Macroeconomic Shocks and Bank Lending in Indonesia*

Iwan J. Azis
Professor
Johnson Graduate School of Management
Cornell University
215 W. Sibley Hall
Ithaca, NY 14853

Phone: (607) 255-4271
Fax: (607) 255-6681
E-mail: ija1@cornell.edu

Willem Thorbecke
Associate Professor
Department of Economics
George Mason University
331 Enterprise Hall, MSN 3G4
Fairfax, VA 22030

Phone: (703) 993-1150
Fax: (703) 993-1133
E-mail: wthorbec@gmu.edu

September 2002

* This paper is part of a research project entitled "Linking Firm and Bank Behavior With Macroeconomic Shocks," sponsored by the Asian Development Bank Institute (ADB-I), Tokyo. We thank Menzie Chinn, Reid Clark, Fawzy Siddick and seminar participants at the Asian Development Bank Institute and the Spring 2002 Washington Area Finance Conference for valuable comments.

Macroeconomic Shocks and Bank Lending in Indonesia

Abstract

Krugman used the Bernanke-Gertler model to explain the Asian Crisis. This model implies that macroeconomic shocks can decrease credit creation by reducing firms' creditworthiness or by eroding bank capital. Foreign banks in Indonesia should be less likely to restrict credit following macroeconomic shocks because they employ better risk management practices, they are less vulnerable to disintermediation, and their customers are largely hedged. We thus use foreign banks as a control group. We find that interest and exchange rate shocks reduce capital and lending more at domestic banks than at foreign banks. This evidence indicates that the crisis curtailed domestic loan supply, forcing firms to restrict exports despite plummeting exchange rates.

Economists have struggled to explain the virulence of the Asian Financial Crisis. With little warning, "the East Asian Miracle" was replaced by contagion and economic implosion. In the hardest hit country, Indonesia, real output fell 14% in 1998 after growing 7% per year between 1970 and 1996. By 2002 output had not regained pre-crisis levels. The exchange rate depreciated from 2,400 rupiah per dollar in June 1997 to 15,000 rupiah per dollar in June 1998 after depreciating only 5% per year from January 1990 until June 1997. In 2002, its value still hovers around 9,000 rupiah per dollar. The percentage of the population living below the poverty line rose to 21% in 1998 after falling to 11% in 1996. In 2002, it remains at 18%. Trying to explain the crisis, Krugman (1999) said it could be understood as an open economy application of the Bernanke-Gertler model.

Bernanke and Gertler have shown that the effects of an adverse macroecoomic shock may be amplified if it restricts the flow of credit (see, e.g., Bernanke, Gertler, and Gilchrist, 1996). A decline in credit creation could occur because a negative shock worsens firms' balance sheets and thus their access to credit or because it restricts the ability of banks to supply loans. In a world of asymmetric information, firms with healthier balance sheets can obtain credit on better terms. Their ability to post collateral and provide down payments reduces the agency costs associated with borrowing. If a negative shock worsens firms' financial positions, it might impair their access to credit. Similarly, an adverse shock might reduce bank capital and thus banks' ability to provide loans. When either firms' balance sheets deteriorate or banks' loan supply declines, the reduction in credit forces firms to reduce spending and output.

Krugman (2001) emphasized the role of deteriorating balance sheets in propagating the Asian crisis. Firms were saddled with short-term foreign currency denominated debt. This debt was largely unhedged against exchange rate risk. Depreciating exchange rates thus multiplied businesses' liabilities and reduced their retained earnings (equity). As companies' net worth plummeted, their access to credit declined and they were forced to curtail spending.[1]

Krugman (2001) also stated that, in the case of Indonesia, bank runs and a freezing up of the credit system played an important role. Declines in bank capital and disintermediation reduced the willingness of banks to supply loans. Business borrowers facing a once in a generation crisis lost their credit lifelines and were forced to curtail spending and production.

Djiwandono (2000), the head of the Indonesian Central Bank (BI) in 1997, describes how banking sector problems developed in Indonesia. When spillovers from Thailand's currency crisis reached Indonesia, BI sought to preserve foreign currency reserves first by widening the exchange rate bands and then by floating the exchange rate. As pressure on the exchange rate continued, BI raised the interest rate on its certificates (Sertifikat Bank Indonesia or SBI's). The Minister of Finance at the same time directed state enterprises to transfer 3.5 trillion rupiah of bank deposits into SBI certificates. These moves damaged the banking sector. Banks were further harmed in October when IMF demands for the closure of 16 banks led to a bank run.

