The transmission mechanisms of monetary policy in Indonesia

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1. The objective of monetary policy

A major change in the conduct of monetary policy in Indonesia in the aftermath of the 1997–2000 crisis was Act no 23/1999 and its revision in Act no 3/2004 that gives Bank Indonesia full autonomy in formulating and implementing policies. First, the objective of the central bank focuses on achieving and maintaining the stability of the rupiah (currency) value, meaning inflation and exchange rate.[2] Second, the central bank has been given independence in conducting its monetary policy (ie determining the monetary instrument used in monetary management), while the government in coordination with the central bank will set the inflation target. Third, the decision on monetary policy rests with the Bank Indonesia's Board of Governors, without any intervention from the government or other parties. And fourth, a clear mechanism for accountability and transparency of monetary policy is outlined in the Act, inter alia by requiring Bank Indonesia to announce its inflation target and plan of monetary policy at the beginning of the year and to provide a quarterly report to the Parliament for its conduct of monetary policy. Against the background, we argue that the most suitable framework of future monetary policy for Indonesia is inflation targeting. Two fundamental prerequisites for inflation targeting – ie, the ability to conduct monetary policy with independence and the absence of conflict with other nominal targets or policy objectives – are fulfilled.

With the mandate of the new Act, Bank Indonesia started to announce its annual inflation target and plan of monetary policy at the beginning of 2000. A monthly Board of Governors meeting has also been conducted to review and set the monetary policy stance and direction.[3] To support the decision-making, the research staff has been charged with providing better analysis and forecasts of inflation, economic, and financial trends as well as policy scenarios for monetary policy. The results of the meetings have been widely communicated to the public through various media, including press releases, press conferences, seminars with academicians and other stakeholders, as well as on the Bank's website. In order to fulfill its accountability to the Parliament, quarterly reports have been provided to include not only reviews of monetary policy, but also other tasks of Bank Indonesia on banking and payment systems.

It should be emphasized here, however, that the current framework is not a formal framework of inflation targeting as adopted by some countries such as the UK and New Zealand. Rather, it is simply a monetary policy with an inflation target. But adoption of the full-fledged inflation targeting framework started in July 2005.

Indonesia has undergone a number of far-reaching structural adjustments in all economic sectors since the early 1970s. As in many other countries, the adjustments were strengthened by faster globalization and have major implications for monetary management

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[2] 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.

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and the transmission mechanism of monetary policy. This paper will discuss the Indonesian experience with regard to the macroeconomic environment and policy objective, how the monetary policy transmission mechanism works in Indonesia, and the impact of financial globalization on the financial market and exchange rate.

2. Macroeconomic environment and policy objectives

It is understood that the macroeconomic environment and structural changes have implications for the policy objectives of monetary policy. The monetary policy objectives or framework adopted in a country are closely related to the degree of financial development, structural adjustment, and the macroeconomic setting in which the monetary policy is implemented. In Indonesia, the relationship among the macroeconomic environment, structural changes, and the objectives of monetary policy in a broad sense can be divided into three periods, namely, before, during, and after the 1997–2000 financial crisis, especially as of mid-July 2005, when Bank Indonesia decided to implement an inflation targeting framework.

First is the *period before the financial crisis (1969–1996)*. During this period, the Indonesian economic environment was characterized by economic growth that was maintained at the reasonable level of around 6% annually, except during the periods 1969–1978 and 1989–1993 when Indonesia experienced booming economic growth of 7–8% per year. The main drivers of the economic growth were agriculture, manufacturing, and mining. The prolonged stable economic growth in this period was supported by high commitment of the New Order government to an economic management philosophy and objectives laid out in a series of five year development plans, which started in 1969/1970.

The New Order government has been committed to the trilogy of development: growth, equity, and stability. For the past 30 years, the government has sought to improve equity while promoting growth. This has led to a substantial reduction in poverty and a general movement toward an increased degree of income equality. Moreover, in order to attain growth and equity, the government has placed a strong emphasis on developing human, as well as physical, capital.

With regard to price development, before the financial crisis inflation could be maintained in the single digits (below 10% annually), with the exception of the period of 1974–1978 when inflation was quite high, around 15%. Inflation in Indonesia was characterized by high inflation on administered prices, especially on food prices, transportation, and other prices regulated by the government. On the external side, the balance of payments, especially the current account, generally showed a deficit of around 2–3% of GDP. The deficit was the result of high import taxes not only on raw materials, but also on machines and other mechanical equipment for production. Henceforth, the capital account showed a surplus figure for both the government and private sectors.

The exchange rate was relatively stable due to the adoption of a managed floating exchange rate system with a certain band. During the pre-crisis period, there was quite a large devaluation of the rupiah in response to relatively significant pressure on the exchange rate. The devaluation happened in 1978, 1983 (38% devalued), and 1986. On the fiscal side, the government implemented the balanced budget principle. By implementing this principle there was always balance between government revenues and expenditure. If a deficit occurred, due to government expenditure being bigger than its income the discrepancies would be covered by borrowing from abroad (government debt) or by issuing domestic government bonds.

During the stabilization period there were several reforms and structural changes. The essential reform in monetary policy started when the credit ceiling was implemented and an interest rate regime was administered. The credit ceiling policy limited the loans of each

credit institution, to control domestic demand, curb domestic inflation, and to attack the deficit in the balance of payments. Then, in 1970, the government declared the rupiah to be fully a convertible currency (free foreign exchange regime), with no restrictions on the flow of foreign exchange into or out of Indonesia. This move was radical at the time and would still be considered radical today by some economists. This sequencing reform was primarily aimed at attracting foreign capital, especially foreign direct investment, and resulted in the appreciation of the rupiah.

Credit reform began in 1983, when the artificial restrictions on the allocation of bank credit and the state bank interest rate were eliminated. Bank Indonesia also reduced its significant role in refinancing bank loans and introduced Bank Indonesia Certificates (SBI) and money market securities issued and endorsed by banks (SBPU). After that, Bank Indonesia adopted indirect monetary policy to reduce the supply of reserve money. Under the indirect monetary policy, monetary policy transmission is viewed to run from monetary base (operating target) through monetary aggregate (intermediate target) to output and inflation (ultimate target).

An immediate outcome of these reforms was to increase substantially interest rates paid on deposits and charges for loans, with an improvement in resource allocation, even though the state-owned banks continued to dominate the system.

Financial sector reform was taken one step further in October 1988 with what was referred to as Pakto 88. Under Pakto 88, restrictions on the operations of foreign banks were eased, the procedures for establishing branch banks were simplified, and the requirements for becoming a foreign exchange bank were relaxed. Pakto 88 also reduced the special privileges and responsibilities of the state-owned financial institutions and narrowed the differential tax treatment affecting various financial instruments. The bank reserve requirement was lowered from 15% to 2% of all deposits, successfully reducing the spread between borrowing and lending rates. The re-utilization of the reserve requirement as an indirect instrument of monetary policy is intended to control bank credit in the light of the surge in capital inflows. In addition, the new provision will strengthen the power of monetary policy to influence the banks' balance sheets.

The period of financial crisis (1997–2000). The economic and financial crisis in Indonesia, which started in mid-1997, has been more severe, prolonged, and difficult to resolve than in any other affected country in the region. The crisis, which was triggered by an excessive depreciation of the rupiah, resulted in the worst recession the economy has experienced. The economy shrank 13.68% during 1998 and the annual rate of inflation reached a very high figure, 77.6% in 1998 (year on year basis). This was also followed by several large scale bank and business failures and a huge increase in the unemployment rate.

Meanwhile, the balance of payments was in good condition, with a current account surplus as a result of high depreciation of the rupiah, and a capital account surplus, mainly due to high repayment of private debts. Unfavorable market sentiment caused excessive exchange rate volatility and made it difficult for monetary policy to maintain the stability of the rupiah, which had a negative impact on the overall macroeconomic situation. The weakening rupiah harmed macroeconomic stability through the pass-through impact on inflation, which led to higher interest rates than optimal to support economic and financial stability. Depreciation also affected the fiscal deficit, by raising the cost of external debt service as the rupiah value of the debt stock exploded.

To cope with the battered rupiah, the government widened the trading band on the rupiah, and also intervened both in forward and spot markets. However, realizing that defending the currency was futile under such strong pressure on the rupiah, the government finally let the exchange rate float in mid-August 1997. Soon after floating the currency, the government adopted an extremely tight money policy by raising interest rates sharply, in addition to suspending several monetary instruments which had expansionary effects such as the auction of SBPUs, discount facilities, and the purchase of SBIs using repos.

