of supporting the balance sheet hypothesis, the latter does not explicitly test whether the firm balance sheet magnifies the adverse effect of a monetary contraction.

This study investigates explicitly the balance sheet channel hypothesis by extending the data used by Agung (2000) to include the crisis period, i.e., the data covers 1992-1999. By including the crisis period when interest rates substantially increased, we can test whether the notable monetary shock indeed influences the investment through its effect on firms' balance sheet.

THE BALANCE SHEET CHANNEL

The theory of balance sheet channel stems from the fact that the credit market is characterized by asymmetric information between borrowers and lenders (Oliner and Rudebusch, 1996). The asymmetric information nature of credit market and limited liability feature in debt contract produce a moral hazard problem. A firm's incentive to create moral hazard by making excessively risky investments is induced by the fact that by making such risky projects, the firm retains most of the profits if the project is successful while debt holders incur most of the losses if the project ends in failure. To compensate lenders for the costs incurred due to possible losses, monitoring costs as well as enforcing outcomes, the lenders impose a premium for obtaining credit.

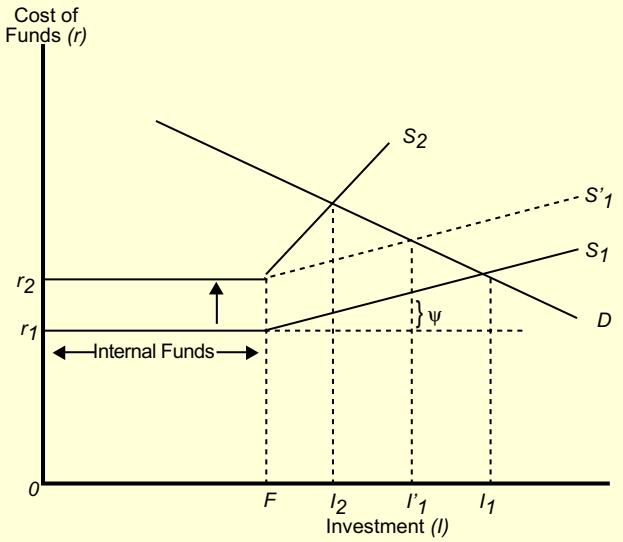
The existence of premium results in an upward sloping supply curve, S_1 (Graph 4.1). Up to a level of internal funds F, the supply curve is horizontal at r_1 the costs of internal funds, which can be decomposed into:

$$r_i = r_i^f + \rho \qquad (1)$$

where r_i^f is the risk-free interest rate such as the policy interest rate, ρ is the risk adjustment specific for the firm. If the credit market is perfect, the costs of borrowings $(L = I - F)$ also equal to r_1. However, under imperfect credit market when lenders impose premium on external funds (Ψ), the costs of borrowing become $r_1 + \Psi$.

The premium on external funds (Ψ) imposed by lenders depends on the level of borrowings (L), the higher loans (borrowings) the firm raises, the higher is the probability of moral hazard that can arise and hence the higher premium the firm will have to pay. This is reflected by the upward sloping S curve. In addition, the premium on the external funds depends on the level of risk free interest rate. The higher the level of risk free interest rate, the lower the discounted value of borrowers' collateral, thus the larger likelihood of the firm to commit moral hazard.

Graph 4.1
The Balance Sheet Channel: Magnification of a Monetary



$$\Psi = \Psi (L, r^f) \tag{2}$$

where $\Psi_L > 0$ and $\Psi_{rf} > 0$.

Since under imperfect credit market the costs of borrowing can defined as $r = r_1 + \Psi (L, r^f)$, a monetary shock (a change in r^f) affects the costs of borrowing, thus investment (I), not only through the direct effect on interest rate (interest rate channel) but also on through the indirect effect by increasing borrowing premium.

$$\frac{\partial r}{\partial r^f} = \frac{\partial \hat{r}}{\partial r^f} + \frac{\partial \Psi}{\partial r^f} \tag{3}$$

The magnification effect of a monetary shock through increasing premium on external funds is the essence of balance sheet channel. In Graph 4.1, a monetary shock, reflected by an increase in the risk free interest rate, pushes the supply schedule from S_1 to S_2' instead of S_1'. The direct effect of a rise in risk free rate on the costs of external funds is reflected by the upward shifting of S_1 to S_1', while magnification effect through increasing premium of external funds is reflected by rotation of S_1' to S_2. The real effect of monetary policy through the balance sheet is the decrease in investment from I_1 to I_2.

Following Oliner and Rudebusch (1996), testing the balance sheet channel empirically, is conducted in the following framework, based on the Graph 4.1 above.
Suppose demand for loans takes the following form:

$$r = -\alpha I + \mu \tag{4}$$

and supply of loans, as described above, takes the following form:

$$r = r_f + \Psi(L, r^f) = r^f + \rho + \beta r^f (I - F) \quad (5)$$

where $\Psi(L,r^f) = \beta r^f L$, $L = I - F$. With $\beta > 0$, $\Psi_L > 0$ *and* $\Psi_{rf} > 0$. Equating demand and supply, the sensitivity of investment with respect to change in internal funds, F and level of borrowing, L, are:

$$\frac{\partial I}{\partial F} = \frac{\beta r^f}{\alpha + \beta r^f} \quad (6)$$

and

$$\frac{\partial I}{\partial B} = \frac{\beta r^f}{-\alpha} \quad (7)$$

To investigate the effect of a monetary policy shock on the sensitivities of investment to the balance sheet position, equations (6) and (7) are differentiated with respect to r^f:

$$\frac{\partial I}{\partial F \partial r^f} = \frac{\beta r^f}{(\alpha + \beta r^f)} > 0 \quad (8)$$

and

$$\frac{\partial I}{\partial L \partial r^f} = \frac{\beta}{-\alpha} < 0 \quad (9)$$

The hypothesis of balance sheet channel represented formally by equations (6) - (9) is used as the framework of empirical investigation which is subject of the next section. That is, we test whether balance sheet positions (cash flow and leverage) are significant in the firms' investment (equations 6 and 7) and whether the sensitivities of cash flow and leverage are higher during the period of monetary contraction (equations 8 and 9).

THE METHODOLOGY AND DATA

Testing the Hypothesis of Balance Sheet Channel

As aforementioned, the essence of balance sheet channel hypothesis is that a monetary policy influences the firm's investment via its effects on firm's balance sheet. By this definition, we can test two hypotheses:

H_1: Firm's balance sheet positions are significant determinants of firm investment spending.

H_2: Firm's investment is more sensitive to balance sheet position during tight money condition than other times.

We use three different balance sheet indicators. First indicator is ratio of cash flow to capital stock reflecting the firm's creditworthiness. The higher the cash flow, the more

creditworthy and hence the higher access of the firm to external funds. The second indicator is the ratio of total debt to capital stock, as a measure of firm's financial leverage. The third balance sheet indicator is sort term debt to total debt to measure the extent the firm has to finance itself short-term rather than long term and therefore related to its access to long term finance. The higher short-term debt as a fraction of total debt, the weaker the balance sheet.

Testing the effects of firm's balance sheet on investment pose some challenges in empirical investigations. The paramount challenge is to control for investment opportunities in order to determine that the shifts in investment take place as a result of a change in a firm's balance sheet, not because of the shifts in demand for capital stock induced by the investment opportunities. Various approaches have been adopted to tackle this problem. In order to capture the investment opportunities, some studies use Tobin's q (Fazzari, Hubbard and Petersen, 1988, inter alia), the Euler equation approach (Bond and Meghir, 1994, Agung, 2000) and sales-accelerator approach (Bond, et al, 1995). In this study we use accelerator model of investment since as found by some studies (e.g. Oliner, Rudebusch and Sichel, 1995) the model usually performs better than the more sofisticated investment models, such as Euler and Tobin's q approaches.

Therefore, to test for hypothesis H_p our baseline investment equation takes the form:

$$IK_{i,t} = \beta_1 IK_{i,t-1} + \beta_2 SK_{i,t-1} + \beta_3 B_{i,t-1} + \alpha_i + \delta_t + \varepsilon_{it} \qquad (10)$$

where $i=1, ..., n$ indexes companies, $t=1, ..., T$ indexes time. IK denotes the investment rate, α_i is firm-specific effect, δ_t is time-specific effect and $\varepsilon_{i,t}$ is a serially uncorrelated error term which is also uncorrelated with all variables. SK is the sales-capital ratio and B is a measure of the firm's balance sheet position *(DK, CK or SD)*. The coefficient β_3 measures the sensitivity of the investment capital ratio with respect to the changes in the balance sheet indicator. If the hypothesis of H_1 is correct, β_3 should be negative when B is measured by DK or SD, and should be positive when measured by CK.

The second hypothesis is whether the sensitivity of the firms' balance sheet on their investment increases during the contractionary periods. To test the hypothesis, the model (1) is augmented by allowing for a different parameter on the balance sheet indicator during the contraction periods. The regression equation (1) becomes,

$$IK_{i,t} = \beta_1 IK_{i,t-1} + \beta_2 SK_{i,t-1} + (\beta_{31} + \beta_{32} M_t) B_{i,t-1} + \alpha_i + \delta_t + \varepsilon_{it} \qquad (11)$$

where M_t is a dummy of monetary tightness. The coefficient β_{31} measure of sensitivity of investment with respect to the balance sheet indicator outside the contraction period only.

The coefficient β_{32} measures the differential effect of balance sheet during the monetary contraction period. The balance sheet channel works if the coefficient β_{32} to be negative for B_{t-1} measured by DK_{t-1} and SD_{t-1}, and positive when measured by CK_{t-1}.

The crucial issue in testing the monetary policy transmission is to identify the periods of monetary contraction (M_t). Given our data covers period 1993-1999, it is quite reasonable to identify the crisis period (1997-1999) marked by a substantial increase in interest rates and Rupiah depreciation. As suggested in Table below, this period is also marked by a substantial decrease in the private investment.

Table 4.1 Comparison Between SBI and Private Investment

Year	r_{SBI}	Private Investment %
1993	10.89	5.7
1994	10.19	18.6
1995	13.83	21.7
1996	13.55	15.2
1997	15.08	6.8
1998	49.73	-32.3
1999	22.31	-21.0

Econometric Issues

We use a dynamic panel data specification to estimate equation (10) and (11). There are several econometric issues which should be addressed in estimating (10) and (11). First, the possible correlation between the regressors and the firm specific effects, i.e., $E(x_{it}\alpha_i) \neq 0$. Second, the possible endogeneity of regressors with respect to v_{it}, i.e. $E(x_{it}\varepsilon_{it}) \neq 0$, for s < t, 0 otherwise. Third, the possible heteroskedasticity of the disturbance eit since the panel data covers many heterogenous firms and several time periods. The problems would result in an upward biased estimate of βs if the OLS estimator is used. Furthermore, as shown by Blundell et al (1992), the estimate of βs will be downward biased if the within-groups estimator is used. Arrelano and Bonds (1991) provide General Method of Moments (GMM) estimators for dynamic panel data which have the above mentioned properties. Basically, in this estimation method, the individual effects are eliminated by taking the *first-difference* of equations (10) and (11) and lagged levels

of variables are used as instruments. The use of lagged variables[3] as instruments is only valid if ε_{it} is serially uncorrelated, otherwise the estimator will be inconsistent. Given that ε_{it} is serially uncorrelated, in the first difference models, the error term becomes a first-order moving average, MA(1). Hence, second-order serial correlation should not exist in $\Delta\varepsilon_{it}$. Arrelano and Bond (1991) provide tests of second-order serial correlation together with Sargan tests of over-identifying restriction, to examine the validity of instruments.

This so-called first-differenced GMM estimator has been widely used in most recent empirical literature concerning the role of financial factors in investment, including prominent studies such as Blundell et al (1992), Devereux and Schiantarelli (1990) and Bond and Meghir (1994). However, in a recent empirical work, Hall, Mairesse, and Mulkay (1998) found that the GMM method of estimation results in much imprecision in the estimated parameters. Using simulation studies, Alonso-Borrego and Arrelano (1996) also found that the first-differenced GMM estimator produces a large sample bias and poor precision, particularly in the setting of dynamic panel data models with a small number of time series observations and large autoregressive parameter. The problem stems from the "weak instruments" of the levels of variables in the first-difference equations. Some progress has been made by Blundell and Bond (1998) to improve the GMM estimator by introducing additional restrictions on the initial conditions process which allows the use of lagged first differences of variables in the levels equations, in addition to lagged levels instruments in the first differenced equations as in the first-differenced GMM. They show that the 'system GMM', GMM(SYS), provides more precise parameter estimates and reduces small sample biases. Since our sample is also characterised by a small number of time series observations, we follow this approach and use the DPD v1.2 program (Doornik, Arrelano, and Bond, 1999) which was run in the Ox v3. Because of heteroskedastic nature of the data, a two-step estimation procedure provided by the DPD98 program was used to obtain a more efficient estimation.

Data

The company data were obtained from the Extel's Company Research database. The samples are unbalanced panel data extracted from 219 non-financial companies listed on the Jakarta Stock Exchange during 1992-1999.

Since we were estimating dynamic models, we selected only the companies with at least three years' observations. Furthermore, we excluded outliers, observations where investment, capital stock or sales increased by a factor of ten or more from one year to the next. Finally, 192

3 i.e. t-2 and further lags for endogenous variables and t-1 and further lags for predetermined variables.

companies were selected. Since the calculation of investment requires lag of capital stock, the sample data becomes 1993-1999. The summary of statistics of variables used is presented in Table 1 and details of the definition of data are presented in Appendix 1.

Table 4.2 Summary Statistics of Variables Used

		I/K	S/K	D/K	C/K	SD/TD
1993	Mean	0.19	2.14	0.64	0.30	0.60
(n=7)	St dev	0.32	0.88	0.49	0.40	0.33
	Median	0.33	1.67	0.42	0.33	0.50
1994	Mean	0.29	1.64	0.61	0.30	0.67
(n=92)	St dev	0.24	1.25	0.48	0.25	0.32
	Median	0.24	1.40	0.61	0.25	0.70
1995	Mean	0.29	1.55	0.65	0.16	0.67
(n=133)	St dev	0.36	1.82	0.46	0.17	0.32
	Median	0.30	1.11	0.60	0.13	0.71
1996	Mean	0.19	1.46	0.72	0.13	0.60
(n=188)	St dev	0.25	1.65	0.47	0.15	0.30
	Median	0.18	1.05	0.65	0.12	0.58
1997	Mean	0.18	1.33	1.17	-0.09	0.64
(n=192)	St dev	0.78	1.60	1.06	0.39	0.55
	Median	0.31	0.90	0.94	-0.01	0.59
1998	Mean	0.10	1.72	1.41	-0.19	0.68
(n=192)	St dev	0.35	2.50	1.58	0.67	0.35
	Median	0.11	1.04	1.00	-0.03	0.81
1999	Mean	-0.02	3.25	1.35	-0.03	0.61
(n=107)	St dev	0.56	15.60	3.38	2.49	0.37
	Median	0.01	1.22	0.74	0.13	0.61
1993-1999	**Mean**	**0.18**	**1.87**	**0.93**	**0.08**	**0.64**
	St dev	**0.41**	**3.62**	**1.13**	**0.65**	**0.36**
	Median	**0.21**	**1.20**	**0.71**	**0.13**	**0.64**

As shown in Table 4.1, generally speaking firms investment ratio have declined since 1997 when Rupiah started to depreciate and interest rate started to rise, and the investment ratio become negative in 1999. The lower investment ratio can be associated by high firms' leverage as reflected by high debt to capital ratio and low creditworthiness as reflected by negative cash flow during 1997-1999.

To shed light on the differential behaviour of firms with different characteristics, we split the sample according to their size, sector and ownership. As suggested by many studies, small firms' investment should be more sensitive to a monetary shock than the large ones. Splitting the sample into different sectors, we could expect that investment of the property sectors whose balance are vulnerable to interest rate, is more sensitive to a change in monetary

Table 4.3 Characteristics of Sample Split

Classification		Variables				
		IK	SK	DK	SD	CK
Size	**Small**	0.12	2.09	0.82	0.76	0.07
	1993-1996	0.21	1.70	0.57	0.76	0.20
	1997-1999	0.04	2.44	1.04	0.75	-0.04
	Large	0.22	1.37	1.21	0.52	-0.03
	1993-1996	0.29	1.36	0.78	0.50	0.16
	1997-1999	0.17	1.37	1.56	0.54	-0.19
Sector	**Services**	0.14	1.65	0.86	0.48	0.04
	1993-1996	0.29	1.66	0.58	0.51	0.26
	1997-1999	0.03	1.65	1.06	0.45	-0.11
	Trade	0.20	5.01	1.48	0.68	0.04
	1993-1996	0.27	3.18	0.77	0.70	0.20
	1997-1999	0.14	6.74	2.15	0.66	-0.11
	Property	0.08	0.38	1.48	0.48	-0.27
	1993-1996	0.36	0.37	0.69	0.45	0.10
	1997-1999	-0.15	0.39	2.15	0.50	-0.59
	Manufacturing	0.18	1.45	0.88	0.69	0.06
	1993-1996	0.22	1.42	0.66	0.67	0.18
	1997-1999	0.14	1.47	1.09	0.70	-0.05
Ownership	**Foreign**	0.18	1.76	0.70	0.73	0.15
	1993-1996	0.23	1.89	0.54	0.76	0.24
	1997-1999	0.13	1.64	0.84	0.70	0.06
	Domestic	0.17	1.73	1.08	0.62	-0.01
	1993-1996	0.25	1.45	0.70	0.61	0.17
	1997-1999	0.10	1.97	1.41	0.63	-0.15

policy stance. Finally, we also expect that investment of domestic firms is more sensitive to a monetary shock than mutinational foreign firms which are able to obtain funds from their head-office in the case of monetary tightening.

The characteristics of sample split are presented in Table 4.2. Balance sheet position of large firms is much more worsened in year 1997-1999 during which we identify as the period of monetary tightening. However, while the drop in balance sheet position of large firms is larger than that of small firms, the decline in the investment of large firms is smaller than that of small firms. This indicates that investment of the large firms is less sensitive to their balance sheet position. Sectoral breakdown of sample suggests that the balance sheet and investment of the property sector is more sensitive than other sector to a change in monetary policy. Finally,

breakdown of sample into foreign and domestic firms suggests that the domestic firms' balance sheet position is more sensitive to the tightening. During the contraction period, the cash flow of domestic firms become negative and leverage increased twice as large as that outside the contraction period.

EVIDENCE FOR A BROAD CREDIT CHANNEL

Importance of Firm's Balance Sheet on Investment

Before reporting the influence of a monetary shock on the firm investment, in this sub-section we report the first hypothesis of the balance sheet channel, i.e., whether the firms' balance sheet positions influence the firms' investment. Table 4.3 reports the estimates of equation (10). In addition to reporting the estimates by the use of the GMM-SYS, for the sake of

Table 4.4 Firms' Balance Sheet Position and Investment Rate

Variable	GMM1	GMM2	OLS	GMM1	GMM2	OLS	GMM1	GMM2	OLS
IK(-1)	-0.05	-0.02	-0.65	-0.05	-0.02	-0.67	-0.03	-0.02	-0.52
	(-0.91)	(-0.50)	(-12.45)**	(-1.34)	(-0.78)	(-13.79)**	(-0.71)	(-0.45)	(-12.05)
SK(-1)	0.09	0.09	0.06	0.07	0.08	0.04	0.05	0.06	0.07
	(4.12)**	(4.11)**	(3.58)**	(3.43)**	(4.86)**	(2.53)**	(1.74)*	(1.67)**	(3.91)**
DK(-1)	**-0.06**	**-0.04**	**-0.09**						
	(-1.52)	(-1.39)	(-4.56)**						
CK(-1)				**0.23**	**0.25**	**0.15**			
			(2.63)**	(3.33)**	(6.58)**				
SD(-1)							**-0.12**	**-0.11**	**-0.11**
							(-1.33)	(-1.85)*	(-1.41)
Wald test	21.99	18.53		24.22	39.90		14.34	10.61	
P	[0.00]	[0.00]		[0.00]	[0.00]		[0.00]	[0.01]	
Sargan test	178.20	86.50		238.80	75.43		154.80	87.37	
P	[0.00]	[0.01]		[0.00]	[0.05]		[0.00]	[0.00]	
M1	-2.38	-2.47		-2.36	-2.40		-2.39	-2.45	
P	[0.02]	[0.01]		[0.02]	[0.02]		[0.02]	[0.01]	
M2	0.69	0.66		0.91	0.92		0.76	0.71	
P	[0.45]	[0.51]		[0.37]	[0.36]		[0.45]	[0.48]	

Note:
Number of sample: 192 firms. Sample period is 1993-1999.
M1, M2 are first-order and second-order serial correlation tests, both are asymptotically N(0,1)
Numbers in the ( ) is t-stat, and in the [ ] is p-value
* Significant at 10%, ** Significant at 5%,

comparison we estimate the equation (10) using GMM-DIF and OLS. The results indicate no sign of second order serial correlation of the first differenced residuals. In all regressions, the coefficients of sales ratio show consistently positive and significant.

The most important result is that coefficients on balance sheet indicators have correct sign. As expected, the coefficients on the debt-capital ratio (DK) and short-term debt to total debt (SD) are negative, while the coefficients on cash flow are positive. The coefficients on the cash flow are significant by the use of GMM and OLS, while the coefficients on the DK is only significant by the use of OLS and that of SD are significant by the use of GMM-SYS. These findings are consistent to a study by Agung (2000) who employ Tobin's q and Euler equation of investment.

To investigate the role of balance sheet in firms' investment for different class of firm, we differentiate the sample into small and large firms. Firms whose assets are greater than sample median are classified as large firm, and otherwise classified as small firms. The results

Table 4.5 Firms' Balance Sheet Position and Investment Rate: Small vs Large Firms

Variable	Small Firms	Large Firms	Small Firms	Large Firms	Small Firms	Large Firms
IK(-1)	0.001	-0.16	0.003	-0.14	-0.01	-0.12
	(0.05)	(-1.67)*	(0.13)	(-1.67)*	(-0.51)	(-1.82)*
SK(-1)	0.08	0.12	0.08	0.04	0.05	0.10
	(4.06)**	(2.07)**	(1.69)*	(1.49)	(4.73)**	(2.81)**
DK(-1)	**-0.10**	**-0.05**				
	(-2.65)**	(-0.78)				
CK(-1)			**-0.30**	**-0.08**		
			(-1.53)	(-1.49)		
SD(-1)					**0.37**	**0.13**
				(4.00)**	(1.05)	
Wald test	16.59	13.94	6.198	7.51	83.48	14.24
P	[0.00]	[0.00]	[0.10]	[0.06]	[0.00]	[0.00]
Sargan test	56.78	59.76	52.91	61.41	45.47	67.90
P	[0.48]	[0.38]	[0.63]	[0.32]	[0.86]	[0.15]
M1	-1.40	-2.18	-1.39	-2.25	-1.40	-2.30
P	[0.16]	[0.03]	[0.16]	[0.02]	[0.16]	[0.02]
M2	-0.93	0.79	-0.94	0.87	0.06	0.85
P	[0.35]	[0.43]	[0.35]	[0.38]	[0.96]	[0.39]

Note:
Sample of large firms: 96 firms, small firms: 96 firms. Sample period is 1993-1999.
M1, M2 are first-order and second-order serial correlation tests, both are asymptotically N(0,1)
Numbers in the ( ) is t-stat, and in the [ ] is p-value
* Significant at 10%, ** Significant at 5%.

for the sample split are reported in Table 4.4 The results firms suggest differential behaviour of the firms' investment. The coefficients of balance sheet indicators for large firms are generally small and not significant. By contrast, the corresponding coefficients for small firms are significant and larger than that of large firm. This indicates that the investment of smaller firms is more sensitive to their balance sheet position than that of larger firms.

Response of Firm's Balance Sheet to a Monetary Shock

Previously we have found that there is evidence of sensitivity of firms' investment to a change in balance sheet position. The next question is whether the investment-balance sheet sensitivity is more pronounced during the period of contraction. The results of the estimations are presented in Table 4. In general, the results suggest that during the monetary tightening, the investment is more sensitive to firm's leverage (DK) and short-term debt (SD). In fact, outside the period of monetary contraction, the coefficients of DK and SD are positive (except by OLS). The positive coefficient of leverage in the investment equation outside the contraction (crisis) period is consistent to Agung (2000) and Harris, et al (1994) who use sample of before the crisis. They argue that a high degree of leverage may act as a signal of creditworthiness, especially during the boom period.

By contrast, during the period of contraction, the coefficients of those variables (MDK and MSD) are negative and significant, as our prior expectation. This indicates that there is evidence for a financial accelerator working during monetary contraction, thus existence of balance sheet channel of monetary policy. That is, during monetary contraction firms' leverage increases and lowering their access to credit market and hence investment.

While the results for leverage shows the existence of financial accelerator during the contraction period, the results for cash-flow ratio is less encouraging. That is, during the contraction period, firms' investment becomes less sensitive to their cash flow. The coefficient of cashflow outside the contraction is 0.53, but during the contraction, the coefficient of cash flow only 0.15 (0.53-0.38). The lower sensitivity of cash flow can be interpreted in the context of the role of cash flow as a signal of future profitability. That is, during the contraction period, the cash flow contains less information on future profitability (Vermeulen, 2000).

The next interesting question is that since the agency costs of external funds for small firms are likely higher than large firms, it is valid to expect that the small firms is most likely to be most influenced by the monetary shock. To test this hypothesis we estimate equation (11) using the sample split of large and small firms. The results are presented in Table 4.5. In general, there is no clear evidence that the small firms' balance sheet, hence their investment, is more influenced by monetary contraction. Although the interaction of leverage and

Table 4.6 Response of Firm's Balance Sheet to a Monetary Shock

Variable	GMM1	GMM2	OLS	GMM1	GMM2	OLS	GMM1	GMM2	OLS
IK(-1)	-0.04	-0.04	-0.64	-0.06	-0.04	-0.68	-0.03	-0.03	-0.54
	(-0.91)	(-0.92)	(-12.42)**	(-1.43)	(-0.95)	(-13.91)**	(-0.56)	(-0.57)	(-12.27)**
SK(-1)	-0.08	0.06	0.06	0.06	0.07	0.04	0.07	0.07	0.07
	(2.63)**	(2.18)**	(3.51)**	(3.19)**	(3.52)**	(2.24)**	(2.59)**	(2.88)**	(3.88)**
DK(-1)	**0.02**	**0.13**	**-0.06**						
	(0.22)	(1.71)*	(-1.15)						
MDK(-1)	**-0.07**	**-0.15**	**-0.03**						
	(-1.03)	(-2.41)**	(-0.65)						
CK(-1)				**0.58**	**0.53**	**0.38**			
				(3.02)**	(2.99)**	(3.25)**			
MCK(-1)				**-0.48**	**-0.38**	**-0.23**			
				(-1.92)*	(-1.63)*	(-1.99)**			
SD(-1)							**0.03**	**0.10**	**-0.05**
							(0.25)	(1.11)	(-0.63)
MSD(-1)							**-0.11**	**-0.18**	**-0.13**
							(-1.65)*	(-3.16)**	(-2.41)**
Wald test	27.05	30.48		64.44	71.90		31.47	61.12	
P	[0.00]	[0.00]		[0.00]	[0.00]		[0.00]	[0.00]	
Sargan test	79.50	72.45		229.70	78.04		160.20	75.46	
P	[0.00]	[0.50]		[0.00]	[0.32]		[0.00]	[0.40]	
M1	-2.39	-2.39		-2.29	-2.31		-2.35	-2.37	
P	[0.02]	[0.02]		[0.02]	[0.02]		[0.02]	[0.02]	
M2	0.67	0.58		1.24	1.13		0.67	0.53	
P	[0.50]	[0.56]		[0.25]	[0.26]		[0.50]	[0.54]	

Note:
Each regression uses sample of 192 firms. Sample period is 1992-1999
M1, M2 are first-order and second-order serial correlation tests, both are asymptotically N(0,1)
Numbers in the ( ) is t-stat, and in the [ ] is p-value

monetary contraction (MDK) for small firms is larger than that of large firms, it is only significant at 15%.

Furthermore, while the coefficients of MSD and MCK for large firms are significant, those for small firms are insignificant. There are two reasons explaining these findings. First, since the foreign liabilities of the large firms are higher than the small firms, their balance sheets are more severely affected by the Rupiah depreciation during the contractionary (crisis) period. An alternative possible explanation is that since the sample covers only the listed firms, there probably is 'a selection bias in favour of picking only the best of small firms' (Devereux and Schiantarelli, 1990, pp.83).

Table 4.7 Response of Firm's Balance Sheet to a Monetary Shock: Small vs Large Firms

Variable	Small Firms	Large Firms	Small Firms	Large Firms	Small Firms	Large Firms
IK(-1)	-0.01	-0.11	0.01	-0.12	-0.03	-0.13
	(-0.60)	(-1.17)	(0.61)	-1.49	-0.71	-1.86*
SK(-1)	0.05	0.11	0.09	0.08	0.04	0.08
	(2.25)**	(1.34)	(1.81)*	2.19**	2.05**	2.10**
DK(-1)	**0.05**	**0.04**				
	(0.52)	(0.22)				
MDK(-1)	**-0.15**	**-0.06**				
	(-1.54)	(-0.64)				
SD(-1)			**-0.12**	**0.15**		
			(-0.50)	(2.12)		
MSD(-1)			**-0.07**	**-0.17**		
			(-0.53)	(-2.27)**		
CK(-1)					**0.59**	**0.72**
					(2.80)**	(2.31)**
MCK(-1)					**-0.32**	**-0.74**
					(-1.34)	(-1.96)**
Wald test	22.78	16.00	23.95	17.86	116.30	23.87
P	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Sargan test	54.92	53.53	58.07	65.70	44.99	65.74
P	[0.94]	[0.96]	[0.89]	[0.72]	[0.99]	[0.71]
M1	-1.40	-2.24	-1.39	-2.25	-1.37	-2.22
P	[0.16]	[0.02]	[0.16]	[0.025]	[0.17]	[0.02]
M2	-1.00	0.88	-1.02	0.88	0.89	0.82
P	[0.32]	[0.38]	[0.31]	[0.38]	[0.37]	[0.41]

Note:
Sample of large firms: 96 firms, small firms: 96 firms. Sample period is 1993-1999.
M1, M2 are first-order and second-order serial correlation tests, both are asymptotically N(0,1)
Numbers in the ( ) is t-stat, and in the [ ] is p-value
* Significant at 10%, ** Significant at 5%.

CONCLUSIONS

This paper has investigated the balance sheet channel of monetary transmission in Indonesia using panel data of Indonesian listed firms over the period 1992-1999. The empirical evidence suggests that firm balance sheet varaibles (cash flow and leverage) is very important determinant in the firm investment and the investments of small firms are more sensitive to their balance sheet changes than those of larger firms. The most important finding is that the sensitivity of investment with respect to a change in balance sheet variables increases during period of monetary contraction. This evidence provides support for the existence of balance

sheet channel in Indonesia. However, we find no evidence that the investments of smaller firms more badly suffered than larger firms during the contraction period, perhaps due to large exposure of the larger firms to domestic currency depreciation that concurrently occur during period of monetary contraction.

While a contractionary monetary policy generates the adverse effects on the real investment through firms balance sheet are supported, the question whether the easing monetary condition improves the firm balance sheet, thus investment, is not answered yet in this study. Under condition of weak balance sheet, an asymmetric effect of monetary policy, i.e., stronger negative effect in the case of contraction but less positive effect in the case of expansion, become possible. This is a challenging area for future research.

References

Alonso-Borrego, C. and Arrelano, M. (1996). *Symetrically normalised instrumental variable estimation using panel data*, CEMFI Working Paper 9612, September, Madrid.

Arrelano, M. and Bonds, S. (1991). Some tests of specification for panel data: Mpnte Carlo evidence and an application to employment equations, *Review of Economic Studies,* 58, pp. 277-97

Agung, J. (2000). Financial constraints, firm's investment and channels of monetary policy in Indonesia. *Applied Economics,* 2000, 32, pp.1637-1646.

Agung, J., Kusmiarso, B., Pramono, B. Hutapea, E.G., Prasmuko, A. and Prastowo, N.J. (2001). *Credit crunch in Indonesia in the aftermath of the crisis: facts, causes and policy implications.* Paper presented in Asia Pacific Finance Association Conference, Bangkok, 23 July 2001.

Bernanke, B. and Gertler, M. (1989). Agency costs, collateral, and business cycle fluctuations, *American Economic Review,* 79, pp. 14-31.

Bernanke, B. and Gertler, M. (1995). Inside the black box: the credit channel of monetary policy transmission. *Journal of Economic Perspectives, Fall,* 9(4), pp. 27-48.

