Three Essays on Banking, Monetary Policy, and Regional Economy in Indonesia

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ABSTRACT

ATET RIZKI WIJOSENO: Three Essays on Banking, Monetary Policy, and Regional Economy in Indonesia.
(Under the direction of Neville Francis)

This dissertation is comprised of three essays. In the first essay, using monthly panel data, we study how changes in the BI rate and reserve rate affect bank portfolio allocation in loans, securities, interbank assets, and deposits. We estimate the aggregate policy impacts and test whether the impacts vary across periods around the 1997 Asian crisis. Further, we analyze if the policy impacts differ between banks with different size of assets, level of capital, and type of ownership. The findings show that an increase in the BI rate and reserve rate have different effects on each bank portfolio items, across bank groups and sub-periods. The impact of an increase in the BI rate is to decrease the aggregate share of bank assets in securities, deposits, and interbank assets. In addition, we find mixed evidence on how loans respond to contractionary BI rate shocks across sub-periods. The aggregate impact of an increase in the reserve rate is to reduce bank asset allocation in loans, interbank market, and deposits, while increasing securities-to-asset ratio. We find in particular that an increase in the reserve rate has a notably stronger contractionary effect on bank loans than that of the BI rate. Policy actions targeted at reducing the supply of loans are more effective in curbing loan growth in Indonesia.

In the second essay, we study the transmission channels of monetary policy at the regional economy level in Indonesia. The findings show that the magnitude and duration of the impact of monetary policy shocks vary across provinces providing evidence of the asymmetric regional effects of monetary policy. Given similar shock, we find that the response of bank loans and deposits vary across regions suggesting the existence of interest rate and credit channels at the regional level. In addition, we also find different responses of trade openness, housing prices and consumer expectations across regions providing evidences of the regional exchange rate, asset price and expectation channels. Further analysis shows that the shares of trade and mining are statistically

significant in explaining the asymmetric provincial responses to monetary policy shocks. We find that the impact of the monetary policy shocks are more muted for provinces which share land borders with foreign countries. This result implies that geography is a key factor in explaining the asymmetric provincial responses.

Finally, in the third essay we construct a banking model to demonstrate the impact of 1997 Asian crisis on banks in Indonesia. We study how banks adjust their portfolio allocation in response to changes in the reserve rate, capital requirement, and loan demand. Specifically, we are interested in testing the hypothesis on whether banks are more sensitive to policy changes in the more stringent, policy regulated post-crisis environment. We estimate the model based on the Indonesian bank panel dataset from April 1993 to July 2014. Our findings show that an increase in the reserve rate and capital requirement have larger impact on portfolio reallocation post 1997. This paper, in part, contributes to the efforts of better identifying bank behavior in Indonesia by providing a theoretical model as a means to study bank portfolio reallocation in response to policy changes.

To my parents, Soeseno and Suwarsilah,

my wife, Dewi Rahmawati, and the boys, Malik, Ammaar, Ghazi

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CHAPTER 1

BANKING DURING ECONOMIC CRISES: A CASE OF INDONESIAN BANKING SYSTEM

1.1 Introduction

Representing approximately 80 percent of the total assets of financial institutions in Indonesia, banking system holds a critical role in the country's economy development. The 1997 banking crisis taught an invaluable lesson on the importance of a sound and healthy banking system. This banking crisis particularly signifies the need for more efforts on identifying bad banking practices in order to improve banking supervision and policy formulation. This paper in part contributes to these efforts by providing studies on how banks adjust their portfolio allocation in response to policy changes during crises and non-crises periods.

Following the Bank Liberalization Act in October 1988, the banking sector in Indonesia has been growing rapidly. The act which allowed private entity to establish new domestic and joint venture banking business in Indonesia, boosted the number of banks from 111 in 1988 to 240 in 1994. As the number of banks increased, the role of banks in economic development expanded significantly as banks became an important source of funding for the economy. During the period between April 1993 and August 1997 bank's loans soared, on average at 145 percent of the total deposits and accounted for 69 percent of bank's asset. Banks relied on external fundings to offset the lack of total funding from deposits, as indicated by high level of bank borrowings at 31.44 percent of total assets. During this period of rapid loans expansion, banks maintained low excess reserves, net interbank assets and investment in securities: each at approximately 2 percent of bank's total assets. This behavior and balance sheet composition seemed to be consistent amongst banks with different asset sizes, capital levels, and ownership prior to August 1997.

Unfortunately, the rapid increase in the number of banks was not accompanied by improved bank regulation and supervision. There were increasing problems related to weak banking corporate governance including collusive practices, violations of prudential regulations, and below standard accounting and auditing practices. These problems were common in part due to weak banking supervision by Bank Indonesia (BI), the Central Bank of Indonesia. During the early bank liberalization period, BI was not an independent institution thus banking supervision interferences were often, especially for business entities, supported by powerful political groups. Bad banking practices, weak bank supervision and regulation enforcement contributed to weakening banking fundamentals.

When the financial crisis hit Indonesia in 1997, most banks suffered huge losses which significantly decreased their capital levels. Banks contracted loan offerings and shifted their asset allocation towards safer instruments including cash, reserves and securities. Loan-to-deposit ratios (LDR), on average, dropped from 106 percent during the April 1993 to July 1997 period (Pre-crisis I period) to 92 percent during the August 1997 to May 2000 (Crisis I period). As the economy continued to decline during the Crisis I period and the public started to lose confidence in banks, the financial structure collapsed causing a severe bank crisis.

The 1997 crisis marked the start of major overhaul of the Indonesian banking system. In order to resolve the bank crisis, the Indonesian government conducted bank recapitalization and restructuring programs. On the policy side, BI became an independent central bank which led to improved banking supervision. These programs aimed to revive the banking sector and strengthen its fundamental. In the post 1997 crisis period, between June 2000 and November 2007, average capital were at 11 percent of total assets. Risk exposure from debt were significantly reduced as bank's borrowings dropped from 20.93 to only 2.47 percent of total assets. Unfortunately, as the economy has not yet fully recovered during the June 2000 to November 2007 period (Post-crisis I/Pre-crisis II period), there were further reduction in loan-to-deposit ratios from average of 78.3 to 66.2 percent. Share of loans to total asset slightly increased from 46.97 to 49.64 percent.

An interesting finding is that although the 1997 crisis had passed, banks on average still maintained high reserves ratio during Post-crisis I/Pre-crisis II period. Reserves holding in bank balance sheet was at 22.33 percent of total assets in the post 1997 crisis, much higher than pre-crisis level which was at 2.81 percent. The precautionary pattern was common across banks, in particular small and medium-size banks. Smaller banks realized that they were hardest hit by the crisis thus accumulated higher reserves and capital ratios than larger banks. On average, the banking system was improving.

The financial crisis in 2008 seemed to have had less effect on the banking system in Indonesia. Despite being global in nature, Indonesian banks performance continued to improve after 2008: Average bank's loans were able to bounce back from decreasing trends from 66.2 to 78.3 percent of the total deposits; Capital and reserves were maintained at 16.35 percent and 22.26 percent of total assets; healthier bank balance sheet as debt-to-asset ratio went from 2.47 to 1.23 percent. Between July 2009 and July 2014 (Post crisis II period) banks' LDR increased on average from 78.3 to 84.7 percent. Banks reduced capital formation and reserve-to-asset ratios. Average capital-to-asset ratios decreased from 16.35 to 15.88 percent, while reserves holding declined from 22.26 to 14.44 percent of total assets.

Using monthly panel data from April 1993 to July 2014, we study how changes in the BI rate and reserve rate affect bank portfolio allocation in loans, securities, interbank assets, and deposits. We estimate the aggregate policy impacts on these portfolio items and test whether the impacts vary across periods around the 1997 crisis (pre-crisis, crisis, and post-crisis periods). Further, we analyze if during these periods the policy impacts differ between banks with different size of assets, level of capital, and type of ownership.

The findings show that an increase in the BI rate and reserve rate has different effects on each bank portfolio items, across bank group and sub-periods. The impact of an increase in the BI rate is to decrease the aggregate share of bank assets in securities, deposits, and interbank assets. However, the cumulative impacts of similar shocks on securities and deposits are reversed. We find mixed evidence on loan responses across sub-periods. During the pre-crisis and crisis periods, an increase in the BI rate has the intended effects of reducing the aggregate bank loans. However, in the subsequent period similar shocks raise loans. The aggregate impact of an increase in the reserve rate is to reduce bank asset allocation in loans, interbank market, and deposits. Similar shocks lead to a higher share of bank assets in securities.

We find in particular that an increase in the reserve rate has a notably stronger contractionary effects in bank loans than that of the BI rate. As the majority of banks fundings obtained from deposits, policy actions targeted at reducing the supply of loans are relatively more effective in curbing loan growth; a one percent increase in the reserve rate generates a substantial reduction in bank deposits, whereas the same shock to the BI rate slightly increases bank deposits.

The remainder of the paper is as follows. Section 1.2 presents a description of the economy of Indonesia and its banking system. In section 1.3, we describe the data source, the dataset construction and present summary statistics. We provide the empirical specification in section 1.4 and the results are presented in sections 1.5. Concluding comments are presented in section 1.6.

1.2 Overview of Indonesian Economy

Indonesia, with an estimated GDP of US$856.1 billion (in 2014) and approximately 250 million in population, is the largest economy in Southeast Asia and the fourth most populous nation in the world. The Indonesian economy largely depend on household consumption which account for 54 percent of total GDP in 2014. Investment and government spending contributing to 32 percent and 9 percent, respectively, while net export represents 2 percent of the total GDP.

Indonesia was an agricultural country until reforms in the late 1980s that attracted foreign investment into export-oriented manufacturing sector. As a result from rapid development of the industrial sector, manufacturing products joined trade and agriculture as the main sectoral contributor to total GDP. In 2014, manufacturing sector contributed to 22 percent of total GDP, while trade and agriculture each represented 14 percent and 13 percent, respectively.

The late 1980s reform also brought major changes in Indonesia's financial system. The reform liberalized the banking system allowing private investors to establish new banks. As the number of banks increased, the banking sector expanded rapidly, increasing the role of banking system in the economy. The rapid development of the manufacturing sector and banking industry contributed to high economic growth, by an average of 7 percent during the period 1980 to 1997.

Despite a well-performing economy, there were serious weaknesses with the economic structure including massive corruptions, rapid depletion of Indonesia's natural resources, imprudent banking practices and weak legal system (World Bank (2003)). The effects of these problems became more apparent as the crisis hit Indonesia in 1997. The effects of financial crisis in 1997 were severe. The Rupiah plunged from Rp 2,600 per US Dollar in August 1997 to Rp 8,000-10,000 range at the end of 1998. The banking system collapsed and went into a costly recapitalization program at up to 37.3 percent of the country's GDP (Laeven and Valencia (2008)). Inflation reached 72 percent and real GDP contracted by 13.1 percent in 1998. Low public confidence in government credibility and the economic system in general resulted in a slow recovery process.

The economic recovery program established during the 1997 crisis slowly brought the economy back to positive growth. The economy was able to reach 4 percent growth in 2000 although the value of Rupiah still fluctuated around 8,000 per US Dollar. The bank recapitalization program resulted in stronger banking system and improved bank intermediation. As a result of the economic and financial reform, Indonesia was able to rebuild the economy creating a stronger fundamental including rapid reduction in public and external debt, improved quality of corporate balance sheets and stronger banking system through higher capitalization and better supervision.

An improved economic structure together with strong domestic demand helped Indonesia maintained positive economic growth at average rate of 6 percent during the most recent global financial crisis in 2008. The domestic consumption which include household and government expenditures were the largest contributor, representing for 65.3 percent of total GDP in 2008 and 66.3 percent in 2009. Government expenditures increased from 8.1 percent in 2008 to 9 percent of total GDP in 2009. While the contribution of household consumption and investment were relatively stable at 57 percent and 23 percent to total GDP. Export's share of total GDP decreased from 49.6 percent in 2008 to 42.8 percent in 2009. While in 2009 import accounted for 32.5 percent of total GDP, lower than 40 percent share in 2008. Although the share of export decreased in 2008, bigger reduction in import helped maintain a positive net impact of foreign trade to total GDP.

1.2.1 The Banking System

The banking system in Indonesia consisted of only a few state and privately-owned banks until the implementation of Bank Liberalization Act in 1988 when the numbers soared. However, despite the significant increase in the number of banks following the 1988 Act, the top 10 private banks and the 6 state banks together account for 75 percent of total bank-system assets (Pangestu

(2003)).

Along with the rising number of banks, there were increasing problems related to weak banking corporate governance including collusive practices, violations of prudential regulations and weak accounting standard. These problems were common in part due to weak banking supervision by Bank Indonesia (BI). During the early bank liberalization period, BI was not independent thus banking supervision interferences were common especially for business entities supported by powerful political groups.

The fragile banking fundamental collapsed when the financial crisis hit Indonesia in 1997. The banking system went into major overhaul in which 70 banks were liquidated and 13 were nationalized Laeven and Valencia (2008). The economic recovery program following the 1997 crisis gave BI its independence through the implementation of 1999 Central Bank Act. BI's independence eliminated third party interferences that had been common prior to the crisis, thus improving the quality of banking supervision and regulation. Stronger banking structure and bank supervision in part contributed to Indonesia's stable economic growth during the global financial crisis in 2008. Indonesia together with China and India were the only G20 members that recorded positive economic growth during 2008 crisis.

1.3 Data

1.3.1 Data Source

The primary data contain selected balance sheet information of all banks in Indonesia excluding the Islamic and Rural Banks. The sample was collected from 241 banks' monthly reports to the Central Bank from April 1993 to July 2014 which were acquired from The Economic and Monetary Statistic Department of the Central Bank of Indonesia. In addition to bank data, we also collected Inflation, Industrial Production Index (as proxy of GDP) and BI Rate (the Indonesian monetary policy rate) as the aggregate measures from IMF Data Library.

The balance sheet information used in the analysis consist of the following items:

Assets	Liabilities
A1. Reserves	L1. Deposits
A2. Loans	L2. Capital
A3. Securities	L3. Debt
A4. Net Interbank	

The assets side of bank balance sheet contains the following items: Reserves (A1) is bank's savings or claims to the Central Bank; Loans (A2) refer to all realized lending extended by bank to non-bank third parties; Securities (A3) include marketable securities issued by non-bank third parties and purchased/owned by bank; Net Interbank (A4) is the net position of all claims and liabilities at other banks. The liabilities side consist of the following items: Deposits (L1) is the non-bank third parties savings which include demand deposits, savings deposits and time deposits; Capital (L2) is the total amount of bank's capital; Debt (L3) consists of securities issued (securities include all short-term and long-term debentures issued by bank to non-bank third parties) and borrowings (borrowings include all borrowings by bank from non-bank third parties) by banks.

The bank dataset is an unbalanced panel as the total number of banks varies during the 256-month sample period due to banks' liquidations, mergers and acquisitions. Since the paper aims at explaining the change of banks' balance sheet over time, it is important to base the estimation on a consistent data series. We apply the following criteria to ensure data consistency.

First, we exclude banks which were liquidated or founded after April 1993. Second, following Peek and Rosengren (1995), we treat banks which merged during our sample period as one entity as if the merger occurred at the beginning of the sample period. With these adjustments, we obtain a balanced panel of 22,528 observations from 88 banks which represent more than 91 percent of total bank assets in Indonesia over the period. In order to have this balanced panel dataset, a considerable number of banks were excluded from the sample, in particular during the period before the 1997 crisis.[1]

[1] However, we find that excluding these banks causes minor impact on reducing sample's representation. Figure 7 shows that there are only slight differences in size and pattern of banks' total assets over the period between the balanced panel and the original (unbalanced panel) dataset. In addition, figures 8 and 9 show that data series of loans and deposits, respectively, in balanced panel resemble those in unbalanced panel.

In this study, we focus on two major economic crises: the 1997 Asian crisis (Crisis I) and the 2008 global financial crisis (Crisis II). Therefore, we divide the dataset into five sub-samples to study how bank behavior is affected by these crises: (1) Pre-crisis I (April 1993-July 1997) which is the period prior the 1997 Asian financial crisis; (2) the Crisis I period between August 1997 and May 2000; (3) Post-crisis I/Pre-crisis II period, time between the two economic crises (June 2000-November 2007); (4) The global financial crisis of December 2007 to June 2009 marked as the Crisis II period; (5) the post crisis II period which runs from July 2009 to July 2014.

In addition to time based analysis, we also conduct the empirical study based on several banks' groupings: by size, by capital level and by type of ownership.[2] The first group, banks by size, is constructed based on bank's average total assets. Large banks are those above the 95^{th} percentile of total assets (11 banks), medium-size banks lie between the 75^{th} and 95^{th} percentiles (32 banks), and small banks lie below 75^{th} percentile (45 banks).

We create another group to reflect banks' level of capital based on Capital Adequacy Ratio (CAR). CAR is calculated by dividing banks' capital with its total assets. We form the categories in this group by referring to 8 percent minimum capital requirement in Basel Accord. There are 75 banks averaging more than 10 percent CAR over the entire sample period which are placed in the high CAR category. Those with CAR between 8 and 10 percent (4 banks) are in the group of adequately-capitalized banks, while 7 banks below 8 percent CAR belong to the low-capitalized group.

The third group is the type of ownership group, which based on banking categories published in Bank Indonesia's Banking Statistics. The publication lists banks by their ownership type into five categories: state banks, private domestic banks, regional development banks, joint venture banks, and foreign banks. The foreign group contains 16 banks from the joint venture and foreign category. The other bank categories which consist of 72 banks are merged into the domestic group.

[2]Further details on constructing bank groups are presented in tables 33 and 34

1.3.2 Banking Data

Following the bank liberalization act in 1988, the banking sector in Indonesia has been growing rapidly. As the number of banks increased from 111 in 1988 to 240 in 1994, the role of banks in the Indonesian economy expanded significantly. Banks had been one of the important channel of funding for the economy.

Table 1 shows the summary statistics of the Indonesian bank balance sheet over the period of observations (April 1993-July 2014). On the asset side, loans, reserves, securities, and net interbank assets together account for 85.73 percent of banks' total assets; loans representing a large portion of banks' assets, on average accounting for 54.61 percent of total assets. Reserves and securities on average account for 15.72 percent and 6.52 percent, respectively, while the net value of banks' assets in the interbank market represents 8.88 percent. On the liabilities side, deposits represent the majority share, on average accounting for 68.15 percent of total liabilities. Capital and debt account for 13.63 percent and 7.93 percent, respectively. This table also shows that the portfolio composition varies widely across banks. Some banks aggressively extend loans (maximum loan to assets ratio is 489.1 percent) while others have very small or zero assets in loans (minimum loan to assets ratio is 0.00 percent).[3] Similarly, we find high variability of portfolio allocation in securities, deposits, reserves and debt.

Two other things stand out from the table (1) Minimum reserves of zero. The bank individual characteristics may in part contribute to the different banks' portfolio allocation. The foreign banks with access to internal source of funding may choose not to collect domestic deposits. Having no deposits, these banks are not required to hold reserves at the central bank. (2) The minimum value of banks' capital is significantly below zero. The sharp reduction in the banks' capital occurred during the Asian financial crisis in 1997. The increasing bad loans during this period greatly reduced the banks' capital as they had to cover for the loan losses.

During Pre-crisis I period as shown in table 2, banks' loans on average accounted for 60.78 percent of total assets allocation, while deposits share averaged 57.02 percent of total assets. Thus

[3] Total assets include net interbank assets which can be negative allowing loan-to-asset ratio above 100 percent

banks on average extended loans more than deposits collected. In order to offset the shortfall of funding from deposits, banks depended on external fundings, as shown by high level of banks borrowings at 17.72 percent of total assets. As a consequence of its rapid loans expansion, banks maintained a low excess reserves to total assets ratio at under 1 percent and invested only 2.02 percent of total assets in securities.