The high level of interest rates and the large depreciation severely affected the fragile banking and real sectors by worsening the banks' asset quality and contributing to corporate failures. To prevent bank runs and a collapse of the entire banking system, Bank Indonesia extended huge liquidity support to commercial banks. As a result, broad money and base money both grew around 30% from December 1997 to March 1998. As people's confidence in the rupiah eroded, a cycle of weakening currency, soaring prices, and expanding money supply threatened to break out in hyperinflation. *Bank Indonesia's main objective was therefore to restore confidence in the national currency.* Hyperinflation had to be prevented and inflation brought down. Bank Indonesia furthermore believed that if prices were stabilized, this would in turn strengthen the value of rupiah against other currency.

To achieve these aims, monetary expansion needed first to be halted and Bank Indonesia needed to regain control over its own balance sheet. All sources of central bank money creation needed to be under control and Bank Indonesia needed to reabsorb excess liquidity in the banking system. Bank Indonesia, with the support of the IMF, pursued a tight money policy stance with base money as a target. Quantitative targets were set up at the level of the central bank's balance sheet. Bank Indonesia did not allow domestic assets to expand – broadly speaking, net domestic assets would also be flat. To protect the foreign asset position, a floor was established for net international reserves (NIR).

To prevent further expansions of liquidity support, in April 1998 Bank Indonesia imposed a high penalty on the discount window facility and commercial banks' negative balance at Bank Indonesia. Furthermore, in May 1998 Bank Indonesia placed a ceiling on deposit rates and the interbank rate guaranteed by the government. The policy aimed at preventing banks from adopting imprudent measures that could lead to self-reinforcing expansion of liquidity support.

Due to a number of constraints in money market instruments such as the thin market of SBIs, open market operations were not able to fully absorb all the excess liquidity in the economy. To achieve the quantitative target, attempts were made to improve the open market operation. On 29 July 1998, Bank Indonesia changed the auction system of SBIs, shifting from an interest rate target to a quantitative target. Furthermore, auction participants, formerly restricted to primary dealers, were expanded to include bankers, money brokers, the capital market, and the general public. These changes were intended to allow greater competition among auction participants, hence the SBI rate was expected to better reflect the interaction between demand and supply.

Another innovation in enhancing monetary policy operations was "rupiah intervention". It is set to support monetary restraint and smooth interest rate volatility in the interbank money market. Accordingly, rupiah intervention not only served as a contractionary instrument but also as an expansionary one. Attempts to control monetary expansion of liquidity support originating from government expenditure were also supported by sterilization in the foreign exchange market, which simultaneously increased the supply of foreign exchange, thereby helping to stabilize the domestic currency.

Although the framework of monetary policy using base money as the policy target seemed to have been effective in the 1980s and early 1990s, the same approach was heavily challenged in periods thereafter. There have been concerns that it is difficult for policymakers to control M0 growth.[4] Three important factors were allegedly responsible for this problem. First, the money markets for SBIs and SBPUs were relatively thin and fragmented. As a result, the central bank found it difficult to control the liquidity of the economy using the instruments indirectly. Second, in certain periods, M0 was endogenous with respect to

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[4] Budiono (1994): "Melihat kembali target moneter kita: M0, M1, atau M2?", (Revisiting our monetary targets: M0, M1, or M2?), unpublished.

output. For example, during periods of "upswing" in the economy, the growth of M0 was largely caused by aggregate demand which was reflected by the growth in foreign borrowing and liquidation of SBIs. Although this did not necessarily mean that the growth of M0 could not be completely controlled, it was a difficult job that sometimes needed an extremely high increase in interest rates in order to slow aggregate demand down. Third, the relationship between nominal income and money became increasingly unstable. Global financial innovation and deregulation had also caused this problem. This in turn made the monetary policy with quantity targets less reliable.

Facing this challenge, Bank Indonesia initially followed a rather pragmatic (eclectic) approach. Without leaving the quantity approach, more attention was given to the development of interest rates. Moreover, the intervention bands under the managed exchange rate regime were widened several times so as to allow some flexibility and ease some of the burden on monetary policy. This pragmatic approach was, however, thought to be transitory before monetary policy turned to a new approach, ie price (interest rate) targeting. However, before the second approach was fully in place, the recent financial crisis forced the monetary authority of Indonesia to postpone its implementation and review the quantity approach for reasons described below.

The period of implementing the new monetary policy framework. A major change in the conduct of monetary policy in the aftermath of the crisis was the new Bank Indonesia Act that gives the Bank full autonomy in formulating and implementing policies. First, the objective of the central bank focuses on achieving and maintaining the stability of the rupiah (currency) value, meaning inflation and exchange rate.[5] Second, the central bank has been given independence in both setting the inflation target (goal independence) and conducting its monetary policy (instrument independence).[6] Third, decisions on monetary policy rest on Bank Indonesia's Board of Governors, without 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, requiring, inter alia, Bank Indonesia to announce its inflation target and plan of monetary policy at the beginning of the year and to provide a quarterly report to the Parliament on its conduct of monetary policy. Against this background, the most suitable framework for future monetary policy in Indonesia is inflation targeting. Two fundamental prerequisites for inflation targeting – ie, the ability to conduct monetary policy with independence and the absence of conflict with other nominal targets or policy objectives – are fulfilled.

With the mandate of the new Act, Bank Indonesia started to announce its annual inflation target and plan of monetary policy at the beginning of 2000. A monthly Board of Governors meeting has also been conducted to review and set the monetary policy stance and direction.[7] To support the decision-making, the research staff have been charged with providing better analysis and forecasts 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 releases, press conferences, seminars with academicians and other stakeholders, as well as on the Bank's website. To meet Bank Indonesia's accountability to the Parliament, quarterly reports have been provided to include not only a review of monetary policy, but also other tasks of Bank Indonesia on banking and payment systems.

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[5]   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.

[6]   A process of amending the Act is now underway in which, among others, the inflation target will be set by the government upon taking into account recommendations from Bank Indonesia.

[7]   The coverage of the meetings would be the annual review for January's meeting, quarterly reviews for April, July, and October's meeting, and monthly reviews for the other months.

It should be emphasized here, however, that during the stabilization period under the IMF program Bank Indonesia adopted base money as the operational target as well as an anchor to achieve the ultimate target. The Bank also monitors various aggregates as well as interest rates. Over the long run, however, we noticed a number of shortcomings in the use of base money as the operating target, such as the difficulties in achieving the target and the poor signal it transmits to the market. Such a poor signal of monetary policy direction and targets obviously fails to meet the need to maintain market expectations on future exchange rate movements. In view of these factors, Bank Indonesia adopted a fully-fledged inflation targeting framework (ITF) in July 2005.

The framework has three primary characteristics, First, monetary policy is directed towards achieving an inflation target explicitly announced to the public for a specified time horizon. In this regard, under the new Central Bank Law – as mentioned above – the inflation target is set by the government after coordinating with Bank Indonesia. Second, monetary policy must be implemented on a forward-looking basis, responding to future developments in inflation. At the operational level, Bank Indonesia uses the BI rate as the policy rate to respond to the future trend in inflation. The BI rate is implemented through open market operations for one-month SBIs, mainly because they have been used as a benchmark by banks and market players in Indonesia, they reinforce the signaling of monetary policy response, and they play an important role in the monetary transmission mechanism.

In formulating monetary policy, the Taylor-type rule is used as a benchmark. Thus, in essence, interest rates used as monetary policy instruments are adjusted so as to respond to deviations in the inflation gap and output gap. Obviously, rules like these are not to be applied mechanically. A balance between rules and discretion, or constrained discretion, is especially necessary when monetary policy must be pursued within an increasingly globalized and complex financial environment.

The third characteristic of the ITF is that monetary policy is implemented on a transparent basis with measured accountability. Inflation targeting is more than a mere framework for monetary policy. Inflation targeting promotes the good governance of a central bank. By announcing the inflation target to the public, the central bank commits itself to its achievement. Uncertainty over future inflation will ease because public expectations have a point of reference, thus economic cost arising from uncertainty will also be reduced. Communication to the public on the future monetary policy direction is vital so that the public can anticipate the central bank monetary policy and to avoid surprises that could trigger volatility in the money market. Communications to the market players are also necessary, especially when financial markets are experiencing turbulence. In financial markets fraught with asymmetric information, the wealth of information held by the central bank is frequently of great benefit in mitigating this issue and thus preventing panic and herding by investors. In this regard, the credibility of the central bank is crucial.