Bernanke, B., Gertler, M. and Gilchrist, S. (1996). The financial accelerator and the flight to quality. *Review of Economics and Statistics,* Feb, 78(1), pp.1-15.

Bernanke, B., Gertler, M. and Gilchrist, S. (1998). The financial accelerator in a quantitative business cycle framework. NBER Working Paper, No. 6455.

Blundell, R. and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics,* 87, pp. 115-143.

Blundell, R., Bond, S., Devereux, M., and Schiantarelli, F.(1992). Investment and Tobin's q: evidence from company panel data. *Journal of Econometrics,* 51, pp. 233-57.

Bond, S. and Meghir, C. (1994). Dynamic investment models and the firm's financial policy. *Review of Economic Studies, Apr.,* 61(32), pp. 197-222.

Deveruex, M. and Schiantarelli (1990). Investment, financial factors and cash flow: evidence from UK panel data, in R. Glenn Hubbard (ed.), *Asymmetric information, corporate finance, and investment.* University of Chicago Press, pp. 279-306.

Doornik, J.A., Arrelano, M. and Bond, S. (1999). *Panel Data Estimation Using DPD for Ox*, http://www.nuff.ox.ac.uk/users/doornik/

Fazzari, S., Hubbard, G.R, and Petersen, B. (1988). Financing constraints and corporate investment. *Brooking Papers of Economic Activity,1,* pp. 141-195

Gertler, M (1988). Financial structure and aggregate economic activity: an overview. *Journal of Money Credit and Banking.* Aug., part 2, pp.559-88.

Goeltom, M.S. (1995). *Indonesia's Financial Liberalization: An Empirical Analysis of 1981-1988 Panel Data.* Institute of Southeast Asian Studies. Singapore.

Hall, B., Mairesse J., Mulkay, B. (1998). Firm-level investment in France and the United States: an exploration of what we have learned in twenty years. N*uffield College Oxford - Economic Discussion Paper, No. 143.*

Harris, J.R., Schiantarelli, F., and Siregar, M.G. (1994). The effect of financial liberalisation on the capital structure and investment decisions of Indonesian manufacturing establishments, *The World Bank Economic Review,* 8, pp.17-47.

Hubbard, G. (1998). Capital-market imperfections and investment. *Journal of Economic Literature,* 36, pp. 193-225.

Krugman, P. (1999). Balance sheets, the transfer problem, and financial crises. mimeo. Jan.

Minguez, J.M.G. (1997). The balance sheet transmission channel of monetary policy: the cases of Germany and Spain, Working Paper, Banco de Espana.

Oliner, S.D. and Rudebusch. G.D. (1996). Is there a broad credit channel for monetary policy? *Federal Reserve Bank of San Francisco Economic Review,* 1, pp. 3-13.

Oliner, S.D., Rudebusch, G.D. and Sichel, D. (1995). New & old model of business investment: a comparison of forecasting performance, *Journal of Money Credit and Banking* 27, (August 1995), pp.806-826

Vermeulen, P. (2000). Business Fixed Investment: Evidence of a Financial Accelerator in Europe. *ECB Working Paper* No. 37, November 2000.

Appendix 1. Definition of Variables Used

Capital stock(K_t) is net fixed asset.

Investment (I_t) is calculated from the following identity:

$$I_t = K_t - K_{t-1} + DEP_t$$

where DEP_t is the depreciation.

Cash flow (X_t) is profit after tax plus depreciation.

Sales are gross sales or turnover.

Debts (D_t) is calculated as the sum of both short and long-term securities and loans including overdrafts.

Appendix 2. Survey Results

In line with the economic recovery process, during the last three years, 42% of firms increased investment, 16% of firms reduce investment, and 42% of firms did not do any investment. An increase in investment experienced by all business sector, except property/ construction which decrease in investment. This supports to the quantitative findings that this sectors is most suffered during the period of monetary contraction.

Graph A.1
Realisation of Investment

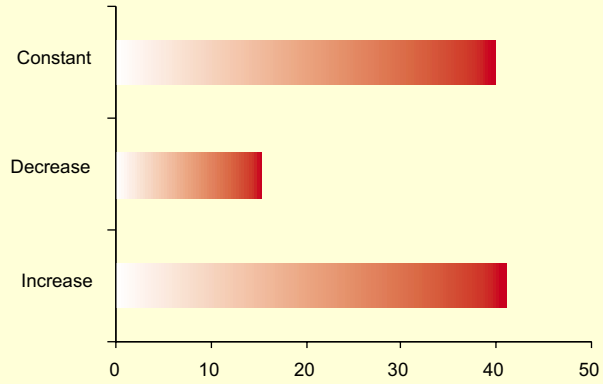
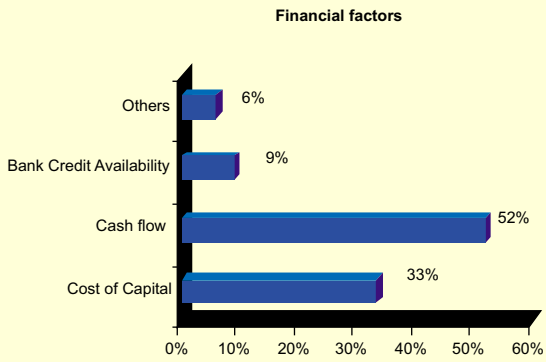
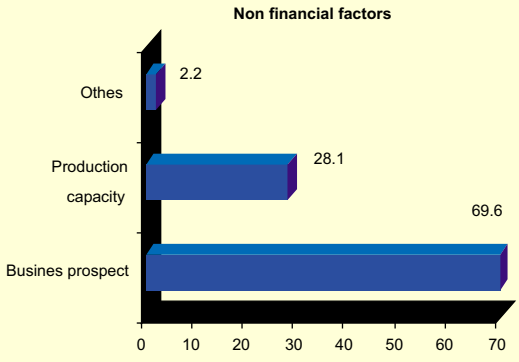


Table A1
Source of Funds and Investment Behaviour During the Last Three Years

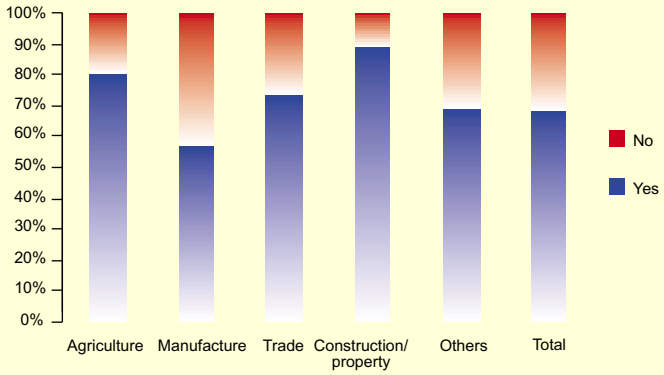
		Sources of funds				
		Internal funds	Bank loans	Capital Market	Foreign borrowings	Total
Investment in the last 3 yrs	Increase	37 28.91%	13 10.16%	2 1.56%	2 1.56%	54 42.19%
	Decrease	9 7.03%	8 6.25%	0 0.00%	4 3.13%	21 16.41%
	Constant	38 29.69%	7 5.47%	3 2.34%	5 3.91%	53 41.41%
	Total	84 65.63%	28 21.88%	5 3.91%	11 8.59%	128 100.00%

To examine how the firms finance their investment activities, cross-tabulation between investment behaviour and the sources of funds was carried out. The results suggest that out of 42.19% of firms that increased the investment during the last three years, 28.91% using internal funds as the main sources of funds, 10.16% using bank loans, and 1.56% using capital market or foreign borrowings as the main sources (Table A1).





To investigate further the financial factors in conducting investment, 52% of firms consider that cash flow is the main determinant of the investment decision (52%). The second financial factor influencing the investment decision is the cost of capital (33%) and bank credit availability is other factor which also affects investment decision (9%). This finding lends support the balance sheet channel hypothesis that cash flow plays an important role in influencing firm's investment decision.

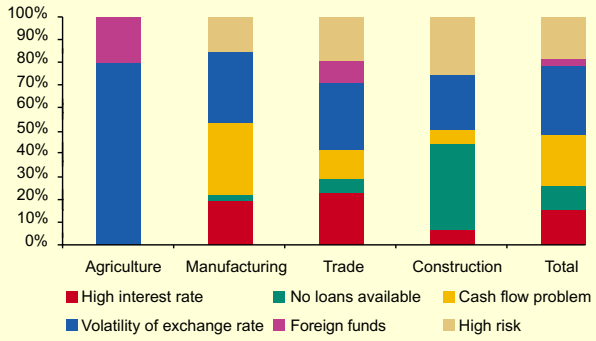


Meanwhile, from non-financial aspects, the investment decision of firms depends upon the future business prospect and capacity utilization (production capacity). In the last three years, majority (68%) of the firms do not have any obstacle to realise their investment, while

32% of the firms have obstacles in investment. As expected, the results indicates that construction/property firms finds the most difficulties in realising the investment.

Those who experienced difficulties in investment considers that the volatility of exchange rate as the main obstacle in the post crisis. The second is the cash flow problem and third is the high business risk. For construction sector the cash flow problem is the main obstacle and for the trade and agriculture sector the exchange rate is the main obstacle.

Graph A.3
Investment Obstacles



Chapter 5

Exchange Rate Channel of Monetary Transmission in Indonesia

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Gunawan, Sari H. Binhadi

INTRODUCTION

In small open economies, with free floating exchange rate system, exchange rate channel becomes very important. Exchange rate movement will influence aggregate demand and aggregate supply. For example, eased monetary policy will depreciate domestic currency, and increase prices of imported goods, thus raise the domestic prices even when there is no expansion in aggregate demand. In this case, exchange rate is regarded as a signal for future price movements. In many countries with the experience of high inflation rate, this condition generates an increase in wages and prices even before the impacts of import costs are working. Meanwhile, in some countries which adopt managed floating regime, monetary policy is less effective but not fully disappears. Sometimes there is a relatively wide band where the exchange rate has a room to fluctuate. Furthermore, if there is an imperfect substitution between domestic and foreign asset, there is a wide enough room for the exchange rate to fluctuate. Under such circumstances, therefore, monetary policy still has its influence on export volume even with the small effect and longer time lag.

Considering the possible changes in the effectiveness of monetary policy under different regimes, this paper attempts to examine further the transmission mechanism of the exchange rate channel to the economy and prices. The issue is even more pronounced for Indonesia to compare the relative strength of the exchange rate channel for the pre-crisis managed floating

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regime and post-crisis free floating regime. In particular, the objectives of this study are : (i) to identify and analyze monetary policy transmission mechanism through the exchange rate channel in the two different periods - before and during— the implementation of free floating system. This study is also aimed to measure the strength of this channel in the two different periods, under managed floating and free floating exchange rate regime; (ii) to estimate the lag structure of monetary policy mechanism through exchange rate channel, and (iii) to estimate the impact of exchange rate innovation (monetary policy shock) on the output and price level.

Analysis in this study is focused on the exchange rate channel according to relative price effect changes. Theoretically, within the exchange rate channel, there are two main channels of monetary policy to be transmitted to the real sector. The first channel is known as direct passthrough effect, through which monetary policy directly influence prices. Meanwhile, in the second channel -indirect passthrough effect- monetary policy influence the prices by way of influencing the output gap (difference between actual and potential output), which will in turn induce the prices to change.

Structural VAR method is applied to estimate the response of exchange rate and inflation to monetary policy shock, as well as the magnitude and lag structures of those impacts. In this study, we divide the framework into two blocks. The first block describes the impact of monetary policy to exchange rate while the second block explains the impact of exchange rate changes to real sector. Exchange rate channel is considered working if a significant impact of monetary policy shock exists.

LITERATURE REVIEW

Exchange rate is one of the important variables in transmission mechanism. Robert Mundell (1962) explains how monetary policy influences the exchange rate and subsequently affects the output and inflation. Mundell shows that perfect capital mobility will lead to a simple relationship between short term interest rate and exchange rate. This so-called interest parity relationship states that interest rate differential between two countries equals to the expected changes in their exchange rates. Capital inflows into the higher return country will occur if this equilibrium condition is not satisfied.

Interest rate parity explains how changes in the short term interest rate will influence the nominal exchange rate. Under this condition, if the central bank raises the short term interest rate, then the exchange rate will appreciate in favor of domestic currency. Therefore, there is a positive relationship between interest rate differential and the exchange rate. The nature of the relationship will depend on the arrangement of the exchange rate system. Under

free floating exchange rate system, the higher the substitution between domestic and foreign assets, the higher the exchange rate responses to interest rate policy-induced changes. On the contrary, in the fixed exchange rate system, if domestic and foreign assets are perfect substitutes, any monetary policy movement will be offset through the capital flows, which consequently leave monetary conditions unchanged.

Interest Rate Parity, Risk Premium, and Exchange Rate

Many literatures disclose the deviation from interest rate parity may occur due to the existence of exchange rate risk. Interest rate parity could be maintained when the exchange rate is covered in forward market, but it will be less accurate under uncovered interest parity. As such, uncovered interest rate parity theory generally applied in explaining the short-term changes in the exchange rate. This is also used in examining the impact of monetary policy to the capital mobility and exchange rate. This relationship can be derived as follow:

$$i = i^* + (E^e - E)/E.100 \quad (1)$$

where i = domestic interest rate,
i^* = foreign interest rate,
E = spot exchange rate, and
E^e = expected exchange rate (forward).

Equation (1) describes the short-run equilibrium in the foreign exchange market, which is simultaneously determined by three variables, namely, domestic interest rate, foreign interest rate, and expected exchange rate. Changes on those variables will affect exchange rate equilibrium. For instance, increased foreign interest rate will make investment abroad more attractive than domestic investment. This condition will encourage people to exchange their domestic currency with foreign currency in order to increase their investment abroad. This activity will in turn enhance the value of foreign currency. If expected inflation remains constant, the expected exchange rate gain will decrease. This condition will lead to domestic currency depreciation because foreign interest rate became more attractive.

Combined with the long-run exchange rate model, the explanation on the behavior of short-run exchange rate can be derived as follow:

$$E = M/M^* x L^*/L \quad (2)$$

$L = L(y,I)$ and $L^* = L^*(y^*,I^*)$

M : money supply

L : real demand for money

Following this monetary approach to exchange rate determination, we can see that, an increase in money supply will lead to exchange rate depreciation. The combination of those two models also assumes that national output is an exogenous factor and speculators are rational. This also means that speculators know the model well and are aware of the consequences of changes in the model variables.

Under the portfolio approach to the exchange rate theory, the ultimate focus is the behavior of private sector financial asset allocation (i.e. domestic currency, domestic bond, and foreign bond). In such condition, when central bank increases the money supply by buying foreign bond in the market, there could be excess demand in foreign bond market and excess supply in the money market. Excess demand in foreign bond market also means excess demand in foreign exchange market, which tends to increase foreign exchange price or depreciate the domestic currency.

On the other hand, risk premium variable is also closely related to interest rate differential, as described by the equation below:

$$r^* - r = \Theta s^2 \left(\frac{V^*}{W - \alpha} \right) \quad (3)$$

Yield differential (r^*-r) consist of three determinants, that is positively related to risk aversion (Θ), negatively related to relative yield variability (s^2), and proportionally related to the differential between actual relative supply (V^*/W) and share of the asset in the minimum variance portfolio (α). Meanwhile, relationship between yield differential and risk premium can be described as follows:

$$r^* - r^- = \Theta s_u^{\ 2} \left(\frac{V^*}{W^-} - (1-a) \right) \quad (4)$$

The effect of increase in real exchange rate variance depends on the relative scale of asset supplies and countries. Furthermore, relationship between forward premium and exchange rate depreciation can be observed as follows:

$$f = d^- - \Theta s^2 \left(\frac{V^*}{W^-} - \alpha \right) \quad (5)$$

Forward premium will exceed anticipated rate of depreciation in the condition when relative supply of foreign securities decrease lower than minimum variance portfolio share. This condition is in line with the theory of negative relationship between foreign exchange risk premium and relative asset supplies.

Meanwhile, to observe the relationship between actual depreciation (d) and forward premium, we can use the equation below :

$$d - f = d - d^- + \Theta s^2 \left(\frac{V^*}{W} - \alpha \right) \quad (6)$$

Excess depreciation = news + risk premium
Decomposition of excess depreciation can be derived into two component : risk premium and unanticipated depreciation.

Monetary Policy Shock and Exchange Rate

Empirical study on the relationship between monetary policy shock and exchange rate for the U.S. case has been done by Martin Eichenbaum and Charles L. Evans (1995). They used three types of shock: (i) orthogonalized shocks to fed-fund rate, (ii) orthogonalized shock of non-borrowed reserves to total reserves ratio, and (iii) changes in Romer and Romer index of monetary policy. Using these three types of shocks, they found that monetary policy contraction leads to: (i) persistent and significant nominal and real exchange rate appreciation, and (ii) persistent significant interest rate parity deviation.

More specifically, their analysis can be summarized as follows. Monetary policy shock in the U.S. is followed by persistent and sharply increase in interest rates and also by decrease in the spread between domestic and foreign interest rate in the same manner. Monetary policy shock also tends to cause nominal and real exchange rate to appreciate. On the other hand, impact of monetary contraction policy is not contemporary; conversely the U.S. dollar tends to appreciate continuously in the longer period.

The U.S. dollar appreciation following monetary policy contraction is in line with the literature about forward premium bias. This literature explains that exchange rate changes in the future are negatively related to forward premium. The last finding of their study is that every increase in 1 unit of Romer and Romer index related to the sharp increase in federal funds rate and the sharp decrease in non-borrowed to total reserves ratio. Maximum response of those variables occur with 6 month lag and also has a high relationship with others monetary policies.

Exchange Rate, International Trade and Inflation

The impact of exchange rate volatility is actually not limited to the balance of payments. This volatility also gives significant impact on the entire economic variable used in monetary policy target, such as wage, corporate profit, inflation rate, and other relevant monetary policy target. Related to the development of relative prices flexibility in the monetary model, Jones (1972), Michael Michaely, Mundell, and Anne Krueger assumed that there are only two kinds of goods produced and consumed in each country, i.e. traded and non traded goods. Demand of

those goods depends on the money prices and nominal expenditure or relative prices and real expenditure measured in traded goods (Z). This relationship can be denoted as :

$$Z=Y-H;\ Y=X1+qX2=Y(q).$$

Real expenditure (Z) is defined as real income (Y) minus real hoarding (H), while real income (real value of output) is defined as a function of relative prices (q). Real rate of hoarding is defined as a function of relative price and real quantity of money : H=H(q,M).
The implication of the impact of exchange rate devaluation on relative prices, can be observed by the following equations:

$$\beta\gamma P_1 + \beta^*\gamma^*(P_1-e) = 0 = dH + dH^* \quad (7)$$

or

$$P_1 = \frac{\beta^*\gamma^*}{\beta\gamma+\beta^*\gamma^*}\, e = \theta e \quad (8)$$

The impact of devaluation on the prices of traded goods in domestic currency shows that, proportionately prices will increase less than the rate of devaluation ($0<\theta<1$). Lowering P*1 = P1/e, will make prices of traded goods decrease lower than the rate of devaluation. Furthermore, the relationship between exchange rate and international trade is described in the J- Curve Theory and Marshall Lerner Condition Theory. [1]

Several references show four ways of exchange rate movements:

(i) As a consequence of using forward exchange market to cover exchange rate risk (hedging). This condition will lead to increasing price in the importing country.
(ii) Exchange rate variability stimulates inflation via lack of discipline in government behavior.
(iii) Exchange rate variability stimulates inflation via lack of private sector discipline.
(iv) Exchange rate variability influences inflation rate by ratchet effect.

METHODOLOGY AND DATA

Methodology and Variable Description

In this study we apply SVAR model to gain non-recursive orthogonalization from the error term in the framework of impulse response analysis. Before applying SVAR method, we conducted unit root test to test the data stationarity and granger causality test to observe

1 Jepma.C.J, H. Jager, E.Kamphuis " Introduction to International Economics", 1996, page. 272-274.

the direction of causality relationship among variables. We also conduct surveys to observe the behavior of economic agents toward monetary policy and exchange rate changes.

For the purpose of analysis in this paper, we use monthly data, ranging from January 1990 to April 2001. Variables used in building of the SVAR model are: interest rates of one-month Bank Indonesia Certificate (RSBI), interest rate differential between one-month JIBOR and one-month SIBOR (IDIFF), country risk (COUNT_RISK) obtained from International Country Risk Guide, net foreign assets (NFA) as a proxy of capital flow, nominal rupiah exchange rate , tradable goods prices (TRP), net export (XNET), real GDP growth (GDPR), and annual inflation rate (INF).

Due to the data constraint, we separate the monetary policy transmission mechanism framework into two parts, block 1 and block 2. In the first block, we estimate the impact of monetary policy shock and country risk to exchange rate, to determine how monetary policy and non-economic factors affect exchange rate volatility. Moreover, in the second block, we estimate the impact of exchange rate volatility to the real sector (inflation rate).

In order to determine the differences between pre-crisis and during crisis evidence, we separate the observations into the pre-crisis period (1990:01 - 1997:07) and after the crisis period (1998:10 – 2001:04). In addition, in this study we also estimate SVAR model to address the question on how monetary policy is transmitted all the way to the real sector through exchange rate channel. For this purpose, we combine SVAR models in block 1 and block 2 into one SVAR model. Unfortunately, the data constraint limits us to estimate the phenomenon after crisis, and thus in this study we only estimated the combined model for the pre-crisis period (1990.1-1997.07).

Model Specification

Variable ordering (see figure 1) applied in the SVAR model estimated in this study are expressed as follows :

Block 1.

SBI rate shock → Interest rate diff → Capital Flows → Exchange Rate (1)

Country risk → Interest rate diff → Capital Flows → Exchange Rate (2)

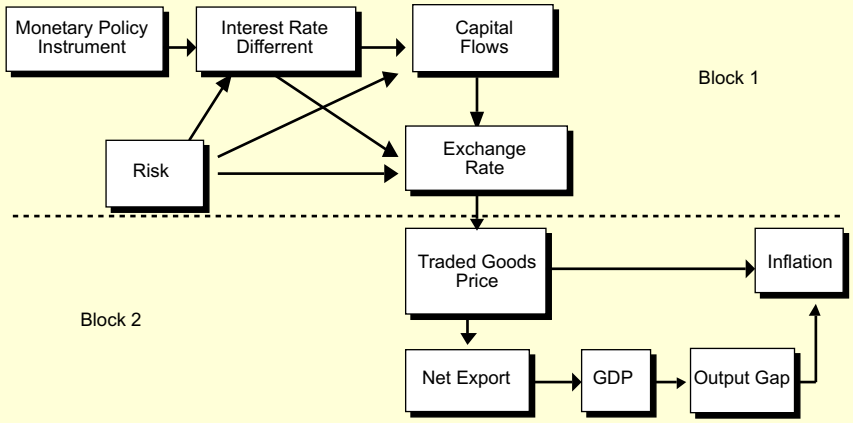
According to the ordering in equation (1) and (2), SVAR model estimated in this paper are specified as :

Model 1A: Xt = (RSBI1)
Yt = (IDIFF, NFA, DEP_YOY)

Model 1B: Xt = (DEP_YOY)
Yt = (RSBI1, IDIFF)

Model 2: Xt = (COUNT_RISK)
Yt = (IDIFF, NFA, DEP_YOY)

Figure 5.1 Exchange Rate Channel Framework



Block 2.

Exchange rate changes → Tradable goods prices → Inflation (3)

Exchange rate changes → Exports → Real GDP growth inflation (4)

According to the ordering in equation (3) and (4) , SVAR models estimated in block 2 described as follows:

Model 3 Yt = (TRP, INF_YOY)
Xt = (DEP_YOY)

Model 4 Yt = (XNET, GDPR_YOY, INF_YOY)
Xt = (DEP_YOY)

SBI rate shock → Interest rate diff → Exchange rate → Tradable good prices → Inflation (5)

Model 5 Yt = (IDIFF, DEP_YOY, TRP, INF_YOY)
Xt = (RSBI1)

SBI rate shock → Interest rate diff → Exchange rate → Net exports → GDP Growth → Inflation rate (6)

Model 6 Yt = (DEP_YOY, XNET, GPDBR_YOY, INF_YOY)
Xt = (RSBI1)

The above SVAR models were estimated using Cholesky decomposition method. This is because this method has already satisfied the $(n^2-n/2)$ criteria. Therefore, the model results are exactly identified and can be estimated using Full Information Maximum Likelihood (FIML) with the assumption that structural errors are normal.

ESTIMATION RESULTS

Estimation results are divided into two periods i.e.: before crisis and during crisis period. We use Chow forecast test to find out whether structural break occurred within this estimation period. Chow test result (attachment 1) tells us that after August 1997 structural changes took place. We omit some observation period (September 1997 to September 1998) when the economic condition in Indonesia was very unstable. Stability test and Granger causality test were also taken before we run Structural VAR model (attachment 2 and 3). Granger causality test is important to detect the right order of variables which will influence the result of VAR estimation.

The Effects of a Monetary Policy Shock on the Exchange Rate

Pre-Crisis Period :

Model 1 : SBI rate shock → Interest rate diff. → Capital flows → Exchange rate

Graph 5.1. shows the effects of SBI rate shock on interest rate differential, capital flows and exchange rate. A monetary tightening is characterized by an increase in SBI rate. This policy causes domestic deposit rate to rise, and therefore, given foreign interest rate, there is an immediate response of increasing interest rate differential. During this period, increasing interest rate differential effectively attracted capital inflows, supported by stable and favorable economic condition. However, large capital inflows did not cause the exchange rate to appreciate, as during the period monetary authorities, under the managed floating regime, maintained the exchange rate within the band with a certain target of depreciation to preserve the international competitiveness. Instead of appreciation, monetary policy tightening was responded by persistent depreciation of rupiah exchange rate after 3 months of time lag. In this case the variability of exchange rate is very much controlled by foreign exchange intervention rather than through open market operation. This was reflected in the variance decomposition of exchange rate which indicate that shock of SBI rate is only contribute less than 6 percent of exchange rate variability in one year.

Model 2 : Country risk shock → Interest rate diff. → Capital flows → Exchange rate

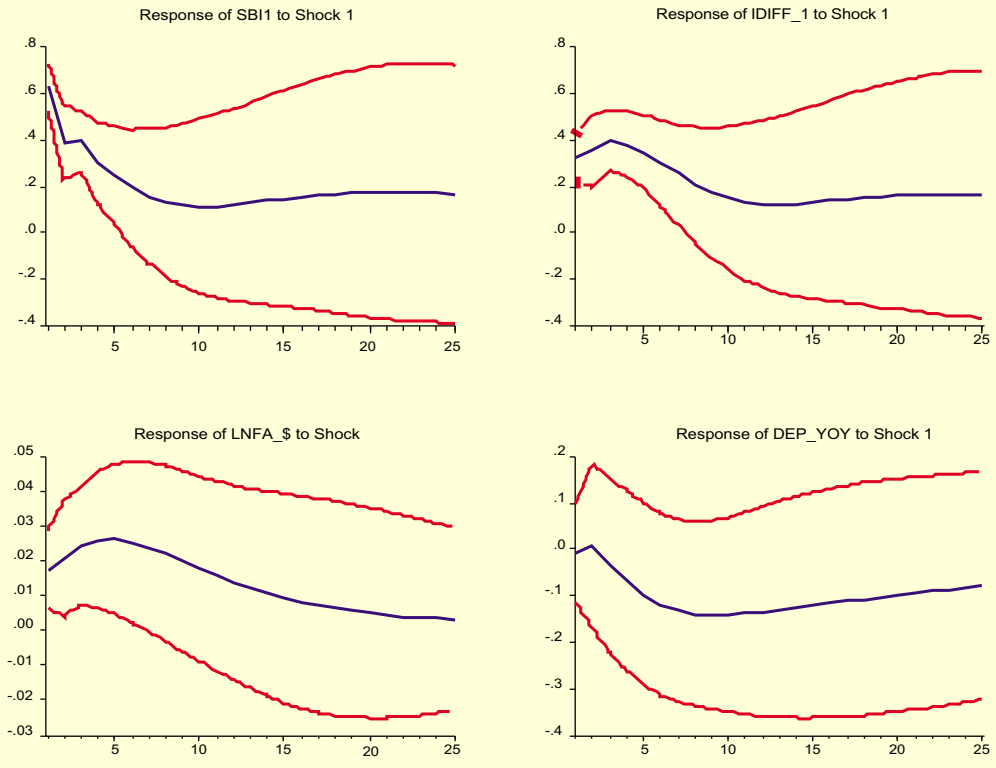
In order to assess the impact of country risk to the rupiah exchange rate, Graph 5.2. shows that improvement in country risk was responded by immediate increase in capital inflows

Table 5.1 Variance Decomposition of Exchange Rate: Model 1 (Pre Crisis)

Period	S.E.	Shock1 SBI rate	Shock2 Idiff	Shock3 capital flows	Shock4 exchange rate
1	0.474323	0.021141	0.222402	3.342533	96.41392
2	0.780966	0.012875	1.283546	1.251234	97.45235
3	1.000188	0.141462	1.813203	0.873064	97.17227
4	1.150978	0.454238	1.927354	1.119432	96.49898
5	1.254817	0.994205	1.812549	1.766104	95.42714
10	1.499234	4.770490	1.597456	7.471204	86.16085
15	1.614796	7.356722	2.191442	12.00373	78.44811
20	1.682729	8.823008	2.590917	14.71129	73.87478
25	1.723702	9.696673	2.837915	16.31526	71.15016

Graph 5.1
Impulse Response to SBI rate shock : Model 1 (Pre-Crisis)

Response to Structural One S.D. innovations ± 2 S.E.



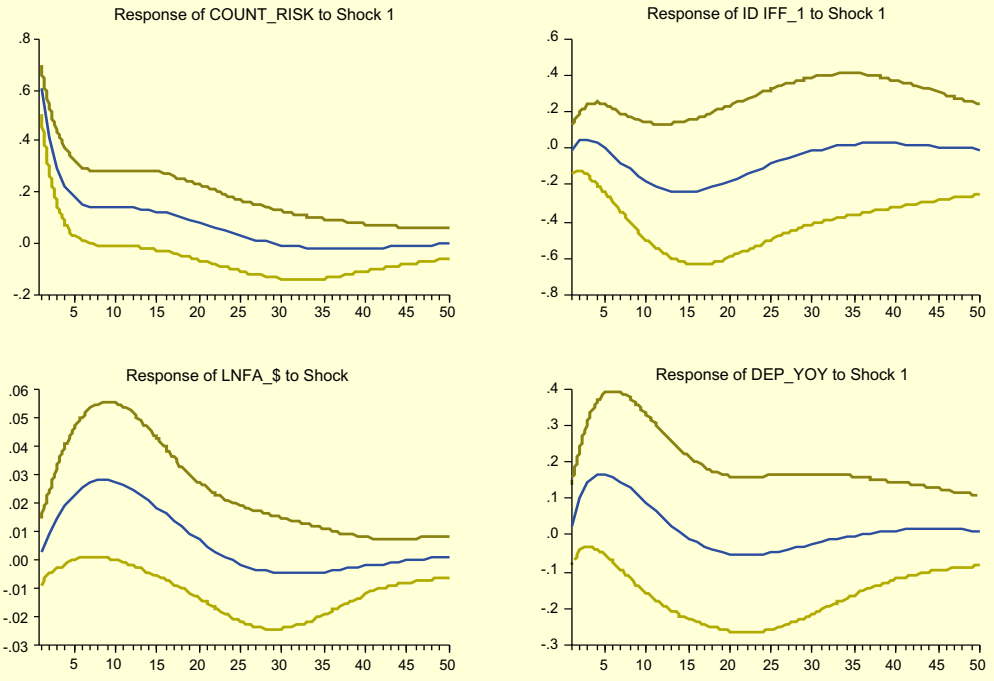
and exchange rate appreciation. Nevertheless, the shock of country risk only contributed less than 8 % to the variability of exchange rate in one year.

Table 5.2 Variance Decomposition of Exchange Rate : Model 2 (Pre-Crisis)

Period	S.E.	Shock1 (country risk)	Shock2 (interest dif)	Shock3 (capital flow)	Shock4 (exchange rate)
1	0.488806	0.300257	0.696177	2.751511	96.25205
2	0.693216	2.213198	0.821477	1.460812	95.50451
3	0.850452	4.249572	1.044097	1.087433	93.61890
4	0.980259	5.929872	1.379576	1.339475	91.35108
5	1.089735	7.137309	1.841029	2.010780	89.01088
10	1.441109	8.095999	6.116414	7.779092	78.00850
15	1.624341	6.637220	12.35584	12.55736	68.44958
25	1.807557	5.997862	21.74267	14.59225	57.66722

Graph 5.2
Impulse Response to Country Risk Shock (Pre Crisis)

Response to Structural One S.D. innovations ± 2 S.E.