Azis (2001) and Enoch *et al.* (2001) discuss how depositors reacted with a "flight to quality", withdrawing funds from private domestic banks and from rupiah accounts

[1] The decline in retained earnings pushed debt/equity ratios unacceptably high, making creditors unwilling to provide loans.

and depositing them into foreign banks and into dollar accounts. Deposits at private domestic banks fell almost 20% between July 1997 and the beginning of 1998 while deposits at foreign banks nearly doubled over this period (see Figure 1).[2] Of the deposits remaining at private banks, the ratio of foreign exchange deposits to total deposits grew 20 percentage points over this period (see Figure 1b).[3] As a result, private domestic banks but not foreign banks were forced to curtail lending (see Figure 2).[4]

The depreciating exchange rates, high interest rates, and flight to quality, by eroding the balance sheets of domestic firms and the capital of domestic banks, caused aggregate lending to plummet. Aggregate credit creation fell because the decrease in loans by domestic banks could not be offset by an increase in loans by foreign banks, since foreign banks lent only 7% as much as private domestic banks before the crisis (see Figure 2).

This paper seeks to measure the effects of macroeconomic shocks on the flow of bank lending in Indonesia. To do this it examines the differential response of foreign and private domestic banks to exchange rate and interest rate shocks. Compared to domestic banks, foreign banks lend to businesses that are more creditworthy and more likely to be hedged against foreign exchange risk. Foreign banks should thus be more willing to lend

---

[2] This evidence indicates that many domestic private banks suffered from a major reduction in funds, while foreign banks found themselves with excess liquidity. Market segmentation is also evident from the following gap: among small and medium sized banks, the average interbank rates for overnight funds increased from 35 to 57 percent in November 1997, while the rates among the prime banks decreased from 30 to 18 percent (Enoch, et.al., 2001).

[3] The central bank, believing banks were solvent but illiquid, extended overdraft facilities known as Bantuan Likuiditas Bank Indonesia (BLBI). BLBI reached 100 trillion rupiah and went to politically powerful banks. It led to moral hazard. Banks used BLBI not to extend loans domestically but to transfer funds abroad.

[4] Goldberg *et al*. (2000) report that foreign banks in Mexico and Argentina had higher loan growth rates during crisis times than domestic banks. Figure 2 shows that this is true for Indonesia also.

following exchange rate depreciations since the balance sheets of their clients will remain healthier. In addition, foreign banks employ better risk management practices than domestic banks. They should thus be better able to preserve bank capital and continue lending in the face of exchange rate and interest rate shocks. Finally, foreign banks are less vulnerable than domestic banks to bank runs that would force them to curtail lending and rebuild liquidity. Thus foreign banks can serve as a control group to measure the effects of macroeconomic shocks on bank lending.

The evidence indicates that interest rate increases and especially exchange rate depreciations decreased capital and loan growth at domestic banks relative to foreign banks. These findings imply that macroeconomic shocks restricted the flow of bank credit in Indonesia during the crisis. The evidence also indicates that these effects were quantitatively important.

This decline in credit creation exacerbated the crisis. The depreciating exchange rate offered firms opportunities to export more. To produce, however, businesses needed working capital. Since the stock and bond markets in Indonesia are underdeveloped and since foreign creditors withdrew funds during the crisis, firms had to rely on banks for funding. When banks restricted lending, businesses were forced to cut production and could not increase exports in response to falling exchange rates.

The next Section considers in more detail the problem of identifying loan supply effects. Section 2 discusses the data and methodology. Section 3 presents the results. Section 4 concludes.

1. IDENTIFYING THE EFFECTS OF MACROECONOMIC SHOCKS ON BANK LOAN SUPPLY

For several reasons foreign banks in Indonesia are less vulnerable to the Bernanke-Gertler effects discussed above than private domestic banks. Foreign banks employ more professional loan application standards than private domestic banks. Consequently their loan pool includes more creditworthy customers. Foreign banks' customers such as joint ventures or multinational corporations were highly hedged against exchange rate risk before the crisis while domestic banks' customers such as domestic firms were largely unhedged.[5] Exchange rate shocks thus worsened balance sheets and access to credit much more for firms borrowing from private banks than for firms borrowing from foreign banks. Further, foreign banks tend to have better risk management practices than domestic banks. Thus foreign banks should be better able than domestic banks to weather exchange rate and interest rate shocks, preserve bank capital, and continue lending. Finally foreign banks are less vulnerable to bank panics than domestic banks because depositors know they are reputable and can be recapitalized from abroad. Thus foreign banks are less likely to experience bank runs that force them to rebuild liquidity and curtail lending. Therefore, investigating differences in lending behavior between domestic and foreign banks in Indonesia can shed light on how the crisis affected bank credit.

The strategy of this paper is to use lending by foreign banks as a control group to identify the effects of macroeconomic shocks on lending by domestic banks. Examining

---

[5] Djiwondono (2000) discusses the fact that domestic firms were largely unhedged.

whether exchange rate and interest rate shocks restrict lending at domestic banks relative to foreign banks can shed light on how the crisis affected bank lending.

The effect of the crisis on loan supply is represented graphically in Figure 3. In a world of imperfect information, an exchange rate depreciation that worsens clients' balance sheets will increase risk premia and reduce domestic banks' willingness to supply loans at existing interest rates. Thus domestic banks' loan supply curves will shift up and to the left. If at the same time the macroeconomic shocks erode bank capital or trigger financial disintermediation, the loan supply curve will shift further up and to the left.