3. Monetary policy transmission mechanism

3.1 General framework of transmission channel

In view of the Bank Indonesia mandate to achieve stability in the rupiah, or in this case to control inflation, it is vital for Bank Indonesia to have a grasp on how monetary policy influences inflation. The monetary policy process that influences the wider economy and inflation in particular is known as the monetary policy transmission mechanism. The individual channels through which monetary policy operates are known as transmission channels. In theory, there are six transmission channels, which are respectively the exchange rate, the asset price, the interest rate, the corporate balance sheet, the credit, and the expectations channels. Each of these channels is described briefly below.

Scheme 1

Summary of transmission mechanism of monetary policy
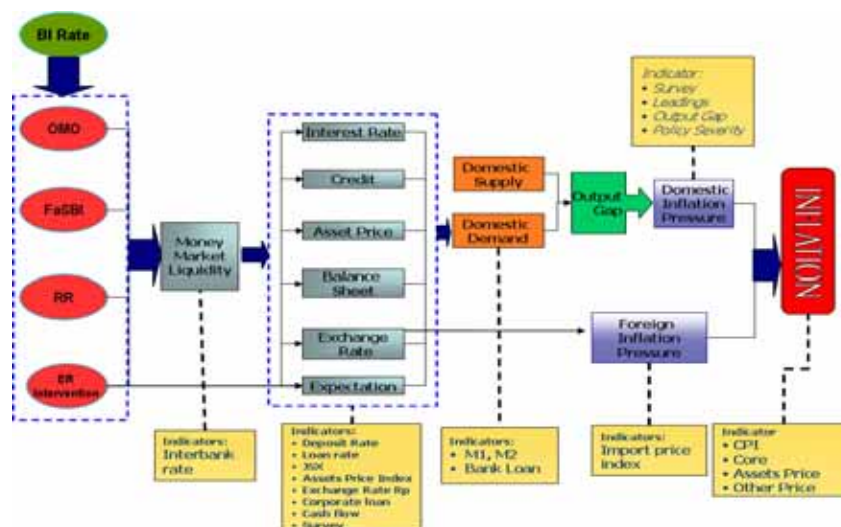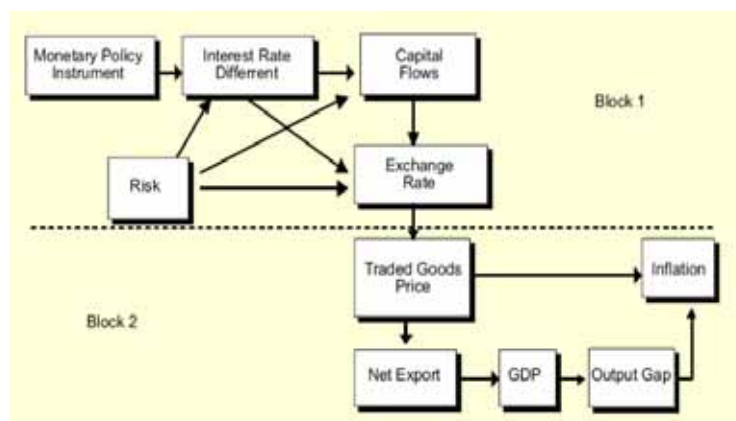

3.2 Exchange rate channel

In small open economies, the exchange rate becomes an 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 a floating exchange rate system, for example, an easing monetary policy will depreciate the domestic currency, and increase prices of imported goods, thus raising domestic prices even when there is no expansion in aggregate demand. Meanwhile, in some countries with a managed floating regime, other monetary transmission channels than the exchange rate will have a relatively larger effect on real output and prices. Nevertheless, there are cases where the exchange rate has room to fluctuate, especially when there is a relatively wide band in a managed exchange rate system or if there is an imperfect substitution between domestic and foreign assets. In these cases, the exchange rate channel of monetary policy still has an influence on output and prices even with a smaller effect and longer time lag.

This section presents the study of Siswanto, et al (2001) and Astiyah (2006), on exchange rate channel of monetary transmission in Indonesia. The channel is decomposed into two blocks. The first block seeks to measure whether a monetary policy shock had a dominant influence on exchange rate movements compared to a risk factor. Dominance of the policy variable shock determines whether the monetary policy could be transmitted to inflation through the exchange rate channel. The second block is aimed at detecting the transmission of exchange rate changes to the inflation rate both directly, through price (direct pass-through effect), and indirectly, through output (indirect pass-through effect). The study is carried out using a structural vector autoregression (SVAR) approach. Variance decompositions measure the monetary policy impact on the exchange rate and inflation, and impulse response functions to analyze lag structures.

Figure 1

Exchange rate channel framework

The findings from the SVAR analysis reveal that during the pre-crisis period, monetary policy transmission through the exchange rate channel was very weak. Monetary authorities' action to maintain exchange rate variability within a certain band had kept the exchange rate relatively stable and predictable. Under such conditions, the interest rate on the SBI instrument did not have a significant impact on the exchange rate, and the exchange rate was not an important determinant of inflation.

Pre-crisis period

The study on direct pass-through in this period revealed that a contraction as a monetary policy was followed by an increasing interest rate differential after two months, which then was followed by an appreciation of the exchange rate to a smaller degree. These responses were immediately followed by decreasing tradable goods prices and inflation rate and reached a peak at lag 8 before its effect diminished and faded after 25 months. The accumulated response of exchange rate and inflation rate to a BI rate shock was very small. This suggested that in the period of managed floating, economic agents found the expected depreciation easy to predict, so that the impact of the shock to inflation was relatively small.

Graph 1

Impulse response to policy rate (SBI) shock
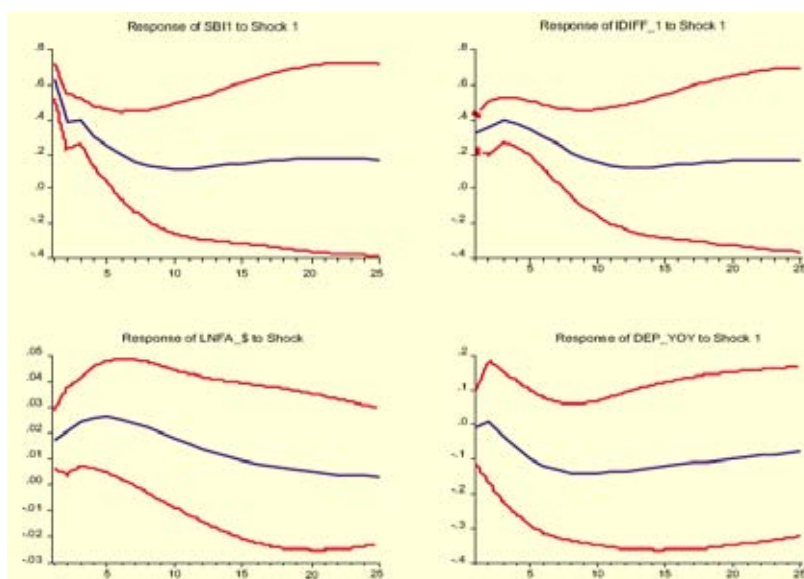
Variance decompositions also show a very small contribution of interest rate shocks to exchange rate (less than 1%) and inflation rate variability (about 9% in 12 months). The variability of the inflation rate was influenced more significantly by tradable goods price changes. This proves that during the pre-crisis period under the managed floating system, the exchange rate channel of monetary policy transmission to the inflation rate was very weak.

Analysis of the indirect pass-through gave a similar result. The change of monetary policy through the SBI rate did not affect the exchange rate. In turn, net exports and GDP growth, as well as the inflation rate, were also not significantly affected as their accumulated response to an SBI rate shock was very small. Variance decomposition estimates also suggest a relatively weak contribution of the SBI shock to the variability of the exchange rate. In turn, the impact of an SBI rate shock to the inflation rate through aggregate demand was very weak. In the short run, an SBI shock only contributed 0.5% to the inflation rate, while in the longer run the relative contribution of an SBI rate shock increased, but only to 10%. This indicates that under a managed floating system, monetary transmission through indirect pass-through was also very weak, even weaker than through direct pass-through.