During Crisis Period

Monetary policy tightening as indicated by increasing SBI rate had significant and immediate impact on increasing interest rate differential. However, such an increase in interest rate differential in favor of domestic interest rate was only responded by a small rise in capital inflows and depreciation of exchange rate. High interest rate differential in favor of domestic rate failed to attract capital inflows due to crisis of confidence. During this period, shock of SBI rate had a dominant contribution (around 60%) to exchange rate variability. However, the impact of shock SBI rate on the exchange rate was confusing, as SBI rate shock was only responded by small appreciation of rupiah after 7 months, and its cumulative impact was negative.

Graph 5.3. Impulse Response to SBI Rate Shock : Model 1 (Crisis Period)

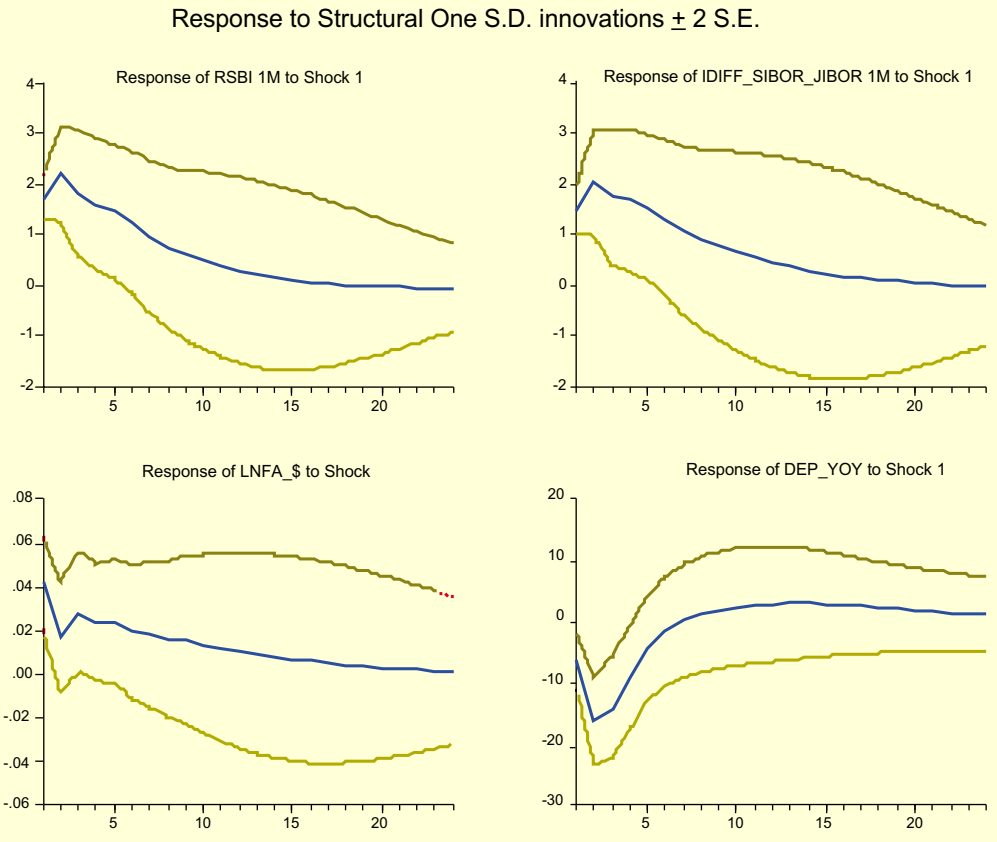


Table 5.3. Variance Decomposition of Exchange Rate : Model 1 (Crisis Period)

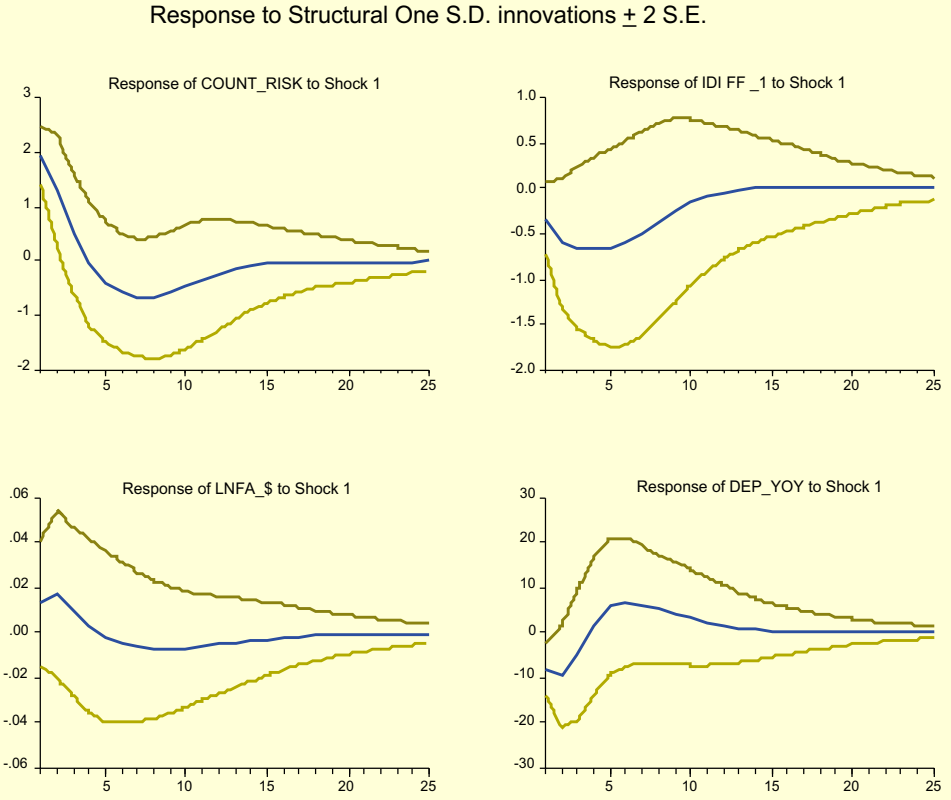
Period	Shock1 SBI rate	Shock2 Interest Dif.	Shock3 capital flows	Shock4 exchange rate
1	5.462136	0.503751	25.66666	68.36745
2	38.94116	2.947953	21.22439	36.88650
3	48.22996	5.322129	15.87663	30.57129
4	49.34403	6.404442	14.58798	29.66355
5	48.66131	6.429347	15.11410	29.79524
10	49.06280	10.02248	15.41954	25.49518
15	49.81778	10.54335	14.99023	24.64865
20	49.81188	10.55045	14.99916	24.63852
25	49.81761	10.56325	14.99935	24.61979

Table 5.4
Variance Decomposition of Exchange Rate : Model 2

Period	Shock1 SBI rate	Shock2 IDIFF	Shock3 capital flows	Shock4 exchange rate
1	27.22595	0.383349	5.988324	66.40238
2	21.37290	12.28199	25.76624	40.57886
3	17.24273	18.79713	31.19549	32.76465
4	15.32052	18.70334	36.68597	29.29017
5	16.64998	17.21243	39.10605	27.03154
10	22.16095	14.91101	40.98601	21.94203
15	22.36129	15.03701	40.96852	21.63318
20	22.34775	15.06794	40.97810	21.60620
25	22.34848	15.07695	40.97393	21.60064

On the contrary, shock of country risk also plays important role (around 20%) in the exchange rate variability. As expected, improvement in country risk was responded by rupiah appreciation after 4 months. The exchange rate continued to appreciate for 12 months and its cumulative response was positive.

Graph5.4
Impulse Response to Country Risk Shock : Model 2 (Crisis Period)



The Effects of Exchange Rate Shock on Inflation Rate

Pre-Crisis Period

Direct Passthrough Effect

Model 3 : Exchange rate shock → Tradable good prices → Inflation

SVAR model tells us that before crisis period when Indonesia implemented managed floating exchange rate, direct passthrough effect of exchange rate to inflation rate was very weak. The inflation rate was not significantly influenced by exchange rate movements. This

fact is understandable since under managed floating system, expected depreciation was predictable, therefore the economic agents had already considered it when setting their business plan.

Nevertheless, the tradable good prices have relatively high contribution to the variability of inflation rate. This explains the important role of import goods prices in determining inflation rate.

Table 5.5 Variance Decomposition of Inflation: Direct Passthrough

Period	Shock1 (exchange rate)	Shock2 (TRP)	Shock3 (Inflation)
1	6.305538	71.863666	21.830795
2	11.64194	76.511530	11.846526
3	9.364390	81.174455	9.4811546
4	7.421366	83.547404	8.9312299
5	7.631634	83.442719	8.9256459
10	17.36059	72.780339	9.8590645
15	16.41286	68.682914	14.904228
20	21.06792	64.767743	14.164337

Indirect Passthrough Effect

Model 4 : Exchange rate shock → Net exports → GDP growth→Inflation

As reflected in table 5.6, under managed floating system, exchange rate shock did not have significant impact on net export, GDP growth and inflation rate. This response indicates that indirect passthrough effect of the exchange rate to inflation rate did not work well. Exports and GDP growth during managed floating before crisis were very much supported by favorable investment climate and stable exchange rate. Meanwhile inflation rate was more determined by changes in administered prices due to government policies adjustments in income and prices.

TRANSMISSION MECHANISM

Direct Passthrough Effect

Model 5 : SBI rate shock → Interest rate differential → Exchange rate → Tradable goods prices→ Inflation

Table 5.6 Variance Decomposition Model 4 (Pre-Crisis)
Response to Exchange Rate Shock

Response to Exchange Rate Shock

Period	1	5	10	15	20	25
Exchange rate	100.00	87.57	86.90	83.84	82.84	82.65
Net Exports	0.34	3.05	6.66	8.20	8.45	8.45
GDP Growth	5.92	6.29	6.64	6.68	6.77	6.81
Inflation	3.62	7.58	7.45	12.11	14.84	15.38

Graph 5.5 shows that increasing SBI rate was responded by increasing interest rate differential and small appreciation of exchange rate started from lag 2. These responses was followed by decreasing tradable goods prices and inflation rate immediately and reach the maximum spike at lag 8 before its effect diminished and faded after 25 months. The accumulated response of exchange rate and inflation rate to SBI rate shock was very small, indicating that in the period of managed floating rate economic agent was easy to predict the expected depreciation, therefore the impact of the shock to inflation rate was relatively small.

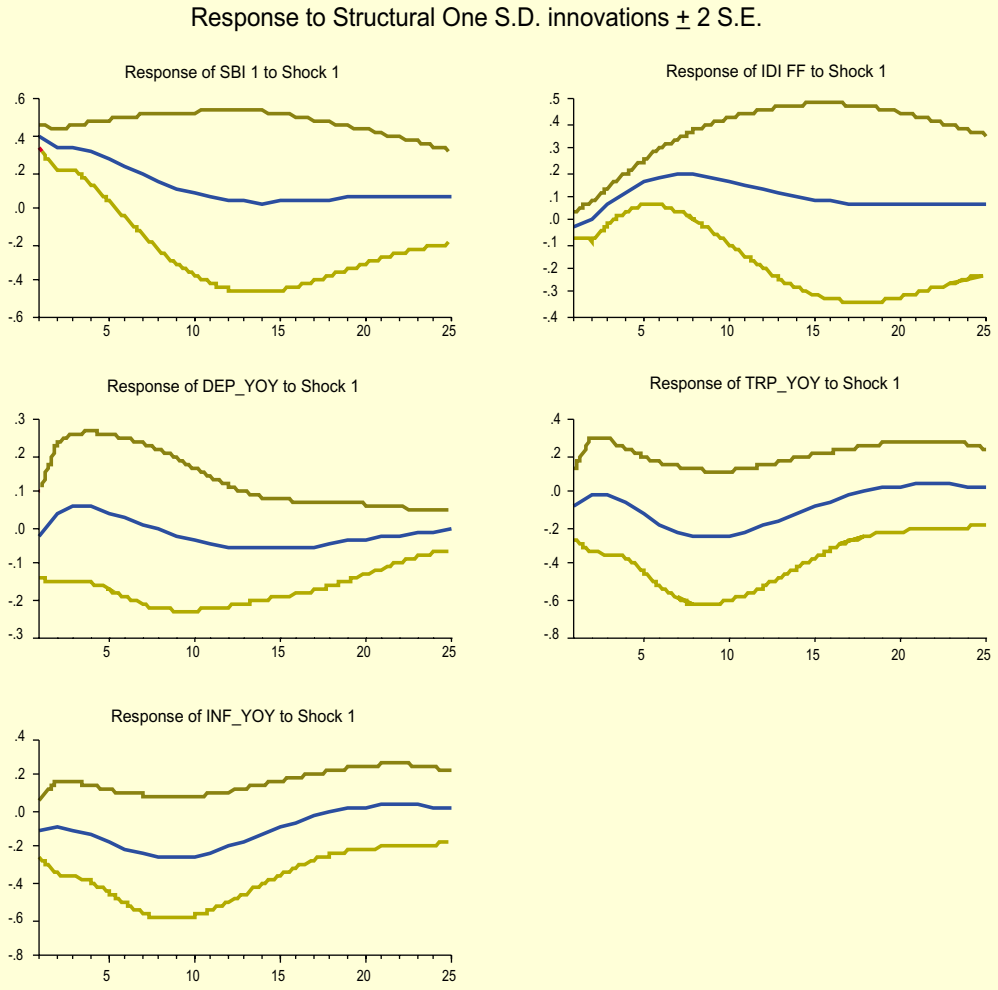
Variance decomposition also shows very small contribution of interest rate shock to variability of exchange rate (less than 1%)and inflation rate (about 9% in 12 months). The variability of inflation rate was influenced more significantly by tradable good prices changes. This proves that during pre-crisis period under managed floating system, the exchange rate channel of monetary policy transmission to the inflation rate worked very weak.

Indirect Passthrough Effect

Model 6 : SBI rate shock → Interest rate differential → Exchange rate → Net export → GDP Growth → Inflation

As explained by graph 5.6, shock of SBI rate only had an impact on interest rate differential after two months lag. However, since the variability of exchange rate was maintained closely, the changes of monetary policy through the SBI rate did not affect the exchange rate. In turn, net export and GDP growth, as well as inflation rate were also not significantly affected as their accumulated response to SBI rate shock were very small.

Graph 5.5 Impulse Response of Model 5 (Pre-Crisis)
Transmission Mechanism : Direct Passthrough Effect



The coefficient of variance decomposition also suggests relatively weak contribution of SBI shock to the variability of exchange rate. In turn, the impact of SBI rate shock to the inflation rate through aggregate demand was very weak. In the short period, SBI shock only contribute 0.5% to the inflation rate, while in the longer time the relative contribution of SBI rate shock increased but only to 10%. This facts tell us that under managed floating system, monetary transmission mechanism through indirect passthrough was also very weak, even weaker than through direct passthrough.

Table 5.7. Variance Decomposition of Inflation (Pre-Crisis)

Period	S.E.	Shock 1 SBI	Shock 2 IDIFF	Shock 3 Nilai Tukar	Shock 4 Trad. Price	Shock 5 Inflation
1	0.69462	2.047478	0.004412	4.664851	69.68663	23.59663
2	1.094044	1.488915	0.18412	7.837362	76.51927	13.97033
3	1.354573	1.514123	0.216494	6.821784	80.23118	11.21642
4	1.519067	1.885785	0.204242	5.480891	81.84694	10.5826
5	1.64953	2.604206	0.189458	7.296551	79.52265	10.38713
6	1.780247	3.580876	0.185465	12.68999	73.56388	9.979793
7	1.911758	4.666596	0.207196	19.42923	66.35881	9.338175
8	2.029778	5.745191	0.267135	25.34597	59.97897	8.662743
9	2.122313	6.758264	0.368912	29.52564	55.24632	8.100865
10	2.185607	7.67533	0.508388	31.94864	52.16521	7.702433
15	2.276116	9.862247	1.32912	32.9091	48.73169	7.167837
25	2.476311	8.489656	1.40583	42.18427	41.76124	6.159012

Table 5.8 Variance Decomposition of Inflation (Pre crisis)
(Transmission Mechanism : Indirect Pass through Effect)

Period	Shock 1 SBI	Shock 2 IDIFF	Shock 3 Nilai Tukar	Shock 4 Net Ekspor	Shock 5 PDB	Shock 6 Inflasi
1	0.020341	0.184727	3.053331	0.057443	3.60E-05	96.68412
2	0.515615	0.656183	5.459295	0.143307	0.143307	92.72422
3	0.570267	0.734664	5.076172	1.263937	0.383055	91.97191
4	0.623115	0.628209	4.095088	1.64891	0.374245	92.63043
5	0.634011	0.55017	4.667684	2.033899	0.450588	91.66365
10	0.597348	0.476308	23.32079	1.808827	9.802486	63.99424
15	1.600658	1.022966	30.58485	2.37064	10.3943	54.02659
20	2.338475	1.27165	30.24117	2.879806	10.57191	52.69698
25	2.238321	1.259397	35.31467	2.65448	11.07645	47.45652

During Crisis Period (1998.10 to 2001.04)

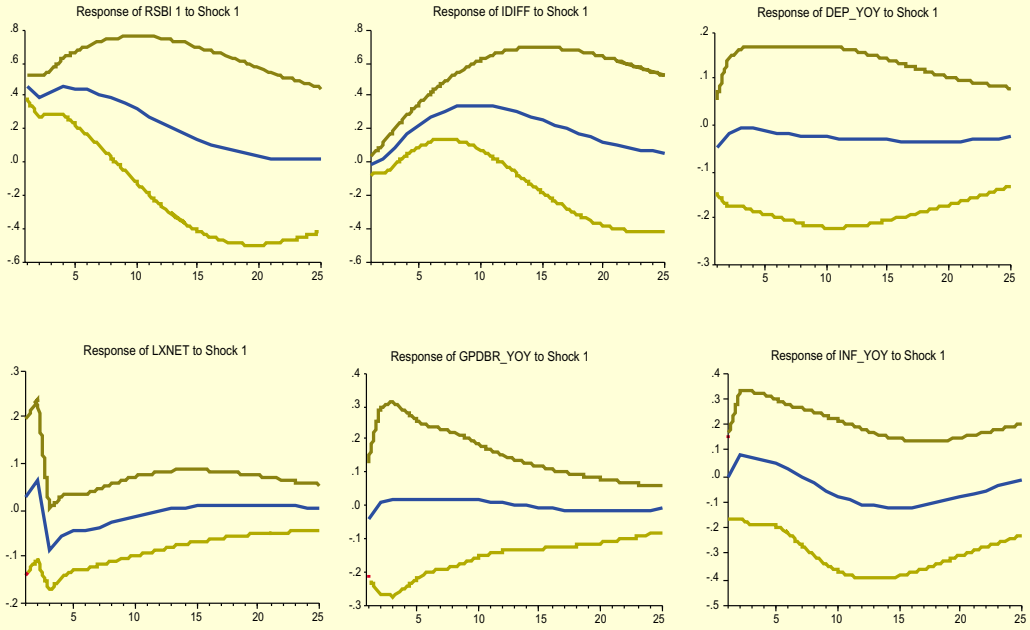
A. Direct Pass-through Effect

Model 3 : Exchange rate shock → Tradable goods prices → Inflation rate

SVAR estimation model during crisis period proves us that exchange rate shock had negative impact on inflation rate which was transmitted directly through tradable goods price. The impulse response graph shows that tradable good prices and inflation rate were very responsive to the exchange rate changes.

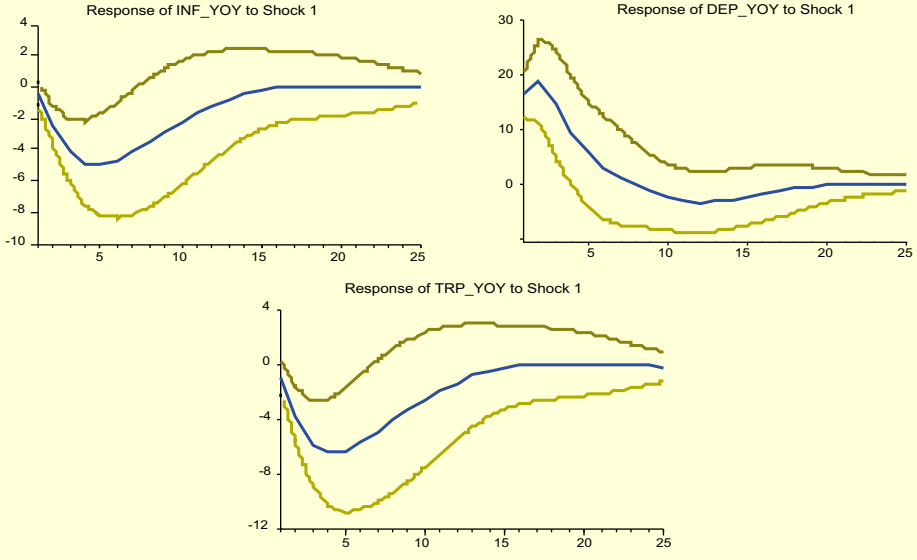
Graph 5.6 Impulse Response of Model 6 (Pre-Crisis)
Transmission Mechanism : Indirect Passthrough Effect

Response to Structural One S.D. innovations ± 2 S.E.



Graph. 5.7
Impulse Response to Exchange Rate Shock Model 3 (Crisis Period)

Response to Structural One S.D. Innovations ± 2 S.E.



A shock of exchange rate appreciation was responded immediately since the first month by persistent declining tradable good prices and decreasing inflation rate. The maximum response achieved at the 5th month before its response diminished and vanished after 15 months lag. The significant response of inflation rate to exchange rate shock is further confirmed by the coefficient of variance decomposition which indicates that exchange rate and tradable good prices have had dominant contribution to the variability of inflation rate during the implementation of floating exchange rate. This evidence proves the existence of significant direct passthrough effect of exchange rate to inflation rate during the implementation of free-floating exchange rate.

Indirect Passthrough Effect

Model 4 : Exchange rate shock → Net export → GDP growth → Inflation rate

Indirect passthrough effect also worked well during the crisis period. Net export responded positively since the third month to the exchange rate appreciation, and its effect started to diminished after the sixth month. Appreciation caused import goods to become cheaper and to a certain extent support the export activities. This favorable impact on the net export leads to positive impact on GDP growth to exchange rate appreciation since the first month. However, the increasing growth of GDP does not cause increasing inflation rate as the actual GDP has not reached its full employment rate.

The indirect pass-through effect of the exchange rate shock caused the inflation to decrease since lag 2. The dominance of exchange rate contribution to the variability of inflation

Table 5.9 Variance Decomposition of Inflation

Period	Shock1 exchange rate (yoy)	Shock2 Tradable good price (yoy)	Shock3 Inflation (yoy)
1	3.36	81.68	14.96
2	38.22	57.92	3.86
3	56.62	41.81	1.56
4	64.49	34.62	0.88
5	67.17	35.10	0.72
10	58.84	36.41	4.75
15	55.02	38.34	5.64
20	55.02	38.41	6.72
25	54.86	38.41	6.73

Graph 5.8
Impulse Response to the Exchange Rate Shock Model 4 (Crisis Period)

Response to Structural One S.D. Innovations ± 2 S.E.

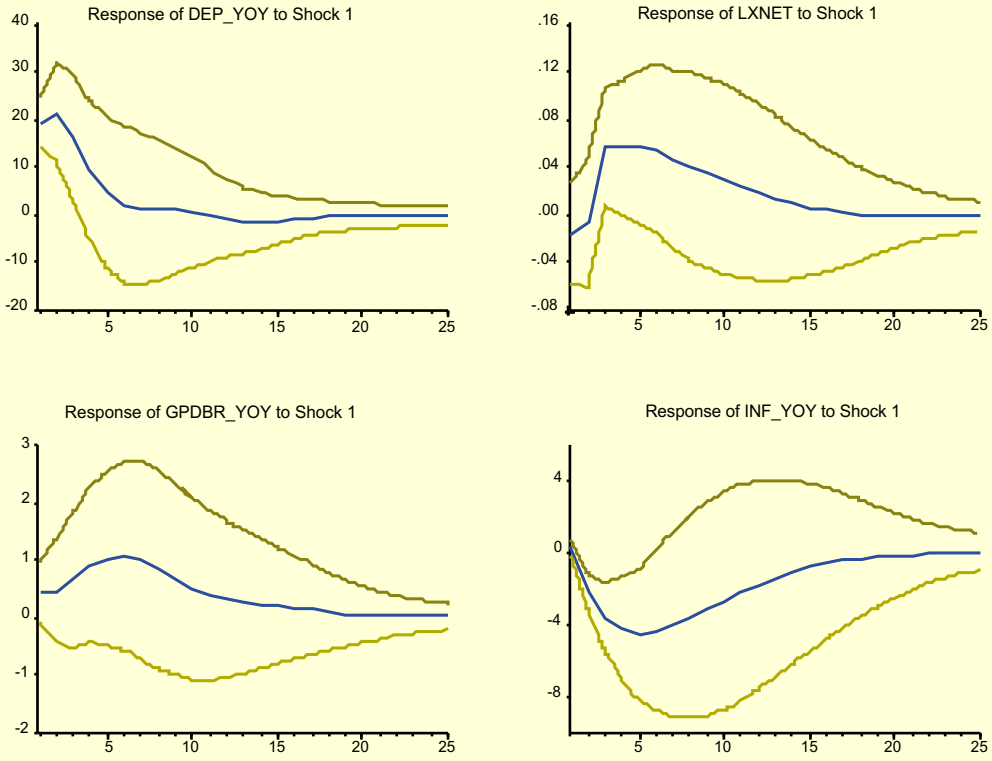


Table 5.10 Variance Decomposition of Inflation (Crisis Period)

Period	Shock1 Exchange rate (yoy)	Shock2 Net Export	Shock3 GDP Growth	Shock4 Inflation (yoy)
1	5.13	0.00	0.21	94.66
2	52.83	3.49	21.64	22.04
3	62.69	1.27	26.20	9.83
4	64.28	0.84	27.51	7.37
5	64.55	0.66	28.58	6.20
10	66.87	0.46	27.01	5.66
15	67.50	1.41	25.52	5.57
20	67.22	1.92	25.29	5.57
25	67.11	2.07	25.25	5.56

is reflected in table 5.10. All these evidence proves that indirect passthrough effect during the implementation of free floating system works significantly but in lesser degree than direct passthrough effect.

EVIDENCES FROM SURVEY

Surveys to the three sectors of economic agents were undertaken to confirm the SVAR estimation result of monetary policy transmission mechanism through exchange rate channel, especially for the current period. Banking sector, companies and households are three economic agents which complement to each other in undertaking their activities. The response of exchange rate to monetary policy changes could be reflected in banking sectors' reaction. Furthermore, the banking sectors will transmit the impact of monetary policy to the real sector through companies and households.

The result of banking sector survey indicates that monetary policy changes through SBI rate could have impact on the exchange rate with less degree than foreign exchange intervention.

Almost all companies are very concerned with the movements of rupiah exchange rate for setting their output price, regardless of the extent of import contents in their production. Exchange rate has a significant negative impact on the output price and the companies will react more to the exchange rate depreciation than to the exchange rate appreciation. Moreover, the households have the same expectation as the behavior of companies in setting output prices due to exchange rate changes. This reaction confirms the strength of pass though effect of the exchange rate to inflation. Details of the results are as follows :

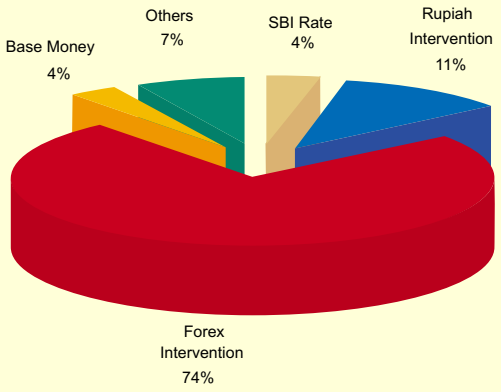
Banking Sectors

Banking sectors indicates that non-economic factors and interaction between supply and demand of foreign exchanges and regional development of exchange rate are the most important factors that determine the movement of rupiah exchange rate.

Most banks view that foreign exchange intervention is the most powerful monetary policy in influencing the exchange rate in the market. Only few banks consider that SBI rate policy could affect the exchange rate (Graph 5.9). If we put in order from the most effective to the lesser ones, the type of monetary policies that have impacts on the exchange rate would be as follows : (i) foreign exchange intervention (2) SBI rate and (3) rupiah intervention. This condition implies that in the current period, Bank Indonesia

can not rely so much on open market operation instruments, including SBI rate, to affect exchange rate. High interest rate would not attract the foreign capital inflow because of persisting high risk premium of Indonesian economy which was reflected in high swap premium.

Graph 5.9
Bank's First Choice of Monetary Policy to Influence Exchange Rate



Kendall's W-Test
Rank Order of Monetary Policy to Affect Exchange Rate

Policy Instrument	Mean Rank
SBI Rate	2.77
Rupiah Intervention	2.94
Forex Intervention	1.5
Base Money	3.77
Others	4.02

Companies' Response of Output Price to Exchange Rate Changes

Almost all companies (93%) are concerned with the movement of rupiah exchange rate, regardless of their business activities. Manufacturing and trading companies have their concerns on the exchange rate changes as they use large portion of imported raw materials for their production.

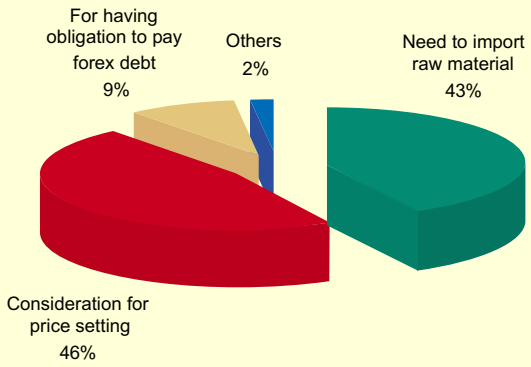
Both companies and others also relates the development of exchange rate to their price setting, although not all of them have import content in their products. Consequently, around 63% of the companies will increase their product price if there are significant depreciation in the exchange rates. However, should the exchange rate appreciate, only 45% companies will decrease their output price. This result indicates an asymmetric behavior of the companies in responding to the exchange rate changes.

The exchange rate changes will cause the output price to change less than 20%, and the price adjustment on the average takes between 1 to 2 months, but the majority of companies

Tabel 5.11
Companies Concern on Exchange Rate Changes According Percentage of Import Content

Import Content		Business Activity					Total
		Agriculture	Manufacture	Trade	Construction	Others	
< 20%	Count	2.0	1.0	5.0	4.0	2.0	14.0
	% within Bussines Activity	50.0	2.0	19.2	36.4	20.0	13.9
20% - 40%	Count		14.0	6.0	2.0	2.0	24.0
	% within Bussines Activity		28.0	23.1	18.2	20.0	23.8
40% - 80%	Count	1.0	17.0	1.0	3.0		22.0
	% within Bussines Activity	25.0	34.0	3.8	27.3		21.8
60% - 80%	Count		10.0	3.0	1.0	3.0	17.0
	% within Bussines Activity		20.0	11.5	9.1	30.0	16.8
> 80%	Count	1.0	8.0	11.0	1.0	3.0	24.0
	% within Bussines Activity	25.0	16.0	42.3	9.1	30.0	23.8
Total	Count	4.0	50.0	26.0	11.0	10.0	101.0
	% within Bussines Activity	100.0	100.0	100.0	100.0	100.0	100.0

Graph 5.10
Companies Concern on Exchange Rate Changes



Tabel 5.12 Price Adjustment of Companies to Exchange Rate Changes

Import Content		Business Activity					Total
		Agriculture	Manufacture	Trade	Construction	Others	
< 20%	Count	2.0	25.0	22.0	12.0	6.0	67.0
	% within Bussines Activity	50.0	55.6.0	64.7	70.6	66.7	61.5
20% - 40%	Count	2.0	18.0	9.0	3.0	2.0	34.0
	% within Bussines Activity	50.0	40.0	46.5	17.6	22.2	31.2
40 - 60 %%	Count		1.0	1.0	2.0	1.0	5.0
	% within Bussines Activity		22.0	2.9	11.8	11.1	4.6
> 60%	Count		1.0	2.0			3.0
	% within Bussines Activity		22.0	5.9			2.8
Total	Count	4.0	45.0	34.0	17.0	9.0	109.0
	% within Bussines Activity	100.0	100.0	100.0	100.0	100.0	100.0

Tabel 5.13 Adjusment Period of Companies to Rupiah Depreciation

Import Content		Business Activity					Total
		Agriculture	Manufacture	Trade	Construction	Others	
< 1 bln	Count	2.0	9.0	11.0	2.0	2.0	26.0
	% within Bussines Activity	100.0	37.5	42.3	15.4	50.0	37.7
1 - 2 bln	Count		7.0	7.0	3.0	1.0	18.0
	% within Bussines Activity		29.2	26.9	23.1	25.0	26.1
2 - 3 bln	Count		5.0	4.0	4.0		13.0
	% within Bussines Activity		20.8	15.4	30.8		18.8
> 3 bln	Count		3.0	4.0	4.0	1.0	12.0
	% within Bussines Activity		12.5	15.4	30.8	25.0	17.4
Total	Count	2.0	24.0	26.0	13.0	4.0	69.0
	% within Bussines Activity	100.0	100.0	100.0	100.0	100.0	100.0

Tabel 5.14 Adjusment Period of Companies to Rupiah Appreaciation

Import Content		Business Activity					Total
		Agriculture	Manufacture	Trade	Construction	Others	
< 1 bln	Count	2.0	11.0	15.0	3.0	1.0	32.0
	% within Bussines Activity	66.7	30.6	53.6	18.8	14.3	35.6
1 - 2 bln	Count	1.0	11.0	6.0	4.0	2.0	24.0
	% within Bussines Activity	33.3	30.6	21.4	25.0	28.6	26.7
2 - 3 bln	Count		9.0	3.0	4.0		16.0
	% within Bussines Activity		25.0	10.7	25.0		17.8
> 3 bln	Count		5.0	4.0	5.0	4.0	18.0
	% within Bussines Activity		13.9	14.3	31.3	57.1	20.0
Total	Count	3.0	36.0	28.0	16.0	7.0	90.0
	% within Bussines Activity	100.0	100.0	100.0	100.0	100.0	100.0

need less than 1 month to adjust their output price in response to either exchange rate appreciation or depreciation.