In 1997, Indonesia was hit by the Asian financial crisis. The impact of this crisis on banking system is very apparent as shown by several bank indicators in the second (top) column of table 2. As the economy slowed, the demand for loans plummeted. On the supply side, banks were also hesitant to extend loans. The combination of weak demand and low supply of loans caused severe contraction in banks loan. The averaged banks loan-to-asset ratio dropped from 60.78 to 46.97 percent. The increasing loan losses contributed to reduced the capital-to-asset ratio from 14.45 to 9.89 percent. A striking finding is a huge jump in reserve-to-asset ratio from 2.81 percent during the Pre-crisis I period to 17.04 percent during the Crisis I period. Learning from the current crisis, bank chose to strengthen its buffer against negative shocks by increasing its reserve holdings. In addition, the crisis might have shifted bank preferences toward low-risk assets contributing to the sharp increase in reserve holding.

By comparing bank indicators in column 1 (Pre-crisis I) and 3 (Post-crisis I/Pre-crisis II) of table 2, we find that the 1997 financial crisis may significantly contributed to the changes of banks' balance sheet structure. During the Post-crisis I/Pre-crisis II period, on average, banks improved prudent banking practices and allocated much higher share of low-risk type of assets compared to the Pre-crisis I period: reserve-to-asset ratio increased from 2.81 to 22.33 percent; securities rose from 2.02 to 8.01 percent of total assets; a significant reduction in debt-to-asset ratio from 17.72 to 2.47 percent. The huge jump in reserve and securities ratio in part were contributed by the combination of these two factors: First, banks loan had not yet returned to Pre-crisis I level. In the Post-crisis I/Pre-crisis II period, loans were at 49.64 of total assets, far below the Pre-crisis period of 60.78 percent. Second, we find significant increase in deposit-to-asset ratio from 57.02 percent in Pre-crisis I period to 74.95 percent in the Post-crisis I period. Facing increased available funding while credit market had not yet recovered, banks shifted their investment toward securities and reserve.

The bank indicators in the first column (bottom panel) of table 2 show resuming positive banks performance despite the occurrence of the 2008 global financial crisis: Loan-to-asset ratio increased to 55.52 from 49.64 percent in the Pre-crisis II period; Capital ratio was slightly above its Pre-crisis I level at 16.35 percent of total assets; Debt ratio was reduced by half from the Pre-crisis II period to reach 1.23 percent.

Table 2 shows that during the Post-crisis II period, the performance of the banking system in Indonesia continued to improve. Loan-to-asset ratio reached 60.42 percent, slightly below the level during bank loans rapid expansion in the Pre-crisis I period at 60.78 percent of total assets. As the credit market started to recover, banks reduced the reserves allocation to 14.44 percent from 22.26 percent of total assets in the previous sub-period. We also find higher bank investment in securities from 6.67 to 10.34 percent of total assets.

The overall balance sheet indicator in the Post-crisis II period shows stronger banks and improved intermediation function. Banks were able to maintain high reserves and capital levels while continuing to increase loans and lowering debt-to-assets ratio. In this preliminary analysis, we find that the 1997 crisis significantly contributed to the deteriorating banking system, while the 2008 global financial crisis had little impact on the banking business in Indonesia.

Banks by Assets Size

The banking assets in Indonesia is highly concentrated in the top tier banks as the 11 largest banks represent on average 71.8 percent of total assets, while the 45 smallest banks account for only 3.5 percent. Table 3 shows the composition of balance sheet across banks with different asset sizes. We find no significant differences in loans and deposits share between small, medium and large banks, although we find that small banks have higher asset share in reserves and capital but much lower debt ratio than the others. The high ratio of average securities to total assets in large banks was the result of the 1997 banks' recapitalization program. The troubled large banks acquired the government issued securities as part of the bailout program causing huge jump in the ratio of their securities to total assets.[4]

Evident from table 4 is that small banks in the Pre-crisis I period accumulated capital-to-assets ratio at 19.2 percent, much higher than their medium and large banks counterparts, having 9.37 and 9.62 percent respectively. Prior to the 1997 crisis, medium and large banks set a high risk balance sheet profile by aggressively extending loans and accumulated large amount of debt. Medium and large banks's loan-to-deposits ratios were at 115.21 percent and 138.56 percent, respectively, compared to small banks which were more conservative by maintaining its loan at 95.14 percent of total deposits. To offset the shortfall of loan funding, medium and large banks accumulated large borrowings in terms of debt causing their debt-to-assets ratio to reach 26.8 and 28.9 percent of total assets; compared to small banks at 8.5 percent of total assets.

Table 4 shows that large banks experienced huge drop in capital ratio from 9.62 to -12.25 percent of total assets as a result of crisis, while small and medium banks saw minor adjustment in capital ratios; small banks capital ratio fell from 19.24 to 15.99 percent; medium banks' capital fell from 9.37 to 8.94 percent. Large banks, which aggressively extended loans during the Pre-crisis I period, experienced massive loan losses. The obligation to charge off those bad loans causing a significant reduction in the capital ratio of large banks.

Two common changes in balance sheet structure among banks with different asset sizes during the Crisis I period were (1)reduction in loans and (2)sharp increase in reserve holding. Small banks' loans dropped from 58.68 to 45.23 percent, medium banks' loans reduced from 61.43 to 47 percent, and large banks' loans decreased from 67.45 to 54.02 percent of total assets. Overall, during the 1997 crisis, banks shifted large portions of their assets toward reserves. This change in bank behavior can be seen as precautionary measure against the crisis. Small banks, the most prone bank category to negative shocks, saw the largest increase in reserve holdings from 2.21 to 18.6 percent. Medium banks raised reserve holdings from 3.02 to 16.82 percent, while large banks' reserve holdings rose from 4.63 to 11.27 percent.

Following the 1997 crisis, we find that small and medium banks continued to increase their

[4]The large banks' statistics in column three of table 4 shows that securities share jumped from 9.56 percent in the Crisis I period to 32.77 percent in the Post Crisis I/Pre-crisis II period.

reserve holdings, while large banks maintained the same reserve level as in the Crisis I period. The third column in table 4 shows that during Post-crisis I/Pre-crisis II period, small and medium banks' reserves were higher by 6.25 percent and 5.76 percent, respectively, from their Crisis I level.

A striking finding from the Post-crisis I/Pre-crisis II period is the huge reduction in debt level for all bank size categories: Small banks' debt were down from 8.85 to 1.42 percent; Medium banks sharply decreased their debt level from 31.55 to 3.38 percent, while large banks managed to lower their debt from 39.44 to 4.12 percent of total assets.

The banking recapitalization program which was implemented as part of the 1997 crisis resolution plans contributed to overall stronger and healthier banks' balance sheet structure. In addition to reduction in debt level, banks managed to maintain their capital levels above the minimum 8 percent requirement. Large banks, in particular, were able to increase their capital ratio to a safe level at 8.59 percent, a huge increase from -12.25 percent in the Crisis I period.

Table 5 highlights that the 2008 global financial crisis had little impact on banking system in Indonesia. The intermediary function improved as shown by increasing loan ratio in each banking size categories although it had not reached the Pre-Crisis I level. Large banks raised their loan ratio by 42.3 percent from the Pre-crisis II level at 41.65 to 59.27 percent. Medium banks' loan increased from 48.92 to 56.19 percent, while small banks had 54.13 percent of loans ratio, slightly higher than the previous sub-period rate of 52.1 percent. The overall bank balance sheet during the Crisis II period was markedly improved as we find reduced debt levels, high reserves and capital ratios in all banking size categories.

In the third column of table 5, we find that during the Post-crisis II period, small banks had higher loan ratio and allocated more investment in securities. Loan ratio increased from 54.13 to 58.82 percent and investment in securities jumped from 4.52 to 9.59 percent. At the same period, we find lower reserve and capital ratios. Small banks' reserve holdings dropped significantly from 26.02 to 16.81 percent of total assets, while its capital-to-asset ratio slightly downed from 22.58 to 19.84 percent.

Overall we find similar pattern of balance sheet changes for medium banks such as higher loans, increased securities, and lower reserve rate, but with one distinction to small banks: Medium banks raised their capital ratio from 9.86 to 11.36 percent. During the Post-crisis II period, large banks behavior resembled their medium sized counterpart except with a slight reduction in large banks' securities-to-asset ratio from 16.08 to 13.3 percent.

Banks by Capital Level

The 75 highly-capitalized banks represent only 34.62 percent of the system assets, thus, the majority of these banks are relatively small. The middle capital level group comprise of several large banks as this category represents on average 33.83 percent of total assets although only comprising 4 banks. The low-capitalized banks on average account for the remaining 31.54 percent of total assets.

Table 6 shows that there were no significant differences in the share of loans and reserves for banks across the different capital levels. Although we find that low-capitalized banks on average hold much higher ratio of debt and a lower deposit ratio. This combination suggest that low-capitalized banks depend on external borrowings in terms of debt to fund their loans given lack of funding from deposits. High-capitalized banks on average maintain lower share of securities to total assets than others.

Table 7 shows that low-capitalized banks largely contributed to the large debt accumulation and the aggressive loan extension behavior found in the aggregate bank preliminary analysis. During the Pre-crisis I period, low-capitalized banks funded loans at 206.54 percent of their deposits: the loan-to-assets ratio was at 72.91 while deposit was only 35.3 percent of total assets. The low-capitalized banks accumulated large debt ratio at 45.7 percent of total assets, while adequately-capitalized banks extended 64.41 percent of total assets as loan, recorded deposits share at 61.27 percent of total assets and accumulated debt-to-asset ratio at 22.56 percent. The bottom panel of table 7 shows that high-capitalized banks were more moderate in extending loans at 100 percent of their deposits and accumulated only 14.11 debt-to-asset ratio.

During the Crisis I period, we find similar pattern of increased reserve holdings, reduced capital levels, and increased debt ratios in each bank category. High-capitalized banks reserve holdings jumped from 2.46 to 17.34 percent. Adequately-capitalized banks increased reserve-to-asset ratio from 4.2 to 10.32 percent, while banks in low-capitalized category raised reserve holding to 17.54

percent from 5.06 percent in the Pre-crisis I period.

Low-capitalized banks' capital ratio plunged to -14.86 percent from 5.56 percent in the Pre-crisis period, while the capital ratio of adequately-capitalized banks dropped from 9.23 to -4.99 percent. An interesting finding is that loan losses of banks during the 1997 crisis period only caused small reduction in capital of highly-capitalized banks from 15.79 to 13.66 percent of total assets.

The bank indicators in the third column of table 7 imply that low-capitalized banks were the worst hit by the 1997 crisis. Its loan ratio sharply decreased from 61.39 to 38.45 percent, a much worse performance compared to the adequately-capitalized banks which only suffered slight reduction from 48.88 to 40.6 percent. In contrast, high-capitalized banks' loan ratio showed improvement from 45.14 to 51.46 percent.

While the capital ratio of low-capitalized banks improved from -14.86 to 3.41 percent during the Post-crisis I/Pre-crisis II period, it was still far below the minimum 8 percent requirement. Adequately-capitalized banks were able to raise their average capital ratio from -4.99 to 6.87 percent, while banks in the high-capitalized category managed to maintain their capital ratio at 13.78 percent, a small increment from 13.66 percent in the Crisis I period.

The second column of table 8 support the preliminary conclusion that the 2008 global financial crisis had little impact on Indonesian banking system. In all bank categories, we find higher loan ratios, stronger capital levels, and low debt ratios. Adequately-capitalized banks' loan ratio significantly increased from 40.6 to 56.23 percent; low-capitalized banks from 38.45 to 46.85 percent; additionally high-capitalized banks slightly increased from 51.46 to 56.52 percent of total assets.

During the Post-crisis II period, we find low and adequately-capitalized banks were able to increase their capital ratios, while the capital ratio of banks in high-capitalized category on average decreased. Along with stronger capital level, banks in each category gained higher loan-to-asset ratios. High-capitalized banks' loan ratio, in particular, reached 61.37 percent of total assets which surpassed the pre-crisis I level at 59.13 percent. As expected, during this period, we also find reduced banks' reserve-to-asset ratio in all bank categories. Since the crisis period was over, banks raised its expectation of having higher economic growth thus shifting their assets from low-risk type such as reserve to instruments with better return including loans and securities.

Banks by Type of Ownership

On average, foreign banks account for 12 percent of the system total assets. The share of foreign bank assets were increasing in particular during the two crises period. During crisis I period, foreign banks accounted for 11 percent, an increase of 4 percent from pre-crisis I period. The share of foreign banks' assets peaked at 14 percent during the 2008 global financial crisis before returning to 11 percent in the post crisis II period.

Table 9 shows no striking differences in the balance sheet composition of foreign and domestic banks except in the deposit and debt ratios. Foreign banks on average accumulate much higher debt ratio while having significantly lower deposit ratio than their domestic counterpart. This summary statistics suggest that rather than relying on deposits from domestic market, foreign banks depend heavily on external borrowings in terms of debt to fund their loans.

Table 10 shows several interesting findings relating to the balance sheet characteristics of domestic and foreign banks. Prior to the 1997 financial crisis, domestic banks on average had much higher capital levels and deposits collection than foreign banks. Domestic banks utilized deposits to extend loans while foreign banks fund a sizeable portion of their loans from debt. As shown in the table, foreign banks extended loans at 69.91 percent of total assets, tripling the amount of its deposit-to-asset ratio at 19.23 percent while at the same time creating very high levels of debt-to-asset ratios at 64.31 percent.

The 1997 crisis in part contributed to the change of foreign bank behavior. During the Post-crisis I/Pre-crisis II period, foreign banks shifted its balance sheet allocation by significantly reducing its debt ratio from 74.4 to 5.7 percent, increased deposit collection from 17.79 to 54.99 percent and raised capital-to-asset ratio from 3.58 to 13.16 percent (see table 11). After the 1997 crisis, in both type of banks, we find similar changing pattern of balance sheet structure: higher reserves, lower debt, increased capital level and larger investment in securities.

The 2008 global financial crisis had little impact on domestic banks. However, the said crisis hit hard countries where most of the foreign banks' originated. The crisis limited the external fundings available as shown in table 11, with the level of foreign banks' debt ratio plunging from

5.7 to 0.07 percent. In the Post-crisis I/Pre-crisis II period, foreign banks increased their deposits collection which allowed them to maintain loan ratio at 54.02 percent, slightly down from the Pre-crisis II period at 56.16 percent. The Post-crisis II balance sheet structure, as shown in column 3 of table 11, indicate the shift in foreign banks' behavior: foreigns banks significantly reduced debt and utilized deposits to finance loans while maintaining high levels of capital and reserves as buffer.

1.3.3 Reserve Requirement

The reserves rate times banks' total deposits determine the minimum funds that each bank has to maintain as reserves at the Central Bank. The policy maker in Indonesia differentiate the reserves rate for Rupiah and foreign currency denominated deposits. For the purpose of this study we use only Rupiah reserve rate due to data limitation; our dataset provides the total amount of deposits all converted to Rupiah. Figure 1 shows the reserve rate on Rupiah denominated deposits over the period of observation where the shaded area marks the two economic crises periods in 1997 and 2008. The trend of reserve rate over the period of observations is increasing. The reserve rate increased by 3 percent during the period prior to the 1997 crisis. In addition, during the Crisis II and Post-crisis II period the rate rose by 2.5 percent and 0.5 percent, respectively. However, the reserve rate was fixed during the Crisis I and Post-crisis I/Pre-crisis II periods.

Figure 2 shows that prior to the 1997 crisis, banks, on average, maintained low level of reserves; below 5 percent of their total assets. During this period, loans growth were very high. Having low reserve level was common for many banks in Indonesia.

The average bank's reserves holding soared as the Asian financial crisis hit Indonesia in 1997. Increased reserves rate from 3 to 5 percent on April 1997, the declining economic growth and increased precautionary buffer during the crisis period are several factors that contribute to the sudden jump in banks' reserve-to-asset ratio. After the 1997 crisis, banks gradually reduced their reserves ratio to approximately 15 percent of their total assets in October 2005.

Banks started to allocate more of their assets in reserves at the end of 2005. The increasing trend of reserves holding persisted to reach above 25 percent of total assets during the 2008 global financial crisis. As in the 1997 crisis, banks perceived the recession period and maintained high precautionary buffer by accumulating larger reserves. As the crisis subsided, reserve-to-asset ratio declined as banks reallocate their assets to more profitable investment. In October 2008, the policy maker increased the reserves rate from 5 to 7.5 percent but interestingly the average reserve-to-asset ratio kept declining to reach slightly above 10 percent of total assets in April 2014.

Figure 3 shows the reserve-to-asset ratio of banks with different size of assets during the sample period. Prior to the 1997 crisis, large banks maintained the highest reserves ratio slightly above medium and small banks. During the 1997 crisis, the trend changed as small and medium banks accumulated higher reserves ratio compared to large banks.

As shown in figure 4, all banks have low levels of reserve-to-asset ratios during the period prior to the 1997 crisis. The trend of reserves holding diverge after the 1997 crisis. The reserves level of adequate and low-capitalized banks tend to coincide while high-capitalized banks maintain large reserves accumulation at approximately 20 percent of total assets. In contrast to the 1997 crisis, we find no significant changes in the bank's reserves level during the 2008 global financial crisis. Following the 2008 crisis, bank's reserve-to-asset ratios were reduced to under 15 percent of their total assets.

Figure 5 shows that foreign and domestic banks have resembling trends of reserve-to-asset ratio until the end of the 1997 crisis when foreign banks slashed their reserves to approximately 10 percent of total assets while domestic banks maintained theirs above 20 percent of total assets. Having less dependence on deposits as a source of funding allows foreign banks to keep lower reserve-to-asset ratio compared to domestic banks and allocate more of their assets to high-return investment. As shown in this figure, foreign banks on average hold significantly lower reserve-to-asset ratio compared to their domestic counterparts.

1.4 Empirical Design

1.4.1 Theoretical Framework

In this subsection, we provide a brief review on the literature which study the impact of monetary policy on bank balance sheets, in particular those which focus on the behavior of different types of banks. This brief review will help to construct a testable hypothesis and interpret our results in comparison with the earlier findings.

Bernanke and Blinder (1992) study the propagation of monetary policy shocks through banking system. This paper provides empirical evidence on how a contractionary monetary policy immediately reduce bank deposits and securities holding, while reducing bank loans and aggregate output with a lag. Kashyap and Stein (1995) also estimates the impact of monetary policy on bank balance sheets but focusing on the cross-sectional differences across bank of different sizes. They show that given a contractionary monetary policy, small banks have larger reduction in loan volume than large banks. A tighter monetary policy have greater effects on small banks' loans which are more likely to have difficulty raising non-deposit fundings. In addition, given similar shocks small banks have deeper reduction in securities holdings than large banks. A contraction in monetary policy initially induces small banks to reduce their loans. If the loans demand were not decreasing, small banks would be willing to liquidate their securities to maintain loan volume.

Kashyap and Stein (2000) studies whether the impact of monetary policy shocks differs across banks with varying characteristics. They provide evidence that a contractionary monetary policy shocks have different effects on loan and security portfolio of large and small banks. They show that a contraction in monetary policy has stronger impact on reducing loans of banks with less liquid balance sheets (low securities-to-asset ratio), the characteristic which largely define small banks. Given a tighter monetary policy, liquidity shrinks and banks with higher liquid assets are more likely to be able to offset reduction in deposits by selling their securities therefore less affected by the shocks.

Kishan and Opiela (2000) shows how banks with different asset sizes and capital leverage ratios respond differently to changes in monetary policy. This paper provides evidence that a contractionary monetary policy has greater effects on reducing loans of small banks regardless their level of capital. In addition, this paper shows that small, undercapitalized banks are more likely to have difficulty offsetting reductions in deposits, stemming from contractionary policy. Therefore we expect to have larger reductions in undercapitalized banks loan supply than that of larger and high-capitalized banks.