Post-crisis period and recent development

SVAR estimation of the model in the post-crisis period, and recent developments, reveal that the direct pass-through effect of the exchange rate to consumer prices is larger than the indirect pass-through. The pass-through effect of exchange rate to inflation varied from 0.05 to 0.14 (Table 1). However, the indirect pass-through effects are negative, but are lower in absolute value than the positive direct pass-through effects. As direct pass-through has a higher magnitude than indirect pass-through, a depreciation (appreciation) of the exchange rate will reduce (increase) GDP. The relatively high pass-through effect of the exchange rate on the domestic economy is related to the high import content of capital goods and raw materials in investment and production activity, as well as to the considerable amount of external debt (balance-sheet effect). Therefore, at this moment an appreciation of the exchange rate is more favorable for the Indonesian economy to boost GDP growth and to lessen inflationary pressure. Exchange rate appreciation will bring inflation down through its direct pass-through effect on production cost. In addition, the appreciation of the exchange rate could generate higher GDP growth through indirect pass-through, as the appreciation will encourage consumption and investment. Indeed, at a certain level, exchange rate appreciation would support exports of manufacturing products with high import content.

Table 1

Exchange rate pass-through coefficients

| No	Model	Estimation period	Pass-through coefficient		
			Direct	Indirect	Total
1.	Quarterly Small Macro (SSM)	1987:Q1–2001:Q3	0.1695	–0.0570	0.1122
2.	Quarterly Modified Small Macro (SSM-Mod)	1991:Q4–2001:Q4	0.0960	–0.0127	0.0833
3.	Quarterly Medium Scale Macro (SOFIE)	1983:Q1–2000:Q4	0.1567	–0.0186	0.1380
4.	Yearly Medium Scale Macro (MODBI)	1970–1997	0.3458	–0.2164	0.1294
5.	Quarterly Single Equation	1996:Q1–2000:Q2			0.1405
6.	Monthly Single Equation	1990:M8–2002:M7			0.0564
Average					**0.110**

More understanding of the behavior of the more flexible exchange rate regime adopted since August 1997 by economic agents has helped stabilize the exchange rate. Markets are beginning to establish a "band" to cushion the movement of rupiah exchange rate fluctuation in their daily activities. Exchange rate volatility has shown a decreasing trend for the last two years.

Graph 2

**Exchange rate and volatility**
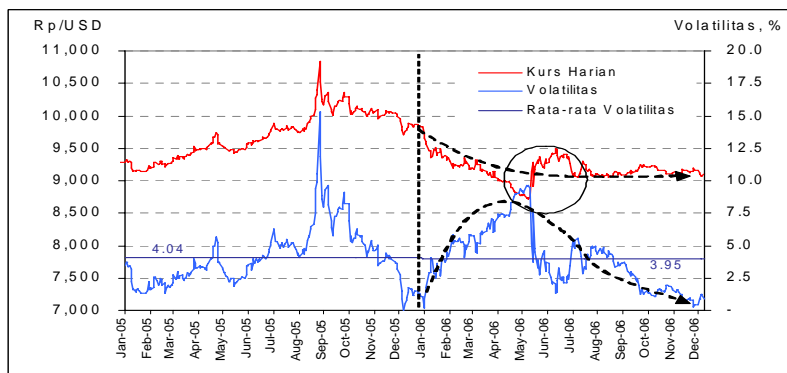
Empirically, this is also seen in the discrepancy between the movements in the wholesale price index, the consumer price index, and the rupiah exchange rate (Graphs 3 and 4). Contrary to its historical data, the exchange rate movement is not transmitted as large as its coefficient estimation to the inflation rate. For example, only part of rupiah exchange rate depreciation in 2005 was transmitted to inflation. The hike in inflation was predominantly explained by the increase in domestic fuel prices and not the depreciation of the currency.

Graph 3

CPI, WPI and exchange rate
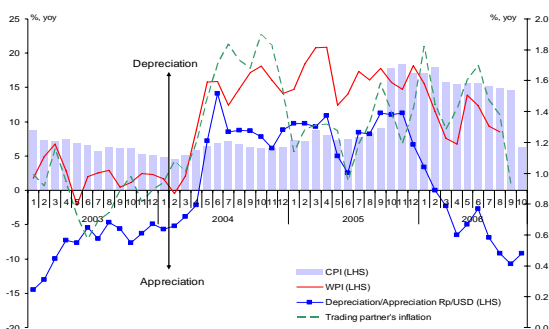
Graph 4

CPI, imported good inflation and exchange rate
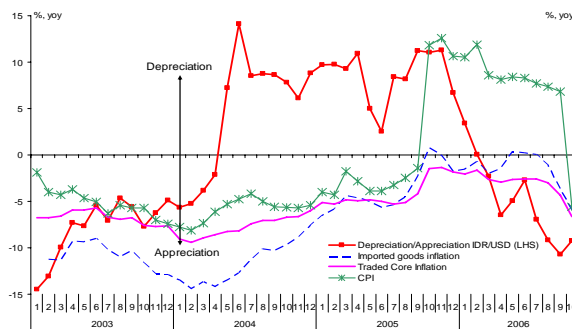
Considering the impact of exchange rate movement on the price formation mechanism (inflation), Bank Indonesia has developed an exchange rate model using the Behavioral Equilibrium Exchange Rate (BEER) approach since 1999. This model focuses on the actual path of the real exchange rate and forecasts this path for one year ahead. There are five variables in this model: three long-run (fundamental) variables, namely the terms of trade (TOT), the relative price of non-traded to traded goods (TNT), and net foreign assets (NFA), and two short-run variables, namely the risk premium and the interest rate differential. All variables have a positive relationship with the real exchange rate, such that an increase in those variables will be followed by a real exchange rate appreciation and a decline in those variables will generate a real exchange rate depreciation.

Recent research on the BEER model (Budiman, Hendarsah, Nugroho, Sylviani (2002)) showed that among those variables that significantly affect the exchange rate, the risk premium had the highest coefficient. This result was different from previous research (Kurniati, Hardiyanto (1999)) which, using the same approach, found that the long-run variable, TNT, dominated the movement of the real exchange rate. As the risk premium has become an important factor in exchange rate movement, the assessment of risk premium indicators was improved by conducting a market expectations survey to form a risk composite index, thus reflecting market perception on Indonesia's country risk.

On the micro side, Bank Indonesia has developed and implemented an on-line monitoring system of foreign exchange to complement the macro model of the exchange rate. First, an International Transaction Reporting System (LLD) was developed in 2000 to improve understanding of the nature and magnitude of foreign exchange transactions involving banks, non-bank financial institutions, companies, and individuals. Second, the on-line analytical processing (OLAP) system was built in 2002 to monitor daily foreign exchange transactions in domestic market. The systems help Bank Indonesia to identify the sources of exchange rate fluctuation and take appropriate measures to avoid further fluctuations in the exchange rate.

3.3 Asset price channel

As is well known, asset price movements contain some information about future economic conditions as well as the future path of inflation. While these properties are true for some countries, they do not necessarily hold for others. Before the crisis, the role of asset prices in the transmission mechanism in Indonesia was not particularly strong or clear. In fact, there was no relationship between asset prices and the economy. Nevertheless, curiosity about the role of asset prices in monetary policy transmission mechanism continues to grow. Bank Indonesia, as the authority in conducting monetary policy, places special emphasis on this transmission mechanism and reviews it on a regular basis. Rapid changes in the economic structure after the crisis struck led to ongoing reexamination of the transmission mechanism.