For foreign banks there will also be some effect of exchange rate and interest rate shocks on loan supply. However, as discussed above, foreign bank customers are largely hedged, foreign banks have better risk management practices, and foreign banks are less vulnerable to disintermediation. Thus their loan supply responses will be attenuated. To the extent that foreign bank loan supply decreases also, our tests will be biased against finding an effect of macroeconomic shocks on domestic loan supply.

It is also necessary to consider loan demand. An exchange rate depreciation that decreases retained earnings would increase loan demand by firms facing short term financing requirements. This would cause the demand curve in Figure 3 to shift up and to the right. Since foreign banks lent to firms that were largely hedged while domestic banks lent to firms that were largely unhedged, customers of domestic banks should experience larger drops in retained earnings following an exchange rate depreciation. Customers of domestic banks would thus have greater needs for short term credit, causing loan demand curves for domestic banks to increase more than loan demand curves for foreign banks. The greater increase in loan demand at domestic banks relative to foreign banks implies that our tests will understate any decline in domestic loan supply (DLS) due to exchange rate depreciations. This will increase the probability of a type II error, implying that our tests will be too conservative. They will tend to fail to reject the null hypothesis that exchange rates depreciations do not reduce DLS even when depreciations do reduce DLS.

2. DATA AND METHODOLOGY

Since exchange rates and interest rates are endogenous it is difficult to infer how changes in these variables affect bank lending and other economic variables. To solve this simultaneous causality problem it is necessary to find components of exchange rates and interest rates that are exogenous to the state of the economy. These can be obtained by employing a vector autoregression (VAR). A VAR is a regression of an *n* by 1 vector of endogenous variables, y_t, on lagged values of itself:

$$y_t = A_1 y_{t-1} + \ldots + A_p y_{t-p} + \varepsilon_t, \;\; E(\varepsilon_t \varepsilon_t') = \Sigma. \qquad (1)$$

Equation (1) can be inverted and represented as an infinite-vector moving average process:

$$y_t = \varepsilon_t + C_1\varepsilon_{t-1} + C_2\varepsilon_{t-2} + C_3\varepsilon_{t-3} + \ldots. \qquad (2)$$

One problem with equation (2) is that the individual error terms in ε_t may be contemporaneously correlated. The Cholesky factorization can be used to obtain orthogonalized innovations. This approach involves finding a lower triangular matrix P such that $\Sigma = PP'$, where Σ is the variance-covariance matrix of ε_t. In this case equation (2) can be rewritten as:

$$y_t = PP^{-1}\varepsilon_t + C_1PP^{-1}\varepsilon_{t-1} + C_2PP^{-1}\varepsilon_{t-2} + \ldots = \Gamma_0\upsilon_t + \Gamma_1\upsilon_{t-1} + \Gamma_2\upsilon_{t-2} + \ldots \qquad (3)$$

where $\Gamma_i = C_iP$, $\upsilon_t = P^{-1}\varepsilon_t$ and $E[\upsilon_t\upsilon_t'] = I$. Equation (3) represents the macroeconomic variables (y_t) as functions of the orthogonalized residuals (υ_{t-I}). If components of υ_t represent shocks to exchange rates or interest rates, impulse-response functions can trace out the dynamic responses of variables such as bank capital or bank lending to exchange rate or interest rate shocks.

The variables we use include the first difference of the rupiah/dollar exchange rate, the consumer price index inflation rate, the growth rate of exports, the interest rate on 1-month central bank certificates (the SBI rate), and measures of bank capital and bank lending by domestic and foreign banks. For bank capital we use the difference between the capital/asset ratios of domestic and foreign banks. For bank lending we use the difference between the growth rates of domestic and foreign bank loans. We obtained these data from the Indonesian Central Statistical Bureau (BPS) and the Indonesian Central Bank (BI).

In calculating impulse-response functions, the ordering of the variables matters. The variables ordered prior are assumed to affect within the month the variables ordered later but not to be affected within the month by them. We assume that changes in the exchange rate are causally prior. The exchange rate was often driven by contagion effects, riots, and changes in confidence during our sample period. We then assume that the central bank SBI interest rate responds to the exchange rate, the inflation rate, and a measure of real activity. We thus place the SBI rate after these variables in the recursive ordering. After the SBI rate we include data on bank capital or bank lending.

To measure real activity, since there are no monthly data on output, unemployment, or industrial production in Indonesia, we use the growth rate of exports.

Exports are an important engine of growth in Indonesia. Thus changes in exports provide information about output growth. [6]

The sample period extends from April 1993 to January 2002. This provides each equation has 106 observations. To preserve degrees of freedom, we use three lags of each variable. The results, though, are similar when we employ two or four lags.

3. RESULTS

Figure 4 shows the effect of an exchange rate shock on inflation. As expected, a depreciation in the exchange rate increases inflation. The middle line represents point estimates and the outer lines represent plus and minus two standard deviation bands. The results indicate that the predicted effect of an exchange rate shock on inflation remains two standard deviations greater than zero for all but one of the first 7 months.