Gambacorta (2005) examines the cross-sectional impact of monetary policy shocks using a comprehensive sample of Italian banks. Less capitalized banks experience larger reductions in deposits following a tightening in monetary policy as these bank are more likely to have difficulty raising non-deposit fundings. In addition, loans of well-capitalized banks are less affected by a contractionary monetary policy shocks as they are observed as less risky and are able to obtain non-deposit fundings. However, in contrast to existing findings in the literature, this paper shows that bank size is not relevant in assessing the impact of monetary policy shocks on loans.

1.4.2 Regression Specification

We construct the regression specifications based on Peek and Rosengren (1995) models to estimate the impact of changes in reserve requirement and monetary policy rate (BI rate) on bank's balance sheet allocation in loans, securities, interbank market and deposits. We seek evidence whether the policy impact differs between crises and non-crises periods. In addition, we study whether the impact differs across bank of different size of assets, level of capital and type of ownership.

$$\begin{aligned}\frac{\Delta PI_{i,t}}{A_{i,t-1}} =& \beta_0 + \sum_{i=0}^{3} \beta_{1,i} \Delta BI\_Rate_{t-1} + \sum_{i=0}^{3} \beta_{2,i} \Delta Reserve\_Rate_{t-i} + \beta_3 Period\_Dummy_t \\ &+ \beta_4 (\Delta BI\_Rate_t * Period\_Dummy_t) + \beta_5 (\Delta Reserve\_Rate_t * Period\_Dummy_t) \\ &+ \sum_{j=1}^{2} \beta_{6,j} Macro\_Vars_{j,t} + \sum_{j=1}^{3} \beta_{7,j} Bank\_Characteristics_{j,t} + \epsilon_{i,t}\end{aligned} \tag{1.1}$$

The regression in equation (1.1) estimates the impact of monetary policy changes on banks' balance sheet. The dependent variables in this equation, $\frac{\Delta PI_{i,t}}{A_{i,t-1}}$, is the change of bank's portfolio items scaled by the total assets. The portfolio items, $PI_{i,t}$, include loans, securities, net interbank assets, and deposits of bank i at time t, while $A_{i,t-1}$ represents the total assets.

The variables of interest in this regression are the changes in reserve rate ($\Delta Reserve\_Rate_t$), the changes in BI rate (ΔBI_Rate_{t-1}) and the interaction terms which are used to estimate the policy impact before and after the 1997 crisis. The regression controls for macroeconomic variables ($Macro\_Vars$): economic growth (g_GDP_{t-1}), and changes in inflation rate(ΔInf). We also control for banks' individual characteristics ($Bank\_Characteristics$): (1)Excess reserves growth

($g\_XReserves_{i,t}$), the extra funds that bank keeps in the central bank on top of its minimum reserves requirement, (2)$AssetGrowth_{i,t}$, and (3)Dummy variable on whether reserve requirement is binding for bank i in period t ($RRDummy_{i,t}$).

The reserve requirement of bank i at period t is binding ($RRDummy_{i,t} = 1$) if the nominal reserves is less than or equal to the required reserves. We obtain bank i nominal reserves data from the bank's monthly balance sheet, while the required reserves are calculated by multiplying the reserve rate with total deposits of bank i at time $t-1$.

$$RRDummy_{i,t} = \begin{cases} 1, & \text{if } Reserves_{i,t} <= Required\_reserves_{i,t} \\ 0, & \text{otherwise} \end{cases}$$

The second regression in equation (1.2) below provides a test on whether banks' responses to changes in reserve rate and BI rate vary based on the following categories: (1)size of assets, (2)level of capital and (3)type of ownership. In addition, we study whether these bank groups' responses differ between crisis and non-crisis period.

$$\begin{aligned}\frac{\Delta PI_{i,t}}{A_{i,t-1}} =& \beta_0 + \sum_{i=0}^{3} \beta_{1,i} \Delta BI\_Rate_{t-1} + \sum_{i=0}^{3} \beta_{2,i} \Delta Reserve\_Rate_{t-i} + \beta_3 Period\_Dummy_t \\ & + \beta_4 BankGroupDummy_{i,t} + \beta_5 (\Delta BI\_Rate_t * Period\_Dummy_t) \\ & + \beta_6 (\Delta Reserve\_Rate_t * Period\_Dummy_t) \\ & + \beta_7 (\Delta BI\_Rate_t * BankGroupDummy_{i,t}) \\ & + \beta_8 (\Delta Reserve\_Rate_t * BankGroupDummy_{i,t}) \\ & + \beta_9 (Period\_Dummy_t * BankGroupDummy_{i,t}) \\ & + \beta_1 0 (\Delta BI\_Rate_t * Period\_Dummy_t * BankGroupDummy_{i,t}) \\ & + \beta_1 1 (\Delta Reserve\_Rate_t * Period\_Dummy_t * BankGroupDummy_{i,t}) \\ & + \sum_{j=1}^{2} \beta_{12,j} Macro\_Vars_{j,t} + \sum_{j=1}^{3} \beta_{13,j} Bank\_Characteristics_{j,t} + \epsilon_{i,t}\end{aligned} \tag{1.2}$$

The variables of interest in this equation are the changes in reserve rate ($\Delta Reserve\_Rate_t$), the changes in BI rate (ΔBI_Rate_{t-1}) and the interaction terms. We interact the policy variables with bank groups ($BankGroupDummy_{i,t}$) and sub sample periods ($Period\_Dummy_t$) to estimate whether the policy impact differ across bank groups during crisis and non-crisis period. The bank groups include banks by size of assets (large, medium and small), banks by level of capital (low, adequate and high-capitalized), and banks by type of ownership (foreign and domestic), while the sub sample periods consist of three dummy variables for periods around the 1997 crisis (pre-crisis, crisis, and post-crisis).

1.5 Results

In this section we present the regression results of equation (1.1) and (1.2) which estimate the impact of changes in monetary policy rate (BI rate) and reserve rate on banks portfolio allocation in loans, securities, interbank assets and deposits. We present the empirical findings on the aggregate policy impact on these portfolio items followed by estimates which test whether the policy impacts differ across banks groups and sub-periods. We define the bank groups by the following categories: (1)Size of assets (small, medium, and large banks), (2)Level of capital (lowly, adequately, and highly capitalized banks), and (3)Type of ownership (domestic and foreign banks). We divide the observations into three sub-periods around the 1997 crisis (pre-crisis, crisis, and post-crisis periods) to test whether the 1997 crisis had impact on shifting banks' responses to policy actions.[5]

1.5.1 The Aggregate Policy Impact

Loans

The first column of table 12 presents estimates on the aggregate policy impact of BI rate and reserve rate on bank loans during the pre-crisis, crisis, and post-crisis periods. An increase in the BI rate generates contractionary effects on loans during all periods except in the post-crisis period. A one percent increase in the BI rate during the pre-crisis and crisis periods reduces loan-to-asset ratio by 0.03 percent on impact, while the 3-month cumulative impact of same shocks is to decrease loans by 0.08 percent. We find that during the post-crisis period the impact of BI rate reverses; a

[5]We do not include the 2008 crisis into consideration as no significant changes on banks' balance sheet during this period (refer to Section 1.3.2)

one percent increase in the BI rate raises the aggregate loan-to-asset ratio by 0.286 percent.

In the pre-crisis period, we find that an increase in the BI rate has the intended effects on reducing bank loans. During this period as the economy continued to grow, demand for loans are high and the credit markets are booming. Banks aggressively extend loans as indicated by a high average of loan-to-deposit ratio (LDR) at 106.6 percent. Banks rely heavily on debt to satisfy lack of funding from deposits; debts on average represent 17.72 percent of banks' total assets (see top left panel of table 2). During this period an increase in the BI rate causes stronger pressure on an already tight banks' liquidity which then induces deeper reduction in loans.

During the crisis period we expect monetary policy to have stronger contractionary effects on bank loans. Given plummeting economic condition, loans demand decrease as borrowers postpone new loans. In addition, banks are reluctant to lend as borrowers' default risk increases. In this period an increase in the monetary policy rate generates additional contractionary effects on both supply and demand side of loans. Loan supply reduces as banks face tighter liquidity, while demand for loans decreases as the cost of borrowing increases.

The 1997 crisis in Indonesia triggered a harsh banking crisis. Fortunately, the bank restructuring program was able to revive the banking system which were severely hit by the crisis. During the post-crisis period, banks were able to lower their balance sheets' exposures to debt; the average bank's debt-to-asset ratio in this period was at 2.47 percent, much lower than in the pre-crisis period at 17.72 percent (refer to table 2). Household confidence in the banking system also increased; the average deposit-to-asset ratio was rose from 57.02 percent during the pre-crisis period to 74.95 percent in the post-crisis period. Despite having abundant liquidity, banks' intermediary function had not fully recovered; the average LDR were only 66.2 percent.

During the post-crisis period, banks and regulators were giving incentives to boost loan growth by simplifying the loan process and lowering fees. The efforts seem to have been successful. In spite of being hit by the 2008 global financial crisis (the crisis II period), banks' LDR increased to 78.2 percent and later reached 84.7 percent after the 2008 crisis. During this period, the strong loan growth may conceal the contractionary effects of monetary policy thus in the aggregate level we find that an increase in the BI rate coincides with higher loan-to-asset ratio.[6]

In addition, the first column of table 12 also shows how changes in the reserve rate affect loans: a one percent increase in the reserve rate decreases the aggregate loan-to-asset ratio by 0.303 percent. However, this impact is only statistically significant with three months lags. We find that the impact of an increase in the reserve rate on loans during the pre-crisis is not statistically different from the impact of similar shocks in the post-crisis period.[7]

The above findings show that during the pre-crisis, crisis and post-crisis periods, a one percent increase in the reserve rate causes a much deeper reduction in loans than similar shock in the BI rate. These results suggest that the reserve rate is a more effective instrument than the BI rate in curbing the aggregate loan growth.

Securities

The second column of table 12 shows that the impact of a one percent increase in the BI rate is to lower asset allocation in securities by 0.016 percent with 2-months lags. However, the long run impact of similar shocks is to raise securities by 0.01 percent to total assets. This table also shows that the impact of BI rate on securities during the crisis period is not statistically different from its impact in the non-crisis periods.

In addition, we find that during the post-crisis the impact of reserve rate on securities is not statistically different from zero. However, in the pre-crisis we find that a higher reserve rate positively affects asset allocation in securities. During this period a one percent increase in the reserve rate raises securities-to-asset ratio by 0.201 percent.

Interbank Asset

The third column of table 12 shows the aggregate policy impact of BI rate and reserve rate on bank asset allocation in interbank market. We find that both BI rate and reserve rate have negative effects on the total bank asset in interbank market. The impact of a one percent increase in the BI rate is to reduce interbank-to-asset ratio by 0.063 on impact. Similar shocks cause 0.052 percent

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[6]Later in the bank groups level analysis, we test whether this anomaly result holds

[7]There are no changes in reserve rate during the 1997 crisis period

3-month cumulative reduction in interbank assets. We find that the impact of BI rate on interbank assets do not vary across sub-periods.

This findings show that an increase in the reserve rate negatively affects banks asset allocation in the interbank market. However, the findings show that the impact of reserve rate on interbank-to-asset ratio during the pre-crisis period is not statistically different from its impact in the post-crisis period. A one percent increase in the reserve rate during these periods causes 0.623 percent reduction in interbank-to-asset ratio.

Deposits

The last column of table 12 shows that an increase in the BI rate causes 0.095 percent reduction in deposits with 2-months lags. However, in the long run the aggregate deposit-to-asset ratio increases by 0.069 percent following a one percent increase in the BI rate. In addition, we find no statistically significant evidence that the impact of BI rate on deposits vary across sub-periods.

The findings show that an increase in the reserve rate negatively affects deposit-to-asset ratio with lags. A one percent increase in the reserve rate causes 0.419 percent reduction in deposits. We find that the impact of reserve rate on deposits during the pre-crisis period are not statistically different from its impact in the post-crisis period.

1.5.2 The Policy Impact on Bank Group by Asset Size

Loans

The first column of table 13 provides estimates on how changes in the BI rate and reserve rate affect loans of small, medium, and large banks during the pre-crisis, crisis, and post-crisis periods. The findings show that a one percent increase in the BI rate during the pre-crisis and crisis periods induces 0.088 percent reduction in small banks' loans. During these periods, we find that the impact of an increase in the BI rate on medium and large banks' loans are not statistically different from its impact on small banks.

In the post-crisis period an increase in the BI rate has a stronger contractionary effects on large banks: a one percent increase in the BI rate reduces large banks' loan-to-asset ratio by 0.169 percent, approximately two times larger than its impact in the pre-crisis and crisis periods. However, we find that the impact of an increase in the BI rate on small and medium banks reverses. Similar shocks raise loan-to-asset ratio on small and medium banks by 0.33 percent. As the majority of banks (77 out of 88) belong to small and medium categories, these results lead the BI rate to have an unintended positive impact on loans at the aggregate level during the post-crisis period.

During the post-crisis period as the economy started to recover, demand for loans were rapidly increased; the average loan-to-asset ratio rises from 46.97 percent during the crisis period to 60.42 percent at the end of post-crisis period. During this period, given an increase in the BI rate large banks, which lend mostly to big firms, may expect declining loans demand as these firms were able to switch to non-bank fundings. In contrast, small-medium banks' loans demand are less affected since the majority of these banks' borrowers are small firms which are highly bank dependent.

This table also shows that the impact of reserve rate on loans in the pre-crisis period vary based on size of bank assets. During this period, a one percent increase in the reserve rate causes a 0.18 percent reduction in small banks' loans. Similar shocks have an opposite impact on increasing loans in medium and large banks by 0.342 percent and 0.164 percent, respectively. Medium-large banks have competitive advantages over small banks to raise debt to replace reduced liquidity due to an increase in the reserve rate. During this period, average debt-to-asset ratio of medium and large were at 26.82 percent and 28.85 percent, respectively, a substantially higher figures than small banks' debt at 8.52 percent (refer to table 4).

During the post-crisis period, an increase in the reserve rate decreases loans in all asset size categories. However, the magnitude of its impact varies. A one percent increase in the reserve rate decreases small banks' loans by 0.18 percent, while reducing medium and large banks' loans by 0.264 percent and 0.442 percent, respectively. During this period reserve rate has a stronger contractionary effects than the pre-crisis period as banks are better regulated to maintain a low exposure to debts. In the post-crisis period, banks managed to reduce their debt-to-asset ratio: small banks' debts level were at 1.45 percent (down from 8.52 percent), while in medium and large banks debts represent 2.63 percent (down from 26.82 percent) and 3.07 percent (down from 28.85 percent) of total assets, respectively (refer to table 5).

Securities

The second column of table 13 shows that an increase in the BI rate has uniform impact across sub-periods on small and large banks' securities. A one percent increase in the BI rate reduces securities-to-asset ratio by 0.016 percent with 2-months lags. However, the long-run impact of similar shocks is to slightly raise securities-to-asset ratio of small and large banks by 0.006 percent.

The impact of an increase in the BI rate on medium banks is weaker. A one percent increase in the BI rate causes only 0.003 percent reduction in medium banks' securities with 2-months lags. In the long run, similar shocks raise securities-to-asset ratio of medium banks by 0.019 percent. This table also shows that the impact of an increase in reserve rate on securities are not statistically different from zero.

Interbank Assets

We find that an increase in the BI rate and reserve rate have statistically significant impact on reducing bank assets in interbank market. A one percent increase in the BI rate causes 0.012 percent reduction in small banks' interbank-to-asset ratio, while decreasing interbank assets of medium banks by 0.095 percent (refer to the third column of table 13). The impact of similar shocks is to lower the interbank-to-asset ratio of large banks by 0.085 percent. The findings show that the impact of BI rate on interbank assets vary by the size of bank assets. However, the magnitude of its impact on each bank size categories are not statistically different between crisis and non-crisis periods.

The findings also show that an increase in the reserve rate has a strong contractionary effects on banks asset allocation in interbank market. However, its impacts are not statistically different between each bank size categories and across sub-periods. The interbank-to-asset ratio of small, medium, and large banks reduce by 0.621 percent in response to a one percent increase in the reserve rate during the crisis and non-crisis periods.

Deposits

The last column of tabel 13 shows that the impact of an increase in BI rate vary by bank with different size of assets. However, its impact during the crisis period are not statistically different from the non-crisis periods. A one percent increase in the BI rate reduces small banks' deposits by 0.095 percent with 2-months lags. However, in the long run similar shocks raise small banks' deposits by 0.018 percent.

The 2-months lags impact of an increase in the BI rate is to raise deposits of small banks by 0.016 percent, while slightly reducing large banks' deposits (by 0.007 percent). We find that the long-run impacts of similar shocks are to increase deposit-to-asset ratio of medium and large banks by 0.129 percent and 0.106 percent, respectively.

This table also shows that changes in the reserve rate have different impacts on deposits of all bank size categories and across sub-periods. During the pre-crisis period, a one percent increase in the reserve rate reduces small banks' deposit-to-asset ratio by 0.842 percent, while causing deeper reduction of deposits on medium and large banks by 2.059 percent and 2.402 percent, respectively. In the period after the 1997 crisis, small banks deposits' responses are the anomaly in the group. Given a one percent increase in the reserve rate, small banks deposits increase by 0.226 percent, whereas similar shocks reduce deposit-to-asset ratio of medium and large banks by 0.991 percent and 1.334 percent, respectively.

The impact of an increase in the reserve rate on reducing deposits are substantially larger in the period before the 1997 crisis. In this period, external fundings were easily accessible and banks maintain a very high level of debt-to-asset ratio. Therefore given a higher cost of holding deposits (due to an increase in reserve rate), the majority of banks reduce a larger portion of their deposits to be substituted by debts. In contrast, during the post-crisis period regulations and prudential bank practices which have been implemented following the bank restructuring program limit banks' exposures to debts. As debts cannot be easily obtained as deposits substituted, we expect similar shocks to induce lower reduction in deposits.

1.5.3 The Policy Impact on Bank by Capital Level

Loans

The first column of table 14 shows that during the pre-crisis and crisis periods, high-capitalized banks reduce their loans by 0.084 percent in response to a one percent increase in the BI rate. During these periods, adequately-capitalized and low-capitalized banks loans' responses to a contractionary monetary policy are not statistically different from the high-capitalized category. Given a one percent increase in the BI rate during the post-crisis period, adequately-capitalized banks substantially reduce their loans by 0.887 percent. In contrast, similar shocks cause an increase in the loan-to-asset ratio of low and high-capitalized banks (by 0.37 percent).

This table also shows that given a one percent increase in the reserve rate during the pre-crisis period, high-capitalized banks reduce their loans by 0.01 percent. In this period the impact of similar shocks on loans do not vary across banks with different level of capital. During the post-crisis period we find that an increase in the reserve rate has a much stronger contractionary effects on loans than the same shocks in the pre-crisis period. A one percent increase in the reserve rate causes 0.536 percent reduction in loans of high-capitalized banks; adequately-capitalized and low-capitalized banks' responses to similar shocks are not statistically different from the high-capitalized category.

Securities

During the pre-crisis and crisis periods, a one percent increase in the BI rate reduce high-capitalized banks' securities by 0.016 percent with 2-months lags, while in the long run high-capitalized banks increase their securities-to-asset ratio by 0.014 percent in response to similar shocks (refer to the second column of table 14). In these periods, given similar shocks adequately-capitalized and low-capitalized banks' responses are not statistically different from the responses of high-capitalized category.

During the post-crisis period we find that each bank category has different responses to changes in the BI rate; a one percent increase in the BI rate reduces high-capitalized banks' securities by 0.016 percent, but increases the securities-to-asset ratio of low-capitalized banks (by 0.363 percent) and adequately-capitalized bank (by 0.324 percent); these results are statistically significant with 2 months lags. During this period, similar shocks induce the long-run largest increment in the securities-to-asset ratio of low-capitalized category (by 0.393 percent), followed by the adequately-capitalized category (by 0.322 percent) and the high-capitalized category (by 0.014 percent).

Table 14 shows that the impact of an increase in the reserve rate on securities is not statistically different from zero except for the adequately-capitalized banks. A one percent increase in the reserve rate induces the adequately-capitalized banks to have a larger asset allocation in securities by 0.407 percent; the impacts do not vary across periods.