Figure 2

Assets price channel
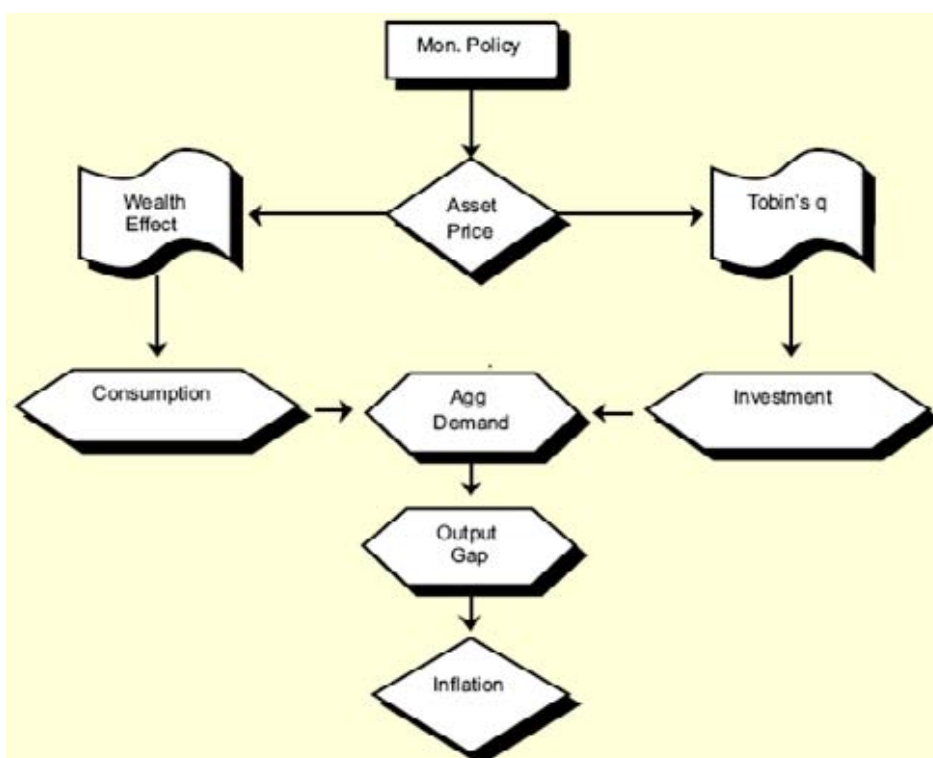
A study by Idris, et al employs VAR models with some structural restrictions. While housing or land prices would have been the best proxy for asset price data, constraints prompted the use of the Jakarta Composite Stock Price Index (JSX). For the pre-crisis period the study concludes that there is no strong evidence on the existence of the asset price channel of monetary transmission in Indonesia. For the post-crisis period up to recently, the study indicated that the asset price channel strongly transmits monetary policy through its impact on investment.

Estimate and variance decomposition of investment path

The study reveals that each parameter has the correct sign as predicted by economic theory, but is statistically not significant. The coefficient on the SBI rate in the JSX equation reflects the monetary policy impact on the JSX index. When Bank Indonesia raises the SBI rate, the deposit rate will rise and people prefer to put their money in the bank. Thus, demand for JSX as an alternative for people to hold their wealth decreases and the JSX index goes down. Moreover, it indicates the existence of a substitution effect. This result also holds for other sample periods, except for the post-crisis period. Although these coefficients are not significantly different from zero, they suggest that monetary policy affects the movement of the JSX index.

The coefficient on SBI in the investment equation for the pre- and post-crisis periods has a negative sign and is statistically significant for post-crisis. This result is consistent with economic theory. Increasing the SBI rate implies a higher cost of investment, therefore discouraging investment. On the contrary, when the policy rate is reduced, that will push activities on the stock market. Estimates of the investment equation reveal that the increase in the JSX index leads to higher investment. Our result shows that the JSX index is positively related to investment in all sample periods, as hypothesized. However, the relationship is significant in explaining the asset price channel.

Model estimates indicate that an increase in investment will cause inflation, representing potential inflationary pressure. This phenomenon does not appear in the post-crisis period, when investment is negatively related to inflation and this is statistically significant. However, in the full sample and the pre-crisis period we find that investment could be inflationary, but it is not clear because the relationship of investment to inflation is statistically insignificant. It appears that the parameter estimates are not robust to explain the existence of the asset price channel. We put inflation variables into the JSX index equation in order to describe the phenomenon where people prefer to hold their wealth in assets at times of higher inflation, and vice versa. Higher inflation implies that it is more profitable to hold assets rather than cash or deposits.

Variance decompositions for investment, which quantify the percentage contribution of each shock to the variation in each variable, reveal that the variances are mostly determined by their own shocks. The variability of the JSX index due to a shock in SBI increases to 34% at 36 months after the shock in the pre-crisis period. Meanwhile, in the post-crisis period, the contribution of SBI drops to less than 25%. This indicates that monetary policy became less dominant in determining the variability of the JSX index in the post-crisis period. It appears that the movement of JSX is not only influenced by the policy rate but also affected by several other non-economic factors, such as global excess liquidity and political and social conditions surrounding Indonesia, which play more important roles in all activity, despite some possibilities of excluding the relevant variables from the model.

Impulse responses for the investment path to JSX only need five months for the pre-crisis period and are faster in the post-crisis period. These results suggest that monetary policy can affect the JSX index within the first five months, after which the impact starts to diminish. The impulse responses from the whole period 1 and 2 also appear to have similar results.

Graph 5

JSX and policy rate (BI rate)
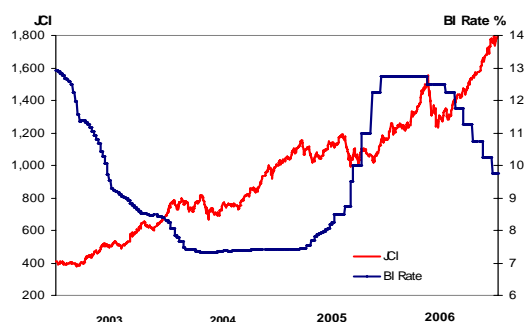
Graph 6

JSX and IDR/USD

Source: Bloomberg
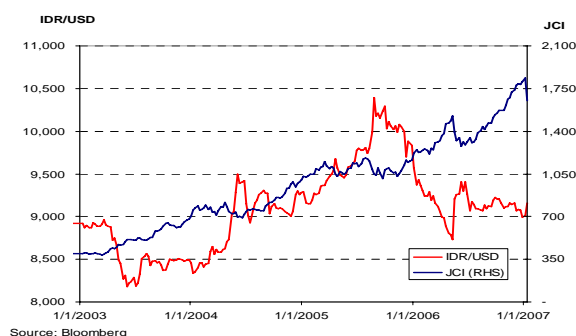
Meanwhile, investment does not respond immediately to the monetary policy shock. It takes approximately 10 months before the shock affects investment in the right direction in the pre-crisis period. A similar result appears in the post-crisis period, but with a more rapid and stronger response. It takes only five months before the monetary policy shock has its impact. Afterwards the effect is diluted. In general, this particular shock does affect investment in the right direction in all sample periods, except for the pre-crisis period.

The response of inflation to tighter monetary policy occurs with a lag. The full impact takes 15–20 months after monetary contraction. The result is in line with previous research regarding the lag of the response of inflation to monetary policy, which is between 18 and 24 months. However, the first response to the shock is to increase inflation. Thus, we can hardly say that SBI can lower inflation through this particular path.

Estimate and variance decomposition of consumption path

Estimate for consumption path. The coefficient on the SBI rate in the consumption equation has an insignificant negative sign, indicating that the contemporaneous substitution effect dominates the income effect. In other words, relatively higher returns from deposits could discourage spending for consumption. However, in the post-crisis period, the reverse result appears. During the crisis, higher consumption mainly came from windfall income resulting from increasing returns on deposits and fiscal expansion. Moreover, during the crisis period, growth was led by consumption.

The coefficient on JSX in the consumption equation indicates that an increase in the JSX index leads to higher consumption. However, the relationship is statistically insignificant. Meanwhile, the coefficient on consumption indicates that increasing consumption leads to higher inflation. This phenomenon appears in the post-crisis period, but in other sample periods the reverse is found. As stated earlier, consumption was the main engine of growth during the crisis, while investment dropped severely. The net result was a narrowing output gap, which led to an increase in general price levels.

The variance decomposition in this particular path shows that the variability of each variable is also mainly attributable to its own shock. The contribution of a shock in SBI variability in inflation is 8% in the pre-crisis period, and jumps to almost 40% after the crisis. In the pre-crisis period, the share of the SBI shock accounts for more than 40% of the variability of the JSX index. However, for other sample periods, the share of SBI shock is less than 11%. Substantial drops in the SBI contribution are due to the fact that the JSX index fluctuates almost independently from economic fundamentals. In other words, business decision-making was determined more by non-economic factors such as negative market sentiment, political upheaval, uncertainties in law enforcement, etc.

The impulse response of JSX to an SBI shock is quite similar to that resulting from the investment path. An SBI shock leads to the fall in the JSX index and reached its maximum impact within six months in the pre-crisis period. Meanwhile, in the post-crisis period, the impact of an SBI shock is not significant compared to the previous sample period. As mentioned earlier, those non-economic factors play an important role in the post-crisis period in determining the fluctuation of the JSX index. This suggests that monetary policy is less dominant in affecting the JSX index.