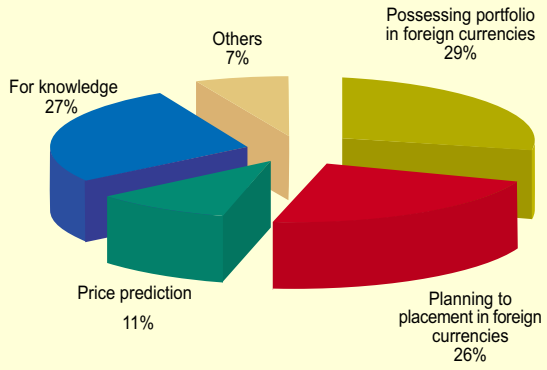
Households' Response to Exchange Rate Changes

Most of the households (70%) pay attention to the movement of the exchange rate as they are concerned with the value of their assets, and exchange rate impact on the

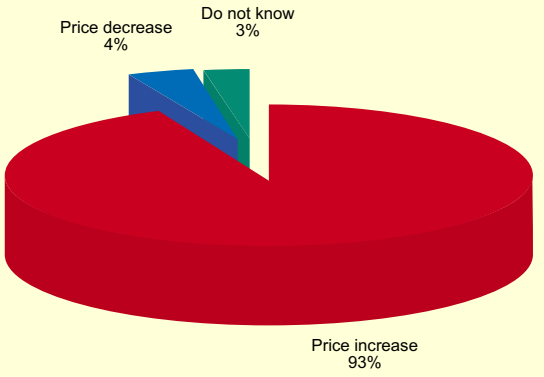
prices. 70% of observed households posses portfolio in foreign currencies especially in term of foreign currency deposits. The motives of their holding assets in foreign currencies are mostly to maintain their assets' value (41%) and to gain profits/speculative motive (42%).

Prices are very sensitive to the rupiah exchange rate changes. If rupiah depreciate against US dollar, almost all of HH (93%) expect that there will be an increase in prices and if rupiah appreciates against US dollar, 75% of HH expect a decline in prices.

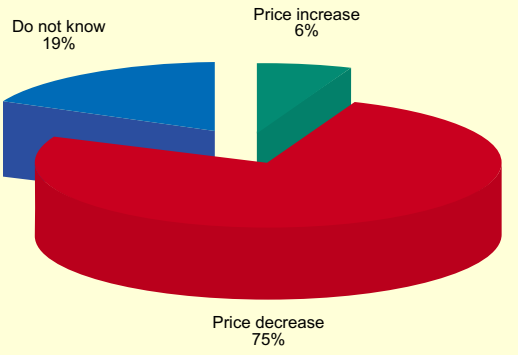
Graph 5.11
Reason for Households to Watch on Exchange Rate Changes



Graph 5.12
Households' Price Expectation Response to Exchange Rate Depreciation



Graph 5.13
Households' Price Expectation Response to Exchange Rate Apreciation



CONCLUSION

Financial and exchange rate crises that hit Indonesia since mid 1997 had caused structural changes to the domestic economy and financial system. At the same time,

monetary authorities have moved the exchange rate system from managed floating to free-floating system. As such, there have been fundamental changes on the role of exchange rate in transmitting monetary policy to the real economy and prices. This study attempts to provide empirical evidences on the exchange rate transmission mechanism for the period before and after the crisis.

Structural VAR estimation shows that during the pre-crisis period, monetary policy transmission mechanism through the exchange rate channel worked very weak. Monetary authorities' action to maintain the exchange rate movements within the band under managed floating system had kept the exchange rate relatively stable and predictable. As such, interest rate on SBI monetary instrument did not have significant impact on exchange rate, and the exchange rate was not an important determinant of inflation rate. It is worth noting, however, that during the pre-crisis period, a rise in interest rate differential followed from a tight monetary policy was effective in attracting foreign capital inflows.

On the contrary, during the implementation of free-floating system, monetary policy transmission mechanism could work better, if the market works efficiently. Unfortunately, high country risk, instability in the domestic socio-political environment, and structural changes in the banking and financial system have led to some disruptions in the working of foreign exchange market mechanism. Exchange rate movements have been driven more by technical factors, stemming from non-economic factors, than economic fundamentals. Therefore, although variance decomposition indicated that SBI rate changes contribute significantly to exchange rate variability, exchange rate response to the shock of SBI rate is still confusing. An increase in domestic interest rate fails to attract capital inflows as country risk of Indonesia is still high.

Nevertheless, under free-floating system the transmission mechanism from exchange rate to the real economy and prices becomes increasingly important. Both direct and indirect passthrough effect of exchange rate to inflation rate are very strong as exchange rate changes dominantly contribute to variability of inflation. Direct pass-through effect works instantaneously since the first month, while indirect pass-through effect started with 2 months lag. The estimation results had been confirmed by the survey result.

Accordingly, under abnormal condition of foreign exchange market that Indonesia has been experiencing so far, monetary authorities should not only depend on conventional monetary instruments (SBI interest rate or base money) to influence exchange rate. Considering that many factors influence the movements of exchange rate, both non-economic factor as well as economic fundamentals, stabilization of

rupiah exchange rate needs commitment and concerted efforts from the central bank and the Government to accelerate economic recovery and create conducive investment climate so as to restore the public confidence on Indonesian economy. Stability in the domestic social and political environment is also paramount for building market confidence.

As a final note, this paper provides preliminary results of research on exchange rate channel of monetary policy transmission in Indonesia. Further works are still needed particularly to measure the magnitude of monetary policy and exchange rate impacts on inflation rate. One agenda is to build a structural model that is able to assess the magnitude of these impacts, to complement the results from this study on relative strength of the exchange rate channel through time series analysis. Therefore, all inputs to improve the study further would be highly appreciated.

References

Bernanke B. and Blinder, A.S. (1992), The Federal Funds Rate and The Channel of Monetary Transmission Mechanism, *The American Economic Review,* September.

Blanchard, Olive Jean and Danny Quah, (1989) The Dynamic Effects of Aggregate Demand and Supply Disturbances, *The American Economic Review,* Volume 79.

Brischetto, Andrea and Graham Voss, (1999) A Structural Vector Autoregression Model of Monetary Policy in Australia, *Reserve Bank of Australia,* December.

Enders, Walter (1995) Applied Econometric Time Series, John Wiley and Sons, Inc.

Engle, Robert F., C.W.J. Granger,*(1987) Co-Integration and Error Correction: Representation, Estimation, and Testing, Econometrica, Volume 55.*

Gerlach, Stefan and Frank Smets, (1995) The Monetary Transmission Mechanism : Evidence from The G7-Countries, BIS.

Gujarati, Damodar N., (1995) Basic Econometrics, McGraw-Hill International editions.

Kakes, Jan, Monetary Transmission in Europe – The Role of Financial Markets and Credit, Edward Elgar: Cheltenhan.

Levi, Maurice D., International Finance- The Markets and Financial Management of Multinational Business, 2nd edition, McGraw-Hill Publishing Company,.

Morsink, James and Tamim Bayoumi, (1999)A Peek Inside the Black Box ; The Monetary Transmission Mechanism in Japan, *IMF Working Paper,* October.

Pindyck, Robert S. and Daniel L. Rubinfeld, (1991)Econometric Model and Economic Forecasts, 3rd edtion, McGraww-Hill, Inc.

Rivera, Francisco L-Batiz and Luis A. Rivera-Batiz, (1994) International Finance and Open Economy Macroeconomics, Macmillan Publishing Co.

Sims, Christopher A., Macroeconomics and Reality, (1980) *Econometrica,* Volume 48, Jan.

Appendix 1.
Chow Test Result For Structural Break Test

Chow Forecast Test: Forecast from 1997:08 to 2000:12			
F-statistic	15.25576	Probability	0.000000
Log likelihood ratio	272.5058	Probability	0.000000
Chow Forecast Test: Forecast from 1997:09 to 2000:12			
F-statistic	13.50870	Probability	0.000000
Log likelihood ratio	255.7115	Probability	0.000000
Chow Forecast Test: Forecast from 1997:12 to 2000:12			
F-statistic	14.19307	Probability	0.000000
Log likelihood ratio	248.2757	Probability	0.000000
Chow Forecast Test: Forecast from 1997:08 to 2000:12			
F-statistic	15.25576	Probability	0.000000
Log likelihood ratio	272.5058	Probability	0.000000
Chow Forecast Test: Forecast from 1998:01 to 2000:12			
F-statistic	14.60134	Probability	0.000000
Log likelihood ratio	246.9232	Probability	0.000000
Chow Forecast Test: Forecast from 1998:09 to 2000:12			
F-statistic	11.76037	Probability	0.000000
Log likelihood ratio	190.5336	Probability	0.000000
Chow Forecast Test: Forecast from 1998:08 to 2000:12			
F-statistic	11.24499	Probability	0.000000
Log likelihood ratio	190.8160	Probability	0.000000
Chow Forecast Test: Forecast from 1998:10 to 2000:12			
F-statistic	12.34881	Probability	0.000000
Log likelihood ratio	190.5221	Probability	0.000000

Appendix 2.

Granger Causality Test Result

Granger Causality Test Result

		PRE CRISIS	DURING CRISIS	
Granger		01/1993 - 07/1997*	08/1997 - 09/1998 **	10/1998 - 04/2001***
		Granger causality lag	Granger causality at lag	
SBI	IDIFF	1, 6 - 11	-	4 - 8
IDIFF	SBI	1, 2, 17, 18	-	2 - 9
SBI	NFA	1, 16 - 18	-	1, 3 ,7
NFA	SBI	1, 2	-	9, 11 - 13
SBI	Depr yoy	-	-	2, 3, 8 - 12, 14
Depr yoy	SBI	1 - 8	-	7 -12, 14
IDIFF	NFA	7 - 11	1	9 - 14
NFA	IDIFF	18	-	1, 12
IDIFF	Depr yoy	18	-	8 - 13
Depr yoy	IDIFF	1 - 3	-	4, 5, 7 - 9
NFA	Depr yoy	1, 2	-	1, 2, 4, 6 - 9
Depr yoy	NFA	4	-	4, 6, 8, 9

* Test to lag 18
** Test to lag 6
*** Test to 14

Appendix 3.

Accumulated Response to Monetary Policy Shock - Pre Crisis

Accumulated Response to Monetary Policy Shock – Pre Crisis

	Variable		Accumulated Respons			
	Respons	Shock	3	6	12	24
Model 1A	Exchange Rate	SBI	-0.0379	-0.03229	-1.1524	-2.423
Model 2A	Exchange Rate	Risk	0.2682	0.7573	1.3386	0.9672
Model 3	Inflation *)	Exchange Rate	0.6841	0.0022	-1.2701	1.0282
Model 4	Inflation	Exchange Rate	0.6869	1.1012	0.3200	-1.4875
Model 5	Exchange Rate*)	SBI	0.2019	0.0636	-0.3999	0.0748
	Inflation*)	SBI	-0.7856	-2.2178	-2.5665	-0.2883
Model 6	Exchange Rate	SBI	-0.0672	-0.1044	-0.2561	-0.6554
	Inflation	SBI	0.1396	0.2783	-0.0915	-0.0566

*) Direct Pass Through

Accumulated Response to Monetary Policy Shock - During Crisis

Accumulated Response to Monetary Policy Shock – During Crisis

	Variable		Accumulated Respons			
	Respons	Shock	3	6	12	24
Model 1A	Exchange Rate	SBI	-36.8457	-52.7691	-42.5559	-7.7401
Model 2A	Exchange Rate	Risk	-22.447	-8.2322	14.9469	19.5152
Model 3	Inflation *)	Exchange Rate	-5.5636	-18.7894	-36.3659	-41.7825
Model 4	Inflation	Exchange Rate	-6.8835	-21.3589	-37.2189	-38.3146

Chapter 6

Monetary Policy Transmission Through Inflation Expectation Channel

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Diah Esti Handayani *

INTRODUCTION

Inflation expectation is one of the key channels in monetary policy transmission mechanism as it plays a crucial role in increasing market appreciation of the current and future inflation. Monetary policy and economic development can influence the formation of expected inflation, which in turn will affect the behavior of economic agents. Theoretically, the change in behavior will be reflected in investment and consumption decisions and thus will influence change in aggregate demand and inflation, as well as on price and wage setting. For Indonesian case, inflation expectation is also paramount for monetary policy making. This is even so since structural change in the Indonesian economy due to economic crisis has driven the significant development of expected inflation. Hence, expected inflation is assumed having a greater role in economic agents behavior. This paper will study factors affecting, establishment of expected inflation and the role of expected inflation channel in the transmission process. Basically, monetary transmission through expected inflation is inter-related to other transmission channels.

Establishment of expected inflation is influenced by factors that are interconnected. Difficulty to identify which factor is exogenous or endogenous indicated a need to conduct a research giving symmetrical treatment of each variable. This symmetrical treatment is done

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through development of a structural function that test both exogenous and endogenous variable. Method used in this paper is structural vector autoregression (SVAR). SVAR is used to determine the role of a shock in a variable towards all variables including itself.

METHODOLOGY

Following other studies, this paper employs SVAR (structural vector autoregression) in assessing the mechanism of expectation transmission channel in Indonesia. SVAR is a variant of the VAR method in which all variables are assumed to be endogenous as well as exogenous. SVAR method requires minimum restriction of endogenous variable. It also possesses an impulse response and variance decomposition facility to measure the shock effect of one variable towards other variables and to identify the role of each variable in the monetary transmission process. However, SVAR methodology also has limitations such as the model's sensitivity towards number of lags and restrictions to be determined.

SVAR model using two variables can be illustrated as follows:

$$y_t = b_{10} - b_{12} z_t + \gamma_{11} y_{t-1} + \gamma_{12} z_{t-1} + \varepsilon_{yt} \quad (1)$$

$$z_t = b_{20} - b_{21} y_t + \gamma_{21} y_{t-1} + \gamma_{12} z_{t-1} + \varepsilon_{zt} \quad (2)$$

Note: y is the first variable and z is the second; b_{12} is contemporaneous effect of a change in variable Z to variable y; γ_{12} shows one unit change of z_{t-1} to y; and e shows white noise disturbance (uncorrelated).

Using matrix algebra, the equation above can be rewritten as follows:

$$\begin{bmatrix} 1 & b_{12} \\ b_{21} & 1 \end{bmatrix} \begin{bmatrix} y_t \\ z_t \end{bmatrix} = \begin{bmatrix} b_{10} \\ b_{20} \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ z_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{zt} \end{bmatrix}$$

$$\mathbf{B}x_t = \Gamma_0 + \Gamma_1 x_{t-1} + \varepsilon_t$$

Inverting the estimation result with B^{-1} will obtain the standard model of VAR:

$$x_t = A_0 + A_1 x_{t-1} + \varepsilon_t \quad (3)$$

Where : $A_0 = B^{-1} G_0$; $A_1 = B^{-1} \Gamma_1$; $e_t = B^{-1} \varepsilon_t$

$$\sum_{\varepsilon} = 1/T \sum_{i=1}^{T} (Be_t)(e_t' B') = B \sum B'$$

Where

$$\sum_{\varepsilon} = \begin{bmatrix} \mathrm{Var}(\varepsilon_1) & 0 \\ 0 & \mathrm{Var}(\varepsilon_1) \end{bmatrix} \quad \sum = \begin{bmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{21} & \sigma_2^2 \end{bmatrix} \text{ dan } B = \begin{bmatrix} 1 & b_{12} \\ b_{21} & 1 \end{bmatrix}$$

To gain a structural model from VAR estimation we need to make $(n\text{-}n^2)/2$ restrictions in matrix B. Restriction to structural shocks is known as orthogonalization. This is done by assuming the existence of an independent error (pure shock) in each variable. The B matrix's restriction is done by a causal ordering method used by Sims (1980). Thus the structural equation for y_t is:

$$y_t = \mu_0 + A_y(L)\varepsilon_{yt} + A_z(L)\varepsilon_{zt}$$

Monetary transmission policy through expected inflation is tested using impulse response and variance decomposition.

Considering the significant influence of economic crisis on inflation expectation, this paper focuses only on the crisis period (1997:07 2000:12). Studies by Caskey (1985) and Lewis (1989) believed that the learning process of rationalization and inflation expectation tends to cause forecast error that is serially correlated with a structural change in the economy. Therefore testing the period before the crisis would be irrelevant.

DATA AND EMPIRICAL MODEL

Data Availability

Expected inflation is one form of expectation, which is difficult to measure (unobservable) as it relates to people's psychological condition. Therefore, we need a good proxy for measuring people's expected inflation. Theoretically, interest rate movement has an implied expected inflation in it. Yet, obtaining expected inflation from interest rate structure is difficult, as there are no forward looking data such as forward interest rate and long term bonds with sufficient time series data. Expected inflation can also be obtained through surveys such as business survey and consumer survey.

Changes in monetary policy could affect the course of economy and prices that in turn will influence the learning process of economic agents in forming their expected inflation. A study by Wuryandani and Anglingkusumo (1998), for example, showed that a switch in Indonesian exchange rate regime in the mid of July 1997 has produced structural changes in the economy which then affect the behavior of expected inflation.

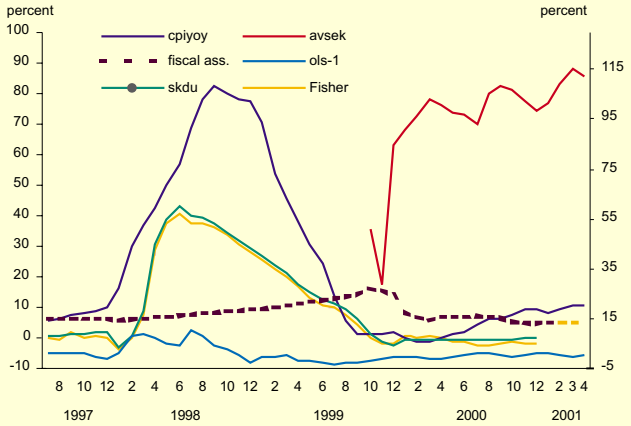
Government's inflation assumption as stated in the State Budget (APBN) could create inflation expectation as long as the government is credible. Nevertheless, this condition could hardly be established to Indonesia where there has been large deviation between the government inflation target and the actual inflation along the history. However, it is hard to determine whether the market's expectation is rational. If it were, then any decision in consumption, investment and pricing policy would reflect underlying aggregate demand.

To choose which data to be used as the expected inflation proxy, several candidates are tested. The candidates are inflation assumption used in the government's budget, inflation expectation from business survey (SKDU), Consumer's survey (SEK), OLS estimation of the expected inflation, and estimated expected inflation using Fisher Theory (Vector Autoregression). Expected inflation data using SKDU is a short sample starting from 1996 at a quarterly basis and it is interpolated into monthly data. The expected inflation, which is from SEK has an even shorter time horizon (starting from late 1999).

OLS estimation is done using quarterly data of exchange rate, 1-month deposit interest rate and inflation. Decision to choose those variables stems from business and consumer surveys, which shows that the 3 quantifiable variables above has an impact on expected inflation. The decision was also made due to the fact that there is difficulty to quantify and obtain other data such as security and political condition, government regulation, distribution and government policy on prices and income. These factors are believed to have tremendous influence on expected inflation. In an expected inflation estimation using OLS, the parameter is used to estimate monthly-expected inflation data. Meanwhile the estimation of expected inflation by decomposing the interest rate (Fisher theory) is obtained by using VAR.

Graph 6.1 shows that SKDU interpolated data indicate a co-movement to inflation and is leading by 1 quarter (3 months). On the other hand, inflation target path in Fiscal assumption tends to be stable in all period except in the crisis period, moreover its movement is not in line with inflation. Fisher Theory estimation showed movement close to inflation and SKDU,

Graph 6.1
Candidates of Expected Inflation Proxy



and so did SEK despite having limited time series data. SKDU, SEK and Fisher theory estimation denote a certain leading time to inflation. Estimation using OLS does not show a corresponding trend with inflation, even though the R-squared value of OLS estimation reach up to 91%.

Table 6.1 Correlation Between Inflation and Candidates

	AVSEK	SKDU	Fiscal ass.	FISHER	OLS
CPIYOY	0.47	0.92	0.24	0.92	0.46

A correlation test between inflation and each candidate showed the following results: both SKDU and Fisher Theory showed a 92% correlation, on the other hand SEK, OLS and Fiscal assumption showed lower correlation respectively: 47%; 46%; and 24% (table 1). Using 5 months lag, Granger Causality Test (table 2) indicated that SKDU and Fisher Theory have reciprocal relationship with inflation. Granger Causality also revealed that there is no relationship between SEK and inflation. This might be due to the limited SEK time series data. Moreover, Fiscal assumption and OLS estimation does not affect inflation at all. On the contrary, inflation affects both Fiscal assumption and OLS.

With the exception of SEK data, OLS test to each candidate exhibit that the result of inflation estimation using those variables sufficiently explains the inflation movement which is shown by a 99% R-squared value of each variable (table 3). The tests above concluded that interpolated SKDU is the best proxy of expected inflation.

Empirical Model

Given the limitation of time series data in the crisis period, research in the SVAR model is limited by 3 alternatives using 3 variables, unchained transmission and 5 variables. The structural hypotheses of this monetary transmission in SVAR are:

Model with 3 Variables

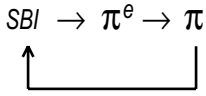
The variables used are monetary policy instrument, inflation expectation and inflation.

Table 6.2 Granger Causality (lag 5)

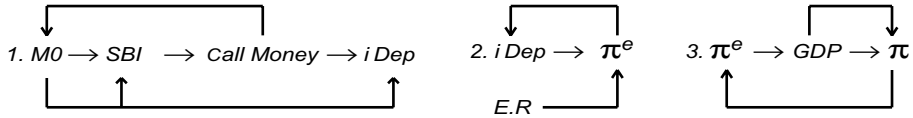
Null Hypothesis	Obs	F-stat	Probability
CPIYOY does not Granger Cause Fiscal Assumption	168	5.97516	0.0000
Fiscal Assumption does not Granger Cause CPIYOY		1.03989	0.3962
SKDU does not Granger Cause CPIYOY	52	2.3263	0.0599
CPIYOY does not Granger Cause SKDU		7.0127	0.0001
AVSEK does not Granger Cause CPIYOY	14	3.05869	0.1932
CPIYOY does not Granger Cause AVSEK		3.83156	0.1491
Fisher does not Granger Caose CPIYOY	139	18.8741	0.0000
CPIYOY does not Granger Cause Fisher		4.69714	0.0006
OLS does not Granger Cause CPIYOY	44	1.85464	0.1700
CPIYOY does not Granger Cause OLS		4.39476	0.0190

Table 6.3 Ordinary Least Square Test

	SKDU	Fiscal Ass.	Fisher	OLS
CPIYOY (-1)	1.475122	0.752515	0.1637772	1.78955
	(0)	(0)	(0)	(0)
CPIYOY (-2)	- 0.879794	- 0.9659	- 0.760121	- 0.8042
	(0.001)	(0.007)	(0)	(0)
CPIYOY (-3)	0.577906	0.465421		
	(0.0392)	(0.0926)		
CPIYOY (-4)	- 326017	- 0.307879		
	(0.0257)	(0.0313)		
SKDU	0.379449			
	(0.0064)			
SKDU (-1)	- 0.403337			
	(0.0317)			
SKDU (-3)	0.606015			
	(0.0012)			
SKDU (-4)	- 0.409527			
	(0.015)			
Fiscal Ass.		0.151151		
		(0.037)		
FISHER			0.150008	
			(.0044)	
OLS				0.677136
				(.0.0129)
R-squared	0.991779	0.988483	0.988773	0.98743
DW	1.93737	2.014439	2.014007	1.95515

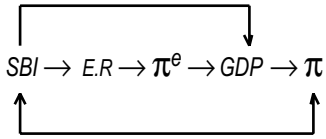


Unchained transmission mechanism into 3 parts



The variables used are base money, SBI, inter-bank call money, deposit interest rate, exchange rate, expected inflation, GDP and inflation.

Model with 5 Variables



The variables used are monetary policy instrument, exchange rate, inflation expectation, GDP and inflation. All of the above hypotheses use restriction based on economic meaning. It is attempted to reach a "just identified" condition with $(n^2-n)/2$ number of restriction.

EMPIRICAL RESULT

Stationarity Data

Unit root test shows that most of the variables are stationary in the first difference except inflation data (CPIYOY) (appendix 1). The problem when using first difference as data is that it is more difficult to interpret the economic meanings.

Structural Vector Autoregressive Model (SVAR)

Starting value used in SVAR is random numbers with a 0.0001 standard normal and a maximum iteration of 1000. The VAR test is stationary as shown by a less than 1 inverse root value (Appendix 2).

SVAR Model with 3 Variables

SVAR estimation with a 3 lags obtains optimal result after the 9th-13th iteration. The structural model using 3 variables shows there is one inconsistent restriction coefficients.

Table 6.4 Structural Model—3 Variables

3 Variable Model : SBI, Expected Inflation, Inflation			
	SBI	Exp.Inflation	Inflation
B=	1	0	0.031601 0.8349
	- 0.432363 0.0172	1	0
	0	0.307101 0.0374	1

Notes : Standard Errors are in parentheses

The variance decomposition result shows that shocks in each variable is more affected by own inertia. The affect of other variables becomes significant after the 3rd period. Monetary policy tends to be influenced by inertia (backward looking policy reaction). Generally, inflation expectation is mainly formed by lag of itself. However, inertia begins to show its influence on expectation in the 3rd period. Monetary policy role has small impact in the expected inflation formation, while expected inflation itself has an influence ranging from 20-30% in inflation formation.

The result of impulse response shows that a change in the monetary policy will have a similar effect on inflation expectation and inflation. Meanwhile, SBI's rate strongest influence on expected inflation is immediate, and will be stable in the 24th period. This indicates that SBI is seen as a signal of monetary policy by the market. The effect of SBI on inflation begins in the 15th period, which implies that there is a time lag of monetary policy. Generally monetary policy will be stable after the 33rd period.

According to the outcome of accumulated impulse responses, response of expected inflation on SBI shock is significant in the beginning of the period. Meanwhile, accumulated response of expected inflation on inertia is more significant than on SBI. This result reveals that market still sees backward looking expectation as the main factor to construct expected inflation. The accumulated impulse response of SBI shock is highly significant in 12th period. However, the response of inertia is more significant than SBI shock within the same period

Table 6.5
Forecast Error Variance of 3 Variables SVAR

Variable SBI, Expected Inflation and Inflation

Variance Decomposition of SBI :

Period	SE	Shock1	Shock2	Shock3
1	2.670	99.871	0.012	0.117
3	6.026	62.761	6.297	30.942
6	13.317	15.468	22.465	62.066
9	17.000	10.527	21.887	67.586
12	18.099	9.629	22.905	67.465

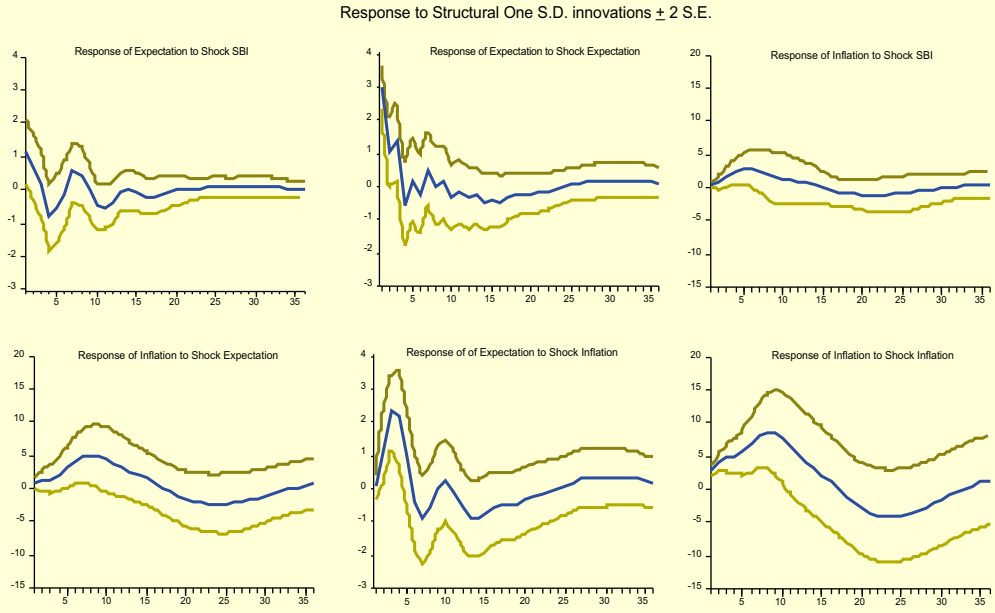
Variance Decomposition of Expected Inflation :

Period	SE.	Shock1	Shock2	Shock3
1	3.208	12.928	87.057	0.015
3	4.528	8.937	58.003	33.061
6	5.268	10.201	44.299	45.499
9	5.454	11.056	42.275	46.669
12	5.576	12.704	41.336	45.960

Variance Decomposition of inflation :

Period	SE.	Shock1	Shock2	Shock3
1	3.049	1.349	9.087	89.563
3	7.562	6.010	7.535	86.455
6	14.747	12.017	17.582	70.401
9	22.735	7.468	21.260	71.272
12	26.433	6.064	22.066	71.869

Graph 6.2
Impulse Response 3 Variables SVAR towards Monetary Policy



range. The lag structure response shows that the maximum effect of SBI and inertia on expected inflation formation is relatively direct for 4 periods. Whilst the maximum effect of SBI and inertia on inflation has a 22 period and 18 period time lag. The outcome of impulse response supports the variance decomposition result.

Table 6.6 Accumulated Impulse Response to Expected Inflation

Variabel Shock	Accumulated response of Expectation		
	6	12	24
SBI	0.53	0.10	-0.57
Expectation	4.78	4.54	1.45
Inflation	6.29	4.29	-1.25

Table 6.7 Accumulated Impulse to Expected Inflation

Variabel Shock	Accumulated response of Inflation		
	6	12	24
SBI	11.03	20.37	12.77
Expectation	13.32	39.43	35.33
Inflation	29.44	74.62	63.46

Table 6.8
Lag structure Of Expected Inflation and Inflation Response

Variabel	Starting impact	Maximum impact
SBI	1	4
Expectation	1	4
Inflation	-	-

Variabel	Starting impact	Maximum impact
SBI	15	22
Expectation	1	8
Inflation	-	-

Unchained Transmission Mechanism

The unchained transmission mechanism is executed by dividing the transmission mechanism into three parts. Difficulty in obtaining optimal result urges the restriction in the SVAR model to be different to the economic theory. The difference is displayed in the formation of expected inflation where in the theory exchange rate is influenced by interest rate through interest rate differential whereas in this case, exchange rate is only dependent on itself.