Interbank Assets

The third column of table 14 shows that the high-capitalized banks reduce their assets allocation in interbank market by 0.041 percent in response to a one percent increase in the BI rate. The findings shows that similar shocks cause deeper reduction in interbank assets of the adequately-capitalized banks (by 0.113 percent). The impact of BI rate on these bank categories during the-crisis period are not statistically different from its impact in the non-crisis periods. The findings also show that given a one percent increase in the BI rate during the pre-crisis period, the low-capitalized banks substantially reduce their interbank assets by 0.62 percent. In the subsequent periods, we find that BI rate has smaller impact on low-capitalized banks; a one percent increase in the BI rate causes only 0.032 percent reduction in interbank assets of low-capitalized banks.

This table also shows that an increase in the reserve rate negatively affects banks asset allocation in interbank market. A one percent increase in the reserve rate reduces interbank-to-asset ratio by 0.622 percent. The impact of reserve rate on interbank assets does not vary between periods, neither across banks with different level of capital.

Deposits

The findings show that a one percent increase in the BI rate decreases deposits of high-capitalized banks by 0.095 percent with 2-months lags. In the long run, similar shocks raise deposit-to-asset ratio of the same banks by 0.062 percent. The findings also show that the impacts are similar across periods. In addition, we find that the same shocks have no statistically different impact on adequately and low-capitalized banks.

The findings also show that an increase in the reserve rate causes reduction in deposits. Given a one percent increase in the reserve rate, deposit-to-asset ratio of high and low-capitalized banks reduce by 0.295 percent. Reserve rate has substantially larger impact on deposits of adequately-capitalized banks; a one percent increase in reserve rate reduce deposits of this bank category by 1.094 percent. We find that the impact of reserve rate in the pre-crisis period is not statistically different from its impact during the post-crisis period.

1.5.4 The Policy Impact on Bank by Type of Ownership

Loans

The findings show that foreign banks have a deeper loans reduction than domestic banks in response to an increase in the BI rate during the pre-crisis and crisis periods. During these periods, a one percent increase in the BI rate reduces foreign banks' loans by 0.176 percent, while causing only 0.062 percent reduction in loans of domestic banks (refer to the first column of table 15). During the post-crisis period, the impact of similar shocks on domestic banks is not statistically different from its impact in the earlier periods. However, we find that given an increase in the BI rate during the post-crisis period foreign banks show an anomaly responses; foreign banks increase their loans by 0.923 percent following a one percent increase in the BI rate.

During the pre-crisis period, a one percent increase in the reserve rate induces foreign banks to decrease their loan-to-asset ratio by 0.119 percent, while causing domestic banks to slightly increase their loans by 0.002 percent. Given similar shocks in the post-crisis period, foreign banks' responses are not statistically different from the pre-crisis period's responses. However, we find that during this period reserve rate have a much stronger contractionary effects on domestic banks' loans; loan-to-asset ratio of domestic banks drop by 0.648 percent following a one percent increase in reserve rate.

Securities

We find that the 2-months lags impact of an increase in the BI rate is to reduce domestic banks' securities by 0.017 percent, while expanding foreign banks' securities by 0.015 percent. In the long run similar shocks positively affect banks' asset allocation in securities. Domestic banks increase their asset share in securities by 0.004 percent following a one percent increase in the BI rate (refer to the second column of table 15). Similar shocks induce foreign banks to raise their securities-to-asset ratio by 0.036 percent. In addition, we find that the impacts of BI rate on foreign and domestic banks' securities do not vary across periods.

The findings show that during the pre-crisis and post-crisis periods, a one percent increase in the reserve rate causes foreign banks to lower their asset allocation in securities by 0.361 percent. During these periods, similar shocks have no statistically significant impact on domestic banks' securities-to-asset ratio.

Interbank Assets

The third column of table 15 shows that during the crisis period, domestic banks reduce their asset allocation in interbank market by 0.046 percent following a one percent increase in the BI rate. The impact of similar shocks during the pre-crisis and post-crisis periods are not statistically different from its impact in the crisis period. In addition, we find no statistically significant evidence that foreign banks respond differently from domestic banks.

The findings show that a one percent increase in the reserve rate induce domestic banks to reduce their interbank assets by 0.621 percent. The impact of reserve rate are common across periods. The findings also show that given similar shocks foreign banks' responses are not statistically different from domestic banks.

Deposits

We find that in the pre-crisis and crisis periods, the impact a one percent increase in the BI rate is to reduce deposits of domestic banks by 0.096 percent, while having an opposite effects on increasing foreign banks' deposits by 0.095 percent; both results are statistically significant with 2-months lags. During these periods, the long run impact of similar shocks is to cause 0.034 percent increment in domestic banks' deposit-to-asset ratio, while boosting foreign banks' deposits by 0.225 percent.

In the post-crisis, we find that the impact of an increase in the BI rate on domestic banks' deposits are not statistically different from its impact in the earlier periods. However, similar shocks induce a significantly different effects on foreign banks' deposit-to-asset ratio; a one percent increase in the BI rate during the post-crisis period reduce foreign banks' deposits by 0.347 percent.

The findings show that an increase in the reserve rate has statistically significant impacts on banks' deposits. A one percent increase in the reserve rate during the pre-crisis and post-crisis periods reduces deposits of domestic bank by 0.322 percent. The findings also show that the impacts on domestic and foreign banks are not statistically different from zero.

1.6 Conclusion

Using monthly banking panel data from April 1993 to July 2014, we estimate the impact of changes in the monetary policy rate (BI rate) and reserve rate on bank portfolio allocation around the 1997 Asian crisis periods (pre-crisis, crisis and post-crisis). The findings show that an increase in the BI rate causes reduction in securities, deposits, and interbank assets during all sub-periods. Similar shock decreases loans in the pre-crisis and crisis periods, but leading to higher loans during the post-crisis period. The findings also show that the impact of an increase in the reserve rate is to reduce loans, interbank assets, and deposits during the pre-crisis and post-crisis periods, while having statistically significant impact on increasing securities only during the pre-crisis period.

An increase in the BI rate has the largest impact on reducing large banks' loans. Given a higher cost of bank borrowings large banks, which lend mostly to big firms may expect declining loans demand as these firms were able to switch to non-bank fundings. In contrast, small-medium banks' loans demand are less affected since the majority of their borrowers are small firms which are highly bank dependent. Contrary to the impact of BI rate, an increase in the reserve rate leads to the largest loans reduction in small banks as these banks will likely to have difficulty raising non-deposits funds compare to medium and large banks.

After the 1997 Asian crisis, an increase in the BI rate and reserve rate generate stronger contractionary effects on domestic banks' loans than those of foreign banks. We find that during this period similar shock induces substantial reduction in foreign banks' deposits. This finding suggest that foreign banks switch to lower cost external fundings thus being less affected by higher cost of fundings in domestic market.

We find that a one percent increase in the reserve rate generates a substantial reduction on deposits, whereas same shock in the BI rate slightly increases deposits. In addition, we also find that a one percent increase in the reserve rate has a notably stronger contractionary effects on bank loans than similar shock in the BI rate, particularly during the post-crisis period. These findings imply that deposits are major source of bank fundings in Indonesia therefore policy actions targeted at reducing the supply of loans are relatively more effective in curbing loan growth.

CHAPTER 2

MONETARY POLICY AND BANKING SYSTEM IN INDONESIA: A REGIONAL ECONOMIC PERSPECTIVE

2.1 Introduction

A vast empirical literature has documented the transmission mechanism of monetary policy and its impact to the real economy. Despite the extensive research analyzing the effect of monetary policy, there are limited studies that examine the policy's impact at disaggregated (regional) level. The majority of these studies, particularly in the case of developing countries, focus on the aggregate responses to monetary policy actions.

This paper fills the gap by studying the differential regional effects of monetary policy in Indonesia. We evaluate the importance of regional heterogeneity for the effectiveness of monetary policy actions. The aggregate effects of monetary policy depend on the distribution of regional sensitivities to monetary policy and the distribution of economic conditions at the time of monetary policy action (Fratantoni and Schuh (2003)). Differences in economic conditions across regions may significantly affect how monetary policy affects the economy at national level. The contributions of this paper are twofold. First, for the Central Bank, this research maps the differential impact of monetary policy across regions which eventually leads to a better understanding of the transmission channels of monetary policy innovations in Indonesia. Second, the results serve as potential inputs for the central and regional governments' policy making. The results allow regional authorities to identify distinct changes in their economic conditions in response to the Central Bank's policy actions. The paper may also provide policy input for the central government which put focus on empowering the regional economy and promoting its role in the country's economic development.

The objectives of this study is to analyze the transmission channel of monetary policy at regional level in Indonesia. We seek evidences whether the responses of regional output to changes in the monetary policy rate vary across provinces. This paper extends the existing literature by providing empirical evidences of the regional impact of monetary policy in a developing country and examining the role of the regional banking system in the propagation of monetary policy shocks while taking into account the inter-regions economic relationship and associated feedback from policy shocks. In addition, this study provides empirical evidences on the impact of monetary policy shocks channeled through the changes in the regional housing prices and consumer expectation. Further, this paper analyze factors that contribute to the regional asymmetric responses to monetary policy shocks.

We employ the impulse response function (IRF) from Vector Autoregression (VAR) framework to document the dynamic provinces' responses to changes in the monetary policy rate. We find that changes in the monetary policy rate have different impact on bank loans and deposits across regions suggesting the existence of interest rate and credit channel at the regional level in Indonesia. The findings also show that several provinces with large reduction in bank loans due to a contractionary policy also experience much slower economic activities. This result provides evidence of the significant role of banking system in the propagation of monetary policy shocks. In addition, we find that the trade openness, housing prices and consumer expectation change differently across regions in response to monetary policy shock providing evidences of the exchange rate, asset price and expectation channels at the island and provincial levels.

The findings show that the magnitude and duration of the impact of monetary policy shocks vary across provinces providing evidences of the asymmetric impact of monetary policy. Further analysis shows the shares of trade and mining are statistically significant in explaining the asymmetric provinces' responses to monetary policy shock. Given a contractionary monetary policy shock, provinces with higher shares of trade and mining sector have larger reduction in GDP per capita. However, we find that the share of manufacturing and the proportion of small firms are not statistically significant in explaining the differential regional effects of monetary policy actions. In addition, the findings show that the impact of the monetary policy shocks are more muted for provinces which have land border with foreign countries. This results imply that geography is a key factor in explaining the asymmetric provincial responses.

The remainder of the paper is as follows. Section 2.2 provides the overview of the Indonesian provinces. The existing studies on the monetary policy transmission are discussed in section 2.3. We present the empirical methodology in section 2.4. The empirical results from the VAR model and analysis on the factors that contribute to the differential regional responses to monetary policy shocks are presented in Sections 2.5 and 2.6. Concluding comments are presented in section 2.7.

2.2 Overview of The Regional Economy

Indonesia, with more than 17,000 islands, is the world's largest archipelago country. The vast number of islands were formerly divided into 26 administrative regions (provinces). Later, based on the Regions Decentralization Act in 1999 several regions had been split into new provinces; in 2012 Indonesia consists of 34 provinces as shown in figure 10.[1]

Table 16 shows the selected islands and provinces' indicators of Indonesian provinces grouped by the country's six main islands: (1)Java, (2)Sumatra, (3)Kalimantan, (4)Sulawesi, (5)Nusa Bali and (6)Papua. This table summarizes the different levels of economic development, population distribution and land area across regions in Indonesia.

The island of Java in which the capital region, Jakarta, resides, is the center of political activity and economic development in Indonesia. It is the largest regional economy in the country, representing 61.39 percent of the total gross domestic product (GDP). Being the largest regional economy, the residents of Java enjoy the highest quarterly GDP per capita at 15,458.11 thousand Rupiah. In addition, Java is also the most populous island as it is the home of almost 60 percent of Indonesian, although accounting for only 6 percent of the country's land area.

Java includes four other provinces besides the capital region: West Java, East Java, Central Java and Yogyakarta. Due to their close proximities to the capital, these provinces gain advantages in access to the country's major economic infrastructures including road, housing, school, harbor, and highway. In addition, large concentration of trade, financial, and manufacturing companies are built and operated in Java. These factors contributed to transforming the provinces in Java which formerly relied on trade of agricultural products into manufacturing, industrial and financial

[1] In order to maintain data consistency, we analyze the data based on the 26 provinces by merging the data of new provinces founded after 1999 into their former provinces

regions.

Located northwest to Java, the island of Sumatra is the second largest regional economy in the country accounting for 20.93 percent of total GDP, with quarterly GDP per capita of 9,179.21 thousand Rupiah. Representing 24.08 percent of the total land area, Sumatra is divided into eight provinces: North Sumatra, South Sumatra, Lampung, Riau, West Sumatra, Aceh, Jambi, and Bengkulu. The revenue of these provinces are mainly derived from export of agriculture products including coffee, palm oil, tea, and sugarcane. The island is also among the largest Indonesia's producer of oil, coal, tin, gold, and silver.

The island of Kalimantan refers to the part of the island of Borneo that belongs to Indonesia. The northern part of the island of Borneo is the sovereign territory of Malaysia and Brunei. Kalimantan is the second largest island in Indonesia accounting for 27.08 percent of the country's land area. This island consists of 4 provinces: East Kalimantan, West Kalimantan, South Kalimantan, and Central Kalimantan. More than 75 percent of this region are forest areas, thus forestry-related products such as timber and processed wood are the mainstay of the Kalimantan's economy. In addition, oil, gas, rubber, and fishery are also the main contributors to the region's economy. This island's economy represents 8.33 percent of the total GDP, with GDP per capita at 14,366.99 thousand Rupiah per quarter. The province of East Kalimantan largely contribute to the high average GDP per capita; East Kalimantan quarterly GDP per capita (31,383.69 thousand Rupiah) is the second largest in the country below only the capital region (Jakarta's is 45,565.70 thousand Rupiah per quarter).

The island of Sulawesi, located in the east of Kalimantan, consists of four provinces: West Sulawesi, South Sulawesi, Central Sulawesi, and Southeast Sulawesi. The size of this island is 10.45 percent of the total land area and is inhabited by 7.32 percent of the total population. The economy of Sulawesi represents 5 percent of the country's total GDP, with GDP per capita of 7,085.07 thousand Rupiah per quarter. The main products of Sulawesi includes coconuts, nutmeg, soy, coffee, and rice; the agricultural sector contributes to approximately 34 percent of Sulawesi's economy. In addition, fishery, commercial timber, and tourism are important contributors to the island's GDP.

Nusa Bali consists of Bali, West Nusa Tenggara and East Nusa Tenggara which are small island provinces located east of Java. These provinces have the lowest average quarterly GDP per capita (5,046.75 thousand Rupiah) and represent only 2.67 percent of the country's total GDP. Agriculture is the dominant sector in generating revenue for West Nusa Tenggara and East Nusa Tenggara, whereas for Bali, tourism (trade and services sector) contributes to approximately 50 percent of the economy.

Papua is the largest island in Indonesia; the size of Papua island represents 27.59 percent of the country's land mass. Despite its large area, the island is only inhabited by (approximately) 6 million, people which represents less than 3 percent of the total population. The island's economy accounts for 1.79 percent of the total GDP and its average GDP per capita is 5,984.57 thousand Rupiah per quarter. This island consists of two provinces: Papua and Maluku. The island Papua is at the most easterly part of the country and is the largest island in Indonesia. Mining is the main contributor to the province of Papua's GDP; the Grasberg Mine, the largest gold mine and third largest copper mine in the world, is located in this province. Along with agriculture and manufacturing, mining sector contribute to approximately 60 percent of this province's GDP. Maluku derives its income mainly from agriculture, forestry and fisheries. These sectors account for approximately 25 percent of the Maluku's GDP.

The statistics presented in table 16 imply large differences in term of the size of economy across regions in Indonesia. The two largest islands' GDP, Java and Sumatra, account for 82.32 percent of total GDP; the share of Java's GDP is approximately three times larger than Sumatra (refer to figure 11a). The inequalities have widened over time as for many years the economic development in Indonesia has been centered only in Java; measured by the size of GDP. Income per capita of islands located farther away from Java show lower levels of economic development.

Figure 11b plots three observations of the frequency distribution of the GDP per capita across provinces over the last twenty years. Each curve represents the distribution of GDP per capita at a certain year around its mean. The curve in the beginning of the sample (1993Q2) suggests large inequalities across provinces as it is heavily right skewed: the majority of the Indonesian provinces have GDP per capita within one standard deviation below the mean, while a small number of them fall well above the mean. In order to depict how the inequalities across regions shifted over time, we plot the three GDP distributions on one graph by normalizing around the mean of each year's observation. Figure 11b demonstrates additional evidence of the large differences in GDP per capita across regions in Indonesia. However, we find that the inequalities have reduced over time. In the fourth quarter of 2012, the distribution is less skewed than in previous periods as more provinces' GDP per capita are located closer to the mean.

Regions in Indonesia are also characterized with large differences in term of economic structure; industrial composition differs widely across islands in Indonesia (refer to table 17). Agricultural sector is the largest contributor to the region's economy except Java. In Java, manufacturing, which is consider as an interest-sensitive sector, has the largest contribution to the economy, representing 25.88 percent of total regional GDP. The share of manufacturing to regional GDP varies widely in other islands. For example, the manufacturing sector in Kalimantan accounts for 20.13 percent, but only 5.1 percent of Nusa Bali's regional GDP. The share of construction, which also considered to be an interest-sensitive sector, also varies across islands. It ranges from a low of 5.21 percent in Sumatra to a high of 8.79 percent in Sulawesi. This table also shows large variation in the share of mining sector, represented 23.37 percent of regional GDP in Papua, but only 1.46 percent of Java's regional GDP. The shares of all other sectors including trade, electricity, transport, finance and services are also varied across regions, but to a lesser magnitude than manufacturing and mining.

In addition to differences in industrial composition, the proportion of large and small firms also varies across regions. Table 18 shows that the share of small firms' output to regional GDP ranges from a low of 11.72 percent in Kalimantan to a high of 59.20 percent in Nusa Bali. Java, the largest regional economy, has 29.29 percent of their total GDP produced by small firms. Regions with large share of mining sector: Sumatra, Kalimantan, and Papua, have relatively small proportion of output represented by small firms; small firms' output represent 16.06 and 11.72 percent of regional GDP in Sumatra and Kalimantan, respectively, while accounted for 16.06 percent of GDP in Papua.

2.3 Theoretical Framework

In this section, we provide a survey of selected literature which examine the transmission mechanism of monetary policy in Indonesia. We document findings on how monetary policy actions affects the real sector providing evidence for interest rate, credit, asset price, expectation, and exchange rate channels. In addition, based on the results in the existing studies we review several factors that may contribute to our key question, the differential regional effects of monetary policy.

2.3.1 Monetary Policy Transmission Channels in Indonesia

The objective of Bank Indonesia (BI) is to achieve and maintain the stability of the Rupiah. Under the adoption of the flexible exchange rate system, the exchange rate is determined by the market, thus the mandate of the central bank is to control inflation. In order to achieve its objective, it is crucial for BI to understand how the monetary policy affect the real economy. The following subsections discuss the existing studies on the monetary policy transmission mechanism in the Indonesian economy.

Interest rate channel

The interest rate channel provides the mechanism on how the central bank's policy affects the real economy through changes in the demand side of the credit market. In the presence of sticky prices, the central bank's control over the short-term nominal interest rate directly impacts the real interest rate. The change in the real interest rate alter the cost of capital which further influences spending behavior of households and investment decisions of firms. These changes in consumption and investment affect the level of aggregate demand and production. Thus, the change in the central bank's policy instrument directly affects investment spending by varying the cost of capital.

Astiyah and Husnan (2005) investigate the propagation of monetary policy shocks to the real economy through the cost of capital using the Granger causality test and VAR analysis. The study includes the possibility of structural break in the Indonesian economy following the 1997 financial crisis; they divide the analysis into pre-crisis and post-crisis periods. The results reveal that the real deposit rate and real investment credit rate were more responsive to monetary policy shocks during the pre-crisis period.