In the pre-crisis period, an SBI shock results in an immediate increase in consumption. But after three months, consumption starts to decrease as expected, and then the impact is 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 and is fully reversed after approximately 25 months. More time is needed to fully reverse the impact of an SBI shock. This indicates the longer impact of monetary policy lingers in affecting the consumption pattern. Furthermore, a positive shock in monetary policy is unexpectedly followed by an increase in inflation, and fully reversed after 15 months. This pattern holds for all sample periods. It reflects once again that monetary policy cannot influence inflation as theory suggested.

Evidence from survey

The Household Assets Survey shows that over 33% of respondents choose bank deposits as their first priority to place their funds. Bank deposits are regarded as the most liquid asset, yet still provide quite attractive returns. Other investment alternatives are in land and housing; 29% and 28% of respondents respectively choose those assets as their first priority. Despite being not as liquid, housing and land have a long history of being a safe haven for long-term investment. On the other hand, only 1% of household respondents place their funds in stock as their first priority.

In line with this result, should respondents have additional funds, the order of preference is similar, except for those of land and housing. Bank deposits are preferred by 38% of respondents, while 36% and 18% of respondents chose housing and land respectively. Meanwhile, stocks are chosen as the prime priority only by 3% of respondents. This evidence fortifies our empirical results that stocks are not a good proxy for household wealth in Indonesia.

According to the survey, the majority of respondents (83%) are not responsive to a decrease in bank deposit rates. Over 80% of respondents will not withdraw their deposits unless the deposit rate decreases substantially. Furthermore, 60% of respondents will not withdraw their deposit even if the interest rate falls to 10%. We suspect this occurs because the majority of respondents spend a total of Rp 1 million to Rp 3 million each month. Consequently, they are relatively insensitive to changes in bank deposit rates. With regard 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 purposes. Out of the 37% respondents that place their money in investment goods, 51% invest in land, 26% in housing, and only 7% in stocks.

Decreasing interest rates on bank deposits lower the cost return from deposits compared to other assets. Thus, the majority of respondents react by looking for investment alternatives with higher returns. The figure below identifies that land is the preferred alternative for respondents to hold their assets. This to some extent reflects the existence of a substitution effect. Meanwhile, if the deposit rate increases, 74% of respondents increase the amount of money in bank deposits, while 8% counter by enhancing their investments, and only 6% respond by reducing their purchases of investment goods.

The majority of respondents (72%) will also put the income generated from an increase in the deposit rate into bank deposits. 15% of respondents use their income for consumption

purposes, and only 8% utilize their additional income to purchase land and housing. This shows that the income effect does not exist in this particular sample group. Furthermore, respondents need a substantial increase in the bank deposit rate before they place additional funds. Almost 80% of respondents require an increase in the deposit rate of more than 4%. All of these findings imply that households do not respond much to a change in the bank deposit rate. Should they withdraw their funds, they put their money in traditional investment alternatives, ie land and housing.

3.4   Interest rate channel

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

Kusmiarso, et al (2001) and Astiyah (2005) conducted analyses to see how the cost of capital, substitution effects, and income effects transmit the change in interest rate as a result of monetary policy. The relationship of the policy rate and real sector variables is investigated using the Granger test and VAR analysis. Furthermore, to have a deeper understanding of bank behavior in responding to the policy rate, several structural equations are also introduced, involving several micro factors on banks, ie the inter-bank overnight rate, deposit rate, and credit rate.

Pre-crisis period

Empirical evidence from the VAR analysis reveals that before the crisis, the real deposit rate and real investment credit rate were strongly influenced by the inter-bank rate. Investment growth, however, was influenced more by the high access to foreign borrowing than the real investment credit rate. Similarly, consumption growth was not significantly affected by changes in the real deposit rate, as the real deposit rate was relatively stable and low.

The structural models provide further evidence on the behavior of bank interest rates, especially the inter-bank rate, time deposit rate, and working capital credit rate. For the interbank interest rate, the central bank certificate (SBI) rate and bank liquidity have been the dominant factors in both the pre- and post-crisis periods, with a stronger impact by the SBI rate in the post-crisis period. Bank liquidity becomes relevant in determining the 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, nor for foreign and joint-venture banks, as they have more access to funding.

The study reveals that the impact of the policy rate was faster in influencing the loan rate (within three months) than the deposit rate (within six months). The behavior is related to the fact that deposit rate represents banks' cost while the loan rate represents banks' revenue. The response and its direction of each variable in the VAR system show that during the pre-crisis period, the cost of capital worked well in transmitting monetary policy using the interest rate. This is explainable as during that period the banking and real sectors were still in normal circumstances, hence they could give proportional responses to the central bank monetary policy.

The real investment loan rate was also responsive during the pre-crisis period as the economy was booming and more funds were needed by the business sector. The weaker responses of the real investment loan rate after the crisis were caused by the negative return as inflation jumped to a much higher level, and banks' concerns about debtor default. Those factors make the non-price factors become stronger in influencing bank lending.

Post-crisis period

After the crisis, the real deposit rate and real investment credit rate response to the inter-bank rate was weaker as compared to the pre-crisis period. The increase of the inter-bank rate following the monetary shock was followed by an increase in the one-month deposit real interest rate with a smaller magnitude until the second month. Meanwhile, the increase of the inter-bank rate was initially followed by a negative growth of consumption for the same period. The real investment credit rate, however, does not correspond proportionately to changes in the real deposit rate because of banks' concern that a higher interest rate will lead to higher debtor default and non-performing loans. Investment growth has been significantly influenced by the real investment credit rate. Likewise, consumption growth has been significantly driven by the real deposit rate.

The real sector has responded significantly to the banking interest rate after the crisis period. Investment growth has responded more strongly as compared to the pre-crisis period to the real investment loan rate because investors have limited access to other sources of financing from domestic financing, ie credit from banks, from offshore borrowing and from other sources such as high-risk paper. The negative return leads to banking sector reluctance to disburse new credit. The existing credit is disbursed on the basis of long-term relationships, because after the crisis most sectors bear higher risk. Meanwhile, in the 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 has been influenced significantly by changes in the inter-bank interest rate in the post-crisis period. The increase of the inter-bank interest rate was initially followed by negative growth in consumption, showing the presence of a substitution effect. However, when the deposit real rate started to decrease, household consumption also decreased with a lag indicating the presence of income effects.

The inter-bank rate, liquidity and its lag determine the time deposit rate. The time deposit rate responds to movement of the inter-bank rate, with the role of the inter-bank rate increasing after the crisis. Since the crisis, banks have been relatively liquid. The loan to deposit ratio (a proxy for liquidity) does not significantly influence the deposit rate, as all groups of banks are unwilling to lend money.

The time deposit rate and the liquidity condition are two determinants of bank behavior in determining the working capital credit rate. Liquidity has become a relevant factor for the loan rate in the post-crisis period as banks have limited access to funding. For non-foreign exchange domestic private banks, however, liquidity has been significant in all periods, because of their limited access to foreign funds and their relatively small asset size. On the other hand, liquidity never becomes a problem for foreign and joint-venture banks in determination of the loan rate as they have perfect capital mobility.

Evidence from survey

A survey of banks, households, and companies was conducted to investigate the response of the banking and real sectors to changes in the interest rate. The findings confirmed the preceding results. In particular, during the post-crisis period a change in the policy rate is transmitted to various retail-banking rates and to the real sector. The loan rate is determined by the deposit rate, borrowers' risk and the SBI rate. There is a significant bank response to substantial changes in policy rates. When SBI rate declines, banks reduce their deposit rates

and portfolio holdings of SBI, and then increase their loan portfolios especially for working capital loans. In addition, banks tend to raise their loan rates and reduce their loan portfolios in the case of tight liquidity or a significant increase in the SBI rate.

The survey also reveals that the household decision to save is influenced by the interest rate. However, slightly different from the empirical finding, households maintain their saving rate even if there is a decline in the deposit interest rate, because of the presence of a government guarantee scheme on deposits. Similarly, households maintain their saving rate when the interest rate rises as they prefer to add to their deposit instead of spending for consumption. Finally, a firm level survey confirms the empirical finding that the growth of investment is not strongly related to movements in the credit rate. In the event of a 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 to own funds for financing their business activities while others postpone their plans for expansion. The response becomes more pronounced if companies perceive that business prospects have become bleak and unprofitable.