SVAR structural model shows that some of the matrix coefficient restriction displayed inconsistent result. Result of variance decomposition indicates that M0's inertia and SBI mostly influence M0 fluctuation. SBI is mostly influenced by itself, while PUAB (inter-bank call money) besides being influenced by itself is also influenced by SBI. The change in deposit interest rate besides being influenced by its inertia is also influenced by SBI, M0 and exchange rate. Exchange rate itself is mostly influenced by its inertia. Meanwhile the change in expected

Table 6.9
SVAR Structural Model- Unchaining Process

Unchained Model : M0 Real, SBI, Inter Bank,Deposit				
	M0 Real	SBI	Inter Bank	Deposit
B =	1	0	- 0.087446 (0.132111)	0
	0.109591 (0.0099943)	1		0
	0	- 8.849454 (0.324559)	1	0
	0.001557 (0.052335)	- 0.537302 (0.094755)	- 0.050458 (0.042831)	1

Notes : Standard Errors are in parentheses

Unchained Model: Deposit, E.R, Expected Inflation			
	Deposit	E.R	Exp. Inflation
B =	1	0	0.210339 (0.302848)
	0	1	0
	-0.187349 (0.199882)	0.02703 (0.005861)	1

Notes : Standard Errors are in parentheses

Unchained Model: Expected Inflation, GDP, Inflation			
	Exp. Inflation	GDP	Inflation
B =	1	0	-0.446738 (0.204216)
	0.03916 (0.046445)	1	0
	0	0.385026 (0.40137)	1

Notes : Standard Errors are in parentheses

inflation is highly influenced by exchange rate and past inflation (adaptive expectation). On the other hand, past inflation also influences GDP. Inertia and GDP mostly determine inflation, while the expected inflation role started to significantly affect inflation after 12 periods. This outcome reflects the role of expected inflation in monetary transmission channel since the crisis period, even though the role itself is not too strong.

only 1 period, while deposit interest rate reaction exists after a 2 period lag. SBI's response towards M0 change becomes significant between the 6th and the 18th period. M0's effect towards PUAB and deposit rate turns stable after the 24th period. The change in the deposit interest rates significantly influences exchange rate at the 6th period and it also influences expected inflation at the 3rd period. The effect on both exchange rate and expected inflation stabilize after the 24th period. Changes in expected inflation influences GDP at the 8th period significantly, thereupon becoming stable after the 36th period. The change of expected inflation affects inflation beginning from the 2nd semester. Based on the accumulated impulse response, deposit and exchange rate shocks have relatively significant influence on expected

Table 6.10
Forecast Error Variance Decomposition of SVAR –Unchaining Process

SVR;MO Real, SBI, Inter-Bank call money, Deposit Rate
Variance Decompositaion of Real

Period	S.E.	Shock1 MO.Real	Shock2 SBI	Shock3 Inter-Bank	Shock4 Deposit
1	7.133	98.711	0.188	1.101	0.000
3	8.539	97.022	1.795	0.949	o.234
6	10.092	79.418	18.163	2.076	0.343
9	11.976	57.323	39.164	3.179	0.334
12	13.405	46.731	49.122	3.816	0.331

Variance Decompositaion of SBI

Period	S.E.	Shock1 MO.Real	Shock2 SBI	Shock3 Inter-Bank	Shock4 Deposit
1	4.236	3.362	96.601	0.038	0.000
3	9.753	1.937	93.023	4.636	0.405
6	14.603	2.286	91.707	5.617	0.390
9	16.951	7.041	87.055	5.549	0.355
12	17.801	12.936	82.003	5.274	0.327

Variance Decompositaion of Inter Bank Call Money

Period	S.E.	Shock1 MO.Real	Shock2 SBI	Shock3 Inter-Bank	Shock4 Deposit
1	9.285	0.505	14.507	84.988	0.000
3	10.912	4.976	14.780	78.499	1.745
6	11.182	6.275	14.522	76.940	2.263
9	11.329	6.509	16.098	75.117	2.276
12	11.434	6.425	17.411	73.914	2.250

Variance Decompositaion of Deposit Rate 1 month

Period	S.E.	Shock1 MO.Real	Shock2 SBI	Shock3 Inter-Bank	Shock4 Deposit
1	3.445	1.795	49.135	1.260	47.810
6	4.205	15.719	33.698	2.011	37.572
9	4.547	22.674	39.108	3.384	43.834
12	4.833	22.958	40.520	3.566	32.957
		21.687	43.474	3.778	31.061

SVR: Deposit rate, Exchange Rate, Expected Inflation
Variance Decomposition of Deposit rate 1 month:

Period	S.E.	Shock1 Deposit	Shock2 ER	Shock3 Exp. Inflation
1	2.688	96.520	1.198	2.283
3	4.240	59.280	36.216	4.504
6	4.723	51.550	43.364	5.087
9	5.025	48.752	45.142	6.106
12	5.414	44.036	50.510	5.453

Variance Decomposition of Exchange Rate:

Period	S.E.	Shock1 Deposit	Shock2 ER	Shock3 Exp. Inflation
1	53.784	0.000	100.000	0.000
3	73.092	0.505	92.835	6.659
6	123.291	2.862	91.198	5.940
9	151.227	2.906	92.964	4.130
12	153.596	2.887	92.963	4.150

Variance Decomposition of Expected of Inflation :

Period	S.E.	Shock1 Deposit	Shock2 ER	Shock3 Exp. Inflation
1	2.435	4.129	32.993	62.878
3	3.427	10.582	50.597	38.822
6	6.007	5.027	81.607	13.365
9	6.040	5.163	81.107	13.729
12	6.172	5.366	80.695	13.939

inflation after 6th period. The maximum impact of deposit and exchange rate on expected inflation happened in the 7th and 4th period respectively. Furthermore, inflation is mainly affected by GDP and inertia. The maximum impact of GDP on inflation appears in the 6th period. Yet, the inverse effect of GDP shock on inflation is a puzzle and remains unexplainable. Meanwhile, increasing expected inflation is responded by increasing inflation directly.

Graph 6.3
Impulse Response Transmission with Unchaining Process

Response to Structural One S.D. innovations ± 2 S.E.

Table 6.11 Accumulated Impulse Response of Expected Inflation

Variabel Shock	Accumulated response of Expectation		
	6	12	24
Dep01	2.83	2.54	2.11
Exchange Rate	8.64	7.60	4.75
Expectation	2.93	2.06	2.13

Table 6.12 Lag Structure of Expected Inflation Response

Variabel	Starting impact	Maximum impact
	months	
Dep01	6	7
Exchange Rate	1	4
Expectation	-	-

Table 6.13 Accumulated Impulse Response of Inflation

Variabel Shock	Accumulated response of Expectation		
	6	12	24
Expectation	4.74	22.15	23.33
GDP	-17.19	-37.97	-27.46
Inflation	29.11	68.71	53.25

Table 6.14 Lag Structure of Inflation Response

Variabel	Starting impact	Maximum impact
	months	
Expectation	2	7
GDP	1	6
Inflation	-	-

SVAR Model with 5 Variables

Maximum lag used in this SVAR model is 3 periods. This 3 period length has fulfilled stationary condition as indicated by low AIC value (Akaike Information Criterion) and SC (Schwarz Information Criterion). The SVAR model reveals that some coefficient is inconsistent even though it can obtain optimum result.

Table 6.15
5 Variables SVAR Model—SBI

5 Variables Model	SBI	Exchange Rate	Expectation	GDP	Inflation
Bo =	1	0	0	0	17,605 (0.685953)
	- 20.7431 (48.81409)	1	0	0	0
	- 1.9779 (2.233175)	- 0.0492 (0.058781)	1	0	0
	- 0.1226 (0.297033)	0.009.90 (- 0.0242)	0.4113 (0.634693)	1	0
	0	- 0.0874 (0.045157)	-2.4657 (0.936132)	0.3786 (0.509075)	1

Result of variance decomposition with a 12 period time horizon indicated that the majority of variable is formed by shocks of other variable. This condition indicates that inflation expectation is affected by inflation, exchange rate and monetary policy instrument. The role of exchange rate towards expectation becomes significant after the 3rd period and it

Table 6.16
Forecast Error Variance Decomposition 5 Variables SVAR—SBI

Variable SBI, Expected Inflation and Inflation						
Period	S.E.	Shock SBI	Shock Dedpreciation	Shock Expectation	Shock GDP	Shock Inflation
1	2.2813	1.1521	55.8427	37.7051	0.3822	4.9180
3	3.7637	6.2010	56.7489	18.1888	0.1461	18.7152
6	5.1908	15.4721	54.6342	13.1790	0.2818	16.4330
9	5.4591	15.0665	53.7807	14.8284	0.7898	15.5347
12	5.9366	18.9112	52.7566	13.4010	0.8118	14.1194
Variance Decomposition of DDEPRYOY:						
Period	S.E.	Shock SBI	Shock Dedpreciation	Shock Expectation	Shock GDP	Shock Inflation
1	54.2784	0.8756	66.4380	28.6579	0.2905	3.7379
3	62.8154	0.7836	60.5423	28.7474	0.9562	8.9706
6	70.2466	2.5286	62.4614	25.8320	1.0561	8.1219
9	75.5887	6.6031	60.9074	22.9742	1.1179	8.3974
12	77.5244	7.6751	60.0817	22.6130	1.1227	8.5074
Variance Decomposition of DSKDU:						
Period	S.E.	Shock SBI	Shock Dedpreciation	Shock Expectation	Shock GDP	Shock Inflation
1	2.4691	8.8474	23.3560	27.0934	2.9349	37.7682
3	3.9258	20.3024	33.1072	10.8534	1.2059	34.5311
6	6.1368	16.3461	54.9251	13.1256	0.5568	15.0464
9	6.2550	15.9664	53.4497	15.2963	0.6817	14.6060
12	6.4860	17.6898	51.8969	15.1048	0.6726	14.6359
Variance Decomposition of DGGDPNLY YOY:						
Period	S.E.	Shock SBI	Shock Dedpreciation	Shock Expectation	Shock GDP	Shock Inflation
1	3.7416	0.7204	0.0945	1.3819	94.7282	3.0751
3	4.9224	0.6094	0.3998	3.8498	91.0781	4.0629
6	5.2256	0.6549	1.5008	5.1391	88.3287	4.3765
9	5.5078	0.7387	3.1736	7.9040	83.4305	4.7532
12	5.6182	0.7450	4.0306	48.8547	81.6418	4.7279
Variance Decomposition ofIHKYOY:						
Period	S.E.	Shock SBI	Shock Dedpreciation	Shock Expectation	Shock GDP	Shock Inflation
1	2.7019	77.2652	12.8437	8.6721	0.0879	1.1311
3	8.1725	71.4694	26.5853	1.7345	0.0328	0.1780
6	16.1116	70.2407	25.6475	0.6658	0.0749	3.3710
9	25.6682	58.7935	34.6903	0.3809	0.0617	6.0736
12	31.0945	53.5911	39.3186	0.3680	0.1520	6.5704

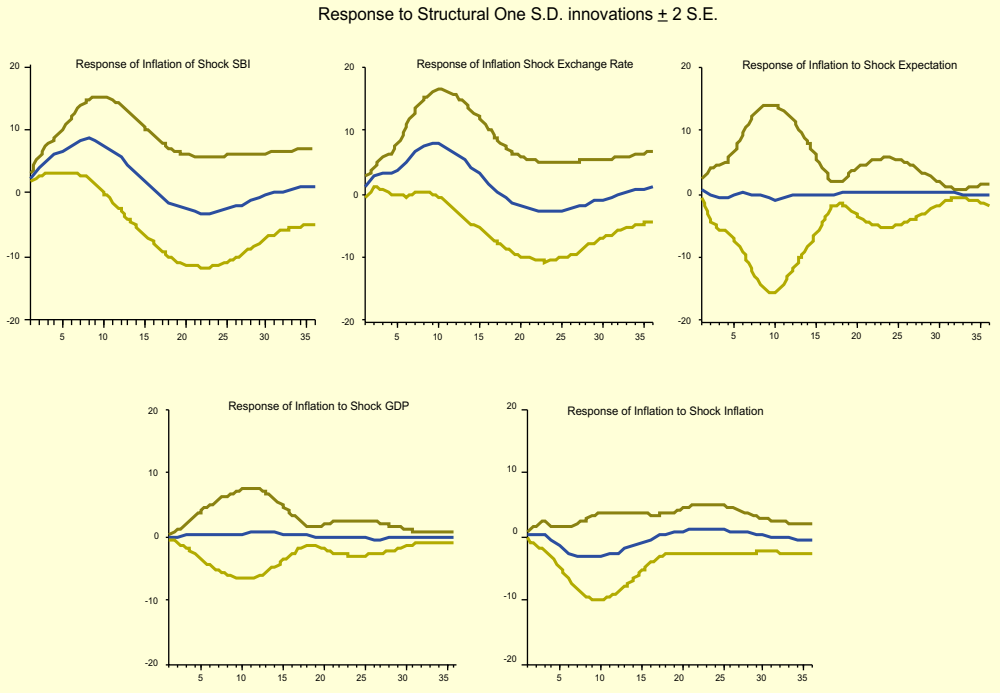
Factorization Structural

is the most outweighing factor in expected inflation configuration. Meanwhile, monetary policy's effect on expectation is relatively similar throughout the entire time horizon. Inertia's role on expected inflation succeeded exchange rate and SBI. Expected inflation does not significantly affect GDP. Aid inflation directly. In this model, inflation is primarily affected by SBI and exchange rate.

According to impulse response result, the formation of expected inflation is predominantly induced by exchange rate. The strongest exchange rate influence is at the 4th period and the influence becomes relatively stable after the 16th period. While the strongest SBI shock is at the 3rd to 5th period and then stabilizes in the 20th period. Expected inflation responded inversely to the inertia shock. This puzzle is inconsistent with the economic theory and is difficult to explain. Besides, this result is contradictory to other models. The role of expected inflation to the GDP development is insignificant.

The formation of inflation is primarily affected by exchange rate and SBI. Exchange rate shock has an immediate impact on inflation, whilst SBI shock has a time lag impact of 17 periods. Maximum response of SBI on inflation supports the recent studies on monetary lag by DKM. The studies revealed that there is a time lag for as long as around 6-9 quarters of monetary

Graph 6.4
Impulse Response 5 Variables SVAR—SBI



policy on inflation. These outcomes indicated that monetary policy should be pre-emptive (forward looking) instead of corrective (backward looking). Meanwhile, expected inflation and GDP have only minor impact to the inflation. In conclusion, the transmission through expectation in this model is fairly weak.

Table 6.17
Accumulated Impulse Response of Expected Inflation

Variabel Shock	Accumulated response of Expectation		
	6	12	24
SBI	5.37	3.03	0.32
Depreciation	6.82	5.31	1.88
Expectation	-0.98	-0.46	0.10
GDP	0.49	1.01	0.48
Inflation	-4.77	-3.72	-2.71

Table 6.18
Lag Structure of Response Expected Inflation

Variabel	Starting impact	Maximum impact
	months	
SBI	1	3
Depreciation	1	4
Expectation	-	-
GDP	2	3
Inflation	1	11

Table 6.19
Accumulated Impulse Response of Inflation

Variabel Shock	Accumulated response of Expectation		
	6	12	24
SBI	31.49	75.94	66.42
Depreciation	18.61	61.82	61.27
Expectation	-0.78	-3.57	-3.24
GDP	0.78	3.33	5.5
Inflation	-4.05	-22.09	-19.91

Table 6.20.
Lag Structure of Inflation Response

Variabel	Starting impact	Maximum impact
	months	
SBI	17	22
Depreciation	1	9
Expectation	4	6
GDP	1	12
Inflation	-	-

EVIDENCE FROM SURVEY

Expected Inflation Formation

Result obtained in the transmission survey (appendix 4) shows that expectation is influenced by exchange rate, inertia and interest rate. In the case of exchange rate movement, household responded symmetrically. Expected inflation of household increases in depreciation and vice versa. This is also the case with companies where they increase expectation when depreciation happens. As for inertia, household uses inertia as a benchmark for projecting future prices. When prices tend to increase continuously, the majority of household expects price to increase and they react by increasing consumption. On the contrary when prices tend to decrease, household responded asymmetrically. In this case

household expected inflation is non-existent, yet it is followed by a relatively increasing consumption. Meanwhile in the interest rate case, when the interest rate increases household will expect a price increase. Nevertheless, when the interest rate decreases household will not react.

Inflation Formation

Inflation is affected by exchange rate, inertia and interest rate. Depreciation of exchange rate tends to make company increase price immediately within less than a month, however exchange rate appreciation does not necessarily make companies react by decreasing prices. Trade and manufacturing industry is the most susceptible sector to exchange rate movement. An increasing inertia trend also tends to urge companies to increase price. Companies also reacted to increasing inertia trend by increasing investment. In the case of interest rate increase, companies responded ambiguously. Companies, which reacted to the increasing interest rate, incline towards price increasing within 3 months. Yet in the situation of declining interest rate, companies reacted asymmetrically.

CONCLUSION

Considering that an economic crisis has changed inflation expectation behavior, this research is focused on the period after the crisis. Problem in data availability urges a research for the appropriate proxy for expected inflation. The candidates are the inflation assumption in the government's budget, VAR estimation through Fisher equation, OLS and interpolated SKDU (Business survey) data. By using some statistical methods such as correlation and Granger causality, the test on those candidates showed that SKDU data is the best proxy for expected inflation despite its limitation as an interpolated data.

This research concluded that in general there is a monetary transmission through expected inflation channel. The result confirms that expected inflation plays a role in inflation formation, even though it is considered not as strong as other variables such as inertia (past inflation). The significant effect of past inflation argued that monetary authority credibility is a very important factor. People observe the credibility of central bank and forms expectation based on what they have learned. In turn, credibility of central bank will determine the effectiveness of inflation targeting.

The expected inflation itself is mainly determined by exchange rate, inertia and interest rate while inflation formation is primarily influenced by the same factors. The implication of this result is central bank has to manage the volatility of these factors to achieve inflation target.

Nevertheless, central bank realizes that these factors are not fully controllable which makes the central bank's task more difficult.

This result is consistent with the evidence from transmission mechanism survey. The survey proved that expected inflation and inflation formations are determined predominantly by exchange rate, past inflation (inertia) and interest rate movement. Nonetheless, the market response to those factors is not always asymmetric. There is a downward rigidity in the firms' price setting, regardless of depreciation or appreciation in the exchange rate. On the contrary, household reacts asymmetrically to the movement of exchange rate. An interesting result from the survey is that market will expect inflation to increase as interest rate increase. The explanation of this result is that market learned when interest rate increased, inflation also increased in the same period in 1998, and the other way around in 1999. In this case, market did not take into account the time lag of monetary policy. In projecting future inflation, market uses past inflation as the benchmark.

Eventually, it is acknowledged that this paper still has many weaknesses considering there are puzzles in it. Further research is still needed to measure the accurate role of expected inflation in transmission mechanism. Any constructive comments are welcomed to rectify and improve the result of this research.

References

1. Ball, Laurance dan Croushore, Dean, (1995) Expectations and the Effects of Monetary Policy, *Working Paper 5344, National Bureau of Economic Research, Cambridge,* November .
2. Brischetto, Andrea dan de Brouwer, Gordon, (1999) *Householders' Inflation Expectations,* Research Discussion Paper 1999-03, Economic Research Department, Reserve Bank of Australia, January.
3. Brischetto, Andrea & Voss, Graham, (1999) A Structural Vector Autoregression Model of Monetary Policy in Australia*, Research Discussion Paper,* Reserve Bank of Australia, Dec.
4. De Bondt, Gabe J, (2000) *Financial Structure and Monetary Transmission in Europe- Cross Country Study*, Edward Elgar Publishing Limited-UK,
5. Enders, Walter, *Applied Economic Time Series*, Iowa State University, USA, 1995, p. 294-339.
6. Gagnon, E Joseph, (1997) Inflation Regimes and Inflation Expectations, *Research Discussion Paper 9701, Department of the Treasury United States,* May.
7. Gaiotti,E. & Altimari, S.Nicoletti, (1996) *Expectations and Monetary Policy Transmission: The Determination of the Exchange Rate and Long Term Interest Rates in the Banca d'Italia's Quarterly Eocnometric Model*, Conference Paper vol.2: The Determination of Long Term Interest Rates and Exchange Rates and The Role of Expectations, Bank for International Settlement (BIS) August.
8. Gerlach, Stefan & Smets, Frank, (1995) The Monetary Transmission Mechanism: Evidence From The G-7 Countries, *BIS Working paper* No.26, April.
9. Honkapohja, Seppo, dan W. Evans, George, (2000) Expectation and the Stability Problem for Optimal Monetary Policies, *Discussion Paper 10/00, Economic Research Centre of the Deutsche Bundesbank,* November.
10. Ireland N., Peter, Expectations, (1999) Credibility, and Time-Consistent Monetary Policy, Working Paper 7234, *National Bureau of Economic Research, Cambridge,* July.
11. Keating, John.W, (1992) Structural Approaches to Vector Autoregressions, *Federal Reserve Bank of St. Louis,* September/October.
12. Mahadeva, Lavan, dan Sterne, Gabriel, (2000) *Monetary Policy Frameworks in a Global Context"* Routledge, Taylor and Francis Group, New York, p.421-454.
13. Mc Callum, Bennett T, (1999) Analysis of the Monetary Transmission Mechanism: Methodological Issues, WP-7395, *National Bereau is Economic Research (NBER),* October.
14. Mishkin, Frederic S., (1996) *Channels of Monetary Transmission: Lessons For Monetary Policy*, Working Paper 5464, *National Bereau is Economic Research (NBER),*, February.
15. Ragan, Christhoper, (1995) Deriving Agents' Inflation Forecasts from The Term Structure of Interest Rate, *Working Paper 95-1, Bank of Canada, Jan* .

16. Roberts, John M, (1998) Inflation Expectations and the Transmission of Monetary Policy, F*inance and Economics Discussion Series,* Federal Reserve Board Washington,DC., -43
17. Siklos, L Pierre, (2000) Monetary Policy Transparency, Public Commentary, and Market Perception about Monetary Policy in Canada, D*iscussion paper 8/00, Economic Research Centre of the Deutsche Bundesbank,* November .
18. Sönderlind, Paul, (1995) *Forward Interest Rates as Indicators of Inflation Expectations*, Institute fo International Economic Studies, Stockholm University, May 28 .
19. St-Armand, Pierre, (1996) Decomposing U.S. Nominal Interest Rate Into Expected Inflation and Ex Ante Real Interest Rates Using Structural VAR Methodology, *Working Paper 96-2, Bank of Canada,* January .

Yoshioka, Shinji., (2001) Relationship among Exchange Rate, Money Supply, Interest Rate and Price Before and After Monetary Crisis, *JICA-TSQ-BAPPENAS,* June .

Appendices

Appendix 1: Stationarity Test (Unit Root Test) for Each Variables

Variable	Level		First Diff.	
	Lag	ADF Test	Lag	ADF Test
Growth M0 nominal	6	-1.088756	1	-4.460814
SBI Rate	2	-1.122431	2	-3.261391
Deposit Rate-month	7	-0.94287	2	-4.158274
Depreciation (yoy)	5	-2.198927	1	-5.151424
SKDU (%) - interpolated	2	-1.254171	2	-4.083874
Growth PDB nominal (yoy)	4	-1.270926	2	-4.647444
Growth CPI(yoy)	4	-1.882221	7	-2.947434

Note : level and first diff. Include NONE in equation test
Critical value for 1% (**) = -2,613;5%(*) = -1,948; 10%(***) = -1,6195

Appendix 2: SVAR Result From Stationarity/Stability Test

Appendix 2.a. SVAR – 3 Variables Lag Structure

Roots of Characteristic Polynomial
Endogenous variables: SBI DSSDU IHKYOY
Exogenous variables: C
Lag specification: 1 3
Date: 10/22/01 Time: 14:41

Root	Modulus
0.937244 - 0.186913i	0.9557
0.937244 + 0.186913i	0.9557
0.399595 + 0.740203i	0.841176
0.399595 + 0.740303i	0.841176
0.586107 + 0.595126i	0.835282
0.586107 - 0.595126i	0.835282
-0.795769	0.795769
-0.407069	0.407069
0.109932	0.109932

No root lies outside the unit circle.
VAR satisfies the stability condition.

Appendix 2.b. SVAR- Unchained Transmission Lag Structure

Roots of Characteristic Polynomial
Variables: M0 real, SBIO, Inter-Bank, Deposit
Lag Specification: 12

Root	Modulus
0.927789 - 0.182861i	0.945638
0.927789 + 0.182861i	0.945638
0.214935 - 0.664613i	0.698504
0.214935 + 0.664613i	0.698504
-0.211391 - 0.554316i	0.593256
-0.211391 + 0.554316i	0.593256
-0.512083	0.512083
0.337271	0.337271

No root lies outside the unit circle.
VAR satisfies the stability condition.

Roots of Characteristic Polynomial
Variables: Expected Inflation, GDP, Inflation
Lag Specification:13

Root	Modulus
0.94514 + 0.186342i	0.965663
0.94514 - 0.186342i	0.965663
0.481424 + 0.763172i	0.902331
0.481424 - 0.763172i	0.902331
0.582758 - 0.763172i	0.830962
0.582758 + 0.763172i	0.830962
-0.763561	0.763561
-0.702327	0.702327
-0.131023	0.131023

No root lies outside the unit circle.
VAR satisfies the stability condition.

Roots of Characteristic Polynomial
Variables: Deposit, E.R., Expected Inflation
Lag Specification: 14

Root	Modulus
0.474671 + 0.769656i	0.904259
0.474671 - 0.769656i	0.904259
0.851084 - 0.258375i	0.889439
0.851084 + 0.258375i	0.889439
-0.579091 - 0.498729i	0.764249
-0.579091 + 0.498729i	1.764249
-0.76363	0.76363
0.259166 - 0.713128i	0.758761
0.259166 + 0.713128i	1.758761
0.618913	0.618913
-0.560142	0.560142
0.376844	0.376844

No root lies outside the unit circle.
VAR satisfies the stability condition.

Appendix 2.c. SVAR - 5 Variables

Lag structure

Roots of Characteristic Polynomial
Variables : SBI, Depreciation, Expectation, GDP, Inflation
Lag specification : 13

Root	Modulus
0.909832 + 0.195424i	0.930583
0.909832 - 0.195424i	0.930583
0.470188 + 0.759511i	0.893271
0.470188 - 0.759511i	0.893271
- 0.876502	0.876502
0.639924 + 0.510836i	0.818814
0.639924 - 0.510836i	0.818814
0.669446 - 0.4122741i	0.786211
0.254125 - 0.756383i	0.771926
0.154125 + 0.756383i	0.771926
0.691287 + 0.316811i	0.760425
0.691287 - 0.316811i	0.760425
- 0.719111	0.719111
- 0.052807	0.052807

Not root lies outside the unit cirle
VAR satisfies the stability condition

Appendix 3: Lag Length Criteria

Appendix 3.a. SVAR - 3 Variables

Lag Length Criteria

VAR Lag Order Selection Criteria
Endogenous variables :SBI, DSSDU IHKYOY
Exogenous variables : C
Date 10/22/01 Time 14.45
Sample : 1997:07 2000 :12
Included observations :42

Lag	Logl	LR	FPE	AIC	SC	HQ
0	- 469.2616	NA	1172965	22.48865	22.61277	22.53414
1	- 348.7243	218.1152	5799.076	17.17735	17.67382	17.35933
2	- 320.2891	47.39209	2316.112	16.25186	17.12069	16.57032
3	- 293.0787	41.46333*	991.3057	15.38470*	16.62589*	15.83965

* Indicates lag order selected by the criterion
LR : Sequential modified LR test statistic (each test at 5% level)
FPE : Final prediction error
AIC: Akaike Information Criterion
SC: Schwaarz information Criterion
HQ: Hannan-Quinn information Criterion

Appendix 3 b

Var Lag Order Selection Criteria
Endogenous Variable : Mo Real, SBI, Inter Bank, Deposit rate
Sample : 1997.07.2000.12
Included Observations :42

Lag	Logl	LR	FPE	AIC	SC	HQ
0	- 620.1654	NA	95123883	29.72216	29.88766	29.78282
1	- 514.8407	185.5722	1358149	25.4686	26.29607*	25.7719
2	- 487.5844	42.83129*	812660.7*	24.93259*	26.42202	25.47853*
3	- 474.8516	17.58344	1005123	25.08817	27.23957	25.87674

Var Lag Order Selection Criteria
Endogenous Variable : Deposit rate, Exchange rate, Expected inflation
Sample : 1997.07.2000.12
Included Observations :42

Lag	Logl	LR	FPE	AIC	SC	HQ
0	- 510.9185	NA	8526634	24.47231	24.59643	24.5178
1	- 454.5527	101.9953	895286.3	22.21679	22.71327	22.39877
2	- 438.3785	26.957	641105.9	21.87516	22.744	22.19363
3	- 412.8117	38.95892	296733.7	21.08627	22.32746	21.54122
4	- 392.8707	27.53755*	182518.8*	20.56527	22.17882*	2115670*

Var Lag Order Selection Criteria
Endogenous Variables: Expected inflation, GDP, Inflation
Sample : 1997.07.2000.12
Included Observations :42

Lag	Logl	LR	FPE	AIC	SC	HQ
0	-408.9646	NA	66420.18	19.61736	19.74148	19.66285
1	-306.4409	185.5191	774.2974	15.16385	15.66033	15.34583
2	-284.8244	36.02748	427.8833	14.56307	15.4319	14.88153
3	-2,549,191	45.56999*	161.0791*	13.56757*	14.80877*	14.02252

* Indicates lag order selected by the criterion
LR : Sequential modified LR test statistic (each test at 5% level)
FPE : Final prediction error
AIC: Akaike Information Criterion
SC: Schwaarz information Criterion
HQ: Hannan-Quinn information Criterion

Appendix 3 c

VAR Lag Order Selection Criteria
Endogenous variables :DSBI DDEPRYOY DSKDU DGGD PNLYOY IHKYOY
Exogenous variables : C
Date 10/22/01 Time 14.48
Sample : 1997:07 2001:03
Included observations :42

Lag	Logl	LR	FPE	AIC	SC	HQ
0	- 798.7829	NA	2.89E+10	38.48224	38.48224	38.3512
1	- 682.4306	199.4611	3.76E+08	35.16646	35.16646	34.38021
2	- 633.744	71.87061	1.28E+08	35.07285	35.07285	33.6314
3	- 569.3982	79.66629*	22669646*	34.23357*	34.23357*	32.13691*

* Indicates lag order selected by the criterion
LR : Sequential modified LR test statistic (each test at 5% level)
FPE : Final prediction error
AIC: Akaike Information Criterion
SC: Schwaarz information Criterion
HQ: Hannan-Quinn information Criterion

a. Household

If rupiah depreciates, what is your expectation on price?

(million)	Price			Total
	Up	Down	Not response	
Rp 1 - Rp 3	52	1	1	54
Rp 3 - Rp 5	41	2	2	45
Rp 5 - Rp 10	28	3	1	32
> Rp 10	19			19
Total	140	6	4	150

If rupiah appreciates, what is your expectation on price?

(million)	Price			
Rp 1 - Rp 3	4	36	14	54
Rp 3 - Rp 5	2	38	5	45
Rp 5 - Rp 10	2	25	5	32
> Rp 10	1	14	4	19
Total	9	113	28	150

If price changes tend to increase, what is your expectation on price?

(million)	Price			Total
	Up	Down	Not response	
Rp 1 - Rp 3	27	3	24	54
Rp 3 - Rp 5	19	6	20	45
Rp 5 - Rp 10	16	2	13	31
> Rp 10	9	2	8	19
Total	71	13	65	149

And what is your action?

(million)	Consumption			Total
	Up	Down	Other	
Rp 1 - Rp 3	2	33	16	51
Rp 3 - Rp 5	4	28	9	41
Rp 5 - Rp 10	1	18	13	32
> Rp 10	2	13	4	19
Total	9	92	42	143

If price changes tend to decline, what is your expectation on price?

(million)	Price			Total
	Up	Down	Not response	
Rp 1 - Rp 3	11	15	28	54
Rp 3 - Rp 5	9	8	28	45
Rp 5 - Rp 10	9	5	17	31
> Rp 10	4	6	9	19
Total	33	34	82	149

And what is your action?

(million)	Consumption			Total
	Up	Down	Other	
Rp 1 - Rp 3	22	8	19	49
Rp 3 - Rp 5	13	13	14	40
Rp 5 - Rp 10	11	5	16	32
> Rp 10	10	2	5	17
Total	56	28	54	138

If deposit rate increases, what is your expectation?