Before the crisis, consumption growth was not significantly affected by changes in the real deposit rate as the latter was relatively low and stable. The abundant sources of foreign borrowing in the pre-crisis period undermined the effect of the real investment credit rate to investment growth. The banking interest rate have limited influence on the real sector as investors have alternative sources of funding from offshore borrowings and other sources such as high-risk paper.

In contrast, after the crisis consumption growth has been significantly driven by the real deposit rate. Similarly, investment growth has been significantly influenced by the real investment credit rate as investors now have limited access to foreign and other borrowing sources.

Credit channel

The credit channel provides an enhancement mechanism that complements the interest rate channel in explaining how monetary policy affects the economy. This channel shows how the impact of interest rate is magnified by the external finance premium (the difference between internal and external source of funding). Bernanke and Gertler (1995) divides the credit channel into two categories: balance sheet channel and bank lending channel.

The balance sheet channel focuses on the impact on the borrowers' balance sheets and income statements caused by changes in monetary policy, while the bank lending channel explains how monetary policy may change the aggregate loan supply in the credit market. The balance sheet channel shows that during a contractionary monetary policy episode small firms, due to higher agency cost, should receive a relatively lower share of credit (the flight to quality). The reduced spending, production and investment by high-agency-cost borrowers amplify the impact of tight monetary policy (Bernanke, Gertler, and Gilchrist (1996)). The theory explains that in response to contractionary monetary policy, banks may shift their loans toward lower-agency-cost borrowers (large firms).

The bank lending channel works as follows. The contractionary monetary policy reduces bank deposits. If the decrease in bank deposits are not replaced by other sources of funding, then bank lending will fall. Hence, monetary policy will reduce the aggregate loan supply in the credit market. Further in countries where banks are a dominant source of funding, the contractionary monetary policy will reduce both investment and economic activity. The necessary condition for the existence of this channel is that bank loan and corporate bond are not perfect substitutes or some borrowers are bank-dependent. This condition ensures that reductions in bank loan supply cannot be fully replaced by bond and that borrowers have no alternative source of funding.

The study of Agung (1998) provides evidence on the low sensitivity of bank lending to a monetary shock in the period before the 1997 crisis. During the tight money period, the loan growth of banks was higher than the deposit growth indicating that banks could still provide loan to borrowers by accessing offshore borrowing. Domestic banks, especially large banks, were major issuers of bonds in international markets during this period.

Asset price channel

The Asset price channel explains how monetary policy influences investment and consumption decisions of firms and households through real estate prices, stock prices, and exchange rates. A change in the policy stance, for example, a decrease in the policy rate, induces adjustments in the short-term money market. Economic agents respond by reallocating their savings towards non-interest bearing assets such as real estate and stocks. The higher demand for said assets pushes the prices of these assets upwards which further increases household wealth and consumption. Higher stock prices increase market value thus induce higher investment. An expansion in domestic demand eventually lead to higher economic growth.

Goeltom (2008) suggests that there is no evidence of a significant role of asset prices in transmitting the monetary policy shocks in Indonesia prior to the 1997 crisis. Nevertheless, after the crisis the study reports the existence of an asset price channel by analyzing the impact of policy rate (SBI) on investment (Jakarta Composite Stock Price Index - JSX).

Expectation channel

The expectation channel describes the effects of changes in monetary policy stance on public expectations of future interest rate, growth, income, and inflation. The changes in expectation affect firms and households savings and investments portfolio decisions. Theoretically, the changes in the agents' behaviors will induce changes in aggregate demand, price, wage setting, and inflation.

Wuryandani, M. I., and H (2001) uses the expectation inflation data from the Bank Indonesia's business survey to test the existence of this channel in Indonesia after the 1997 crisis. The analysis focuses on the post 1997 crisis period in considering the fact that the financial crisis would have changed the expectation of inflation in Indonesia. Their impulse responses show that the policy rate (BI rate) has immediate and strong impact on expected inflation: an indication that the market view the BI rate as a signal of monetary policy. The effect of the BI rate on inflation begins in the 15th month after the shock which implies a long monetary policy lag. The paper concludes that in general monetary transmission through an expectation inflation channel does exist.

Exchange rate channel

Astiyah and Husnan (2005) conducts a study on the exchange rate channel of monetary policy in Indonesia using structural VAR. The research investigates the following: First, whether monetary policy shocks propagate to the inflation rate through the exchange rate channel by comparing the impact of policy shocks to a risk factor. Second, it measures the transmission of exchange rate changes to the inflation rate through price (direct pass-through) and output (indirect pass-through) effects.

The findings show that before the 1997 crisis the exchange rate channel in Indonesia was very weak. The change in the policy rate did not have a significant impact on the exchange rate, and the exchange rate was not an important determinant of inflation. However after the crisis there were contrary evidence: changes in the exchange rate have significant impact on inflation. An appreciation of the exchange rate lowers the inflation rate through its direct pass-through effect to the production cost. The exchange rate appreciation could also increase consumption and investment thus generating higher output growth through indirect pass-through effects.

2.3.2 Determinants of Differential Regional Effects of Monetary Policy

The existing literature suggests several determinants that lead to differential regional effects of monetary policy. Carlino and DeFina (1998) argues three factors that may contribute to the region's differences. First, regional differences in the mix of interest-sensitive industries; the different composition of interest-sensitive industries which make up each region's economy allow monetary policy actions to have differential regional effects. For example, region with predominantly capital-intensive industries could be more sensitive to changes in monetary policy. Second, regional differences in the proportion of large and small firms; given tightening monetary policy, large firms usually have greater access to external non-bank funding relative to small firms which depend more on bank loans. As a result, regions with high proportion of small firms could have larger responses to monetary policy actions.

The third factor suggested by Carlino and DeFina (1998) relate bank size with its ability to provide loans. Kashyap and Stein (1995) suggests that contractionary monetary policy have larger impact on reducing small bank's lending ability than large banks; the latter can find alternative funding options more cheaply and easily than small banks. Consequently, given contractionary policy we expect regions with high proportion of small banks to have larger reduction in economic activity due to lower credit availability. However, Carlino and DeFina (1998) also consider that cross-regions lending may diminish this impact.[2] Supporting this argument, Petersen and Rajan (2002) documented an increasing trend in the distance between small firms and their lenders in the United States. Their findings suggest that advances in computing and communications have increased the availability and timeliness of hard information which in turn allow financial institutions to lend to more distant clients. In addition, Carling and Lundberg (2002) find no evidence that geographical proximity between borrowing firm and lending bank matter in credit risk management.

Other studies on the regional effect of monetary policy outside the United States suggest similar findings. Arnold and Vrugt (2002) studies the regional and sectoral effects of monetary policy in the Netherlands for the period 1973 to 1993. This paper finds that large regional variation in monetary policy transmission is significantly related to industrial composition. The same authors in Arnold and Vrugt (2004) estimate the impact of interest rate shocks on regional output in Germany and conclude that the differential regional effects of monetary policy are related to industrial composition, but not to firm size or bank size.

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[2] Borrowers may secure fundings from outside their own regions

There also had been studies on the regional effect of monetary policy which focused on a specific economic sector. Among others, Fratantoni and Schuh (2003) study the importance of regional heterogeneity in housing market for the efficacy of monetary policy. This paper argues that housing is a potential source of regional heterogeneity as it is a critical channel of monetary policy transmission and a volatile leading indicator of business cycle, however, housing market are characterized by idiosyncratic and regional factors. The results show significant differences between the dynamic responses of model with and without housing. They argue that incorporating microeconomic heterogeneity such as housing market is important in assessing the effects of monetary policy on macroeconomic conditions.

In the literature of banking and geography, there are different views on the importance of physical distance on bank-firm relationship. O'brien (1992) argues that deregulation and modern communications allows banks and other financial institutions not to be in financial centers. In contrast, Tschoegl (2000) acknowledges that improvement in communication technology allows banks to disperse from traditional center activities. However, at the same time the banks have kept in the international financial centers in which involving innovative, customized activities and large-scale transaction. This paper argues that bank location still matters for economic performance.

Alessandrini, Croci, and Zazzaro (2005) examines evidence that geography of banking may be relevant at the international, national and inter-regional levels. Instead of using physical distance, they study the impact of functional distance on bank performance. Functional distance is defined as the *economic* distance from a region of a bank which, even physically close to local customers, has its decisional center and strategic functions far away from it. Their findings suggest that *economic* distance affects bank performance in terms of credit allocation, pricing, efficiency, and profitability, which depend on the degree of development of regions to which banks are proximate; functional distance has a positive impact on banking performance in the case of less developed areas.

The different effects of monetary policy actions also determined by the types of borrowers. This argument consistent with broad credit view which emphasizes that information asymmetries between lenders and borrowers may reduce the availability of loans in the credit market, particularly for small firms. This small borrowers rely mainly on banks' loan as it is too expensive for them to borrow on the open market by issuing securities. Therefore small firms are likely to be hit the hardest by changes in monetary policy. Gertler and Gilchrist (1991) and Gertler and Gilchrist (1993) study the different responses of large versus small firms to changes in monetary policy. Their findings suggest that monetary policy shocks have a larger impact on small firms. In addition, using data for the U.S. manufacturing sector Oliner and Rudebusch (1993) provides evidence that a contractionary monetary policy shifted loans from small firms to large firms.

Existing literature provides evidence on the relationship between the economy' openness and the effectiveness of monetary policy. Karras (1999, 2001) seek to provide evidence on how economy's openness affect the impact of monetary policy on inflation and output.[3] The findings suggest that openness magnify the impact of monetary policy on inflation, whereas suppressing its impact on output: the higher degree of openness, the smaller (larger) the output (inflation) effects of a given change in money supply. Berument, Konac, and Senay (2007) also study how openness affect the effectiveness of monetary policy in changing output growth and inflation. However, they find no significant relationship between openness and the efficacy of monetary policy; the direction, significance and nature of its relationship vary considerably across countries.

2.4 Data and Empirical Approach

The dataset consist of quarterly regional economic data and aggregate macro variables over the period of 1993Q2 until 2012Q4. The regional data include the gross domestic product (GDP) per capita, bank loans, bank deposits, inflation rate, housing price index, consumer expectation index and regional export. The aggregate macro variables consist of the monetary policy rate (BI Rate), inflation rate and exchange rate (USD/IDR). We acquire the regional data from the Economic and Monetary Statistic Department of the Central Bank of Indonesia while the macro variables were collected from the IMF Data Library.

Table 19 shows the aggregate and regional data availability in our dataset. The housing price and consumer expectation indexes were collected from surveys conducted by Bank Indonesia. The housing price survey compiles prices from a sample of 491 housing developers in 14 cities

[3]openness defined as the sum of export and import divided by total GDP

while the consumer expectation survey gathers a sample from approximately 4,600 household respondents in 18 cities in Indonesia. We use the sum of region's export and import scaled by province's GDP as proxy for regional trade openness. We include trade openness to represent exchange rate channel of monetary policy.

2.4.1 Empirical Approach

Having painted a picture of the different states of regional banking, industrial composition, small firms' contribution and demographics (see Section 2.2), we surmise that a one-size fits all monetary policy will have differing effects across regions in Indonesia. For example, the different states of regional banking will dictate the strength of the interest rate and credit channels in the regions, the region's industrial composition will determine whether exchange rate channel exists (tradeable vs non-tradeable sectors), regions with higher degree of bank-dependent industrial sector could be more responsive to monetary policy, demographics and income will determine the size/existence of asset price and expectation channels.

We employ Vector Autoregression (VAR) framework to study the impact of monetary policy shocks in the aggregate and regional level. A VAR is an n-equation, n-variable linear model in which we regress each variable on its own lags and the lagged values of other variables in the system. The framework allows us to capture the dynamics in the time series data since each variable has an equation explaining its evolution based on its own and other variables' lags. This method is relatively simple since the only prior knowledge is a list of variables which can be hypothesized to affect each other intertemporally, and sometimes, intratemporally.

$$z_t = C + A_1 z_{t-1} + \ldots + A_p z_{t-p} + u_t \tag{2.1}$$

Equation (2.1) shows the VAR specification where p is the number of lags and C represents a constant and a dummy variable to incorporate the possible structural shift in the Indonesian economy following the 1997 financial crisis. In this model, we construct the column vector z_t to consist of these variables in the following order: $RGDP_{i,t}$, $RGDP_{-i,t}$, CPI_t, XR_t, BI_Rate_t, $RLoan_{i,t}$, $RLoan_{-i,t}$, $RDeposit_{i,t}$, $RDeposit_{-i,t}$. We assume that changes in the monetary policy rate ($BIRate$) affects the variables ordered before it with a one-period lag: regional real output per capita ($RGDP$), inflation (CPI) and exchange rate (XR), while immediately affecting variables ordered afterwards: regional bank loans ($Loan$) and regional bank deposits ($Deposit$).

We run the specification in equation (2.1) on all 26 provinces which are grouped into six islands: Sumatra, Java, Kalimantan, Sulawesi, Nusa Bali and Papua. $RGDP_{i,t}$ is the real GDP per capita for province i while $RGDP_{-i,t}$ consists of the aggregate real GDP per capita of the remaining provinces within the same island of province i plus the aggregate real GDP per capita of the other five islands. CPI_t is the inflation rate, XR_t is the exchange rate (USD/IDR), and BI_Rate_t is the monetary policy rate. $RLoan_i$ is the total of bank loans in province i while $RLoan_{-i,t}$ consists of the total loans in the remaining provinces within the same island of province i plus the loans of the other five islands. $Deposit_i$ is the total bank deposits in province i while $Deposit_{-i,t}$ consists of the total deposits in the remaining provinces within the same island of province i and the total deposits in the other five islands.

The real gross domestic product of each province divided by the number of population, $RGDP_i$, represents the level of economic activities in each province. Bank loans ($Loan$) and deposits ($Deposit$) account for the level of provinces' banking development. The independent variables with subscript $_{-i,t}$ are included to represent the inter-relationship between regional economy and associated feedback from policy shocks.

2.5 Empirical Results

This section presents the estimation of the VAR models which shows the dynamic responses of the aggregate and regional economic indicators to monetary policy shocks. We use impulse response functions (IRF) of the VAR model specified in equation (2.1) to document the impact of monetary policy shocks on (1)bank loans, (2)bank deposits, and (3)real GDP per capita. We discuss the impact responses, the cumulative responses, and the same quarter responses of these three economic indicators at island and provincial level.[4] Instead of discussing the significance of individual responses, we intend to use these IRFs along with the frequency distribution graphs to

[4]The trough period of aggregate responses

depict the dispersions of the impact of monetary policy shocks across provinces in Indonesia.

In addition, we consider the propagation of monetary policy shocks through other transmission channels: exchange rate, asset price, and expectation channel. We construct separate VAR models to represent these channels using the following data: trade openness (exchange rate channel), housing prices (asset price channel), and consumer expectation index (expectation channel). The estimation of these models provides tests as to whether the impact of monetary policy varies across regions and whether these channels exist at the regional level.

2.5.1 Bank Loans

Island Results

Figure 12 depicts the island loan growth responses in comparison to the aggregate loan growth responses following a surprise one standard deviation increase in the monetary policy rate (BI rate). This figure shows that given a higher BI rate the magnitude and duration of loan responses vary across islands providing the evidence of asymmetric impact of monetary policy shocks on loan at the regional level.

The largest reduction of loan growth for the aggregate (0.895 percent) and Java (1.037 percent) occur in the second quarter after a surprise one standard deviation increase in the BI rate. The largest loan growth reductions for Papua (2.814 percent), Kalimantan (1.120 percent), Sulawesi (0.823 percent) and Sumatra (0.594 percent) are in the first quarter after the initial shock, whereas Nusa Bali has its largest loan growth reduction (1.769 percent) in the eighth quarter following the same shock. We find that these islands' responses are statistically significant except for Nusa Bali.

The left panel of table 20 shows that the cumulative impact of a one standard deviation increase in the BI rate is to reduce the aggregate loan growth by 3.243 percent. Similar shocks induce 7.538 percent cumulative reduction of loan growth in Papua, while leading to a much smaller cumulative reduction of loan growth in Kalimantan (3.428 percent), Java (3.405 percent), Sulawesi (2.464 percent), Sumatra (2.172 percent), and Nusa Bali (1.769 percent).

Table 20 also shows that the immediate impact of a one standard deviation increase in the BI rate is to reduce the aggregate loan growth by 0.586 percent, while its impact varies across islands. The largest immediate reduction in loan growth is in Papua (2.814 percent) followed by

Kalimantan (1.120 percent), Sulawesi (0.823 percent), Sumatra (0.594 percent), and Java (0.464 percent), respectively. In contrast, we find that the same shock raises the loan growth in Nusa Bali by 0.023 percent on impact. These results are statistically significant except for Java and Nusa Bali.

The above findings show that a contractionary monetary policy shock has the largest and most persistent impact on reducing loan growth in Papua, whereas having the least impact in the Nusa Bali region. In addition, we find that the aggregate loan's response resembles that of Java; the dominant share of Java at approximately 70 percent of total loans greatly influences the aggregate loan growth's responses to changes in the BI rate. These results show that monetary policy shocks for the most part have the intended effects on regional bank loans: contractionary monetary policy shocks lead to reductions in bank lending providing evidence of interest rate and credit channels at the island level.

Provincial Results

The cumulative impact of a surprise one standard deviation increase in the BI rate is to reduce the loan growth of all provinces. However, the magnitudes of the impact vary; table 21 shows that the cumulative reduction in loan growth range from the smallest in West Sumatra (by 0.055 percent) to the largest in Maluku (by 14.71 percent). In addition, we find that a surprise one standard deviation increase in the BI rate has immediate impact on reducing loan growth for the majority of provinces (24 out of 26). We again find Maluku to have the largest immediate loan reduction (by 3.451 percent), while the smallest reduction is in East Nusa Tenggara (0.019 percent). Central Java and Riau are the anomalies to this group. The immediate impact of similar shocks is to increase loan in Central Java (by 0.022 percent) and Riau (by 0.582 percent). However, these results should be interpreted carefully as the confidence bands are wide.

All provinces in Java (figures 13b - 13f) have negative cumulative loan responses to a surprise one standard deviation increase in the BI rate, however, the magnitudes vary. Table 21 shows that the cumulative loan reductions of these provinces range from the largest in West Java (4.973 percent) to the smallest in Yogyakarta (0.258 percent). The immediate impact of a surprise one standard deviation increase in the BI rate is to reduce loans in all Java's provinces, except Central

Java. However, given a sizeable uncertainties around these IRFs, caution must be taken when interpreting these results.

A surprise one standard deviation increase in BI rate negatively affects loan growth of all provinces in Sumatra (figures 13g - 13n). The cumulative reduction of loan growth in Sumatra spans between 0.055 percent (in Riau) to 3.835 percent (in Jambi). Table 21 shows that the immediate impact of similar shock on loans varies from the smallest reduction in Bengkulu (by 0.531 percent) to the largest reduction in Aceh (by 2.160 percent).

Given a surprise one standard deviation increase in the BI rate, table 21 shows that West Kalimantan has the largest cumulative reduction in loans (by 7.291), a substantially larger responses than other provinces in the same island: Central Kalimantan (3.467 percent), East Kalimantan (2.390 percent), and South Kalimantan (2.376 percent). Figures 13b - 13f show that similar shock has statistically significant immediate impact on reducing loans in all provinces in Kalimantan, except East Kalimantan.

In the island of Sulawesi, table 21 shows that the cumulative contractionary impacts of a surprise one standard deviation increase in the BI rate on loans range from 0.879 (Southeast Sulawesi) to 3.835 percent (South Sulawesi). Figures 13s - 13v show similar shock immediately reduces loan growth in Central Sulawesi (by 0.579 percent) and South Sulawesi (by 0.642 percent); these results are statistically different from zero.