Figures 5 and 6 show the effects of exchange rate shocks and inflation shocks on the SBI rate. The results indicate, as expected, that a depreciation of the currency and an increase in inflation both increase the rate on central bank certificates. This implies that the Indonesian Central Banks responds to an unexpected depreciation or increase in inflation by raising the SBI interest rate. For the exchange rate the interest rate response remains two standard deviations above zero for 12 months and for the inflation rate the interest rate response remains two standard deviations above zero for 10 months. Nasution (2002) discusses how BI raises the SBI rate to reduce inflationary pressure and to strengthen the exchange rate.

---

[6] We also use total returns on the JSX Index as a measure of real activity. Stock prices in theory equal the expected present value of future cash flows. Thus changes in stock prices should provide information on shocks to future cash flows and economic activity. The results were unchanged when we employ stock returns instead of export growth.

Figures 7 and 8 show the effect of exchange rate and interest rate shocks on the difference between the capital/asset ratios of private domestic banks and foreign banks. In the first case, a one standard deviation unexpected depreciation in the exchange rate causes the capital/asset ratio of domestic banks to fall by 1.7 percentage points more that the capital asset ratio of foreign banks. A one standard deviation shock represents a depreciation of 868 rupiah per dollar. In the second case, a one standard deviation unexpected increase in the interest rate causes the capital/asset ratio of domestic banks to fall by 0.8 percentage points more that the capital/asset ratio of foreign banks. A one standard deviation shock represents an increase in the SBI rate of 2.13 percentage points. For both exchange rate and interest rate shocks the responses are two standard deviations below zero. Exchange rate depreciations and interest rate increases thus reduce capital at domestic banks more than at foreign banks.

Figures 9 and 10 show the effect of exchange rate and interest rate shocks on the difference between the growth of loans at private domestic banks and foreign banks. In the first case, a one standard deviation unexpected exchange rate depreciation causes a shortfall of domestic loan growth relative to foreign loan growth of 4.6% in the initial period. The associated t-statistic is 6.68. In the second case, a one standard deviation unexpected interest rate increase causes a shortfall of domestic loan growth relative to foreign loan growth of 1.1% in the initial period and 1.6% in the second period. The associated t-statistics are 1.74 and 2.45 respectively. For an exchange rate shock the response of the difference in loan growth tapers off quickly. However, since we are examining loan growth, a 4.6% fall in the growth rate of domestic loans in the first period implies that the level of domestic loans will fluctuate around a level 4.6% less than it would have been without the depreciation.[7]

There is thus a large and statistically significant difference between the response of domestic banks and foreign banks to macroeconomic shocks. Exchange rate depreciations and interest rate increases reduce capital at domestic banks more than at foreign banks. They also decrease lending at domestic banks relative to foreign banks. The important implication of these findings is that macroeconomic shocks during the crisis curtailed the ability of domestic banks to supply loans. Since domestic banks provided almost fifteen times more loans than foreign banks, the increase in loans by foreign banks could not offset the decrease in loans by domestic banks. The crisis thus caused a large reduction in the amount of credit channeled through the banking system, forcing firms to curtail production and exports.

4. CONCLUSION

This paper has sought to test and measure quantitatively the effects of exchange rate and interest rate shocks on bank loan supply in Indonesia. To do this, it has investigated whether domestic commercial banks and foreign banks respond differently to exchange rate and interest rate shocks. Compared to domestic banks, foreign banks have customers who are more likely to be hedged against exchange rate risk, foreign banks employ better risk management practices, and foreign banks are less vulnerable to bank panics. Thus foreign bank loan supply should respond much less to macroeconomic shocks than domestic bank loan supply. Therefore examining differences in lending

[7] The evidence in Figures 7-10 supports the argument discussed by Goldberg et al. (2000) that foreign banks increase the stability of lending by diversifying the available sources of equity capital.

behavior between domestic and foreign banks in Indonesia can shed light on how the crisis affected domestic loan supply.

Evidence from impulse-response functions indicates that interest rate increases and especially exchange rate depreciations caused a much larger decrease in the capital of domestic banks than of foreign banks. The evidence also indicates that these shocks reduced lending at domestic banks relative to foreign banks. These results imply that there was a large decrease in the supply of loans during the crisis.

This decrease in intermediation played an important role in exacerbating the crisis. The depreciating exchange rate provided opportunities for firms to export. To cover production costs, however, they needed letters of credit and short-term financing. The erosion of bank capital and firms' balance sheets limited the flow of credit to exporting firms. They thus had to forego exporting opportunities and curtail production.

Future research could incorporate the findings of this paper into a computable general equilibrium model (e.g., Azis, Azis, and Thorbecke, 2001). This would make it possible to trace the channels through which a decrease in credit supply affected the economy. It would also make it possible to quantify the effects of a decrease in loan supply on investment, exports, and output during the crisis.

References

Azis, Iwan J. "Modeling Crisis Evolution and Counterfactual Policy Simulations: Indonesia 1997-1999." Asian Development Bank Institute Working Paper 23, 2000.