(million)	Price			Total
	Up	Down	Not response	
Rp 1 - Rp 3	27	13	14	54
Rp 3 - Rp 5	16	12	16	44
Rp 5 - Rp 10	18	5	9	32
> Rp 10	11	3	4	18
Total	72	33	43	148

If deposit rate decreases, what is your expectation?

(million)	Price			Total
	Up	Down	Not response	
Rp 1 - Rp 3	14	12	28	54
Rp 3 - Rp 5	15	11	17	43
Rp 5 - Rp 10	8	10	14	32
> Rp 10	6	10	3	19
Total	43	43	62	148

b. Company

If interest rate increases, do you change your price policy?

	Price Policy changes		Total
	Yes	No	
Agriculture	1	6	7
Manufacture	22	32	54
Trade	25	17	42
Construction	14	5	19
Others	4	10	14
Total	**66**	**70**	**136**

If your answer is yes, what is your price policy?

	Price policy			Total
	Up	Down	Fixed	
Agriculture	1		1	2
Manufacture	17	3	4	24
Trade	18	6	2	26
Construction	11	2	1	14
Others	4		2	6
Total	**51**	**11**	**10**	**72**

How long is your price policy adjustment?

	Price policy adjusment				Total
	< 1 mt	1 - 2 mt	2 - 3 mt	> 3 mt	
Agriculture	1	1			2
Manufacture	2	11	5	5	23
Trade	8	9	5	7	29
Construction	2		4	9	15
Others		2	1	4	7
Total	**13**	**23**	**15**	**25**	**76**

If interest rate decreases, do you change your price policy?

	Price Policy changes		Total
	Yes	No	
Agriculture		7	7
Manufacture	10	42	52
Trade	17	25	42
Construction	8	11	19
Others	2	12	14
Total	**37**	**97**	**134**

If your answer is yes, what is your price policy

	Price policy			Total
	Up	Down	Fixed	
Agriculture			1	1
Manufacture	7	4	4	15
Trade	5	9	7	21
Construction	2	3	6	11
Others		1	1	2
Total	**14**	**17**	**19**	**50**

How long is your price policy adjusment?

	Price policy adjusment				Total
	< 1 mt	1 - 2 mt	2 - 3 mt	> 3 mt	
Agriculture	1	1			2
Manufacture	2	6	1	2	11
Trade	9	5	4	4	22
Construction	2	2	1	3	8
Others		2		1	3
Total	**14**	**16**	**6**	**10**	**46**

Do you monitor exchange rate movement?

	Monitor			Total
	Yes	No	Not answer	
Agriculture	7	1		8
Manufacture	53	1		54
Trade	39	4		43
Construction	17		1	18
Others	12	2		14
Total	**128**	**8**	**1**	**137**

What are the reasons to monitor exchange rate movement?

	Reason				Total
	Import	Price Policy	Pay Debt	Other	
Agriculture	2	3	1	1	7
Manufacture	33	18	3	1	55
Trade	9	23	6	1	39
Construction	4	9	1		14
Others	6	6			12
Total	**54**	**59**	**11**	**3**	**127**

If rupiah depreciates, do you increase your product price?

	Price Policy changes		Total
	Yes	No	
Agriculture	4	5	9
Manufacture	36	18	54
Trade	27	17	44
Construction	15	4	19
Others	6	8	14
Total	**88**	**52**	**140**

How long is your price adjustment

	Price policy adjusment				Total
	< 1 mt	1 - 2 mt	2 - 3 mt	> 3 mt	
Agriculture	2	1			3
Manufacture	11	11	9	5	36
Trade	15	6	3	4	28
Construction	3	4	4	5	16
Others		1	2	4	7
Total	**32**	**24**	**16**	**18**	**90**

If rupiah appreciates, do you decrease your product price?

	Price Policy changes		Total
	Yes	No	
Agriculture	2	7	9
Manufacture	23	31	54
Trade	24	19	43
Construction	11	8	19
Others	3	11	14
Total	**63**	**76**	**139**

How long is your price adjustment

	Price policy adjusment				Total
	< 1 mt	1 - 2 mt	2 - 3 mt	> 3 mt	
Agriculture	2				2
Manufacture	9	7	5	3	24
Trade	11	7	4	4	26
Construction	2	3	4	4	13
Others	2	1		1	4
Total	**26**	**18**	**13**	**12**	**69**

If rupiah depreciates, what is your expectation on general price

	General price			Total
	Up	Down	Fixed	
Agriculture	7		1	8
Manufacture	42	3	10	55
Trade	33	4	5	42
Construction	17	2		19
Others	12		1	13
Total	**111**	**9**	**17**	**137**

If price tends to increase, what is your expectation on price?

	General price			Total
	Up	Down	Fixed	
Agriculture	5	2	3	10
Manufacture	37	1	17	55
Trade	32	1	8	41
Construction	12	2	4	18
Others	7	1	5	13
Total	**93**	**7**	**37**	**137**

If price tends to increase, do you adjust your price policy?

	Price Policy changes		Total
	Yes	No	
Agriculture	3	6	9
Manufacture	32	21	53
Trade	33	5	38
Construction	13	4	17
Others	5	8	13
Total	**86**	**44**	**130**

If your answer is yes, what is your price adjustment?

	Price policy			Total
	Up	Down	Fixed	
Agriculture	3		1	4
Manufacture	30		4	34
Trade	28	1	2	31
Construction	13			13
Others	4		1	5
Total	**78**	**1**	**8**	**87**

How about your investment policy?

	Invest. Policy changes		Total
	Yes	No	
Agriculture	3	6	9
Manufacture	23	28	51
Trade	22	12	34
Construction	11	5	16
Others	6	5	11
Total	**65**	**56**	**121**

What do you do with your investment policy?

	Invest. Policy changes			Total
	Up	Down	Fixed	
Agriculture	2	1		3
Manufacture	13	7	3	23
Trade	12	7	6	25
Construction	2	7	3	12
Others	2	2	2	6
Total	**31**	**24**	**14**	**69**

Chapter 7

Asset Price Channel of Monetary Transmission in Indonesia

Rendra Z. Idris, Tri Yanuarti
Clarita L. Iskandar, Darsono

INTRODUCTION

While most central bank objective is to pursue price stability, the understanding of how monetary policy is transmitted to inflation is somehow still unclear, despite bulk of literature that deals with this matter. Bank Indonesia as the authority in conducting monetary policy always puts exceptional attention regarding this transmission mechanism and reviews it in quite regular basis. Rapid changes in the economic structure after the crisis struck led to a reexamination of the transmission over and again.

As mandated by the new central bank law, Bank Indonesia has to set and achieve the targeted inflation. Setting the target is one story but how to reach the target is another thing. The understanding of the transmission of monetary policy, formulated to reach the target, becomes a necessity. Monetary policy works through various channels such as credit, interest rate, exchange rate, asset price and expectation channel. Each channels pose its own characteristics and the relationship between all variables are somehow hardly understood. Moreover, there is no guarantee they will move in the same direction. For that reason, the authority must explore all the channels that work in the system.

This paper focuses on the role of assets price in the transmission mechanism of monetary policy. As openly known, asset price movement contents some information about future

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economic condition as well as future path of inflation. While these properties are true for some countries, they do not necessarily hold for other countries. For some countries, as experienced in Japan, UK and some Nordic countries, the heavy swing of asset price has created large fluctuations in the real economy. The general causes of such heavy swing consist of the mix of ease monetary policy, real business cycle, and financial liberalization. Moreover, monetary conditions were a common background factor behind assets prices inflation (Hoffmaister and Schinasi, 1994) and some assets price show a power to predict future inflation (Filardo, 2000). In other countries, however, the role of asset price in the transmission mechanism is not really strong or clear. In fact, there could be no relationship between asset price and the economy. Gluck and Mader (1998) showed that term spreads in Austria had little predictive power to predict future industrial production and inflation. Jaillet and Sicsic (1998) pointed out that there is no link between equity price and growth of consumption in France. However, the growing queries about the role of asset price still take place.

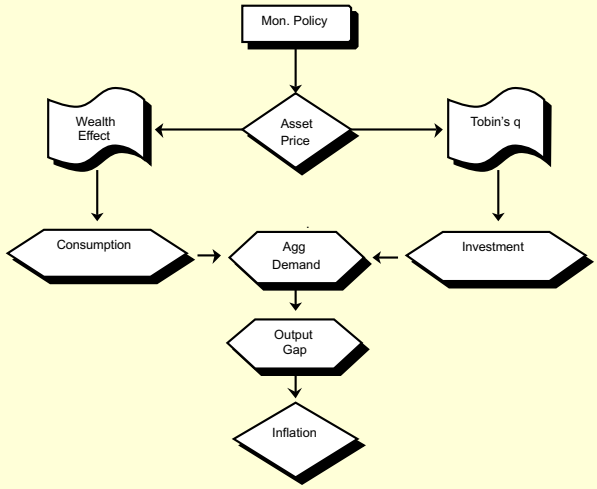
The aim of this paper is to investigate whether the asset price channel exists in Indonesia, what information content it possess, and the role of asset price in designing monetary policy. This paper examines the asset price channel using structural/identified VAR models. The structural models have been used extensively in current research of transmission mechanism. Since how the variables interact each other is still unclear, some structural restrictions need to be implemented based on economic theory. Many researchers use a common structural model to identify the impact of monetary policy for the economies (Kim and Roubini, 1999; Breschetto and Voss, 1999). Housing price or land price should have been the best proxy for asset price. Yet, the data availability restrains present research of doing so. Alternatively, Jakarta Composite Stock Price Index, JSX hereafter, is used.

THE ROLE OF ASSETS PRICE IN MONETARY TRANSMISSION

As mentioned earlier, the common objective of a central bank is to achieve price stability. While in the longer term, monetary variables do not affect real variables, in the short term it might. In as much as the complexity of relationship among economic variables turns unwieldy, thorough reexamination about how monetary policy transmitted to the real variables becomes major concern. The rising importance of asset price movement in gauging the economic activity through wealth and yields effect gains its popularity since the late 80's. Furthermore, asset price also possess a forward looking properties as it reflect expectations about future income streams, as important as the information content about the future course of inflation.

Mishkin (1995) remarked that, despite most monetarists loath to confide themselves with specific channel of transmission since the mechanism is always changing during different

Chart 7.1 Asset Price Channel



business cycles, there are at least two channels that accentuate monetary transmission mechanism, which are Tobin's q theory of investment and wealth effect of consumption.

Under Tobin's q theory, monetary policy is transmitted to the economy through its effect on the valuation of equities. If q --defined as the relative market value of firms to the replacement cost-- is high, it means that the market price of the firms is high relative to the replacement cost of capital. Hence, company will issue equity to finance their expansion (e.g. to build new plant or buy new equipment). As a result, investment spending will rise for companies can buy a lot of equipment with only small issuance of equities and vice versa.

The remaining question is how monetary policy alters equity price. If contractionary monetary policy is taken place, people will find they have less money to spend. Hence they need to cut off some unnecessary spending, and most likely they will dilute their spending on equity prices. Moreover, the increase in interest rate results in a higher cost of holding money. The return from deposits is higher compared to equity, other things stay the same, leads to decreasing demand for equity, thereby causing the price of equity to fall. Once equity prices fall, the market value of firms follows. Consequently, the ability of firms to make an expansion or to change worn equipment is diluted. Thus, investment-spending declines followed by a decline in economic growth. This will ease the pressure on output gap, resulting in a lower inflation.

The other asset price channel for monetary transmission happens through wealth effects on consumption. As the authority tightens its monetary stance, e.g. increasing interest rate, the asset price tends to fall. Adopting Modigliani's life cycle income hypothesis that says consumption spending is determined by the lifetime resources of consumer, the drop in asset

price decreases the value of wealth, thus decreasing the lifetime income. Hence, consumption and aggregate output should fall accordingly.

Both ways, investment and consumption, show how the monetary policy transmitted to the real variables by altering asset price. While theoretically it is quite easy to understand, but in real world this might not be the case. The mechanism can be somewhat confusing.

METHODOLOGY

To examine the asset price channel of monetary policy transmission mechanism empirically, structural/identified vector autoregression VAR (SVAR) is employed in both investment and consumption path. This research is based on Mishkin (1995) framework of asset price channel:

a. Investment path:

$$M \rightarrow P_e \rightarrow q \rightarrow \text{Investment} \rightarrow \text{Output}^1$$

b. Consumption path:

$$M \rightarrow P_e \rightarrow \text{wealth} \rightarrow \text{Consumption} \rightarrow \text{Output}$$

Some modifications are made for this framework in order to cope with the main objective of price stability. First, instead of using output, we are using the year-on-year inflation as a final objective. Second, we exclude the q from the system (investment path); hence price of equity directly affects investment growth. The rationale is not really different from Tobin's q, unless the increase in equity price does not has to go through the evaluation of relative market value to the replacement cost of capital before the management decides to buy new equipment, to replace the old one, or to build a new plant. The same spirit also holds for consumption path in which the increase in equity price is assumed to create more consumption directly, as the real wealth of consumer increases.

Each of these two paths will be investigated in four different periods of examination. The first is pre-crisis period (January 1989-June 1997), the period that regarded as "normal" period with the characteristic of managed-floating exchange rate regimes. The second is the post-crisis period (July 1997-present), to check whether any significant differences in the economic structure compare to the normal period. The third is the whole period 1 (January 1989-present, excluding crisis period), for finding a "normal" pattern of asset price channel. The last is the whole period 2 (January 1989-present), to explore whether the monetary policy transmission somehow holds the theory.

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1 M is monetary aggregate, P_e is equity prices, and q is relative market value of firm to replacement cost of capital.

Structural Vector Autoregression Framework

Structural Vector Autoregresion (SVAR) model actually is an extension of the vector autoregression (VAR) introduced by Simms (1980). The VAR model highlighted the inability of economists to agree in a true economic structure, thus it allows the data to speak for themselves. In analyzing the dynamic characteristic, the VAR model provide an impulse response function and variance decomposition which are obtained by imposing a mechanical restriction, such as Choleski decomposition. But, this method of restriction most likely does neither have nor portrait any economic structure. This is the reason why this method sometimes called as atheoretical model. To deal with this problem, some structural contemporaneous restrictions are applied, thus it will unlock economic information embedded in the VAR. In this paper, SVAR concept is applied in order to do so.

The SVAR specification for this asset price channel considers the following set of four variables:

$$x_t = (i_t, a_t, Z_t, \_t)$$

where i_t is an SBI rate, a_t is a JSX index, Z_t is a demand pressure, it can be either investment (for investment path) or consumption (for consumption path), _t is a year-on-year inflation, and x_t is a 4 x 1 vector of variables. To construct the variance decomposition and the impulse response function, all variables in the system will be ordered in such fashion according to their contemporaneous exogeneity. However, the ordering of these variables is not arbitrary. SBI rate as a policy variable should be considered the most contemporaneously exogenous variable. Bank Indonesia uses the SBI rate as its operating instrument in the short run. The rest follows this ordering consecutively, JSX index, demand pressure, and finally inflation.

The ordering of variables is important since it will greatly affect the variance decomposition and the impulse response function. The VAR ordering tells that at any given period, an innovation in the SBI rate will directly affect equity price through change in return, other things equal, but not the other way around. Any innovations in other variable will not affect SBI at the same period of time. Later on, both changes in SBI rate and equity price will alter demand pressure as they will change the relative price of firms' value per unit replacement cost and change the lifetime resource of income. Finally, they are going to affect the change in goods' prices.

In place of flavoring economic meaning to this model, some structural restrictions are applied. This is the principal of structural VAR, known as identification problem. The restriction is needed for it is the requirement for solving the system. One of the most common restrictions

among others is Choleski decomposition, which decomposes the residual from VAR in triangular fashion to recover the VAR system, and Blanchard-Quah method. The problem with these ways of decomposing is they do not have structural interpretation. The aim of structural VAR is to use economic theory to recover the structural innovations.

The structural VAR used is represented as follows .[2] First, recalls that x_t is n x_1 vector of variables and u is mean zero structural innovations. Thus, the pth order SVAR model is written as:

$$\begin{aligned} B(L)x_t &= u_t \\ Eu_t u_t' &= D \\ Eu_t u'_{t+s} &= 0, s \neq 0 \end{aligned} \tag{1}$$

for t = -(p-1)...T.

The associated reduced form VAR representation for the structural model above is:

$$\begin{aligned} A(L)x_t &= \varepsilon_t \\ E\varepsilon_t \varepsilon_t' &= \Sigma \\ E\varepsilon\ \varepsilon'_{t+s} &= 0, s \neq 0 \end{aligned} \tag{2}$$

where $A(L) = B_0^{-1}B(L) = I - A_1L - A_2L^2 - \mathrm{K} - A_pL^p \; and \varepsilon_t = B_0^{-1}u_t.$

As mentioned earlier, to recover the SVAR model from this reduced form VAR representation requires some restriction. The restriction has to be made in such a way so that the number of parameters resulted from the reduced form VAR at least equals the number of parameters in structural equation. The necessary condition for the model to be exactly identified is that there must be the same number of parameters in B0 and D as there are in , the covariance matrix from the reduced form. This is the order condition.

The relationship between the reduced form and the structural model can be expressed as:

$$\Sigma = (B_0^{-1})D(B_0^{-1})' \tag{3}$$

where a prime (') indicates the transpose operator.

Exact identification requires that the parameter in B_0 and D, of which there are $2n^2$-n, be uniquely recoverable from the reduced form. Since Σ has n(n+1)/2 parameters, we require $2n^2$-n-n(n+1)/2 restriction on B_0 and D. It is standard in the SVAR literature to restrict D to be diagonal, imposing n(n-1) restriction.

For exactly-identified model with no restriction on A_j, a simple two-step maximum likelihood estimation procedure can be employed, assuming the structural errors are jointly normal. This is the full information maximum likelihood (FIML) estimator for the SVAR model. First, Σ is estimated as, $\hat{\Sigma} = (1/T)\sum_{t=1}^{T} \hat{\varepsilon}_t \hat{\varepsilon}_t'$ where ε are the OLS residuals from each equation of the reduced form model. Estimates of B_0 and D are then obtained by maximizing the log

2 The representation of structural VAR is based on study by Breschetto and Voss (1999)

likelihood for the system conditional on Σ. This amounts to finding the solution to the system of non-linear equations given in equation (3).

When the model is over-identified, however, the two-step is not the FIML estimator for the SVAR model. The estimates are consistent but not efficient since they do not take the over-identification restriction into account the reduced form. Nevertheless, this is a common means to estimate these models, and we use this method.

In this paper, we analyze two paths of asset price channel, the investment path and consumption path. For the investment path, we restricts the elements of the B_0 matrix as follows:

$$B_0 x_t = \begin{bmatrix} 1 & 0 & 0 & 0 \\ -b_{21} & 1 & 0 & -b_{24} \\ -b_{31} & -b_{32} & 1 & 0 \\ 0 & 0 & -b_{43} & 1 \end{bmatrix} \begin{bmatrix} i_t \\ a_t \\ I_t \\ \pi_t \end{bmatrix} \tag{4}$$

where: i_t = SBI rate
a_t = equity price
I_t = investment
π_t = inflation rate

The structural variance covariance matrix D is assumed to be diagonal. The model is over-identified. Thus, for simplicity, we make an individual equation of the model in complete detail.

$$\begin{aligned} i_t &= u_{1t} \\ a_t &= b_{21} i_t + b_{24} \pi_t + u_{2t} \\ I_t &= b_{31} i_t + b_{32} a_t + u_{3t} \\ \pi_t &= b_{43} I_t + u_{4t} \end{aligned} \tag{5}$$

The interest rate equation is interpreted that SBI rate is independent from contemporaneous movements in any variables. SBI is a policy variable and monetary authority has a full discretion in determining the rate. JSX index is assumed to respond to a change in SBI rate and inflation immediately. When SBI rate increase, it will be followed by an increase in deposit rate. Higher return in deposit attracts people to shift their possession of alternative asset, in this case equity, into deposits. Thus, demand for equity reduces, led to a decrease in equity price. At the same time, contractionary monetary policy will provide lesser amount of money held by public. People will most likely to reduces their spending on equity rather than give up other expenditure. This will also create lower demand for equity.

Investment is affected by change in equity price and interest rate. While the impact of a change in interest toward investment is obvious, equity price affects the investment through the increase in firms' value. Both variables work in the opposite direction. Lastly, inflation is solely determined by demand pressure. As investment increase, the aggregate demand rise more rapidly

than the increase in potential, creates narrowing output gap. Hence, inflation increases. This also explains the impact of monetary policy that can only alter inflation pressure from demand side.

The same restrictions are imposed in the consumption path. In this system, equity price and interest rate determines the growth of consumption. When monetary authority tightens monetary condition, e.g. increase SBI rate, the cost of holding money increases. People no longer wants to hold money unless for the daily transaction. Higher yield from deposit will force people to cut down some unnecessary expenses. Thus, consumption declines. Equity price also determined the consumption through its effect on lifetime resource of income (wealth effect). As equity price drops, so does the lifetime income. Hence, people will find they are less wealthy as before, and then start to reduce their consumption. Other equations in consumption path are the same.

For estimation, we used a two-step procedure. The first step of the procedure was OLS estimation of the coefficients of the VAR system. The second step we estimate the structural parameter of SVAR by imposing restriction as explained above, to solve the system.

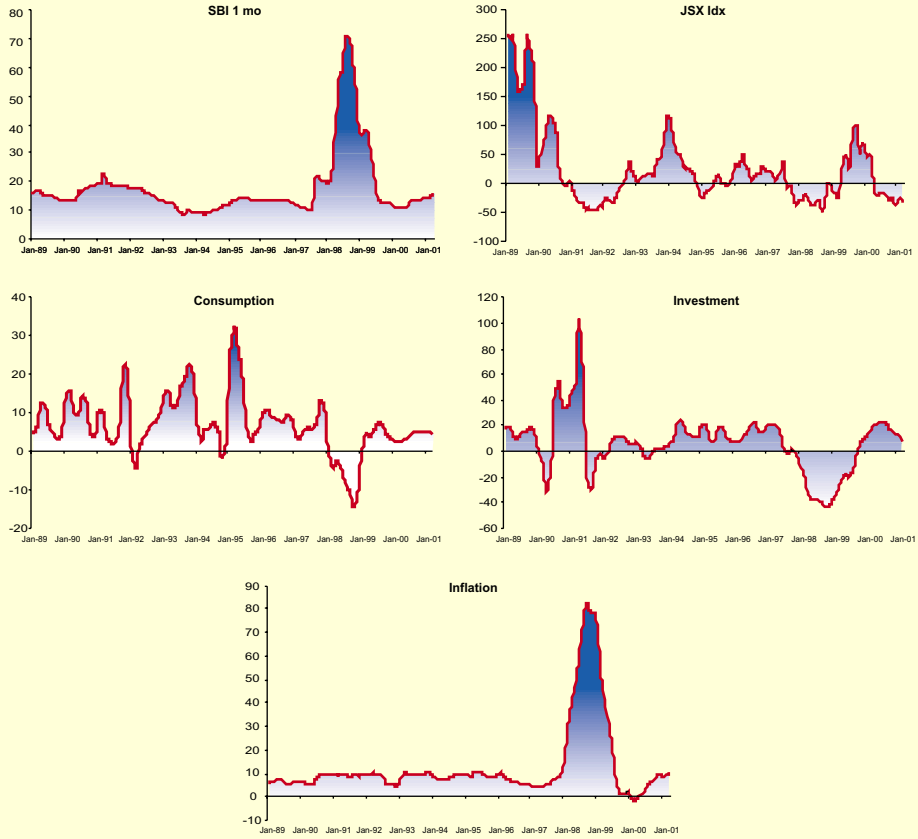
EMPIRICAL RESULTS

Data

As mentioned earlier, there will be five variables used in these two structural models, i.e. SBI rate, the Jakarta Composite Stock Exchange (JSX) index, investment, consumption and year-on-year inflation. All variables are in annual-growth terms except for SBI rate. SBI rate is considered as policy variable and its nature creates an exogeneity. For the proxy of asset price, we use JSX index. This JSX data series is available in monthly basis. In fact, Borio et al. (1994) had proposed the used of composite asset price index as the proxy for asset prices. This composite index consists of housing/residential property price, commercial property price, and financial asset index, while other durable assets are not counted in due to their small share in total wealth. In Japan, the land price is used as a proxy for asset price. In fact, the variables chosen should reflect the biggest part of wealth that can significantly change behavior of spending. Meanwhile, in Indonesia, the availability of such data is limited, thus refraining us from choosing JSX index. JSX index is determined by several factors within the context of a more general macroeconomic system such as monetary policy and inflation. Unfortunately, for investment and consumption, the data is only available in quarterly basis. Hence, we need to do some interpolation to derive from quarterly into monthly.[3] Full details of the data including source are available in the data Appendix 1.

3 The data conversion method used is provided built-in the Eviews program.

Graph 7.1
Variables



Graph 7.1 present the series as we used in the estimation for all period 1989:01 – 2001:03, 141 observations. In this research, we divide data series into four samples period as explained earlier. The sample periods we choose are more appropriate because of the structural changes, in particular the economic and financial crisis that occurred since July 1997. In mid 1997, the monetary crisis in Asia was spread to Indonesia, where the economic indicators such as monetary policy (SBI rate) and prices skyrocketed. Here, we define the crisis period as a period when the data showed an abnormal pattern.

Unit Root

We noticed that using the data at level terms provides more information, but time series data usually possess a unit root. To avoid using a non-stationary data in the VAR model, Dickey-

Fuller test is employed. In fact, up to present, the problem of unit root is still in controversy due to relatively weak methods available for testing unit roots. Brochette and Voss (1999) estimate the structural VAR model in levels. They accept the loss in efficiency in favor of keeping the long-term behavior needed in analyzing structural relationship between variables. Alternatively, to cope with the non-stationary problem while constructing variance decomposition and impulse response function, they employed the bootstrap procedure. Another approach proposed by Blanchard and Quah (1989) has estimated a VAR model where some variables were assumed to be stationary while others had unit roots. Alternatively, King, Poser, Stock and Watson (1991) use co-integrated model, where the variables are stationary at different order, but some linear combinations of the variables are stationary. [4]

Table 7.1 Result of Dickey Fuller Test

Variables	Lag	ADF Test
LEVEL:		
SBI Rates	1	-2.86
Jakarta Stock Exchange (JSX) Index	12	-1.88
Consumer Price Index	10	1.63
Real Investment	12	-1.34
Real Consumption	1	-0.92
ANNUAL GROWTH		
Growth of investment	1	-5.99 ***
Inflation	1	-3.78 ***
Growth of consumption	1	-7.45 ***
Growth JSX Index	1	-3.23 **

Notes : Critical value : 5 % = -2.87, 1%=-3.46

Based on this Dickey-Fuller test indicates that all variables in level, except SBI rate which is close to 5% significant level , contain unit roots. Hence, they are not appropriate for a VAR model. Eventually, the annual-growth series were stationary. Thus, we employ the SBI rate in level and four other variables in annual-growth.

Lag Length

To construct the SVAR model, it is required to decide how long the lag length is. We employ two criteria i.e. Akaike Information Criterion (AIC) and Hannan-Quinn Information (HQ). Both AIC and HQ based on two times the average log likelihood function. We employ these criteria

4 Keating (1992).

Table 7.2 Result of Dickey Fuller Test

Lag term in VAR model	Pre-crisis model		Post-crisis model		Whole period without break		Whole period	
	AIC	HQ	AIC	HQ	AIC	HQ	AIC	HQ
0	33.73	33.76	33.06	33.13	30.67	30.71	33.73	33.76
1	25.93	26.11	23.60	23.90	22.67	22.86	25.93	26.10
2	24.57	24.88*	23.07*	23.62*	21.09	21.43	24.57	24.88*
3	24.63	25.07			20.97	21.46	24.63	25.07
4	24.53	25.11			20.84	21.48	24.53	25.11
5	24.36	25.08			20.55	21.34	24.36	25.08
6	24.22*	25.07			20.28*	21.22*	24.22*	25.07

Note:
(*) indicates lag order selected by the criterion
AIC: Akaike information criterion
HQ: Hannan-Quinn information criterion

because the statistic value of AIC and HQ indicate enough penalties for increasing dependent variables, which is equal to lengthen lag term in VAR model. Furthermore, AIC indicates the gap between the most desirable model and the actually tested model. The smaller AIC implies the better actual tested model. Therefore, the model with the smallest AIC should be specified.[5]

Table 7.2 reports the result of AIC and HQ for the SVAR investment path. According to AIC, all VAR model show the best statistic at six lags, and according to HQ, pre-crisis model

Table 7.3 Lag Length Test for Consumption Path

Lag term in VAR model	Pre-crisis model		Post-crisis model		Whole period without break		Whole period	
	AIC	HQ	AIC	HQ	AIC	HQ	AIC	HQ
0	26.55	26.60	31.57	31.63	31.71	31.74	31.77	31.80
1	19.27	19.48	24.43	24.73	23.09	23.27	24.01	24.18
2	18.81	19.19*	23.36*	23.70*	21.97	22.30	22.56	22.87*
3	18.98	19.54			21.92	22.39	22.59	23.03
4	19.01	19.74			21.80	22.45	22.46	23.03
5	18.63*	19.54			21.47	22.23*	22.25*	22.96
6	18.74	19.82			21.43*	22.33	22.25	23.10

Note:
* Indicates lag order selected by the criterion
AIC: Akaike information criterion
HQ: Hannan-Quinn information criterion

5 Yoshioka (2001).

with two lags does. For the post-crisis, we only test until two lags because of insufficient number of observation to estimate the model. Table 7.3 presents the result of the lag length test for SVAR consumption path. For the post-crisis, we use a similar lag with the SVAR model for investment path.

Although both models are described the Hannan-Quinn criteria and AIC, ultimately we use AIC to estimate the VAR model due to its wide acceptance and applicability for all models that can be estimated by the most likelihood method.

Granger Causality Test

To test statistical causality relationship among variables, we employ the Granger Causality test for all four types of empirical exercises. The result of Granger causality analysis employing the investment path is presented in Table 7.4 SBI rate does not Granger-causes the

Table 7.4 Results of Granger Causality Analysis for Investment Path

Sample period: 1989:01 - 1997:06 (Pre-crisis)				Probability
From To	SBI Rate	JSX Index	Investment	Inflation
SBI rate		0.47	0.13	0.0000
JSX index	0.58		0.36	0 . 4 2
Investment	0.78	0.62		0.28
Inflation	0.00	0.10	0.04	
Sample period: 1998:06 - 2001:03 (Post-crisis)				
From To	SBI Rate	JSX Index	Investment	Inflation
SBI rate		0.56	0.01	0.00
JSX index	0.50		0.01	0.47
Investment	0.43	0.36		0.04
Inflation	0.56	0.06	0.00	
Sample period: 1989:01 - 1997:06 1998:06 - 2001:03 (Whole period 1)				
From To	SBI Rate	JSX Index	Investment	Inflation
SBI rate		0.40	0.02	0.00
JSX index	0.91		0.40	0.47
Investment	0.90	0.72		0.44
Inflation	0.00	0.32	0.02	
Sample period: 1989:01 - 2001:03 (Whole period 2)				
From To	SBI Rate	JSX Index	Investment	Inflation
SBI rate		0.47	0.13	0.00
JSX index	0.59		0.36	0.42
Investment	0.78	0.62		0.28
Inflation	0.00	0.10	0.04	

Table 7.5 Results of Granger Causality Analysis For Consumption Path

Sample period: 1989:01 - 1997:06 (Pre-crisis)				Probability
From To	SBI Rate	JSX Index	Consumption	Inflation
SBI rate		0.98	0.85	0.70
JSX index	0.00		0.97	0.70
Consumption	0.44	0.75		0.83
Inflation	0.10	0.47	0.82	
Sample period: 1998:06 - 2001:03 (Post-crisis)				
From To	SBI Rate	JSX Index	Consumption	Inflation
SBI rate		0.61	0.73	0.58
JSX index	0.00		0.8336	0.07
Consumption	0.00	0.38		0 . 0 4
Inflation	0.00	0.32	0.01	
Sample period: 1989:01 - 1997:06 1998:06 - 2001:03 (Whole period 1)				
From To	SBI Rate	JSX Index	Consumption	Inflation
SBI rate		0.80	0.83	0.00
JSX index	0.00		0.42	0.22
Consumption	0.05	0.85		0.11
Inflation	0.00	0.67	0.54	
Sample period: 1989:01 - 2001:03 (Whole period 2)				
From To	SBI Rate	JSX Index	Consumption	Inflation
SBI rate		0.79	0.68	0.00
JSX index	0.00		0.34	0.20
Consumption	0.01	0.86		0.05
Inflation	0.00	0.54	0.20	

JSX index and investment for all sample period. We find some causality between variables that inconsistent with economic theory. In general, JSX index does not Granger-cause other variables. In general, JSX index does not granger cause other variables, except in post crisis where JSX precedes inflation. It means that asset prices do not appear to precede other three variables. Table 7.5 presents the result of Granger Causality Test for consumption path. SBI rate Granger-causes the JSX index and inflation for all sample period. The result also holds for inflation to SBI rate for the whole period 1 and whole period 2. It does not fulfill our assumption in VAR model that SBI is unaffected by other variables. Another result shows that JSX index does not cause the consumption in all sample period. It means that the link between JSX index and consumption is too weak. Based on Granger Causality test for the two models, we do not use these results to make restriction in the SVAR analysis. Later, we use economic theory to make some restriction in SVAR analysis.