Table 21 shows that a surprise one standard deviation increase in the BI rate reduce loan growth in West Nusa Tenggara and Bali by 2.051 percent and 2.494 percent, respectively, while causing only 0.755 percent loan growth reduction in East Nusa Tenggara. We find that none of these provinces have statistically significant immediate responses to the BI rate shocks (figures 13w - 13y).

Figures 13z - 13aa show that provinces in the island of Papua (Maluku and Papua provinces) have distinct pattern of loan responses compare to others. These provinces responses, Maluku in particular, are much more volatile and longer in duration. Maluku cumulatively reduces its loan growth by 14.710 percent, while Papua has 4.425 percent cumulative reduction in loans in response to a one standard deviation increase in the BI rate (table 21). In addition, we find that similar shock has statistically significant immediate impact on reducing loans in Maluku (by 3.451 percent) and Papua (by 1.431 percent).

Table 21 shows that the second quarter responses for majority of the provinces, which coincides with the trough period of the aggregate loan response, are mainly negative (averaging -0.389 percent). These findings provide similar evidence to those found at regional level: contractionary monetary policy shocks negatively affect loan growth suggesting the existence of interest rate and credit channel at provincial level.

We construct frequency distribution graphs of the provincial responses to depict the dispersion of the impact of monetary policy shocks on bank loans across provinces in Indonesia. Figure 14a shows the frequency distribution of the cumulative loan responses to a one standard deviation increase in the BI rate; the distribution is slightly left skewed. However, the dispersions are not considerably wide as most of these provinces' responses still fall within one standard deviation above the mean. Similar pattern is found in figure 14b in which we plot the impact provincial responses to a one standard deviation increase in the BI rate.

In figure 14c, we plot the provinces' responses which coincides with the period of the largest reduction in the aggregate response. The pattern of the 2nd quarter provinces' responses is different from the cumulative and immediate responses. This figure implies a similar 2nd quarter responses across provinces; the distribution is right skewed, however, the dispersion across provinces are narrow as the majority of responses fall within one standard deviation below the mean. Figures 14a - 14c give a graphical depiction of the asymmetric bank loans' responses to monetary policy shocks at provincial level, for select points in the response period.

2.5.2 Bank Deposits

Island Results

Figure 15 shows that the immediate impact of higher BI rate is to reduce island deposit growth, however, for majority of the islands the impact reverses in the third quarter after the initial shocks. There are sizable dispersions around the aggregate response even up until ten quarters after the initial shock. Table 20 shows that the immediate impact of a one standard deviation increase in the BI rate is to reduce the aggregate bank deposits growth by 0.043 percent. Similar shocks reduce deposit growth in Java (by 0.116 percent), Kalimantan (by 0.232 percent), Sulawesi (by 0.071 percent), Nusa Bali (by 0.233 percent) and Papua (by 0.546 percent), whereas increasing deposit growth in Sumatra by 0.016 percent on impact.

Table 20 shows that the cumulative impact of a surprise one standard deviation increase in the BI rate is to raise the aggregate deposit growth by 0.515 percent. The cumulative impact of similar shocks is to increase deposit growth across all islands except Java. This table shows that the cumulative expansionary impacts extend from 0.080 percent (in Papua) to 1.174 percent (in Sumatra). In constrast, the cumulative responses of Java island to a surprise one standard deviation increase in the BI rate is to decrease deposit growth by 0.133 percent.

Table 20 also shows that the largest reduction of aggregate deposit growth (by 0.587 percent) occurs in the second quarter after the BI rate shock. The largest reduction in deposit during the second quarter response is in Sumatra (-0.548 percent) followed by Nusa Bali (-0.402 percent). We find that the largest second quarter contractionary responses in Java (0.532 percent), Kalimantan (0.373 percent), Papua (0.306 percent), and Sulawesi (0.231 percent) are not statistically significant.

The above findings show that the magnitude and duration of the impact vary across islands providing evidence of the asymmetric impact of monetary policy shocks on regional bank deposits. In addition, the results also serve as evidence of regional bank lending channel; fall in deposits bolster the credit channel by reducing amount of funds available for loans.

Provincial Results

The cumulative impact of a surprise one standard deviation increase in the BI rate is to raise deposit growth of the majority of the provinces. However, we find that the magnitudes of the impact vary. The middle panel of table 21 shows that the cumulative increment in deposit growth range from 0.308 percent (in Maluku) to 1.839 percent (in Riau).

We find mixed evidence on the immediate impact of a surprise one standard deviation increase in the BI rate on deposit growth; given similar shock, 14 provinces show reduction in deposit, while the rest of them (12 provinces) display a higher growth in deposit.

Figure 16b - 16f show that responding to a surprise one standard deviation increase in BI rate provinces in Java have similar pattern of changes in deposit growth, where there are as many negative as positive responses on impact. The responses of provinces in Sumatra, Kalimantan Sulawesi, and Nusa Bali Papua display no discernible patterns worth mentioning. However, Maluku and Papua, that displayed sizable drops in loans on impact suffered similar drops in deposits.

The middle panel of table 21 presents the cumulative, impact and second quarter responses of bank deposits to changes in the BI rate at provincial level. This table shows that for majority of the provinces the impact and second quarter deposit responses to higher BI rate are negative. The average impact and second quarter deposit responses to a one standard deviation increase in the BI rate is to reduce bank deposits by 0.046 percent and 0.164 percent, respectively. Similar shock increase the provincial cumulative responses on average by 0.805 percent.

The frequency distribution graph in figure 17a shows large dispersion of cumulative responses at the provincial level. The responses largely vary across provinces, although the entire distribution is slightly skewed to the left as most of the responses fall within one standard deviation above the mean. We find similar response pattern in figure 17b; the provincial immediate responses spread out around the mean, nonetheless most of the them fall within one standard deviation below the mean. Figure 17c shows that the majority of the second quarter provinces' responses fall within one standard deviation below the mean. These figures present further evidence on the asymmetric impact of monetary policy shocks on deposit growth at provincial level.

2.5.3 Real GDP per capita

This subsection focuses on our key question: does monetary policy affect economic activities of the regions differently?

Island Results

Figure 18 shows the changes in aggregate and island GDP per capita following a surprise one standard deviation increase in the BI rate. Given contractionary monetary policy shocks the magnitude and duration of the GDP per capita responses vary across islands providing evidence of the asymmetric impact of monetary policy shocks on regional economic activities.

There is no difference in impact responses since monetary policy is restricted to not having any immediate effects on this variable. However, in subsequent periods we see some divergent responses. Three quarters after shock all the IRFs, except that of Papua, behave similarly; Papua has a milder drop after the initial rise in the second quarter. Thereafter, Papua stays positive and even obtains a higher peak while the others experience a falls in output growth. Around eight quarters after shock the responses display more synchronicity but twenty quarters out some apparent differences remain.

The right panel of table 20 shows that the cumulative impact of a surprise one standard deviation increase in the BI rate is to reduce the aggregate GDP per capita by 0.797 percent. Given similar shock, the cumulative reduction in GDP per capita vary across islands from the smallest in Papua (by 0.115 percent) to the largest in Java (by 0.843 percent). This table also shows that two quarters after the BI rate shocks, GDP per capita for the aggregate and Java region decrease by 0.018 percent and 0.007 percent, respectively. However, the GDP per capita in all other regions rise in the second quarter following similar shocks; the largest increase is in Kalimantan (0.099 percent) followed by Nusa Bali (0.085 percent), Papua (0.068 percent), Sulawesi (0.058 percent), and Sumatra (0.036 percent), respectively.

Given a one standard deviation increase in the BI rate, the largest reduction in regional output per capita is in Java (-0.208 percent) followed by Sulawesi (-0.192 percent), Sumatra (-0.157), Nusa Bali (-0.152), and Kalimantan (-0.138 percent), respectively; these responses occur in the third quarter after the initial shocks. In Papua, the largest reduction in GDP per capita (-0.147 percent) occurs in the seventh quarter after the BI rate rose. The impacts are statistically significant in all islands except in Kalimantan and Papua. The above findings show that changes in the monetary policy rate have intended effects on the regional economic activities: contractionary monetary policy shocks lead to reduction in GDP per capita at island level.

Provincial Results

The cumulative impact of a surprise one standard deviation increase in the BI rate is to reduce the GDP per capita of the majority of provinces. However, the magnitudes of the impact vary (see the right panel of table 21). The cumulative reductions in GDP per capita extend from 0.046 percent (in Papua) to 2.167 percent (in Maluku). The Aceh, East Kalimantan, and West Nusa Tenggara responses are the anomaly in this group; the cumulative impact of similar shock is to increase the GDP per capita in Aceh (by 0.074 percent), East Kalimantan (by 0.191 percent), and West Nusa Tenggara (by 0.566 percent).

Figures 19b - 19f show that the impact of higher BI rate is to reduce GDP per capita in all Java's provinces. While West Java is the most sensitive to this contractionary policy its bank variables responses were not as different from their norms (refer to figure 13b and 16b). In fact West Java was one of the provinces that saw initial increases in both loans and deposits (though small in magnitude) on impact, counter to what one would expect with such sizable output drop off.

Figures 19g - 19n show that majority of the provinces in Sumatra have similar GDP per capita responses following contractionary monetary policy shocks. This figure shows that GDP per capita in all Sumatra's provinces (except Aceh) decrease in the second quarter after an increase in the BI rate. The Aceh response is the anomaly of this group. It is positive after the first period and after the tenth quarter is persistently negative for some time. Even after twenty quarters, when all the other responses have asymptote to the x-axis the Aceh's response shows no sign of converging.

Figures 19o - 19v show that for majority of the provinces in Kalimantan and Sulawesi the second quarter impact of higher BI rate is to increase GDP per capita. However, three quarters after the same shocks all of these provinces have reduction in their GDP per capita. Four of the responses are positive for initial quarters, while the other three are clearly negative. There is more dispersion in these responses compared to those of Java and Sumatra provinces.

The second quarter impact of higher BI rate is to increase GDP per capita for provinces in Nusa Bali region, while negatively affect GDP per capita for provinces in Papua region (refer to figure 19w - 19aa). These IRFs display the greatest disparity when compared to the previous three presented, especially later in the response period, we see wider dispersions in IRFs: figure 19w show that West Nusa Tenggara has a clear positive response and approaches its steady state from above, while in figure 19z Maluku's responses is sizably negative and approaches its steady state from below. Twenty periods out, unlike the other responses, Papua (see figure 19aa) has no intention of returning to steady state.

Figure 20a shows that the cumulative GDP responses only slightly vary across provinces as the majority of these responses (approximately 77 percent) fall close to the mean. Figure 20b, which plots the provinces' responses in the fourth quarter after the BI rate increase, implies large variation across provinces.[5] Although the majority of responses are close to the mean, the distribution is slightly right skewed as some responses fall under one standard deviation below the mean. The above findings serve as evidence on the different impact of monetary policy on economic activities at provincial level.

2.5.4 Discussion of Results

Table 22 outlines ten provinces with the largest reduction in loan growth following a one standard increase in BI rate, while tables 23 and 24 present the ten largest provincial reduction in bank deposits and GDP per capita, respectively. Except for Jakarta, table 23 shows that contractionary monetary policy shocks have no cumulative impact on reducing source of funds providing weak or no evidence of bank lending channel.

These tables show that Maluku is the only province which appears in all three top ten lists, attesting to disparities in IRFs across variables. The cumulative impact of a one standard deviation increase in BI rate is to reduce loan growth in Maluku by 13.369 percent. However, the same shock has positive cumulative impact on deposit growth in said province. These findings imply that reduction in loan is not the result of limited source of funds suggesting evidence of a strong interest rate channel but a weak bank lending channel in Maluku; higher interest rate prevents new borrowings which then reduces demand for loans. In Maluku a one standard deviation increase in the monetary policy rate has intended effect on lowering economic activity (2.135 percent reduction in GDP per capita).

Tables 22 and 24 show that in addition to Maluku, West Java, Aceh and East Java are provinces with large reductions in loan growth that also have slower economic activities due to a contractionary monetary policy shock. However, similar shocks have no discernible effect on reducing bank deposits in these regions. These findings again provide evidence of a strong interest rate channel but weak or no support for the existence of bank lending channel.

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[5] the maximum impact in the aggregate level

2.5.5 Other Channels of Monetary Policy

In the following subsections, we complement the study by analyzing the propagation of monetary policy shocks through exchange rate, asset price and expectation channels. In order to estimate whether these channels of monetary policy exist, we modify the VAR model in Section 2.4.1 to include the following data series: regional trade openness (exchange rate channel); regional housing price (asset price channel); regional consumer expectation (expectation channel). In addition, we use regional (cities) inflation data to account for the role of regional inflation heterogeneity.

We define two VAR models to estimate the evidence of the three other channels of monetary policy: First, VAR in equation (2.2) estimates the existence of exchange rate channel. Second, equation (2.3) tests the existence of asset price and expectation channel. We analyze these channels separately to allow estimation of exchange rate channel using longer data series for trade openness.[6]

$$z_t^a = C + A_1 z_{t-1}^a + \ldots + A_p z_{t-p}^a + u_t \tag{2.2}$$

In equation (2.2), the column vector, z_t^a, consist of the following series: $RGDP_{i,t}$, $RGDP_{-i,t}$, $RCPI_t$, XR_t, $TradeOpen_{i,t}$, $TradeOpen_{-i,t}$, BI_Rate_t, $Loan_{i,t}$, $Loan_{-i,t}$, $Deposit_{i,t}$, $Deposit_{-i,t}$. In this model we assume the monetary policy rate ($BIRate$) affects variables ordered before it with a one-period lag: real GDP per capita ($RGDP$), regional inflation ($RCPI$), exchange rate (XR), and regional trade openness ($TradeOpen$), while immediately affecting variables ordered later: bank loans ($Loan$) and bank deposits ($Deposit$).

$$z_t^b = C + A_1 z_{t-1}^b + \ldots + A_p z_{t-p}^b + u_t \tag{2.3}$$

In equation (2.3), the column vector, z_t^b, consist of the following series: $RGDP_{i,t}$, $RGDP_{-i,t}$, $RCPI_t$, XR_t, BI_Rate_t, $Loan_{i,t}$, $Loan_{-i,t}$, $Deposit_{i,t}$, $Deposit_{-i,t}$, $RHousing_{i,t}$, $RHousing_{-i,t}$, $RConsExp_{i,t}$, $RConsExp_{-i,t}$. In this model we again assume the monetary policy rate ($BIRate$)

[6] Regional trade openness data available since 2000, while consumer expectation index and housing price only available starting 2001 and 2006, respectively (refer to Table 19)

affects variables ordered before it with a one-period lag: real GDP per capita ($RGDP$), regional inflation ($RCPI$) and exchange rate (XR), while immediately affecting variables ordered after: bank loans ($Loan$), bank deposits ($Deposit$), regional housing prices ($RHousing$), and regional consumer expectations ($RConsExp$).

We include $TradeOpen_{-i,t}$, $RHousing_{-i,t}$, and $RConsExp_{-i,t}$ in both equations (2.2) and (2.3) to represent the inter-relationship between regions and feedback from policy shocks. $TradeOpen_{-i,t}$ includes the average trade openness of the remaining provinces within the same island of province i and the average trade openness in the other five islands. $RHousing_{-i,t}$ consists of the average housing price index of the remaining provinces within the same island of province i and the average housing price index in the other five islands. Similarly, $RConsExp_{-i,t}$ consists of the average consumer expectation index of the remaining provinces within the same island of province i and the other five islands.

We calculate regional inflation ($RCPI_{i,t}$) by taking the average inflation rate of all cities located in province i. Similarly, regional housing price ($RHousing_{i,t}$) and regional consumer expectation ($RConsExp_{i,t}$) are the average values of these variables for all cities in province i. Table 19 shows the limitation in regional data availability therefore models in equation (2.2) and (2.3) are estimated using shorter sample sizes than those in Section 2.4.1.

Regional Trade Openness

The findings show that an increase in the BI rate has the intended effects on trade openness (the share of export and import to total GDP). A contractionary monetary policy leads to exchange rate appreciation, a stronger financial account, and a weaker current account. Therefore, given an increase in the BI rate we expect to have reduction in trade openness measure. In addition, we find that provinces with high export-to-import ratios have higher sensitivities to an increase in the BI rate.

Figure 21 shows that the overall impact of an increase in the BI rate is to reduce trade openness at the island level. Java, Sumatra, and Sulawesi show similar responses. Kalimantan and Nusa Bali experience increase in trade openness at first, however, after four quarters their IRFs display similar pattern. Papua shows distinct responses as its trade openness measure sharply increases and stays positive during the first five quarters; the IRF of Papua shows similar pattern afterwards.

Figures 22b - 22f show that an increase in the BI rate has no compelling impact on trade openness in Yogyakarta, Central Java, and East Java, while in contrast, similar shocks generate sizable reduction of trade openness in West Java and Jakarta. Figure 22g - 22n show that similar shocks reduce trade openness in all provinces in Sumatra, although majority of these provinces display brief increase during the first three quarters responses.

The impact of an increase in the BI rate on trade openness vary across provinces in Sumatra (figures 22g - 22n). Given a surprise one standard deviation increase in the BI rate, we find a sizeable reduction in trade openness in Jambi, North Sumatra, Riau, South Sumatra and Lampung. However, similar shock cause no compelling impact on trade openness in Bengkulu, Aceh, and West Sumatra.

Figures 22o - 22r show that a contractionary monetary policy induce large reduction of trade openness measure in South Kalimantan but having moderate to non-sizable impact in other provinces in island of Kalimantan. Unlike other provinces in Sulawesi (figures 22s - 22v), we find that a surprise one standard deviation increase in the BI rate has no compelling impact on trade openness in Central Sulawesi. In addition, we also find that similar shocks induce non-significant impact on trade openness in Nusa Bali provinces, except for West Nusa Tenggara which displays positive responses during the first five quarters but reduction in trade openness afterwards. (see figures 22w - 22y).

Figure 22z shows an anomaly responses in the province of Maluku. Given an increase in the BI rate, trade openness measure in Maluku sharply increases and stays in the positive zone until the sixth quarters after the shocks; the IRF becomes negative in the seventh quarter responses and returns to equilibrium approaching the twentieth quarters. Figure 22aa shows that same shocks have consistent negative impact on trade openness measure in Papua.

Figures 23a and 23b display similar dispersion pattern of trade openness' responses to monetary policy actions. Both figures show that the cumulative and aggregate maximum responses widely vary across provinces. Some responses are in the right tail, but overall the distribution are skewed to the left as more responses fall one standard deviation above the mean.

Housing Prices

Figure 24 plots the responses of housing prices to monetary policy actions across regions over twenty quarters period. Given a contractionary monetary policy actions, Nusa Bali is the anomaly in the group as it shows large positive impact responses. The group's impact responses are mainly positive except for Sulawesi that responded negatively at first. However, after eleventh quarters all the IRFs, with the exception of Sumatra, display similar pattern. Again, caution must be taken when interpreting these results as there are sizeable uncertainties around the IRFs.

The aggregate impact of monetary policy shock on housing prices is small in magnitude. Table 25 shows that given a surprise one standard deviation increase in the BI rate, the aggregate housing prices rise by 0.135 percent on impact. In the ninth quarter, the aggregate housing prices decrease by 0.027 percent. During the subsequent periods as the impact of higher BI rate weakens, the aggregate housing prices return to its equilibrium level. In cumulative the impact of higher BI rate is to increase aggregate housing prices by 0.322 percent.

This table also shows that following an increase of the BI rate by one standard deviation, over twenty quarters period the housing prices in Kalimantan increase by 0.424 percent, while causing smaller impact in Java (0.358 percent), and Nusa Bali (0.227 percent). In contrast, similar shocks leads to 1.954 percent reduction of housing prices in Sumatra and 0.061 percent lower housing prices in Sulawesi. During the trough period of aggregate housing rice response, all islands except Kalimantan and Sulawesi have negative responses.