3.5 Bank lending channel

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

The study utilizes a battery of tests to analyze the bank lending channel. It employs a vector autoregression VAR approach using aggregate and disaggregated data to see the effects of monetary policy on bank balance sheets. With disaggregated data, hypotheses underlying the bank lending channel can be analyzed. Complementary to the VAR analysis, long-run demands and supply equations of the Indonesian credit market are estimated, derived from a vector error correction model (VECM) in order to identify whether adjustment towards equilibrium in the credit market is dominated by supply, as suggested by the lending channel.

Overall, the study provides a comprehensive investigation on the existence of the bank lending channel of monetary transmission in Indonesia before and after the crisis. Given the existence of "bank dependent borrowers" as the secondary condition of the bank lending channel clearly satisfied, the study particularly focuses on the first condition for existence of the bank lending channel; that is, whether monetary policy affects the quantity of bank lending.

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, their 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 diminish. Since bank loans in many countries, especially developing countries, remain the main source of external finance for business enterprises, a disruption

of bank loan supply can reduce 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; and (2) bank loans and securities must be imperfect substitutes for some borrowers.

Agung (1998) uses the money market interest rate (interbank money market) as the monetary policy variable by arguing that Bank Indonesia often indirectly targets interbank interest rates. An alternative is the SBI rates which have been widely used as the benchmark by the market, in particular since banks' holdings of SBIs increased dramatically. The problem with using the SBI rates is that the auction system has been changed three times. Before 1993, Bank Indonesia targeted the quantity of SBIs in the auction (cut-off rate), but since 1993 the system was changed to the stop-out rate, in which the monetary authority sets the interest rates on SBIs and the market determines the quantity of SBIs. The stop-out rate system was changed again into the cutoff 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.

Pre-crisis period

Before the crisis, bank lending was almost not affected by tight monetary policy. This result is consistent with findings by Agung (1998) who also uses pre-crisis data. One reasonable explanation of the low sensitivity of lending to a monetary shock is that before the crisis, especially since the beginning of the 1990s, the access of domestic commercial banks to international sources of funds was relatively easy. Hence, in spite of tight money, banks could still provide loans to their borrowers. A survey conducted by Hadad (1996) also found a similar phenomenon. During the tight money period (eg in the aftermath of the so-called Gebrakan Sumarlin), the loan growth of state banks and large private banks was higher than their deposit growth. In fact, domestic banks were major issuers of bonds in international markets during the period. Large banks obviously have better credit ratings than smaller ones and are thus able to raise funds less expensively. This differential behavior of state and private banks is clearly reflected in the fact that loans of state banks are completely insensitive to a monetary shock, while those of private banks are more sensitive.

Post-crisis period

The relatively high sensitivity of commercial bank lending for the whole sample is partly influenced by the behavior of bank lending during and after the crisis. Given the weakening of firms' balance sheets amidst low economic prospects, a monetary tightening worsens firms' financial position and raises the probability of default, and hence reduces the willingness of banks 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 circumstances, they argue, tight money exacerbates the unwillingness of banks to lend. This is also confirmed by a study on the balance sheet channel that concludes that there is a financial accelerator effect of monetary policy, especially after the crisis. Similar impulse responses are obtained if we use the PUAB rate as the policy variable, although the effect of a change in the SBI rate seems to be more pronounced than a change in the PUAB rate.

The lag of bank lending to a shock can be attributed to the fact that bank loans (especially investment loans) are mostly supplied 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 the actual loans that have been drawn. As a result of this system, banks cannot prevent borrowers from drawing credit even when monetary conditions are tightened. Banks can only reduce the supply of new loans, which presumably does not immediately lead to a substantial fall in aggregate lending.

A disaggregation of total bank loans into corporate lending and individual (household) lending, however, suggests that the insignificant response of aggregate lending stems from the loans to firms. By contrast, loans for individuals drop significantly in the aftermath of a monetary shock. This may be explained by the so-called "flight to quality" phenomenon. That is, in a monetary contraction, to compensate for the decline in cash flow, creditworthy borrowers have access to short-term loans, while loans to less creditworthy borrowers such as individuals or small firms will be rationed.

Evidence from survey

This section presents an analysis based on a survey of banks and firms. The survey is designed to generate answers to some important questions on the behavior of banks and firms in the aftermath of a monetary crisis. From the banking survey, the main issue examined is whether banks reduce their loan supply after a monetary crisis, as expected by the bank lending channel hypothesis. How do they reduce loan supply, by price or non-price mechanisms? If they reduce their loan supply with a lag, how do they maintain their funding? From the firm survey, the issues examined are: what are sources of funds, and what is the sensitivity of demand for bank lending after a monetary tightening? Are they rationed during tight money periods?

As outlined previously, the existence of the bank lending channel of monetary transmission depends on whether bank lending is a dominant source of external funds. The survey indicates that in conducting their business activities, firms use internal funds as the main source of financing (60.71%). Meanwhile, bank credit is still the main source of external funds. About 20.71% of firms use bank credit as the main source of funds. As found in many studies using pre-crisis data, banks are the main source of funds for at least 40% of firms' financing.

Firms using internal funds as the main source of financing rely mainly on head/business group (46%) and retained earnings (44%). The income from deposit interest and foreign exchange profits are only around 4%. Referring to the credit crunch survey, the main reasons for using internal funds are the relatively high loan rate, underutilization of their own capital, tightness of credit procedures, and the existence of bank credit rationing.

Firms using bank loans as a main source of financing come from the manufacturing sector (37.9% share). Trade and property/construction each have about 20.7%, while the agriculture sector has only 13.8%. Classified according to business scale, the respective shares of bank financing are: large firms 55.2%, medium firms 41.4% and small firms only 3.4%. The agriculture sector and small scale businesses experience difficulty obtaining bank credit. Obstacles to obtaining bank credit are tightness of collateral condition, declining cash flow, and credit rationing.

Lending behavior after a monetary shock: The existence of the bank lending channel is determined by whether or not monetary policy influences loan supply. The survey indicates that in the case of tight money, the majority of banks (77%) will reduce their loan supply. As indicated by the quantitative study, foreign and joint-venture banks are less influenced by 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 tight money policy. Meanwhile, all private non-foreign exchange banks and regional banks reduce their loan supply. This supports previous empirical findings (eg Agung (1998)) that small banks' reliance on deposits as the source of funds makes their lending 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 (eg 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.

In the case of monetary tightening reflected in an increase in the SBI rate, banks reduce bank lending supply either by price mechanisms, through increasing the loan rate or

tightening credit conditions, and non-price mechanisms, through reducing new loans. The 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 private and regional banks reduce lending by rationing credit rather than by raising the loan interest rate. Meanwhile, state banks and foreign banks raise the interest rate in order to reduce loans. A similar result is found in the case of monetary easing (a fall in the SBI rate); that is, around 72% of banks reduce loan rates and around 20% raise the loan supply.

3.6   Expectations channel

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

Considering that an economic crisis has changed inflation expectation behavior in Indonesia, another study (Wuryandani, et al (2001)) focuses its studies on the period after the crisis. Problems in data availability pose challenges in identifying the appropriate expected inflation proxy. Several candidates for measuring inflation expectations are tested; they include the inflation assumption in the government budget, VAR estimation through the 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 of those candidates showed that the business survey (SKDU) data is the best proxy for expected inflation despite its limitations as interpolated data.

A correlation test between inflation and each candidate showed the following results: both SKDU and the Fisher theory showed a 92% correlation; on the other hand SEK, OLS, and fiscal assumptions showed lower correlations (47%, 46% and 24%, respectively). Using five months lag, Granger causality tests indicated that SKDU and the Fisher theory have a reciprocal relationship with inflation. Granger causality tests also revealed that there is no relationship between SEK and inflation. This might be due to the limited SEK time series data. Moreover, fiscal assumptions and the OLS estimation do not lead inflation at all. On the contrary, inflation leads both the fiscal assumption and OLS.

With the exception of SEK data, an OLS test for each candidate series exhibit indicates that using those variables sufficiently explains the inflation movement which is shown by a 99% R-squared value of each variable. Based on the tests above, interpolated SKDU is the best proxy of expected inflation.

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

The analysis of impulse responses shows that a change in monetary policy will have a similar effect on inflation expectations and inflation. Meanwhile, the SBI rate's strongest influence on expected inflation is immediate, and stabilizes in the 24th period. This indicates that the SBI is seen as a signal of monetary policy by the market. The effect of the SBI on inflation begins in the 15th period, which implies that there is a time lag of monetary policy. Generally, the effect of monetary policy on inflation is stable after the 33rd period.