Azis, Iwan J., Erina Azis, and Erik Thorbecke. "Modeling the Socio-economic Impact of the Financial Crisis: The Case of Indonesia." Final report prepared for the International Food Policy Research Institute and the World Bank, 2001.

Bernanke, Ben, Mark Gertler, and Simon Gilchrist. "The Financial Accelerator and the Flight to Quality." *Review of Economics and Statistics* 78 (February 1996), 1-15.

Djiwandono, J. Soedradjad. "Bank Indonesia and the Recent Crisis." Working paper, University of Indonesia, 2000.

Enoch, Charles, Barbara Baldwin, Olivier Frécaut, and Auto Kovanen, "Indonesia: Anatomy of a Banking Crisis, Two Years of Living Dangerously, 1997-99." IMF Working Paper 01/52, 2001.

Goldberg, Linda, B. Gerard Dages, and Daniel Kinney. "Foreign and Domestic Bank Participation in Emerging Markets: Lessons from Mexico and Argentina." National Bureau of Economic Research Working Paper 7714, 2000.

Krugman, Paul. "Analytical Afterthoughts on the Asian Crisis." Working Paper, Princeton University, 1999.

Krugman, Paul. "Balance Sheets, the Transfer Problem, and Financial Crises." In *International Finance and Financial Crises, Essays in Honor of Robert P. Flood, Jr.* , edited by Isard, P., Razin, A. and Rose, A. Dordrecht, Kluwer, 2001.

Nasution, Anwar. "Economic Recovery from the Crisis in 1997-98." In *Economi Indonesia di Era Politik Baru Ikhsan*, edited by Mohammed Ikhsan, Chris Manning, and Hadi Soesastro, Jakarta, Kompas, 2002.

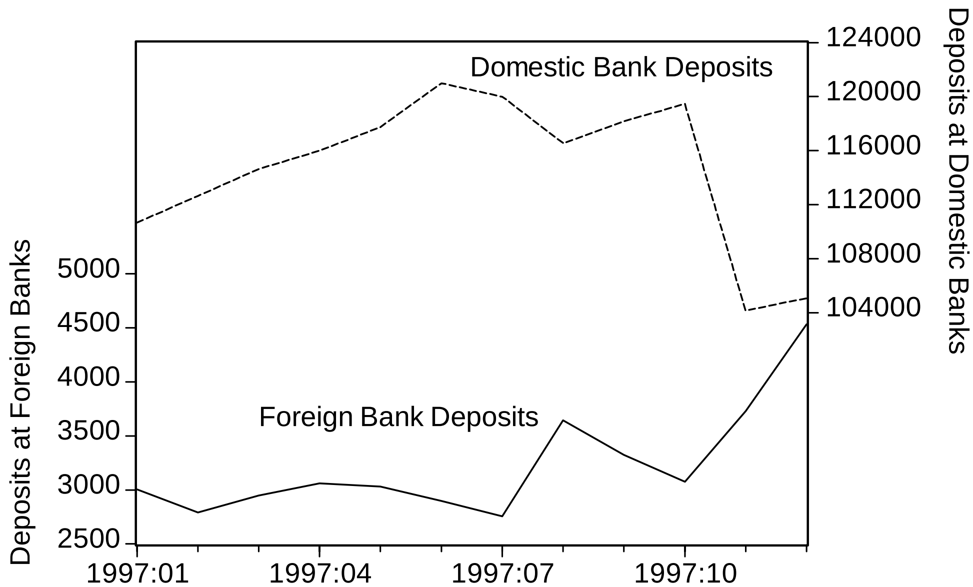

Figure 1. Savings and Time Deposits at Private Domestic Banks and Foreign Banks in Indonesia (billions of rupiah).

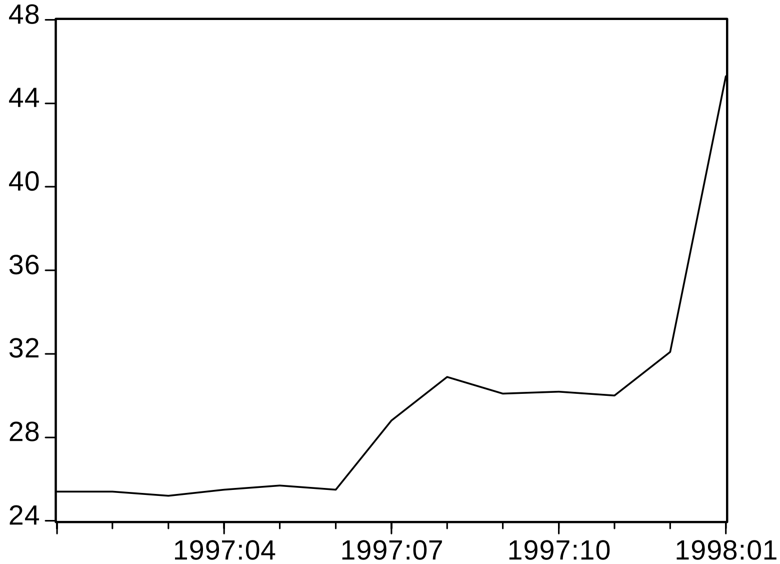

Figure 1b. Percentage of Time Deposits Held in Foreign Currencies at Private Domestic Banks in Indonesia