SVAR Results

In this section, we present the results of SVAR analysis, which consists of three parts analysis. First, SVAR model estimates relationship of each variable in the system. Second, variance decomposition of each model provides the share of the variance of each variable explained by other variables in the system. Finally, the impulse response function indicates how the variables respond to various shocks.

Estimates for Investment Path

Table 7.6 reports the parameter estimates for the structural model. The first four parameters of each model are standard deviations for structural shocks and each of these estimates is significantly different from zero. While we cannot reject the over-identification restriction for pre-crisis and whole period 2 models at standard significance level, the marginal significance level for both periods are quite low. However, the marginal significance level for both post-crisis and whole period 1 is much greater than that of the former.

In the pre-crisis model, we find that each parameter has correct sign as predicted by economic theory, but statistically not significant. Parameter of SBI rate (b_{21}) in the JSX equation reflects monetary policy impact to the JSX index. When Bank Indonesia raises SBI rate, deposit rate will raise and people prefer to put their money in to the bank. Thus, demand for JSX as an alternative for the people to hold their wealth decreases and JSX index goes down. Moreover, it indicates the existence of substitution effect. This result also holds for other sample periods, except for the post-crisis. Although, these coefficients are not significantly different from zero, however it suggests that monetary policy could affect the movement of JSX index.

The parameter of SBI (b_{31}) in investment equation for pre and post-crisis has a negative sign and statistically significant for post-crisis. This result is consistent with economic theory. Increasing SBI rate implies more expensive for investment, therefore discouraging investment. On the contrary, this parameter in both whole period 1 and 2 has positive sign. These results appear inconsistent, suggesting that the parameter estimate is not robust to describe the impact of monetary policy on the investment.

Parameter estimate of JSX index (b_{32}) in investment equation explains the relationship between JSX index and investment. The increase in JSX index leads to a higher willingness of investors to invest. Our result shows that the parameter estimate for all sample periods have a positive sign, as hypothesized. However, the relationship is somehow insignificant in explaining the assets price channel. We suspect that the JSX index is not fully appropriate as a proxy of asset price.

Table 7.6 Estimates for Investment Path

	Pre-crisis		Post-crisis		Whole period 1		Whole period 2	
	Parameter	S.E	Parameter	S.E	Parameter	S.E	Parameter	S.E
$ó_i$	0.7799*	0.0556	3.4051*	8.2462	1.7455*	0.1082	2.0533*	0.1223
$ó_a$	17.145*	1.2373	15.290*	8.1418	18.4232*	1.1247	18.7227*	1.115
$ó_l$	5.1602*	0.3724	1.862*	-7.9141	7.5881*	0.4688	7.4380*	0.4430
$ó_E$	0.6838*	0.0493	2.258*	8.1783	1.1854*	0.0735	1.6095*	0.0958
b_{21}	-1.7793	2.2727	0.3666	0.4678	-0.9030	0.9256	-0.6258	0.7680
b_{31}	-0.1295	0.6862	-0.204*	-2.1495	0.5694	0.3881	0.4720	0.3058
b_{32}	0.0226	0.0307	0.0288	1.3594	0.0438	0.0363	0.0332	0.0338
b_{43}	0.0041	0.0136	-0.592*	-3.0814	0.0157	0.0138	0.029*	0.0182
b_{24}	1.9371	2.5674	2.706*	2.4768	2.265*	1.375	1.1048	0.9851
∞^2	3.7061	(0.0542)	1.4646	(0.2262)	1.9416	(0.1635)	4.2605	(0.0390)

Note :

- The test for over-identification is a LR test. The marginal significance level is in parentheses.
- An asterisk (*) indicates significance at the 5 percent level.

Parameter estimate of investment (b_{43}) describes that increase in investment will cause the inflation, representing potential inflationary pressure. This phenomenon does not appear in the post-crisis, where the sign of parameter is negative and statistically significance. However, in full sample and pre-crisis, we find an indicator that investment has potential inflationary pressure, but is not really clear because it is statistically insignificant. It is appear that the parameter estimates are not robust to explain the existence of assets price channel. We put inflation variable into the JSX index equation in order to describe the phenomenon where people prefer to hold their wealth in asset at the higher inflation, vice versa. Higher inflation implies that it is more profitable to hold assets rather than cash or deposits. The estimated parameter for inflation (b_{24}) has a correct sign as predicted. However, its robustness is sensitive to a change in sample period. For the post-crisis and whole period 1, the parameter is statistically significant.

Variance Decomposition for Investment Path

Variance decomposition, which quantifies the percentage contribution of each shock to the variation in variable, is shown in appendix Table A.1 to A.4. In general, the variances of the variables are mostly determined by their own shocks. After six months, the variability of JSX index due to shock of SBI increases to 34% at 36 months after shock in pre-crisis. Meanwhile, in the post-crisis period, the shock of SBI shares drops to less than 25%. It indicates that monetary policy became less dominant in determining the variability of JSX index in post-crisis. This

might be the case when non-economic factors, such as political and social conditions surrounding Indonesia, play more important role in all activity, despite some possibilities of excluding the relevant variable from the model.

In order to acknowledge how JSX index is transmitted into investment, we need to examine how JSX index's shock explains variability of investment. As shown in the table, JSX index is hardly to contribute to the variance of investment in the four sample periods tested that explain only less than 21% after 36 months. In line with the result of estimated structural VAR parameter, we suspect that JSX index is not a proper proxy for asset price. Furthermore, the share of SBI shock accounted to the variability of investment decreases significantly in post-crisis, from 52% in pre-crisis to 26%. Herewith, we suspect that the investment decision after the crisis hit is more based on the non-economic factors.

Investment shock shares only a small portion of the inflation variability. However, the percentage goes up if we include the crisis period. As mentioned earlier, the variance of inflation is determined mainly by its own shock. In the pre-crisis period, Bank Indonesia had multiple objectives and inflation was not the sole target then. It is reflected by small role of SBI shock to the variability of inflation. In contrast, in the post-crisis period, monetary policy can alter more, jump from 5% in pre-crisis to 36% after 18 months.

Impulse Response for Investment Path

Innovations on SBI rate

Graph A.1. in Appendix shows that after we introduced innovation in SBI rate during the pre-crisis the JSX index immediately falls and reach its maximum effect within 5 months. For the post-crisis, the graph shows the similar story except that the respond is faster (appendix Graph A.2). These results suggest that monetary policy can affect JSX index within the first 5 months, and after that the impact start to diminish. The impulse response from the whole period 1 and 2 also appear to have similar results (appendix Graph A.3 to Graph A.4).

Meanwhile investment does not respond immediately to the monetary policy shock. It needs approximately 10 months before the shock affects investment in the right direction in the pre-crisis period. Similar result appears in post-crisis but with more rapid and stronger respond. It needs only 5 months before the monetary policy shock to have its impact. Afterwards the effect is diluted. In general, this particular shock does affect investment in right direction in all sample period, except for the pre-crisis.

The response of inflation to the contraction of monetary policy takes some time before the monetary policy can bring inflation down. The full impact takes 15–20 months after

contraction. It seems that the result is in line with the previous researches regarding the lag of monetary policy towards inflation, which is between 18-24 months. However, the first response to the shock is to increase inflation. Thus, we can hardly say that SBI can affect inflation through this particular path.

Innovation on JSX index

On the bottom left graph in appendix Graph A.1 to Graph A.4, we can see the behavior of investment series in response to the JSX index shock. In pre-crisis period, it seems that investment is relatively neutral to innovation in JSX index. It might be explained, partly, by the distortion in business environment. Lots of gigantic plants were built not on the basis of market-wise decision. However, in general it appears that positive shock in stock index caused investment to rise with some delays up to 5 months.

Innovations on Investment

The implication of one standard deviation innovation in investment also resulting a puzzle in terms of response by inflation in all sample period examined. An increase in investment was responded by immediate decrease in inflation within the first 5 month before it starts to respond to the increase in demand pressure. Later on, the impact fades away and converges to the long run level.

Estimates for Consumption Path

Table 7.7 presents the estimate for consumption path, the associated standard errors and a likelihood ratio test of the over-identification restriction. The first four parameters are standard deviations for structural shock. These estimates are significantly different from zero. Meanwhile, parameter estimate for all models are mostly insignificantly different from zero. However, we cannot reject the over-identification restriction at the standard significance levels, except for whole period 1.

In the consumption path, parameter of SBI rate (b_{21}) has incorrect sign as an increase in SBI rate should reduce JSX index, for all sample periods, except in post-crisis. This result left some puzzle, but we suspect it is related to financial liberalization took place in Indonesia since late 80's that changed consumption pattern. On one side, attractive interest rate pushed public to place their fund in the bank, hence, creating bulk of loanable fund. On the other side, rising in competition among banks resulted in huge extending credits, especially consumer credits.

Table 7.7 Estimates for Consumption Path

	Pre-crisis		Post-crisis		Whole period 1		Whole period 2	
	Parameter	S.E	Parameter	S.E	Parameter	S.E	Parameter	S.E
—i	0.81*	0.06	3.96*	0.42	1.75*	0.11	2.07*	0.12
—a	17.00*	1.23	18.15*	1.91	18.90*	1.17	18.96*	1.13
—c	2.91*	0.21	1.94*	0.20	2.71*	0.17	2.65*	0.16
—_	0.66*	0.05	2.38*	0.25	1.23*	0.08	1.66*	0.10
b_{21}	1.12	2.15	-0.09	0.68	0.25	0.95	0.87	0.77
b_{31}	-0.34	0.37	0.03	0.07	0.02	0.14	0.08	0.11
b_{32}	0.01	0.01	0.02	0.02	0.00	0.01	0.00	0.01
b_{43}	-0.06*	0.02	0.16	0.19	-0.08*	0.04	-0.04	0.05
b_{24}	-1.20	2.64	1.56	1.17	-2.02	1.35	-1.48	0.96
$—^2$	2.71	(0.05)	13.33	(0.00)	1.59	(0.21)	0.68	(0.01)

Note :
- The test for over-identification is a LR test. The marginal significance level is in parentheses.
- An asterisk (*) indicates significance at the 5 percent level.

Increasing consumption boosted by credit expansion overcame the substitution effect. During the post-crisis, spike in interest rate created a huge substitution effect, while loanable fund cannot be transmitted to consumers as known as the credit crunch phenomenon.

In pre-crisis, parameter of SBI rate (b_{31}) in consumption equation has an insignificant negative sign. It indicates that contemporaneous substitution effect plays more dominantly than income effect. In other words, relatively higher return from deposits could discourage spending for consumption. However in post-crisis, the reverse result appears. During the crisis, higher consumption mainly came from the windfall income resulted from increasing return of deposits and fiscal expansion. Moreover, during this crisis period, the growth is characterized by consumption driven as the engine.

Parameter of JSX (b_{32}) in consumption equation explains the relationship between JSX index and consumption. Our result shows that the estimated parameters for all samples have positive signs, meaning that the increase in JSX index creates a higher income to consume. It clearly shows that the wealth effect works in Indonesia. However, the relationship is somehow statistically insignificant.

Parameter of consumption (b_{43}) describes that increasing in consumption will cause inflation, representing part of demand pressure. This phenomenon appears in post-crisis, but in other sample periods turn the other way around. In this consumption path, as stated earlier, consumption was the main engine of growth during the crisis. In the same time, investment dropped severely. The net result is narrowing output gap, which led to an increase in general price levels.

Variance Decomposition for Consumption Path

Similar to the investment path, the variance decomposition in this particular path shows that the variability of each variable is also mainly attributable to its own shock (Appendix Table A.5 to Table A.8). In general, it could be conclude that the effectiveness of monetary shock increases after crisis hit. The contribution of shock in SBI in explaining variability in inflation contains for 8% in the pre-crisis period, and jump to almost 40% after crisis.

In the pre-crisis period, share of SBI shock accounts for more than 40% of the variability of JSX index. However, for other sample periods, share of SBI shock is less than 11%. Substantial drops in SBI contribution are due to the fact that JSX index fluctuates almost independently from economic fundamental. In other words, business decision-makings were determined more by heavy non-economic factors such as negative market sentiment, political upheaval, and uncertainties in law enforcement etc.

Consumption variability that is attributable to movement in JSX index is just slightly different, between pre and post-crisis. JSX index shock contributes approximately 12% and 10% consecutively for the variability in consumption. Hence, the income effect stemmed from the ups and downs in JSX index is hardly to differ. In this case, we suspect that income generated from asset prices (JSX) is not big enough to influence the variability of consumption. It is consistent with our previous result where JSX index is not fully appropriate as a proxy of asset prices.

Impulse Response for Consumption Path

Innovations on SBI rate

In general, impulse response of JSX to SBI shock is quite similar to impulse response resulted from investment path. As shown in appendix, SBI shock leads to the fall in JSX index and reached its maximum impact within sixth months in the pre-crisis period. Meanwhile, in the post-crisis the impact of SBI shock is not significant enough compared to the previous sample period. As mentioned earlier, those non-economic factors play an important role in post-crisis in determining the fluctuation of JSX index. It suggests that monetary policy is less dominant in affecting JSX index. Furthermore, we find the same pattern as in pre-crisis hold for other sample periods (appendix Graph A.6 to Graph A.8).

In the pre-crisis periods, the first response of SBI shock results an immediate increase on consumption. But, after three months, consumption starts to decrease as we expected and then the impact was fully reversed after 14 months. This pattern does not hold for other sample

periods. Instead of experiencing an increase, consumption drops right after the shock being implied and fully reversed after approximately 25 months. Longer time needed to fully reversing the impact of SBI shock indicates the longer impact of monetary policy lingers in affecting consumption pattern.

Furthermore, a positive shock in monetary policy was unexpectedly responded with increase in inflation, and fully reversed after 15 months. This pattern holds for all of sample periods. It reflects once again that monetary policy cannot influence inflation as theory suggested.

Innovation on JSX index

In post-crisis, consumption shows the response as suggested by economic theory although with some 7 months delay. Hence, an increase in JSX index led to an increase to a higher consumption and reached its peaks after 12 months. Since then it starts to converge to its long run equilibrium. However, the result from other sample periods shows a different pattern. As mentioned earlier, in the pre-crisis periods, consumption was fueled by consumer credits. Therefore, the wealth effect is insignificantly influencing consumption.

Innovation on Consumption

Inflation increases in response to consumption shock in the pre-crisis and whole period 1. It takes approximately 1 to 2 years to fully reverse the impact. In contrast, the other periods show the opposite pattern. In fact, the result leaves a puzzle since a positive consumption shock leads to a decrease in inflation as their first response. It takes quite a while before inflation starts to rise.

EVIDENCES FROM SURVEY

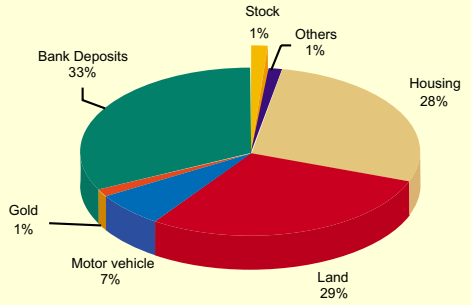
In this section we shall present the evidence from survey, which was conducted to provide additional information on how household response to monetary policy through change in bank deposit rate. We divide the evidence into two parts i.e. composition of household's assets portfolio and household's response to a change in deposit rate.

The survey involved 150 households in Jakarta. Most of respondents (36%) have total expenditure of Rp1 million to Rp3 million each month, while 30% have Rp3 million – Rp5 million worth of expenditure, 21% with Rp5 million to Rp10 million, and only 13 % with total expenditure above Rp10 million. Based on type of employment, 27% are civil servants, 23% private sector employee, 22% entrepreneur, while 28% includes other type of employment.

Composition of Household's Assets

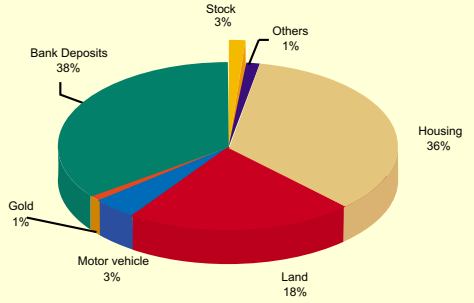
Survey shows that over than 33% of respondent choose bank deposits as their first priority to place their fund. Bank deposits is regarded as the most liquid asset, yet still provide quite attractive return. Other investment alternatives are in land and housing, where 29% and 28% of respondent choose those assets respectively as their first priority. Despite being not so liquid, housing and land have a long history of being a save-haven place for long-term investment. On the other hand, only 1% of household respondent place their fund in stock as first priority.

Graph 7.2
Composition of Household's Assets



In line with this result, should respondents have additional fund, the order of preference is similar, except for those of land and housing. Bank deposit is preferred by 38% of respondents, while 36% and 18% of respondents chose housing and land respectively. Meanwhile, stock is chosen as prime priority only by 3% of respondents. This evidence fortifies our empirical results that stock is not a good proxy to reflect households' wealth in Indonesia.

Graph 7.3
Household's Preference for Investment from Additional Fund

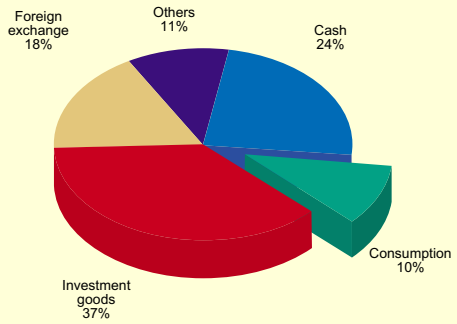


Household's response to change in bank's deposit rate

According to the survey, majority of respondents (83%) are not responsive to the decrease in bank's deposit rate. Over 80% of respondents will not withdraw their deposits, unless the deposits rate decrease substantially. Furthermore 60% of respondent will not withdraw their deposit even if interest rate decreases to level at 10%. We suspect this phenomenon take place due to the characteristic of majority of respondents who possess total expenditure worth of Rp 1 million to Rp 3 million for each month. Consequently, they are relatively insensitive to changes in bank's deposit rate.

With regards to alternatives for fund placement, the survey suggests that over 37% of respondents place their withdrawn money in investment goods, 24% prefer to hold cash, and 18% prefer to buy foreign exchange. In contrast, only 10% of respondents use the withdrawn money for consumption purpose. Out of 37% respondent that place their money in investment good, 51% of which invest in land, 26% in housing, and only 7% invest in stocks.

Graph 7.4
Household's Preference for Fund Placement

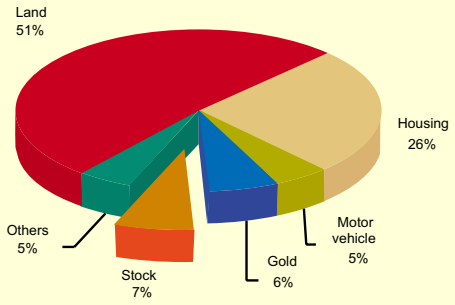


Decreasing interest rate on bank's deposit results in a lower cost of holding money. The return from deposits is lower compared to other assets. Thus, majority of respondents reacts to find investment alternatives with higher return. The figure below identifies that land is most preferable alternative for respondent to hold their assets. This condition to some extent reflects the existence of substitution effect. Meanwhile if the deposits rate increases, 74% of respondents respond by increasing amount of money in bank deposit, while 8% counter with enhancing their investment, and only 6% respond by reducing their purchase on investment goods. Another evidence shows that majority of respondent (72%) will put their income generated

from increase in deposit rate into the bank deposit, 15% of respondent use their income for consumption purpose, and only 8% utilize their additional income to purchase land and housing. This evidence shows that income effect does not exist in this particular sample group. Furthermore, respondents need substantial increase in bank deposits rate before they place additional fund. Out of total respondents, almost 80% require an increase in deposits rate of more than 4%.

All of these findings imply that households are hardly to respond the changes in bank deposits rate. Should they withdraw the fund, they will put their money into traditional form of investment alternatives, i.e. land and housing.

Graph 7.5
Household Preference for Investment Goods



CONCLUDING REMARKS

In general, using stock prices as proxy for asset prices, we can conclude that the study provides little evidence on the existence of asset price channel of monetary transmission in Indonesia. Even though monetary shocks could alter financial asset portfolio, yet they failed to be transmitted further to inflation.

We suspect the absence of asset price channel owes to the use of stock prices as proxy for asset prices, in the sense that JSX index could not properly reflect the wealth of the economy. Survey result later verifies the insignificant portion of stocks in household's portfolio, i.e. less than 5%. Moreover, the limited number of observation, particularly for the post-crisis periods, to some extent restrains the system to fully grab the long run relationship.

To cope with these limitations, we suggest generating reliable data series on housing or land prices that are more appropriate in reflecting the wealth, and possess closer link with monetary policy. Other agenda is strived to apply other approaches to illustrate asset price channel more appropriately.

References

Bernanke, Ben and Ilian Mihov. (1995)Measuring Monetary Policy, *National Bureau of Economic Research,* Working Paper No. 5145, June.

Bernanke, Ben and Mark Gertler. (2000) Monetary Policy and Asset Price Volatility, *National Bureau of Economic Research, Working Paper* No. 7559, February.

Bernanke, Ben and Michael Woodford. (1997) Inflation Forecast and Monetary Policy, *Journal of Money, Credit, and Banking,* Vol. 29, no. 4, November , part 2.

Borio, C.E.V., N. Kennedy, and S.D. Prowse. (1994) Exploring Aggregate Asset Price Fluctuations Across Countries: Measurement, Determinants and Monetary Policy Implications, *Bank for International Settlements, Economic Papers no 40, April.*

Brischetto, Andrea and Graham Voss. (1999)A Structural Vector Autoregression Model of Monetary Policy in Australia, *Reserve Bank of Australia, Research Discussion Paper,* December .

Campbell, John Y. Asset Pricing at the Millenium, (2000) National Bureau of Economic Research, Working Paper no. 7589, March.

Cote, Agathe and Jean-Francois Fillion. (1998)The Term Structure of Interest Rate and the Conduct of Monetary Policy in Canada in *Bank for International Settlements Conference Papers* on The Role of Asset Prices in the Formulation of Monetary Policy, March, pp 1-23.

Enders, Walter. *Applied Econometric Time Series,* (1995)John Wiley & Sons, Inc.

Filardo, Andrew J. Monetary Policy and Asset Prices, Federal Reserve Bank of Kansas City, *Economic Review*, Third Quarter-2000, pp 11-37.

Gluck Heinz and Richard Mader. (1998) Information Content and Wealth Effects of Asset Prices – The Austrian Case, in Bank for International Settlements Conference Papers on The Role of Asset Prices in the Formulation of Monetary Policy, March, pp 196-209.

Goodfriend, Marvin. Financial Stability, (2001) Deflation and Monetary Policy, *Monetary and Economic Studies* (special Edition), February, pp 143-176.

Hayes, Simon, Chris Salmon and Sanjay Yadav. (1998) Equities: What Can They Tell Us About The Real Economy? in Bank for International Settlements Conference Papers on The Role of Asset Prices in the Formulation of Monetary Policy, March.

Hoffmaister, Alexander W., and Garry J. Schinasi. (1994) Asset Prices, Financial Liberalization and the Process of Inflation in Japan, *IMF Working Paper* 94-153, December.

Jaillet, Poerre and Pierre Sicsic. (1998) Asset Prices: Relationships with Demand Factors and Credit, and Implications for Monetary Policy in Bank for International Settlements

Conference Papers on The Role of Asset Prices in the Formulation of Monetary Policy, March, pp 210-238.

Uemura, Shuici and Takeshi Kimura. (1998) Japanese Share Prices in Bank for International Settlements Conference Papers on The Role of Asset Prices in the Formulation of Monetary Policy, March, pp 193-165

Jung, Tachun, Yuki Teranishi, and Tsutomu Watanabe. (2001) *Zero Bound on Nominal Interest Rates and Optimal Monetary Policy*. Hitotsubashi University, February.

Keating, John W. (1992) Structural Approaches to Vector Autoregressions, Federal Reserve Bank of St. Louis, September/October.

McCallum, Bennett T.(1999) Analysis of the Monetary Transmission Mechanism: Methodological Issues, National Bureau of Economic Research, Working Paper no. 7395, October .

Meltzer, Allan H. (1995) Monetary, Credit and (Other) Transmission Process: A Monetarist Perspective, *Journal of Economic Perspectives*, Vol. 9, number 4 – Fall, pp 49-72.

Mishkin, Frederic S. (1995) Symposium on the Monetary Transmission Mechanism, Journal of Economic Perspectives, vol. 9, number 4 – Fall, pp 3-10.

Mori, Naruki, Shigenori Shiratsuka, and Hiroo Taguchi. (2001) Policy Responses to the Pos-bubble adjustments in Japan: A Tentative Review, Monetary and Economic Studies (special Edition), February, pp 53-102.

Sellin, Peter. (1998) *Asset Prices and Monetary Policy in Canada* in Bank for International Settlements Conference Papers on The Role of Asset Prices in the Formulation of Monetary Policy, March, pp 166-177.

Shigemi, Yosuke. (1995) Asset Inflation in Selected Countries in *Bank of Japan Monetary and Economic Studies,* vol. 13, no. 2,

Shiratsuka, Shigenori. (2001) Asset Price Fluctuation and Price indices, Monetary and Economic Studies (special Edition), February, pp 103-128.

Smets, Frank. (1997) Financial Asset Prices and Monetary Policy: Theory and Evidence, *Bank for International Settlements*, Working Paper no 47, September.

Yoshioka, Shinji. Relationship Among Exchange Rate, Money Supply, Interest Rate, and Prices Before and After Monetary Crisis in Indonesia: A Vector Autoregression Model Analysis, *JICA-TSQ, Bappenas*, TSQ Discussion Paper, 2001/02 – no. 1.

Appendix 1.
Data : Source and Construction

Table A.1 Variance Decomposition for Investment Path in Pre-crisis

Variable	Month(s) Ahead	S.E.	SBI Shock	JSX Price Shock	Investment Shock	Inflation Shock
SBI rate						
	1	0.77	100.00	0.00	0.00	0.00
	2	1.04	99.53	0.23	0.12	0.12
	3	1.31	96.67	0.21	2.86	0.26
	6	2.01	88.43	1.20	10.01	0.36
	9	2.55	82.42	2.44	14.66	0.48
	12	2.97	80.89	2.63	15.39	1.09
	18	3.55	77.22	1.89	15.70	5.18
	24	3.84	71.35	1.84	15.43	11.38
	36	4.02	65.65	2.52	14.36	17.47
JSX Price						
	1	17.25	0.63	98.78	0.00	0.59
	2	25.59	0.30	95.11	0.06	4.52
	3	30.95	1.43	93.22	0.06	5.29
	6	37.98	18.95	74.71	0.49	5.85
	9	43.54	27.22	64.04	1.08	7.66
	12	47.26	28.61	62.58	1.98	6.83
	18	49.82	33.19	57.51	2.61	6.69
	24	50.30	33.01	56.69	2.78	7.52
	36	51.62	34.38	54.29	3.19	8.14
Investment						
	1	5.17	0.02	0.56	99.42	0.00
	2	11.65	40.71	0.15	59.11	0.03
	3	16.70	48.60	0.25	50.59	0.56
	6	20.74	56.44	2.56	36.80	4.20
	12	22.27	52.31	8.29	34.45	4.95
	18	22.60	51.00	10.27	33.69	5.04
	24	22.94	51.09	10.73	32.86	5.32
	36	23.36	51.62	10.63	32.27	5.47
Inflation						
	1	0.68	0.00	0.00	0.10	99.90
	2	1.12	2.55	0.09	0.81	96.55
	3	1.40	6.12	0.21	1.60	92.07
	6	1.87	4.70	1.35	3.72	90.24
	9	1.96	4.60	2.05	4.74	88.62
	12	1.98	4.79	2.58	4.72	87.91
	18	2.00	5.48	2.61	4.73	87.18
	24	2.00	5.59	2.69	4.74	86.98
	36	2.01	6.49	2.67	4.97	85.88

Table A.2 Variance Decomposition for Investment Path in Post-crisis

Variable	Month(s) Ahead	S.E.	SBI Shock	JSX Price Shock	Investment Shock	Inflation ShocK
SBI rate						
	1	3.41	100.00	0.00	0.00	0.00
	2	4.96	92.04	4.70	0.17	3.10
	3	6.17	78.96	12.02	2.70	6.32
	6	8.68	51.33	21.28	15.13	12.27
	9	9.76	44.27	22.52	18.62	14.59
	12	10.24	43.23	23.19	18.49	15.09
	18	10.43	42.68	23.81	18.36	15.16
	24	10.47	42.57	23.75	18.47	15.21
	36	10.57	42.32	23.83	18.55	15.30
JSX price						
	1	17.71	1.95	81.87	3.11	13.07
	2	23.87	7.38	59.97	5.36	27.28
	3	27.62	6.61	49.33	7.10	36.95
	6	32.14	16.02	39.73	8.02	36.23
	9	34.00	20.92	38.89	7.33	32.86
	12	34.22	21.32	38.87	7.34	32.47
	18	35.70	22.07	37.58	8.95	31.40
	24	36.67	22.40	37.09	9.67	30.84
	36	36.84	22.43	37.08	9.76	30.74
Investment						
	1	2.16	12.66	4.58	82.03	0.73
	2	3.45	10.94	1.93	86.80	0.33
	3	4.27	7.79	1.29	90.31	0.60
	6	5.96	10.35	4.21	76.42	9.01
	9	8.20	22.17	11.56	51.64	14.63
	12	10.12	25.25	16.81	41.57	16.38
	18	11.56	25.39	20.21	37.13	17.28
	24	11.65	25.37	20.57	36.78	17.29
	36	11.80	25.48	20.65	36.51	17.37
Inflation						
	1	2.69	2.85	1.03	18.48	77.64
	2	4.14	8.51	2.46	11.80	77.23
	3	5.50	25.18	4.45	6.79	63.58
	6	10.42	48.24	14.79	6.26	30.71
	9	13.73	40.49	21.45	12.93	25.13
	12	15.05	36.85	23.13	15.51	24.51
	18	15.52	36.29	23.91	15.57	24.23
	24	15.58	36.26	23.86	15.69	24.20
	36	15.78	36.06	23.94	15.89	24.11

Table A.3 Variance Decomposition for Investment Path in Whole Period 1

Variable	Month(s) Ahead	S.E.	SBI Shock	JSX Price Shock	Investment Shock	Inflation Shock
SBI rate						
	1	1.75	100.00	0.00	0.00	0.00
	2	2.86	99.61	0.04	0.32	0.03
	3	3.94	98.77	0.25	0.60	0.37
	6	5.72	96.55	0.49	1.86	1.10
	9	6.38	95.07	0.41	2.75	1.77
	12	6.77	94.6	0.48	3.18	1.71
	18	7.02	94.33	0.63	3.13	1.90
	24	7.10	92.49	0.70	3.89	2.91
	36	7.17	90.94	0.70	4.90	3.46
JSX price						
	1	18.65	0.68	97.23	0.02	2.07
	2	27.86	0.50	95.80	0.72	2.99
	3	33.50	0.74	94.38	2.59	2.29
	6	38.95	2.63	86.26	8.30	2.81
	9	40.76	3.69	83.40	10.27	2.64
	12	42.76	4.60	82.22	10.02	3.16
	18	44.66	4.43	78.85	12.15	4.57
	24	45.95	4.30	75.62	14.28	5.80
	36	46.56	4.31	74.21	15.32	6.17
Investment						
	1	7.66	1.92	1.10	96.95	0.02
	2	12.90	0.87	0.81	98.31	0.01
	3	16.99	0.86	0.85	98.09	0.20
	6	18.89	1.39	1.62	94.56	2.42
	9	19.77	4.70	5.62	87.17	2.50
	12	20.09	6.15	6.73	84.39	2.73
	18	20.52	8.38	6.65	81.90	3.08
	24	20.56	8.57	6.66	81.66	3.11
	36	20.62	8.77	6.63	81.37	3.23
Inflation						
	1	1.19	0.02	0.01	0.99	98.98
	2	2.01	3.67	0.19	3.57	92.58
	3	2.62	22.73	0.19	5.12	71.97
	6	5.09	56.11	0.09	11.04	32.75
	9	7.04	61.66	0.06	14.57	23.70
	12	7.96	61.84	0.08	16.98	21.10
	18	8.34	62.52	0.26	17.63	19.59
	24	8.46	61.65	0.32	17.81	20.22
	36	8.67	60.95	0.31	18.56	20.17