According to the outcome of accumulated impulse responses, the initial response of expected inflation to an SBI shock is significant. Meanwhile, the accumulated response of expected inflation on inertia is more significant than on the SBI. This result reveals that the market is still backward-looking in forming expected inflation. The accumulated impulse response of the SBI shock is highly significant in the 12th period. However, the response of inertia is more significant than the SBI shock over the same time horizon. The lag structure response shows that the maximum effect of SBI and inertia on expected inflation formation is relatively direct for four periods. The maximum effects of SBI and inertia on inflation have a 22 period and 18 period time lag respectively. The impulse response analysis supports the variance decomposition results.

Evidence from survey

The survey also shows that expected inflation and inflation formation are determined predominantly by the exchange rate, past inflation (inertia), and the interest rate. Nonetheless, the market response to those factors is not always symmetric. There is a downward rigidity in firms' price setting, regardless of depreciation or appreciation in the exchange rate. On the contrary, households react asymmetrically to exchange rate movements. An interesting result from the survey is that the market expects inflation to increase as the interest rate increases. The explanation for this result is that the market learned in 1998 that when the interest rate increased, inflation also increased; the opposite occurred in 1999. In this case, the market did not take into account the time lag of monetary policy. In projecting future inflation, the market uses past inflation as benchmark.

4. Conclusion

The financial crisis of 1997 brought about significant changes in the Indonesian economy, including the monetary policy transmission mechanism. Before the crisis, the Indonesian economy was in a "boom" period with ample foreign capital flows. Under these circumstances, the interest rate channel worked quite well in transmitting monetary policy into the deposit and lending rates. 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. This is confirmed by the finding that did not affect bank lending prior to the crisis due to banks' ability to access funds from international sources. In the meantime, the exchange rate channel was not very 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 a predictable rate of depreciation, and thus 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 a floating exchange rate system. This undoubtedly has fundamental implications for the functioning of the monetary transmission mechanism. Exchange rate movements become more pronounced in affecting the real economy and prices, while the effectiveness of monetary policy to influence the exchange rate has been undermined by the fact that exchange rate movements have been driven more by non-economic factors. Likewise, expectations have become more important in affecting inflation, but the behavior of inflation expectations has been driven mostly by price inertia and the exchange rate. The interest rate channel still works quite well in transmitting monetary policy, even though its magnitude has been affected by conditions in the banking system and overall higher uncertainty and risk factors. 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 the 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.

Appendix 1:
Summary of transmission mechanism in Indonesia

Channel	Before crisis			Crisis 1997/1998 - 1999/2000	After crisis 2000:01 - 2005:03
	SBI/PUAB-channel	Channel - inflation	Total effect		
	Especially exchange rate and interest rate channels			Especially assets price, credit and balance sheet channel	Especially Exchange rate, asset price, interest rate and credit
Exchange rate			**Present but not strong**	Strong via direct pt	**The strongest channel for monetary transmission to core inflation, via direct pass-through**
- direct pt	Present	Present	8% variation inflation explained by rSBI after 25 months and around 42% each explained by exchange rate and tradable prices.	No comprehensive test	Present
				55% variation inflation explained by rSBI after 15 months	59% variation in inflation explained by shock to SBI after 1 year
- Indirect pt	Present	Present	2% variation inflation explained by rSBI after 25 buland, 47% explained by itself and 35% by exchange rate	Not consistent with hypothesis	Not functioning well
Asset price	Present	Result not consistent: investment rises in response to SBI shock (others variables expected by hypothesis)	Not functioning well.	**Start functioning via investment channel (data 1996 2003)**	**The strongest channel for monetary transmission channel to headline (CPI) inflation, especially via investment channel**
					43% variability of inflation explained by shock to SBI, 21% explained by deposit rate, and 17% by investment growth.
Interest rate			**Occurred but not strong**	Not functioning well	**Functioning well especially via cost of capital channel**
- cost of capital	Present through investment growth	No test in both investment deflator and CPI deflator	2.9% investment growth explained by rPUAB after 1 year, 83% explained by itself	Result not consistent as rPUAB increased, rKI declined so the investment growth also decreased	Occurring (functioning well)
				19% variation investment deflator explained by rPUAB, 41% explained by itself, 26% by investment growth	60% variability of inflation can be explained by shock to SBI after 1 year
- subst / income	Present	Present through consumption deflator	1.6% consumption deflator explained by rPUAB after 1 year, 91% explained by itself.	Result not consistent: when rPUAB increases, rDEP decreases followed by positive consumption growth after 1 month	Occurring (functioning) well
				38% variation on consumption growth explained by rPUAB, 52% explained by itself	54% variability of inflation explained by shock on SBI after 1 year
Balance sheet	Worsening debt/cap dan shortdebt/totdebt, precisely increase investment		Not effective	**Stronger, possibly due to extreme monetary contraction and high rupiah exchange rate depreciation.**	
Credit	Response of credit volume to SBI shock is low	Not present	Not effective		Present
					41% inflation variability explained by shock SBI after 1 year.
Expectation	No test due to lack of data			Not effective	
				Still backward looking (adaptive), 72% influence by the variable itself	

Appendix 2:
Impulse response function of inflation to shocks from policy rate (SBI) in the baseline model and in the models with each channel of transmission
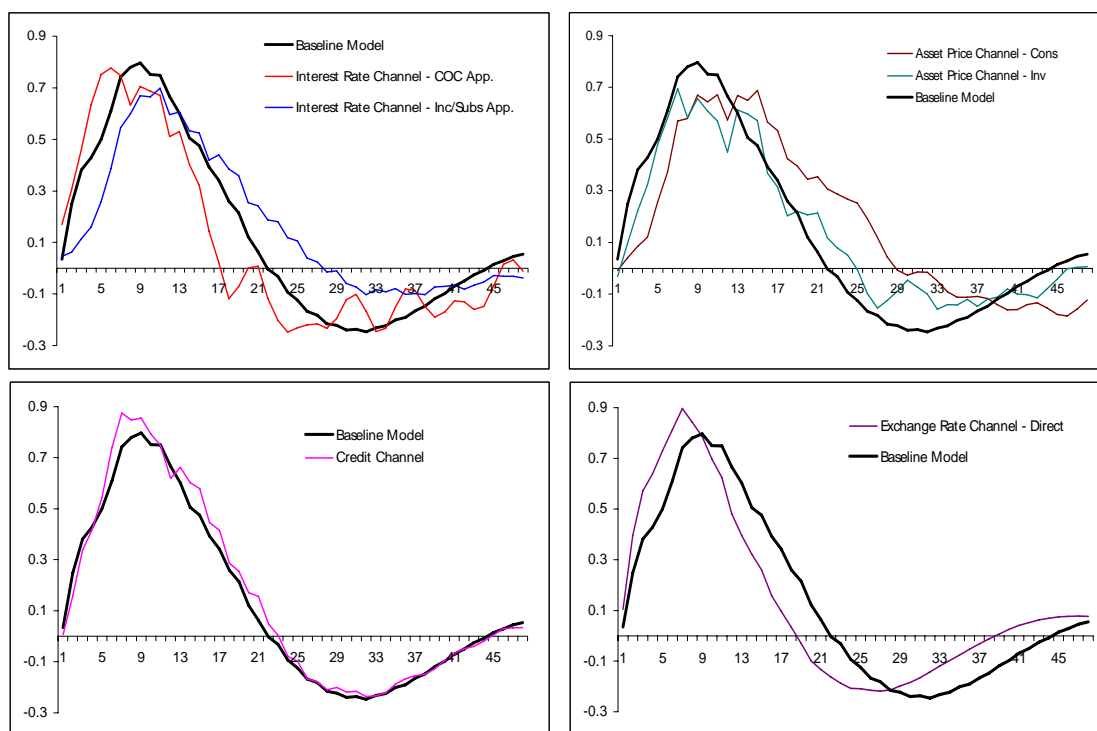

Table A1

Correlation between the impulse response function of the baseline model and each channel of transmission

	IR_Baseline Model
IR_Baseline model	1.000000
IR_Credit	0.926666
IR_Asset Price Inv	0.960693
IR_Asset Price Cons	0.803701
IR_Exchange rate	0.907771
IR_Interest Rate Inv	0.927826
IR_Interest Rate Cons	0.914049

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