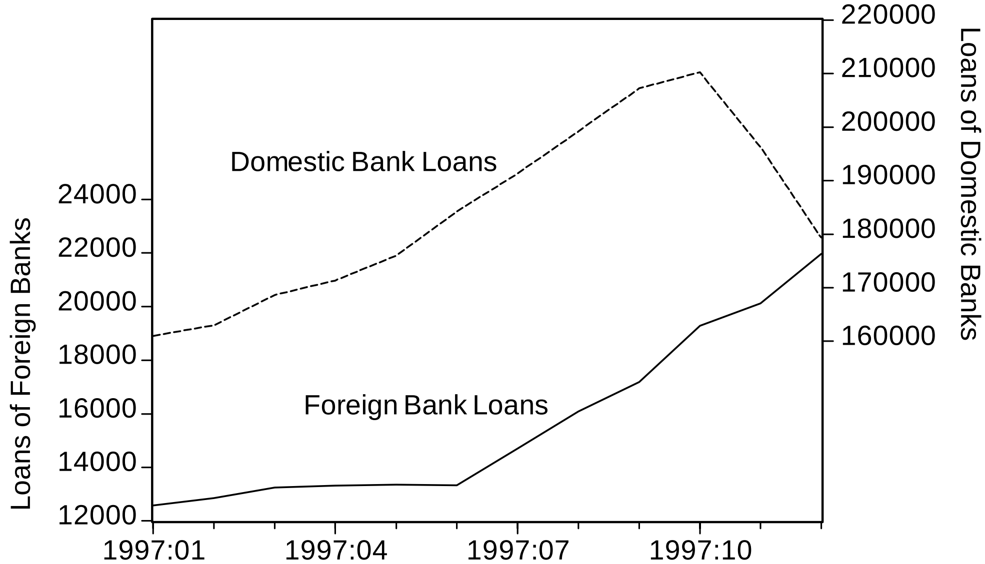

Figure 2. Loans of Private Domestic Banks and Foreign Banks in Indonesia in 1997 (billions of rupiah).

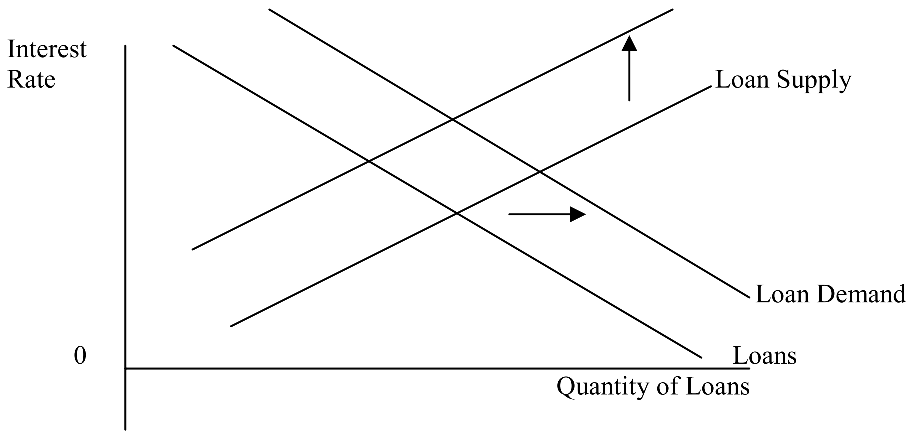

Figure 3. The Supply and Demand for Bank Loans

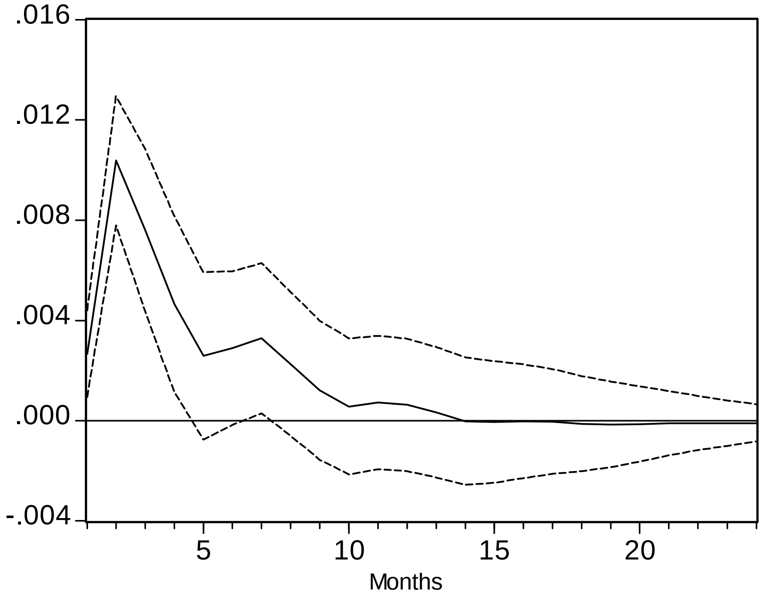

Figure 4. Response of Inflation to a One Standard Deviation Depreciation of the Rupiah