Figures 25b - 25e show that given a contractionary monetary policy shock, housing prices in Java's provinces increase on impact. These figures display sizable changes in housing prices for all provinces in Java, except Central Java. The responses of provinces in Java vary in magnitude. However, after tenth quarters all the IRFs show similar pattern. Figures 25f - 25i show mixed evidence on the impact responses of provinces in Sumatra; given an increase in the BI rate, housing prices North Sumatra and South Sumatra decrease, while in contrast, same shocks increase housing prices in West Sumatra and Lampung.

Similarly, figures 25j - 25m show that in Kalimantan, Sulawesi, and Nusa Bali regions the initial housing price responses vary across provinces. However, these responses tend to converge to steady state level after eleven quarters.

Table 26 shows that given a surprise one standard deviation increase in BI rate, the changes in housing prices vary across provinces. The cumulative housing price responses for majority of the provinces (9 out of 12) are positive; the cumulative changes in housing price on average is 0.091 percent. The impact responses to similar shocks are also positive (averaging 0.107 percent): 9 out of 12 provinces saw increment in the housing prices following an increase in the BI rate. The right column of this table shows that five quarters after the initial shock, housing prices in all provinces on average decrease by 0.001 percent. This table supports the previous findings on the asymmetric impact of monetary policy across provinces and also serves as evidence (albeit a weak one) of the asset price channel at the provincial level.

An increase in the BI rate should negatively affect housing prices. However, our findings show that for the majority of regions, the immediate impact of similar shock is to increase housing prices. The anomaly responses in part derived from a specific consumers' characteristic which assume housing as a safe investment. A contractionary monetary policy leads to lower consumer expectation which then induce consumer to assign more of their assets in safe investment. Holding the housing supply constant and/or inelastic, higher demand lead to increase price.

Figure 26a shows that approximately 70 percent of the housing responses across provinces fall within one standard deviation away from the mean. Figure 26b, in which we plot the immediate impact of BI rate on the housing prices, shows that the distribution is right skewed as more responses fall near one standard deviation below the mean. Figure 26c shows that the majority of the second quarter (the trough period of aggregate housing prices response) responses fall within one standard deviation away from the mean while only two provinces' responses were well above the mean (within two standard deviations).

Consumer Expectation

The impulse response function in figure 27 shows that the initial impact of a contractionary monetary policy shock vary across regions. The impact of a surprise one standard deviation increase in the BI rate is to reduce the level of consumer expectation in 3 out of 6 regions. Sumatra and Sulawesi are anomalies as similar shocks significantly increase their consumer expectation level on impact. Even after twenty quarters, when all the other responses converge to the steady state level the Sumatra's response shows no sign of converging.

Table 25 shows that the initial impact of a one standard deviation increase in the BI rate is to reduce the consumer expectation index in Java (by 0.152 percent), Kalimantan (by 0.498 percent) and Nusa Bali (by 0.592 percent), while significantly increasing those in Sumatra (by 1.019 percent) and Sulawesi (by 1.041 percent). The large positive responses in Sumatra and Sulawesi contribute to put the impact of BI rate on the aggregate consumer expectation on the positive side: the immediate impact of similar shock is to increase the aggregate consumer expectation index by 0.182 percent.

Figures 28b - 28e show that for majority of provinces in Java the impact of a contractionary monetary policy shock is to reduce consumer expectation level, except in West Java which shows a slight increase on impact. This figure also shows that among provinces in Java, similar shocks have the largest impact on Central Java. The consumer expectation level in East Java significantly vary until ten quarters after the initial shock. Unlike Java provinces, we find larger disparities of consumer expectation's response among province in Sumatra (see figures 28f - 28i). However, nine quarters after the initial shock the Sumatra provinces' responses converge and tend to return to the steady state level, except for South Sumatra. Figures 28j - 28m show large dispersion across provinces in Kalimantan, Sulawesi, and Nusa Bali before the responses flatten in the twelve quarter after the initial shock.

Table 26 shows that a contractionary monetary policy shocks has intended effects on reducing consumer expectation. The cumulative and impact responses to a surprise one standard deviation increase in BI rate on average are -0.233 percent and -0.138 percent, respectively. This table supports the hypothesis of asymmetric impact of monetary policy across provinces in Indonesia. In addition, this findings provide evidence of the expectation channel of monetary policy at provincial level.

Figure 29a shows that the (20 quarters) cumulative responses of 9 provinces are within one standard deviation away from the mean while three others are in the two standard deviation range from the mean. The distribution of the immediate impact of BI rate on consumer expectation is slightly right skewed as more responses fall within one standard deviation below the mean (refer to figure 29b). Figure 29c, in which we plot the provinces' responses six quarters (the trough period of aggregate consumer expectation response) after the BI rate increased, shows that approximately 83 percent of the responses fall within one standard deviation away from the mean.

2.6 What factors contribute to the asymmetric regional responses?

In this section, we examine select factors that may contribute to the different provincial responses to monetary policy actions. Carlino and DeFina (1998) provide evidence that the different U.S. states responses to monetary policy shock in part can be explained by varying share of manufacturing and extractive industries across states. In our study, in addition to the share of manufacturing and mining we test whether trade, hotel, and restaurant sector has significant contributions to the differential regional effects of monetary policy in Indonesia. Trade, hotel, and restaurant sector has relatively large contribution to regions' economy although it's share varies across islands, ranging from 14.04 percent in Sulawesi to 21.96 percent in Java (see table 17); this sector accounted for approximately 17 percent of the country's total GDP. In addition, we include the following factors: the share of small firms to regional GDP to examine whether larger proportion of small firms result in higher sensitivity to monetary policy actions; geographical location to account for the spillover effects from neighboring countries and control for the archipelagic nature of Indonesian regions.

The independent variables of the regression in equation (2.4), IR_i, include the following variables: (1)the cumulative impulse responses and (2)the same quarter responses from the baseline specification (26 provinces); i represents provinces. The cumulative response is the total change of regional GDP per capita over 20 quarters in response to a monetary policy shock. While the same quarter response is the province's response at a certain quarter which coincides with the peak/trough period of the aggregate GDP response.

$$\begin{aligned} IR_i =& \beta_0 + \beta_1 Manufac_i + \beta_2 Mining_i + \beta_3 Trade_i + \beta_4 SmallFirmsShare_i \\ &+ \beta_5 DummyBorder_i + \sum_{j=1}^{6} \beta_{6,j} DummyIsland_{i,j} + u_i \end{aligned} \tag{2.4}$$

The regional responses to monetary policy actions are explained by the following independent variables. The average share of manufacturing ($Manufac_i$), mining ($Mining_i$), and trade ($Trade_i$) sector to regional GDP. $SmallFirmsShare_i$ represents the share of small firms' output to regional GDP. We include two dummy variables to control for geographical location: (1) $DummyBorder_i$ for regions which share the same island with foreign countries: Provinces in the island of Kalimantan bordered with Malaysia, while the province of Papua share the island with Papua New Guinea; (2)$DummyIsland$, a dummy variable which controls for provinces within the same island (see figure 10).

Table 27 shows the estimation result of equation (2.4) with cumulative responses as the dependent variable. This table shows that the shares of trade, hotel, and restaurant sector are statistically significant in explaining the asymmetric provinces' responses to monetary policy actions. The results imply that given a contractionary monetary policy shock, regions' economy with higher share of trade, hotel, and restaurant sector have larger cumulative reduction in GDP per capita. The results also show that higher share of manufacturing and mining sector induce larger regional responses, however, the effects are not statistically significant. We also find that the composition of small firms has no statistically significant impact on the regional responses to monetary policy actions.

Table 27 also shows that geographical location in part explains the differential regional effetcs of monetary policy in Indonesia. Provinces located on the same island bordering foreign countries (Kalimantan and Papua) are less affected by monetary policy actions and the results are statistically significant. We find that the responses of provinces in Sumatra, Sulawesi, and Nusa Bali are not statistically different to those Java.

Table 28 shows that the shares of mining and trade sector are statistically significant in explaining the 4th quarter provinces' responses to monetary policy shock. Given an increase in the monetary policy rate, higher shares of mining and trade sector induce larger reduction in GDP per capita. This table also shows that the shares of mining and trade sector are statistically significant in explaining the different 4th quarter provinces' responses to monetary policy shock. Given an increase in the monetary policy rate, higher shares of mining and trade sector induce larger reduction in GDP per capita. We find that the share of small firms is not statistically significant in explaining the regional response to monetary policy actions. The results on the role of geographical location provided in this table are consistent with the previous findings in table 20: provinces which border with foreign countries (Kalimantan and Papua) are less sensitive to changes in monetary policy; Provinces in Sumatra, Sulawesi, and Nusa Bali have similar responses to those in Java, while provinces in Kalimantan and Papua show weaker responses to monetary policy action than Java's provinces. We again find geography to be an important factor. The big jump in R^2 due to geography implies that there are unmodeled regional factors that explain the differences in IRFs.

2.7 Conclusion

We employ vector autoregression (VAR) model to investigate whether province respond differently to monetary policy shock. We estimate the role of regional banking system in the propagation of monetary policy shocks. In addition, we document the changes in regional housing prices, consumer expectation, and level of trade openness in response to monetary policy actions.

The findings show that the magnitude and duration of the impacts of monetary policy actions vary across provinces providing evidence of the asymmetric regional effects of monetary policy actions. We find that changes in the monetary policy rate have different impact on bank loans and deposits across regions suggesting the existence of interest rate and credit channel at the regional level in Indonesia. The findings also show that several provinces with large reduction in bank loans due to a contractionary policy also experience much slower economic activities. This result provides evidence of the significant role of banking system in the propagation of monetary policy shocks. In addition, we find that the housing prices and consumer expectation change differently across regions in response to monetary policy shock providing evidences of the asset price and expectation channel at island and provincial level.

The findings suggest that the aggregate level analysis of monetary policy would provide an incomplete depiction of the impact of monetary policy in Indonesia as the responses to monetary policy actions are greatly vary across provinces. Provinces in Java, Sulawesi, and Sumatra have much larger responses than those in Kalimantan, Nusa Bali, and Papua. This findings imply analysis on the regional impact of monetary policy provide more detail input needed by monetary authority to evaluate the efficacy of its policy.

We further study factors that contribute to the different provinces' responses to monetary policy shock. We find that the shares of trade and mining are statistically significant in explaining the asymmetric provinces' responses to monetary policy shock. Given a contractionary monetary policy shock, provinces with higher shares of trade and mining sector have larger reduction in GDP per capita. However, we find that the share of manufacturing and the proportion of small firms are not statistically significant in explaining the differential regional effects of monetary policy actions. In addition, the findings show that the impact of the monetary policy shocks are more muted for provinces which have land border with foreign countries. This results imply that geography is a key factor in explaining the asymmetric provincial responses.

CHAPTER 3

CRISIS, DEBT AND THE INDONESIAN POLICY RESPONSE: A BANK PORTFOLIO ALLOCATION MODEL

3.1 Introduction

The 1997 Asian crisis marked the start of major overhaul of the Indonesian banking system. The banking crisis which occurred during this period taught an invaluable lesson on the importance of a sound and healthy banking system. In order to resolve the bank crisis, the Indonesian government conducted bank recapitalization and restructuring programs. On the policy side, BI became an independent central bank which led to improved banking supervision. These episodes strongly suggest that there was a structural break in the banking system between the pre-crisis and post-crisis periods.

We construct a banking model based on Furfine (2001) with new features that define the specific characteristics of banking system in Indonesia. Our model considers the impact of banking crisis which potentially has shifted bank behavior in portfolio allocation. In addition, our model also examines the role of bank debt in affecting bank decision to adjust its portfolio allocation. This paper in part contributes to the efforts of better identifying bank behavior by providing a theoretical model as a means to study bank portfolio reallocation in response to policy changes.

The model features a representative bank which maximizes its profit by choosing portfolio allocation in risky assets, safe assets and debt given its balance sheet constraint and various adjustment costs. We estimate the model's parameters using nonlinear least square method on the banking dataset which includes balance sheet information from 241 banks in Indonesia during the period of April 1993 to July 2014. We divide the dataset into two sub-samples which represent the period before and after the 1997 Asian crisis. We obtain two set of parameters which define banking system in the pre and post crisis period. Given the estimated parameters, we find the solutions of the models and conduct simulation to estimate bank portfolio reallocation in response to changes in the reserve rate, risk-based capital requirement, and loan demand.

The findings show that an increase in the reserve rate has the intended effects on curbing risky assets growth. However, we find that during the post-crisis period a similar shock generates much larger contractionary effects on risky assets allocation than those in the pre-crisis period. This result suggest that the 1997 Asian crisis period created a structural break in bank's behavior, marked a shift in the structure of bank balance sheets in Indonesia, and was the impetus to significant changes in the banking system in general.

The findings also show that an increase in the capital requirement reduces growth in risky assets, but increases allocation in safe assets. The results are similar across sub-periods. The findings support the hypothesis that higher capital requirement provides incentives for banks to shift their portfolio toward safer assets. In addition, the simulation results show that reduced loan demand, which represents an economic downturn, has the expected effects on bank portfolio adjustments. Facing an economic downturn, bank perceives an increase in the risk of default thus shifting its portfolio allocation away from risky assets towards safer assets.

The remainder of the paper is as follows. Section 3.2, which is adopted from Francis and Wijoseno (2016), presents a description of the banking system in Indonesia. In section 3.3, we describe the construction of the model and in section 3.4 we explain the data source and present the approach to obtain the model's parameters. We provide the simulation results in section 3.5 and concluding comments are presented in section 3.6.

3.2 Overview of Indonesian Banking System

The banking sector in Indonesia was strongly regulated by the government thus consisted of only a few state and privately-owned banks until the implementation of Bank Liberalization Act in October 1988. Following the Act, the banking sector in Indonesia has been growing rapidly. The act allows private entities to establish new domestic and joint venture banking businesses in Indonesia. The implementation of this act attracted a large number of new investors, both foreign and domestic, to establish banking businesses in Indonesia. As a result, the number of banks substantially increased from 111 in 1988 to 240 in 1994. However, despite the significant increase in the number of banks following the 1988 Act, the top 10 private banks and the 6 state banks together account for 75 percent of total bank-system assets (Pangestu (2003)).

As the number of banks increased, the role of banks in economic development expanded significantly as banks became an important source of funding for the economy. The first column of table 29 shows that during the pre-crisis period, banks' loans on average accounted for 60.78 percent of total assets allocation, while deposits share averaged 57.02 percent of total assets. Thus banks on average extended loans more than deposits collected. In order to offset the shortfall of funding from deposits banks depended on external fundings, as shown by high level of banks borrowings at 17.72 percent of total assets. As a consequence of its rapid loans expansion, banks maintained a low excess reserves to total assets ratio at under 1 percent and invested only 2.02 percent of total assets in securities.

Accompanying the rising number of banks were increasing problems related to weak banking corporate governance, including collusive practices, violations of prudential regulations, and weak accounting standard. The rapid increase in the number of banks was not accompanied by improved bank regulation and supervision. During the early bank liberalization period, Bank Indonesia (BI) was not independent thus banking supervision interferences were common especially for business entities supported by powerful political groups. Bad banking practices, weak bank supervision and regulation enforcement contributed to weakening banking fundamentals.

The bank indicators shown in the second column of table 29 suggest that banks were severely hit by the crisis. The combination of weak demand and reduced supply of loans caused severe contraction in banks loan. The averaged banks loan-to-asset ratio dropped from 60.78 to 46.97 percent. The majority of banks suffered huge losses which significantly decreased their capital levels. The capital-to-asset ratio reduced from 14.45 to 9.89 percent. In addition, reserve-to-asset ratio jumped from 2.81 percent during the pre-crisis period to 17.04 percent during the crisis period.

The banking system went into major overhaul in which 70 banks were liquidated and 13 were nationalized Laeven and Valencia (2008). The economic recovery program following the 1997 crisis gave BI its independence through the implementation of 1999 Central Bank Act. BI's independence eliminated third party interferences that had been common prior to the crisis, thus improving the quality of banking supervision and regulation.

The significant differences of bank indicators between the pre-crisis and post-crisis suggest that the 1997 Asian crisis may have significantly contributed to the changes of banks' balance sheet structure (refer to table 29). During the post-crisis period, on average, banks improved prudent banking practices and allocated much higher share of low-risk type of assets compared to the pre-crisis period: reserve-to-asset ratio increased from 2.81 to 22.33 percent; securities rose from 2.02 to 8.01 percent of total assets; a significant reduction in debt-to-asset ratio from 17.72 to 2.47 percent. The huge jump in reserves and securities in part were contributed to the combination of these two factors: First, bank loans had not yet returned to pre-crisis levels. In the post-crisis period, loans were at 49.64 of total assets, far below the pre-crisis period of 60.78 percent. Second, we find significant increases in the deposit-to-asset ratio from 57.02 percent in pre-crisis period to 74.95 percent in the post-crisis period. Having increased available funding while the credit market had not yet recovered, banks shifted their excess funds into securities and reserves.

An interesting finding is that although the 1997 crisis had passed, banks on average still maintained high reserves ratio during the post-crisis period. Reserve holdings on banks balance sheets were at 22.33 percent of total assets in the post 1997 crisis, much higher than the pre-crisis level which was at 2.81 percent.

3.3 Data and Model

3.3.1 Bank panel data

The bank panel dataset, which were collected from the Central Bank of Indonesia, contains selected monthly balance sheet information from 241 banks in Indonesia during the period of April 1993 to July 2014.[1] The bank dataset is an unbalanced panel as the total number of banks varies during the 256-month sample period due to banks' liquidations, mergers and acquisitions. Since the paper aims at explaining the change of banks' balance sheet over time, it is important to base the estimation on a consistent data series. We apply the following criteria to ensure data consistency.

[1]The dataset excludes balance sheet information of the Islamic and rural banks

First, we exclude banks which were liquidated or founded after April 1993. Second, following Peek and Rosengren (1995), we treat banks which merged during our sample period as one entity as if the merger occurred at the beginning of the sample period. With these adjustments, we obtain a balanced panel of 22,528 observations from 88 banks which represent more than 91 percent of total bank assets in Indonesia over the period. We divide the sample into the pre-crisis (May 1993 - July 1997) and post crisis (June 2000 - July 2014) periods. The bank panel data consists of the following balance sheets items:

Assets	Liabilities
Required reserves ($\tau_t D_t$)	Deposits (D_t)
Excess reserves (X_t)	Capital (K_t)
Securities (S_t)	Debt (B_t)
Loans (L_t)	

The assets side of bank balance sheet includes the following items: Required reserves ($\tau_t D_t$) is the minimum bank's savings or claims to the Central Bank which is determined by the amount of its deposits; Excess reserves (X_t) is the additional bank's savings or claims to the Central Bank above the minimum requirement; Securities (S_t) include marketable securities issued by non-bank third parties and purchased/owned by bank; Loans (L_t) refer to all realized lending extended by bank to non-bank third parties.

The liabilities side consists of the following items: Deposits (D_t) is the non-bank third parties savings which includes demand deposits, savings deposits and time deposits; Capital (K_t) is the total amount of bank's capital; Debt (B_t) consists of securities issued (securities include all short-term and long-term debentures issued by bank to non-bank third parties) and borrowings (borrowings include all borrowings by bank from non-bank third parties) by banks.

In addition to bank balance sheets data, we use various interest rates data to calibrate the rate of return on bank balance sheet items in the pre-crisis and post-crisis periods (refer to table 30). We use the average lending rate and deposit rate, which were obtained from the International Financial Statistics-IMF over each sub-sample period to represent the rate of return on risky assets (r_t^R) and deposits (r_t^D), respectively. The rate of return on safe assets (r_t^S) was calibrated using the average money market rate, while the rate of return on debt (r_t^B) is represented by the average interbank rate; these data series were collected from the Central Bank of Indonesia.

3.3.2 Banking Model

We construct a banking model based on Furfine (2001) to demonstrate the impact of 1997 Asian crisis on banks in Indonesia. In particular we study how banks adjust their portfolio allocation in response to changes in the reserve rate, risk-based capital requirement, and loan demand. In addition, our model also examines the role of bank debt in affecting bank decisions to adjust their portfolios. Specifically, we are interested in whether or not banks are more sensitive to policy changes in the more stringent, policy regulated post-crisis environment.