Table A.4 Variance Decomposition for Investment Path in Whole Period 2

Variable	Month(s) Ahead	S.E.	SBI Shock	JSX Price Shock	Investment Shock	Inflation Shock
SBI rate						
	1	2.05	100.00	0.00	0.00	0.00
	2	3.43	95.81	0.27	0.99	2.93
	3	4.91	87.09	0.31	2.47	10.13
	6	8.15	66.15	0.17	8.14	25.53
	9	9.53	59.68	0.42	12.94	26.96
	12	10.56	59.25	1.21	16.12	23.41
	18	11.40	59.60	3.25	16.03	21.12
	24	11.97	54.27	3.64	17.35	24.74
	36	12.53	50.18	3.45	20.99	25.38
JSX Price						
	1	18.83	0.44	98.65	0.02	0.89
	2	27.74	0.42	96.80	0.43	2.35
	3	32.98	1.11	94.86	1.59	2.45
	6	37.72	4.36	88.04	5.33	2.27
	9	39.50	5.61	85.28	6.78	2.33
	12	41.62	6.49	83.77	6.64	3.11
	18	44.71	6.03	76.28	10.05	7.64
	36	49.72	6.86	62.31	18.40	12.43
Investment						
	1	7.52	1.80	0.68	97.51	0.01
	2	12.77	0.63	0.49	98.83	0.05
	3	17.02	0.39	0.52	98.44	0.66
	6	19.86	1.17	1.50	90.59	6.73
	9	21.51	5.88	5.54	80.42	8.16
	12	22.39	8.54	5.49	75.53	10.44
	18	23.61	12.67	5.71	70.99	10.63
	24	23.91	13.31	6.11	69.50	11.09
	36	24.52	12.90	5.91	68.46	12.73
Inflation						
	1	1.62	0.03	0.01	1.79	98.17
	2	3.05	2.78	0.13	4.39	92.71
	3	4.27	13.04	0.25	6.48	80.23
	6	8.33	29.64	0.15	14.49	55.72
	9	12.23	32.00	0.20	20.86	46.94
	12	14.43	32.83	0.87	25.87	40.43
	18	15.94	35.42	3.20	27.03	34.34
	24	16.76	32.43	3.97	26.71	36.89
	36	17.91	29.59	3.67	30.17	36.57

Table A.5 Variance Decomposition for Consumption Path in Pre Crisis

Variable	Month(s) Ahead	S.E.	SBI Shock	JSX Price Shock	Investment Shock	Inflation Shock
SBI rate						
	1	0.81	100.00	0.00	0.00	0.00
	2	1.12	99.30	0.05	0.62	0.02
	3	1.42	98.30	0.06	1.40	0.24
	6	2.22	97.57	0.25	1.72	0.46
	9	2.78	97.80	0.21	1.29	0.69
	12	3.22	97.64	0.17	1.11	1.08
	18	3.70	96.02	0.15	1.58	2.25
	24	3.85	94.06	0.19	2.03	3.72
	36	3.90	92.33	0.24	2.48	4.96
JSX price						
	1	17.02	0.27	99.50	0.01	0.22
	2	24.83	0.15	99.63	0.08	0.15
	3	30.04	0.96	96.00	0.51	2.53
	6	37.43	21.35	71.90	3.99	2.75
	9	43.63	30.67	58.12	4.53	6.68
	12	48.26	36.58	52.53	3.81	7.08
	18	50.93	41.03	47.79	4.46	6.71
	24	51.32	41.76	47.20	4.40	6.64
	36	51.67	42.42	46.64	4.37	6.57
Consumption						
	1	2.94	0.98	0.70	98.32	0.00
	2	4.91	1.78	5.49	92.39	0.34
	3	6.53	1.76	9.61	88.39	0.24
	6	7.48	8.28	12.62	73.82	5.28
	9	7.99	12.86	11.79	68.23	7.12
	12	8.07	13.34	11.67	67.86	7.13
	18	8.20	13.42	11.87	67.21	7.50
	24	8.24	13.55	11.79	67.17	7.49
	36	8.25	13.54	11.80	67.07	7.59
Inflation						
	1	0.68	0.06	0.04	5.57	94.33
	2	1.12	3.63	1.20	6.50	88.67
	3	1.42	8.29	3.20	7.60	80.91
	6	1.90	7.55	5.29	12.56	74.60
	9	2.00	7.95	7.03	14.04	70.98
	12	2.03	7.91	8.08	14.19	69.82
	18	2.03	7.86	8.28	14.12	69.73
	24	2.04	7.92	8.39	14.11	69.59
	36	2.04	8.22	8.38	14.08	69.32

Table A.6 Variance Decomposition for Consumption Path in Post Crisis

Variable	Month(s) Ahead	S.E.	SBI Shock	JSX Price Shock	Investment Shock	Inflation Shock
SBI rate						
	1	3.96	100.00	0.00	0.00	0.00
	2	6.68	94.77	0.09	0.04	5.10
	3	8.72	86.63	0.55	0.46	12.36
	6	12.45	67.29	0.82	5.71	26.18
	12	15.64	52.75	10.24	4.03	32.98
	18	16.51	48.63	17.01	3.72	30.64
	24	17.07	48.70	16.41	3.57	31.31
	36	17.63	46.86	17.95	3.38	31.81
JSX price						
	1	18.43	0.03	95.91	0.07	3.99
	2	25.55	0.27	86.08	1.82	11.83
	3	28.77	0.23	83.42	1.45	14.90
	6	34.48	0.79	80.21	3.91	15.09
	9	36.67	1.64	79.89	3.89	14.58
	12	37.43	2.15	79.95	3.79	14.11
	18	39.91	8.39	71.17	3.74	16.71
	24	41.94	10.23	66.66	3.44	19.68
	36	42.97	10.76	66.12	3.32	19.80
Consumption						
	1	1.98	0.43	4.17	95.23	0.17
	2	3.14	2.64	2.28	95.00	0.08
	3	3.81	10.36	1.73	87.50	0.42
	6	5.22	41.88	1.18	50.73	6.21
	9	5.78	43.55	1.36	41.37	13.72
	12	5.98	40.96	4.37	38.76	15.91
	18	6.16	39.48	8.50	36.59	15.43
	24	6.27	39.72	8.48	35.44	16.35
	36	6.37	39.05	9.55	34.34	17.05
Inflation						
	1	2.39	0.01	0.07	1.63	98.29
	2	4.35	10.06	1.06	19.58	69.30
	3	6.72	25.50	0.46	25.37	48.67
	6	14.23	49.38	1.63	12.08	36.91
	9	19.28	47.47	4.87	7.45	40.20
	12	21.81	41.36	11.35	5.90	41.39
	18	23.71	36.14	21.14	5.13	37.59
	24	24.77	37.31	20.62	4.84	37.23
	36	25.94	35.98	21.90	4.46	37.66

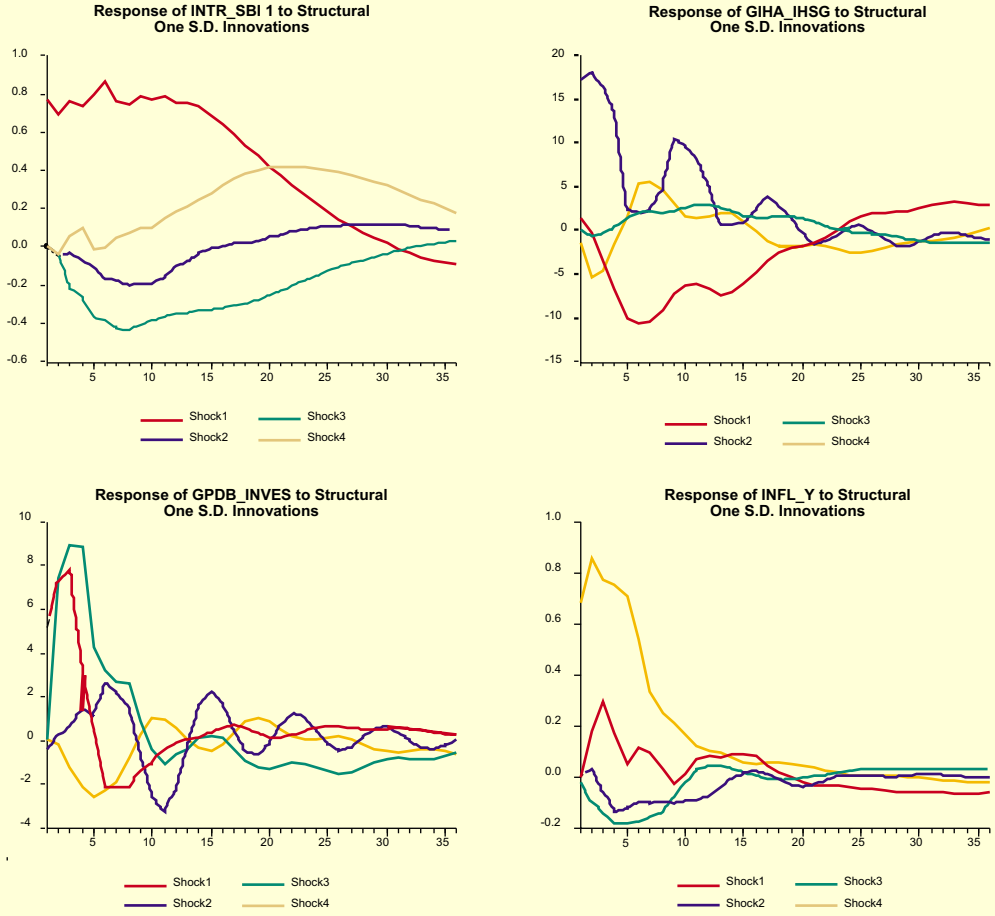
Table A.7. Variance Decomposition for Consumption Path in Whole Period 1

Variable	Month(s) Ahead	S.E.	SBI Shock	JSX Price Shock	Investment Shock	Inflation Shock
SBI rate						
	1	1.75	100.00	0.00	0.00	0.00
	2	2.85	99.80	0.18	0.00	0.02
	3	3.92	99.45	0.22	0.01	0.32
	6	5.64	98.79	0.24	0.10	0.88
	9	6.28	97.37	0.33	0.69	1.61
	12	6.66	97.41	0.29	0.75	1.55
	18	6.91	97.04	0.37	0.77	1.82
	24	6.97	95.66	0.62	0.79	2.93
	36	7.02	94.89	0.81	0.78	3.52
JSX price						
	1	19.06	0.05	98.19	0.05	1.71
	2	28.64	0.03	98.65	0.55	0.77
	3	34.24	0.34	97.31	1.40	0.95
	6	39.68	1.25	87.82	9.96	0.97
	9	43.09	3.20	82.67	13.18	0.95
	12	45.20	3.71	82.70	12.24	1.35
	18	47.04	3.50	82.40	11.92	2.19
	24	47.93	3.56	81.81	11.82	2.82
	36	48.34	3.59	81.70	11.71	2.99
Consumption						
	1	2.71	0.02	0.03	99.95	0.00
	2	4.65	0.45	1.26	98.28	0.01
	3	6.20	1.33	2.15	96.48	0.04
	6	7.05	13.60	2.82	83.51	0.07
	9	7.48	20.71	2.61	76.02	0.66
	12	7.56	21.30	2.66	75.38	0.65
	18	7.62	22.07	2.75	74.48	0.70
	24	7.64	22.27	2.76	74.17	0.80
	36	7.64	22.25	2.78	74.08	0.88
Inflation						
	1	1.25	0.00	0.00	2.78	97.22
	2	2.08	2.43	0.29	2.04	95.24
	3	2.68	19.35	1.23	1.37	78.06
	6	4.94	58.48	1.61	0.54	39.38
	9	6.65	67.87	1.97	0.41	29.75
	12	7.43	70.38	1.98	0.54	27.10
	18	7.76	72.09	1.92	0.69	25.30
	24	7.90	71.13	2.17	0.70	25.99
	36	8.12	71.09	2.40	0.67	25.84

Table 8. Variance Decomposition for Consumption Path in Whole Period 2

Variable	Month(s) Ahead	S.E.	SBI Shock	JSX Price Shock	Investment Shock	Inflation Shock
SBI rate						
	1	2.07	100.00	0.00	0.00	0.00
	2	3.45	96.71	0.00	0.08	3.20
	3	4.90	87.95	0.02	0.40	11.63
	6	8.13	66.64	0.06	2.69	30.62
	9	9.44	62.44	0.10	3.50	33.96
	12	10.29	65.37	0.37	3.20	31.06
	18	10.98	66.79	1.65	3.03	28.52
	24	11.52	60.81	2.56	2.77	33.85
	36	12.01	58.07	2.60	2.56	36.77
JSX price						
	1	19.20	0.89	97.47	0.01	1.64
	2	28.37	0.49	98.29	0.30	0.91
	3	33.42	0.79	97.72	0.77	0.73
	6	38.75	2.68	87.44	9.20	0.69
	9	42.57	6.05	80.70	12.59	0.65
	12	44.82	6.66	80.37	11.83	1.15
	18	47.41	6.09	77.44	10.81	5.67
	24	49.22	6.53	73.64	10.14	9.69
	36	49.81	7.14	72.28	9.92	10.65
Consumption						
	1	2.65	0.41	0.02	99.57	0.00
	2	4.59	1.58	0.84	97.58	0.00
	3	6.15	2.69	1.44	95.86	0.00
	6	7.17	17.79	1.77	79.16	1.29
	9	7.77	28.07	1.68	67.92	2.32
	12	7.90	28.96	1.73	66.01	3.30
	18	8.05	30.86	2.00	63.88	3.25
	24	8.12	30.70	2.25	62.79	4.25
	36	8.20	30.33	2.33	61.65	5.69
Inflation						
	1	1.66	0.00	0.00	0.35	99.65
	2	3.13	1.89	0.20	0.32	97.58
	3	4.43	11.13	0.46	1.16	87.25
	6	8.43	30.14	0.24	1.48	68.15
	9	11.98	35.37	0.16	2.02	62.45
	12	13.74	39.23	0.28	2.12	58.37
	18	14.83	44.20	1.52	2.06	52.22
	24	15.72	39.92	2.77	1.86	55.45
	36	16.92	38.48	2.76	1.63	57.12

Graph A.1
Impulse Response for Investment Path in Pre-crisis

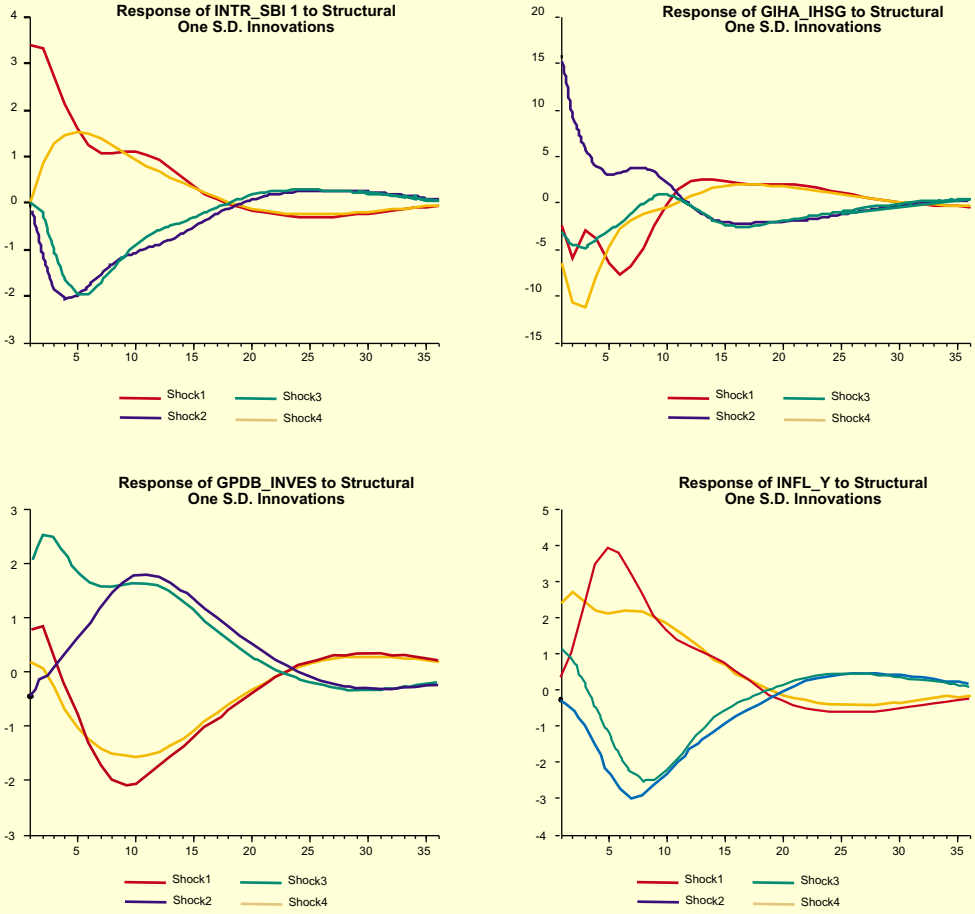


Note:

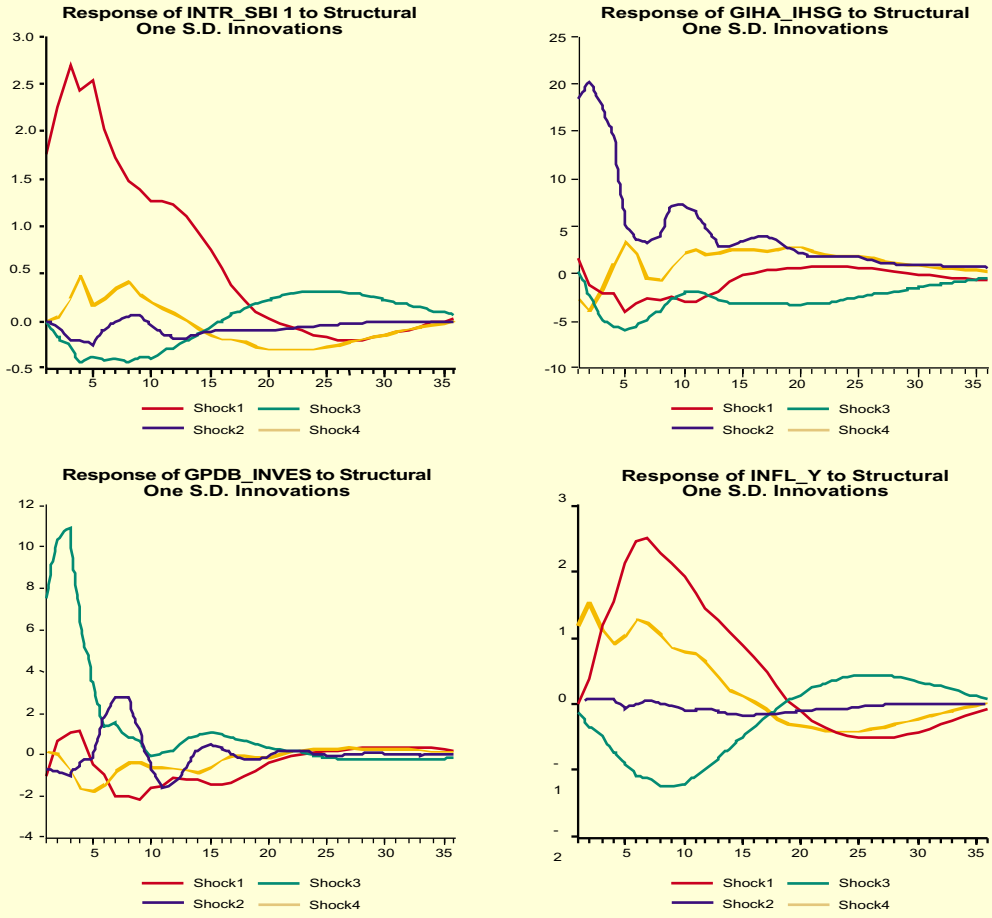
- INTR_SBI : SBI rate
- GIHA_IHSG : JSX price
- GPDB_INVES : investment
  INFL_Y : inflation

- Shock 1 : a one standard deviation shock to the SBI
- Shock 2 : a one standard deviation shock to the JSX price
- Shock 3 : a one standard deviation shock to the investment
- Shock 4 : a one standard deviation shock to the inflation

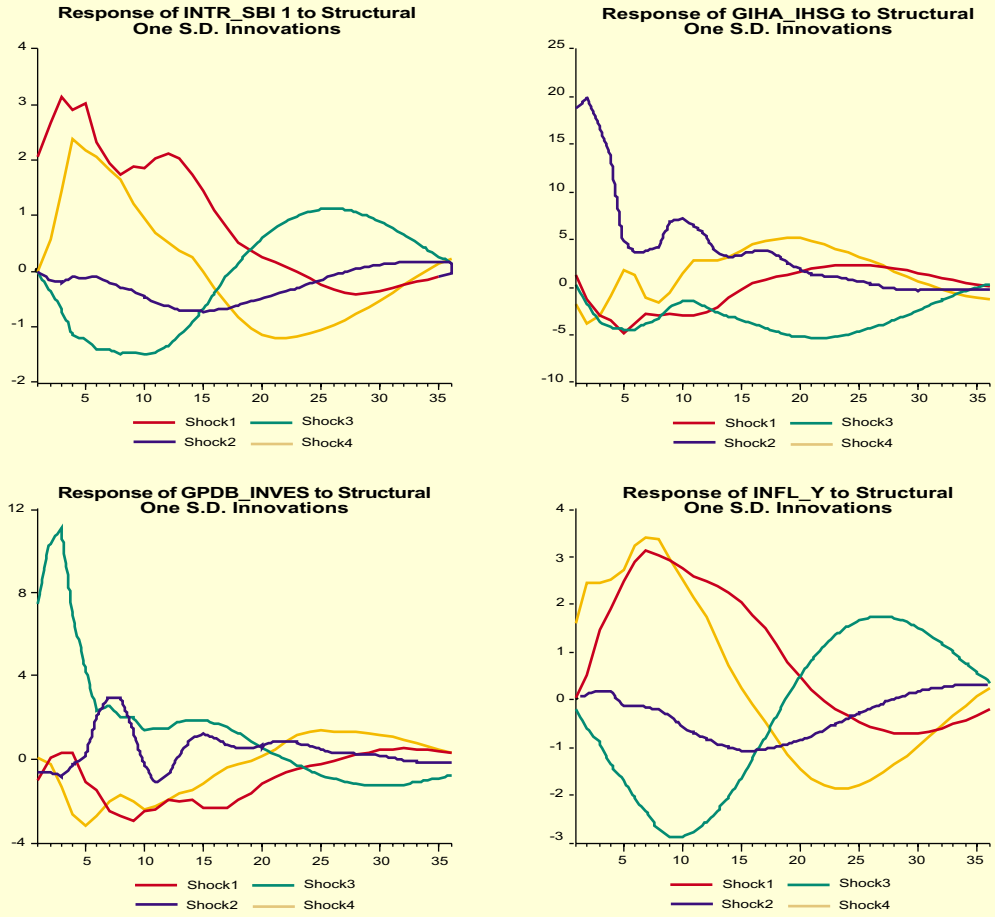
Graph A.2
Impulse Response for Investment Path in Post-crisis



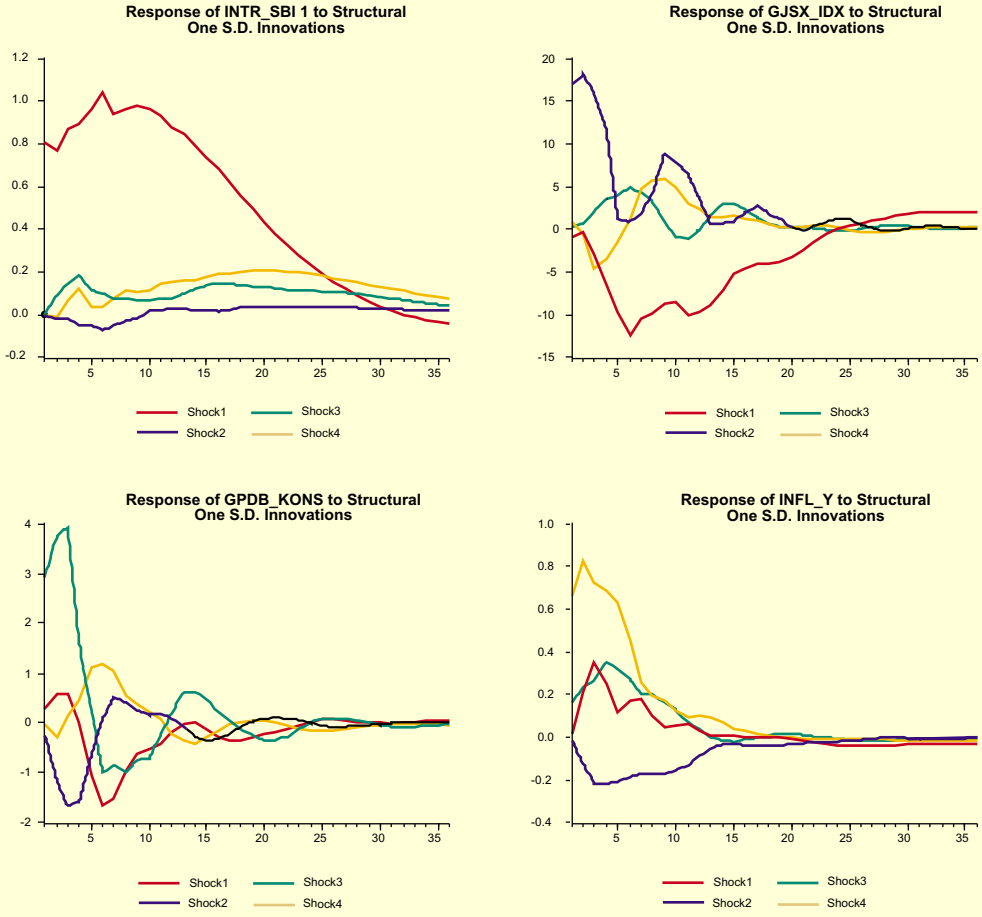
Graph A.3
Impulse Response for Investment Path in Whole Period 1



Graph A.4
Impulse Response for Investment Path in Whole Period 2



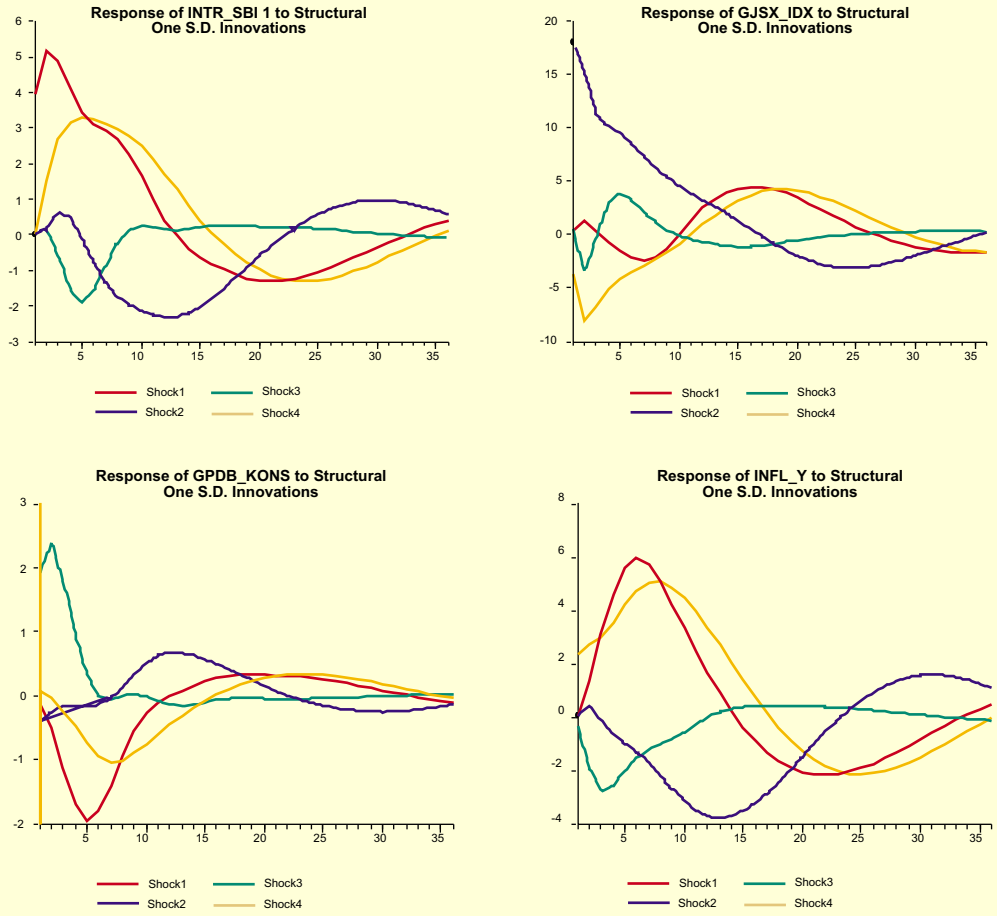
Graph A.5
Impulse Response for Consumption Path in Pre Crisis



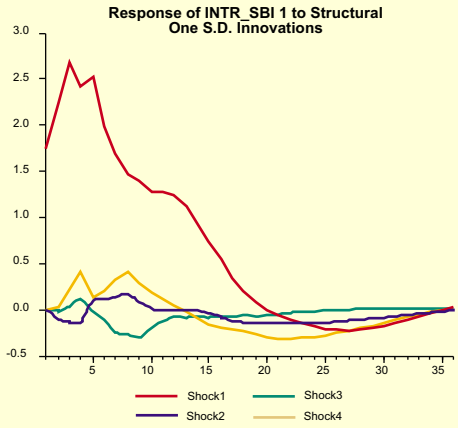
Note:
- INTR_SBI1 : SBI rate
- GIHA_IHSG : JSX price
- GPDB_KONS : consumption
- INFL_Y : inflation

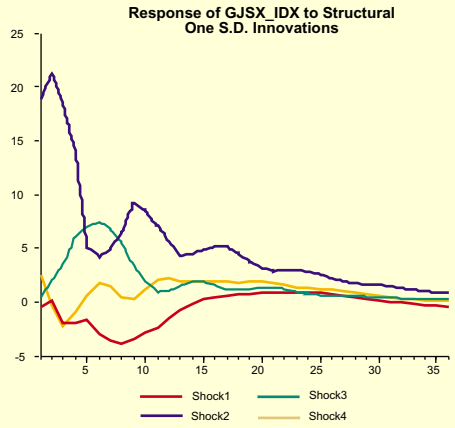
- Shock 1 : a one standard deviation shock to the SBI
- Shock 2 : a one standard deviation shock to the JSX price
- Shock 3 : a one standard deviation shock to the consumption
- Shock 4 : a one standard deviation shock to inflation

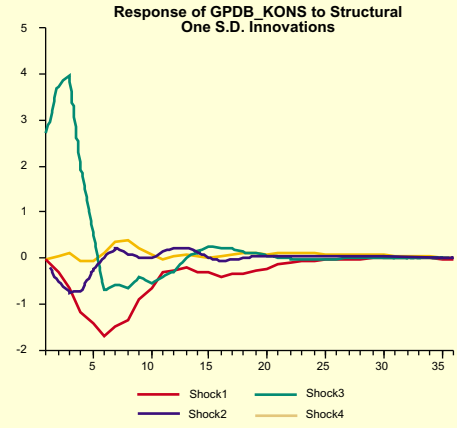
Graph A.6
Impulse Response for Consumption Path in Post Crisis

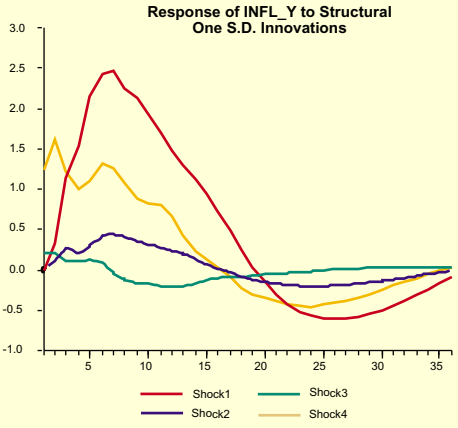


Graph A.7
Impulse Response for Consumption Path in Whole Period 1









Graph A.8
Impulse Response for Consumption Path in Whole Period 2