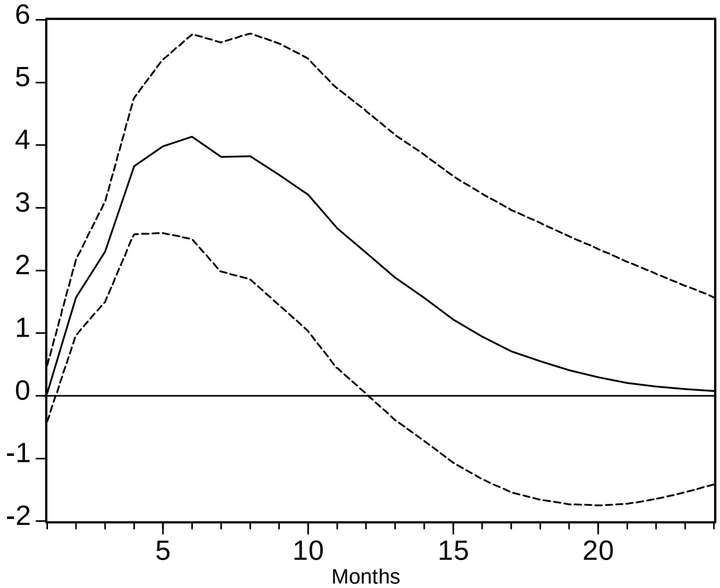

Figure 5. Response of the SBI Rate to a One Standard Deviation Depreciation of the Rupiah

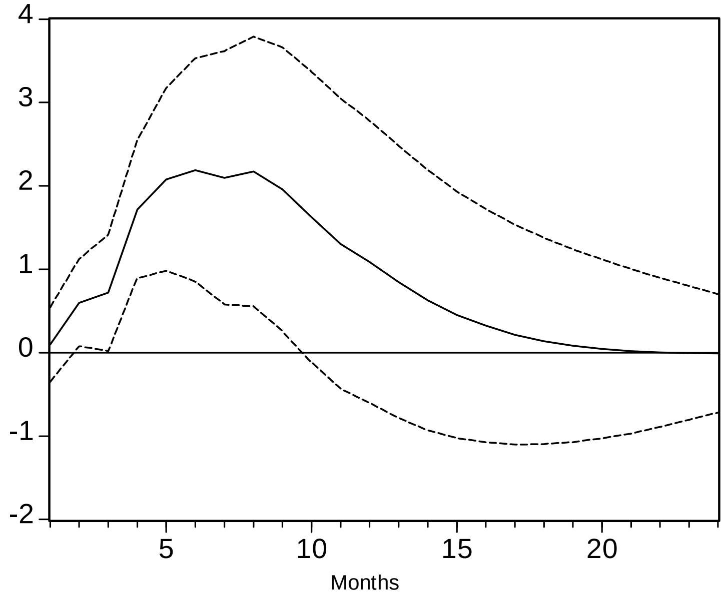

Figure 6. Response of SBI Rate to a One Standard Deviation Positive Shock to Inflation

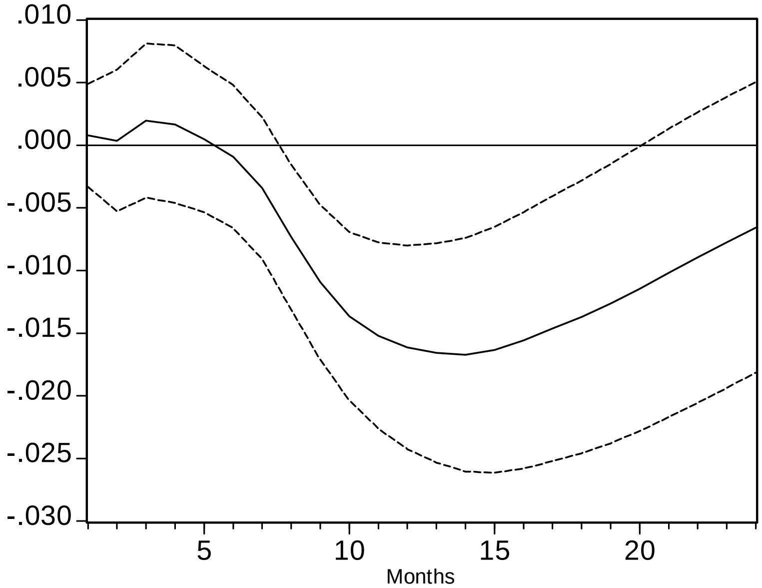

Figure 7. Response of the Difference Between the Capital/Asset Ratios of Private and Foreign Banks to a One Standard Deviation Depreciation of the Rupiah

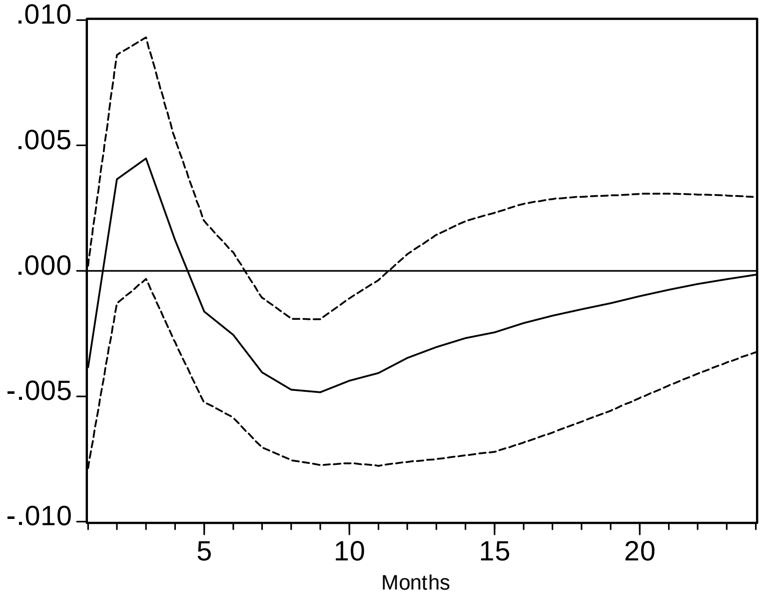

Figure 8. Response of the Difference Between the Capital/Asset Ratios of Private and Foreign Banks to a One Standard Deviation Positive SBI Shock

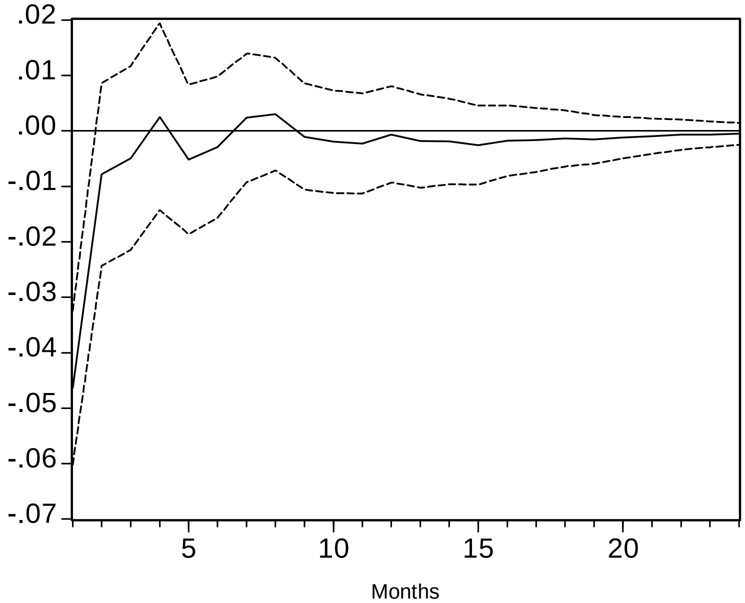

Figure 9. Response of the Difference Between Loan Growth at Private and Foreign Banks to a One Standard Deviation Depreciation of the Rupiah

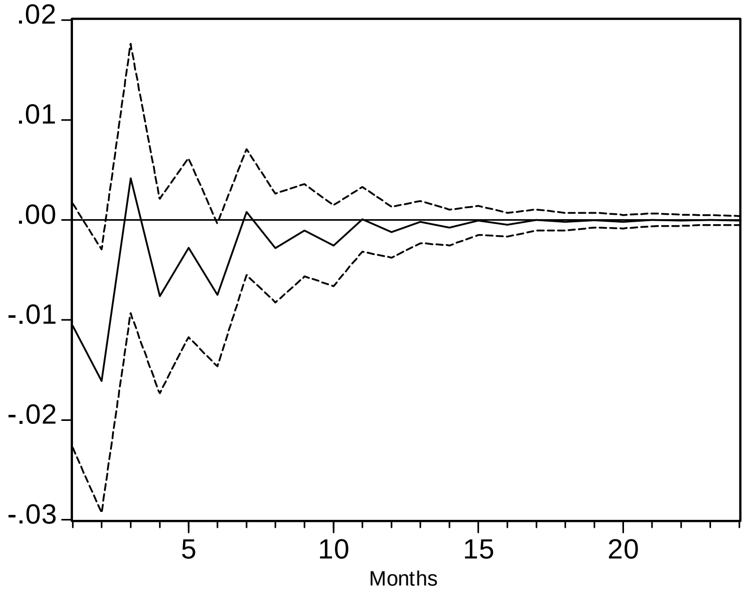

Figure 10. Response of the Difference Between Loan Growth at Private and Foreign Banks to a One Standard Deviation Positive SBI Shock.