The model features a representative bank which maximizes its profit by choosing portfolio allocation in risky assets, safe assets and debt given its balance sheet constraint and various adjustment costs. We estimate the model's parameters using nonlinear least square method on the Indonesian banking dataset. Given the estimated parameters, we find the solutions of the model and simulate the policy changes to estimate how banks reallocate their portfolios.

We introduce the following notations:

$$\begin{aligned}
&A_t^R = L_t \\
&A_t^S = SX_t + \tau_t D_t \\
&\text{where} \\
&SX_t \equiv S_t + X_t \\
&\tau_t \equiv \text{regulatory reserve rate}
\end{aligned} \tag{3.1}$$

We assume the asset side of the representative bank's balance sheet to contain only two types of items: risky assets (A_t^R) and safe assets (A_t^S), while the liabilities sides include deposits (D_t), capital (K_t), and debt (B_t). We define the safe assets to include securities (S_t), required reserves ($\tau_t D_t$) and excess reserves (X_t), while the risky assets contain only loans (L_t).

Balance sheet constraint

The balance sheet constraint is defined as the total of bank's assets equal to the total of bank's liabilities. Using the definition of safe assets in equation (3.1) on (3.2), we get the balance sheet constraint in equation (3.3).

$$A_t^R + A_t^S = D_t + K_t + B_t \tag{3.2}$$

$$A_t^R + SX_t = (1 - \tau_t)D_t + K_t + B_t \tag{3.3}$$

Capital adjustment costs

Based on the risk-based capital requirement, bank is required to maintain a certain amount of capital which depends on the risk level of its assets; higher risk-level assets requires a larger capital holding. Since our model assumes only two type of assets: risky and safe assets, the calculation of how much capital that bank needs to maintain in each period is simplified to equation (3.4).

$$k_t^R \equiv \frac{K_t}{w_R A_t^R + w_s A_t^S} > d_t \tag{3.4}$$

In this equation, w_R and w_s represent the weights for risky and safe assets, respectively. Banks are required to maintain their capital level above the minimum risk-based capital ratio, d_t, which is set by the Central Bank.

Given a violation of the minimum capital requirement, the Central Bank imposes sanctions which vary from a simple case of being denied the ability to extend new loans to a more severe punishment of being taken over or liquidated. The sanctions for capital requirement violations impose real costs on banks. For simplicity, we assume that all banks incur the costs, regardless their capital levels. However, given an increase in the regulatory minimum, banks with higher capital level incur lower adjustment costs. The function G_t, in equation (3.5), specifies the capital adjustment costs schedule.

$$G_t = (w_R A_t^R + w_s A_t^S)\gamma^R g(k_t^R - d_t) \tag{3.5}$$

$$g(k_t^R - d_t) = \eta_0 - \eta_1 ln[k_t^R - d_t] \quad (3.6)$$

In this equation, parameter γ^R captures the potentially different sanctions imposed by the Central Bank for a similar violation of capital regulation across sub-sample period; the differences may occur based on the Central Bank's judgment on the banking system and economic conditions. For example, during a tight liquidity or overheat economy the Central Bank may enforce stronger punishments for a violation of capital regulation to prevent banks taking excessive risk; during this period γ^R would be higher than in the normal economic condition. The function of capital adjustment cost includes multiplication by the total risk-weighted assets to capture the setting that costs only apply to these portion of assets.

In equation (3.6), function $g(\cdot)$ calculates the costs for banks with capital level k_t^R to meet the risk-based capital requirement, d. We expect to have the value of parameter η_1 to be positive. Therefore, given an increase in the parameter d_t, banks with higher capital ratios will have smaller capital adjustment costs than those with lower capital ratios.

Loan adjustment costs

We introduce the following setting to model how banks are subject to loan adjustment costs. Banks incur costs when expanding loans higher than demand as they will likely need to accept borrowers with lower credit ratings. Similarly, if banks reduce their loans when loan demands are high, they will likely incur costs for losing the opportunity to net higher asset returns. In brief, banks incur costs for adjusting loans at a different rate than loan demand. The function J_t in equation (3.7) calculates the bank loan adjustment costs. In this equation, l_t is defined as the gross growth rate of risk-weighted assets, while ρ_t represents the loan demand. We use the average loan growth at time t as a measure for loan demand.

$$J_t = (w_R A_t^R + w_s A_t^S) j(l_t - \rho_t) \quad (3.7)$$

where

$$l_t = \frac{w_R A_t^R + w_s A_t^S}{w_R A_{t-1}^R + w_s A_{t-1}^S}$$
$$j(l_t - \rho_t) = \frac{1}{2}\alpha(l_t - \rho_t)^2$$

The function j of loan adjustment cost includes multiplication by the total risk-weighted assets to capture the setting that costs only apply to this portion of assets. The functions j, with parameter ρ_t as a measure of loan demand, calculates the costs for banks to adjust their loans. We expect to have the value of parameter α to be positive; higher α implies that deviations from loan demand incur greater loan adjustment costs.

Debt adjustment costs

In the model, we introduce the setting that banks incur costs when their debt grows at a different rate than the optimal level ($\bar{b}$). The optimal level of debt is defined as the average bank's debt-to-asset ratio over the sub-sample period. Banks are likely to incur costs when debt is above its optimal level as they are exposed to higher risks. Correspondingly, if banks maintain below optimal debt levels, they will likely incur costs from losing additional funding. The function H_t in equation 3.8 calculates the costs imposed on banks for changing debt. We define parameter b_t as the risk-based debt ratio. We expect to have the parameter θ to be positive; higher θ implies that deviations from optimal debt levels incur greater costs.

$$H_t = (w_R A_t^R + w_s A_t^S) h(b_t - \bar{b}) \tag{3.8}$$

where

$$b_t \equiv \frac{B_t}{w_R A_t^R + w_s A_t^S}$$
$$h(b_t - \bar{b}) = \frac{1}{2}\theta(b_t - \bar{b})^2$$

Similar to other costs schedules, the function of debt adjustment cost includes multiplication by the total risk-weighted assets to capture the setting that costs only apply to these portions of assets.

Capital evolution

Equation 3.9 shows how bank's capital changes over time. Bank capital accumulation depends on the previous period's capital and profits. Banks' profits are obtained from return on portfolio allocation in risky and safe assets less its interest expenses on debt and deposits. In addition, banks face uncertainty from portfolio allocation. We define this uncertainty as ϵ_t which is added to the bank capital evolution equation.

$$K_t = K_{t-1} + r_t^R A_t^R + r_t^x A_t^S - r_t^B B_t - r_t^D D_t + \epsilon_t \tag{3.9}$$

Bank maximization problem

Given balance sheet constraint, various adjustment costs, and capital evolution, bank maximizes its profit by choosing how much to allocate in risky assets (A_t^R) and safe assets (securities and reserves) (SX_t).[2] In addition, bank also chooses how much fundings raised by issuing debt (B_t).

$$\max_{A_t^R, SX_t, B_t} E \sum_{t=1}^{\infty} \beta^t \{ r_t^R A_t^R + r_t^x SX_t - r_t^B B_t - r_t^D D_t - G_t - J_t - H_t \} \tag{3.10}$$

We abstract from modeling the uncertainty around asset returns, that is, the risk return trade-offs. However, there are mechanisms in place to stop the banks from choosing only the high return risky assets, namely the capital, loan, and debt adjustment costs. The capital adjustment costs defined in equation (3.5) and (3.6) implies that banks incur higher capital adjustment costs (G_t) for a larger share of portfolio in the risky assets; a larger allocation in the risky assets reduces bank's risk-based capital ratio (k_t^R) thus bank incurs higher costs to meet the risk-based capital requirement (d_t). In addition, choosing only the high return risky assets will likely incur higher loan adjustment costs (J_t; see equation (3.7)) and debt adjustment costs (H_t; see equation (3.8)); choosing only the high return risky assets will likely result in large deviations from loan demand (optimal debt level) thus incur high loan (debt) adjustment costs.

[2] Banks are unable to choose required reserves, $\tau_t D_t$ (refer to equation 3.1)

First order conditions

The first order condition with respect to A_t^R is as follows:

$$\begin{aligned}
&\left(\frac{1-\tau_t}{1-\tau_t-r_t^D}\right)\left(r_t^R-\frac{r_t^D}{1-\tau_t}\right)\left[1-\gamma^R g'(k_t^R-d_t)\right]\\
&-\big(w_R+w_S\frac{\Delta A_t^S}{\Delta A_t^R}\big)\gamma^R\Big[g(k_T^R-d_t)-g'(k_t^R-d_t)k_t^R\Big]\\
&-\big(w_R+w_S\frac{\Delta A_t^S}{\Delta A_t^R}\big)\Big[j(l_t-\rho_t)+j'(l_t-\rho_t)l_t\Big]\\
&-\big(w_R+w_S\frac{\Delta A_t^S}{\Delta A_t^R}\big)\Big[h(b_t-\bar{b})-h'(b_t-\bar{b})b_t\Big]\\
&=-\beta\big(w_R+w_S\frac{\Delta A_t^S}{\Delta A_t^R}\big)j'(l_{t+1}-\rho_{t+1})l_{t+1}^2
\end{aligned} \tag{3.11}$$

where

$$\frac{\Delta A_t^S}{\Delta A_t^R}=\frac{\tau_t}{1-\tau_t}\left[1-\left(\frac{1-\tau_t}{1-\tau_t-r_t^D}\right)\left(r_t^R-\frac{r_t^D}{1-\tau_t}\right)\right]$$

The first order condition with respect to SX_t is as follows:

$$\begin{aligned}
&\left(\frac{1-\tau_t}{1-\tau_t-r_t^D}\right)\left(r_t^X-\frac{r_t^D}{1-\tau_t}\right)\left[1-\gamma^R g'(k_t^R-d_t)\right]\\
&-\big(w_S\frac{\Delta A_t^S}{\Delta SX_t}\big)\gamma^R\Big[g(k_T^R-d_t)-g'(k_t^R-d_t)k_t^R\Big]\\
&-\big(w_S\frac{\Delta A_t^S}{\Delta SX_t}\big)\Big[j(l_t-\rho_t)+j'(l_t-\rho_t)l_t\Big]\\
&-\big(w_S\frac{\Delta A_t^S}{\Delta SX_t}\big)\Big[h(b_t-\bar{b})-h'(b_t-\bar{b})b_t\Big]\\
&=-\beta w_S\frac{\Delta A_t^S}{\Delta SX_t}j'(l_{t+1-\rho_{t+1}})l_{t+1}^2
\end{aligned} \tag{3.12}$$

where

$$\frac{\Delta A_t^S}{\Delta SX_t}=1+\left(\frac{\tau_t}{1-\tau_t}\right)\left[1-\left(\frac{1-\tau_t}{1-\tau_t-r_t^D}\right)\left(r_t^R-\frac{r_t^D}{1-\tau_t}\right)\right]$$

Finally, the first order condition with respect to B_t is as follows:

$$\begin{aligned}
&\Big(\frac{1-\tau_t}{1-\tau_t-r_t^D}\Big)\Big(r_t^B-\frac{r_t^D}{1-\tau_t}\Big)\big[-1+\gamma^R g'(k_t^R-d_t)\big] \\
&-\big(w_S\frac{\Delta A_t^S}{\Delta B_t}\big)\gamma^R\Big[g(k_T^R-d_t)-g'(k_t^R-d_t)k_t^R\Big] \\
&-\big(w_S\frac{\Delta A_t^S}{\Delta B_t}\big)\Big[j(l_t-\rho_t)+j'(l_t-\rho_t)l_t\Big] \\
&-\big(w_S\frac{\Delta A_t^S}{\Delta B_t}\big)\Big[h(b_t-\bar{b})-h'(b_t-\bar{b})b_t\Big]-h'(b_t-\bar{b}) \\
&=-\beta w_S\frac{\Delta A_t^S}{\Delta B_t}j'(l_{t+1-\rho_{t+1}})l_{t+1}^2
\end{aligned} \tag{3.13}$$

where

$$\frac{\Delta A_t^S}{\Delta A_t^R}=\frac{\tau_t}{1-\tau_t}\Bigg[-1+\Big(\frac{1-\tau_t}{1-\tau_t-r_t^D}\Big)\Big(r_t^B-\frac{r_t^D}{1-\tau_t}\Big)\Bigg]$$

3.4 Estimation

We estimate the model's parameters based on the sub-samples surrounding the 1997 Asian crisis.[3] We obtain estimates of the model's parameters using the following procedure. First, we separately solve equations (3.11), (3.12), and (3.13) using nonlinear least squares to get the initial values. Second, we feed the initial values into the system of three equations (i.e., solve all three simultaneously) and use nonlinear least squares to obtain the parameters estimates of regulatory monitoring cost (γ^R), capital adjustment cost (η_1), loan adjustment cost (α), and debt adjustment cost (θ). During the estimation, we restrict the values of γ^R, η_1, α, and θ to be non-negative.

Table 31 shows the estimated values of capital adjustment cost's parameters, γ^R and η_1, in the pre-crisis period are substantially higher than in the post-crisis period. In the pre-crisis, the credit market was booming and bank's loans soared.[4] In this period the banking system's liquidity was tight as banks competed to extend loans. The higher values of γ^R in the pre-crisis period indicates

[3]We failed to find model convergence when using the full sample and with the crisis period data. This seems to imply that the 1997 Asian crisis caused a break in bank behavior; there are two economies at work, pre and post crisis with no unifying model

[4]During the pre-crisis period, loan were approximately at 145 percent of total deposits and represented roughly 69 percent of bank's assets

that given a violation in the capital requirement, the regulator will likely impose higher sanctions than for a similar case in the post-crisis period; in the pre-crisis period higher sanctions provide larger barriers for banks to extend loans thus curbing the loan growth. The estimated values of η_1 suggests that given an increase in the regulatory capital ratio, during the pre-crisis period banks incur higher capital adjustment costs than those in the post-crisis period. During the pre-crisis period, in which the banks' liquidity was tight, it would likely to be more costly for banks to obtain additional fundings to meet the new regulatory capital ratio.

The estimated values of parameters α and θ in table 31 indicate that given a deviation from loan demand (optimal debt level), in the pre-crisis period banks incur higher loan (debt) adjustment costs than in the post-crisis period. Higher parameter values in the pre-crisis period reflect larger costs for banks if they fail to exploit the strong loan-growth or if banks were taking excessive risks by extending loans (debt) more than loan demand (optimal debt level).

Given the model parameters in tables 30 and 31, we solve the model to obtain its steady state values. Table 32 shows that during the pre-crisis period bank assets grows at substantially higher rate than those in the post-crisis period. However, during the pre-crisis period we also find that banks maintained a very high exposure to debt. In this period the steady state value of debt ratio was 16.89 percent, a significantly higher ratio than the post-crisis value of 4.28 percent.

3.5 Simulation Results

In this section, we present the simulation results on how a bank adjusts its portfolio in response to changes in the reserve rate, capital requirement, and loan demand. We provide estimates on how a bank alters its portfolio in risky assets, safe assets, and debt during the pre-crisis and post-crisis periods. The simulation also serves to test whether the crisis in part contributed in shifting bank responses to policy changes or the change in the efficacy of said policies.

3.5.1 Responses to an increase in the reserve rate

We simulate the effect of a one percent increase in the reserve rate parameter, τ_t, to test the hypothesis on whether an increase in the reserve rate is an effective measure to curb loan growth. Given similar shock, we describe balance sheet adjustments in safe assets and debt. In addition, we run two simulations using the estimated parameters of the pre-crisis and post-crisis periods to test whether the crisis has shifted bank responses over time.

Figures 30 and 31 show that the impact of an increase in the reserve rate on balance sheet allocation varies across portfolio items and sub-periods. During the pre-crisis period a one percent increase in the reserve rate reduces growth in risky assets by 0.020 percent on impact, while causing only 0.008 percent reduction in safe assets-growth. A similar shock positively affects debt-growth, although the magnitude is minuscule. In the post-crisis period, given a one percent increase in the reserve rate a bank reduces its portfolio allocation in risky assets by 0.158 percent. A similar shock induces deeper reductions in safe assets (by 0.916 percent), while lowering debt by only 0.002 percent.

In order to measure the relative importance of these results, we normalize the changes in portfolio items with their average growth rate over the corresponding sub-sample period; the average growth rates were calculated directly from the bank panel dataset. During the pre-crisis period the banking system's average growth in risky assets was 2.842 percent, while in the post-crisis period risky assets grew at 0.899 percent. Given an increase in the reserve rate, during the post-crisis period reduction in risky assets-growth represents 17.6 percent of the average system's growth, while in the pre-crisis reduction in risky assets-growth only accounts for 0.7 percent of the average growth. Given these statistics, our findings show that an increase in the reserve rate during the post-crisis has substantially larger relative impact on reducing risky assets-growth than in the pre-crisis period.

In addition, we find that the average growth in safe asset during the pre-crisis (at 5.614 percent) is similar to the post-crisis growth (at 5.136 percent). However, given an increase in the reserve rate, reduction in safe assets-growth in the post-crisis period explains 17.8 percent of the average growth, while only representing 0.14 percent of the pre-crisis period's average growth. These findings show that the relative magnitude impact of an increase in the reserve rate on reducing safe assets-growth during the post-crisis period is considerably larger than in the pre-crisis period.

The findings show that an increase in the reserve rate has the intended effects on curbing growth in risky assets. However, we find that during the post-crisis period a similar shock generates much larger contractionary effects on risky assets allocation than those in the pre-crisis period. In the pre-crisis period, given an increase cost of deposit fundings banks switch to debt as an alternate source. In this period, the availability of non-deposit funding allows banks to have smaller reduction in risky asset-growth. In contrast, during the post-crisis period a higher standard of prudential practices and more stringent banking supervision discourage banks from increased exposure to debt. As a consequence, given an increase in the reserve rate during the post-crisis period we find larger reductions in safe assets as banks liquidate their securities for additional funding.

This result suggest that the 1997 Asian crisis period created a structural break and marked a shift in the structure of bank balance sheets in Indonesia and caused significant changes in the banking system in general. In particular, we find that the shifted structure of bank balance sheet contributes to explaining the larger impact of reserve requirement policy on bank portfolio allocation during the post-crisis period than in the pre-crisis period. Francis and Wijoseno (2016) provides empirical evidences which suggest a similar conclusion; that an increase in the reserve rate during the post-crisis period in Indonesia generates stronger contractionary effects on loans than in the pre-crisis period.

3.5.2 Responses to an increase in the capital requirement

Figures 32 and 33 describe the simulated effects of a one percent increase in the capital requirement parameter, d, on bank portfolio allocation. These figures show that during the pre-crisis period a one percent increase in the risk-based capital requirement induces bank to decrease its portfolio allocation in risky assets (by 0.124 percent). Similar shock causes a larger portion of portfolio allocated in safe assets (by 12.321 percent), while having no compelling impact on debt growth. We find similar results on the impact of capital requirement during the post-crisis period, although its impact is slightly lower in magnitude than those in the pre-crisis period. A one percent increase in the capital requirement in the post-crisis period causes a 0.110 percent reduction in risky assets growth. The same sized shock increases growth in safe assets by 10.872 percent, while having negligible impact on debt growth. During all sub-periods, debt seems to be unaffected by changes in capital requirements. This is not surprising given these debt cannot be counted towards bank capital.[5]

The relative impact of an increase in the risk-based regulatory capital ratio on risky assets-growth in the post-crisis period is substantially larger than in the pre-crisis period; the post-crisis reduction in the growth of risky assets represents 12.2 percent of the average growth, while in the pre-crisis period reduction in risky assets-growth only explains 4.36 percent of the average growth. In addition, our findings show no significant differences on the relative impact of the capital regulation on safe assets-growth across the two sample periods. Given an increase in the risk-based regulatory capital ratio, in the post-crisis period increment in the growth of safe assets represents 211.7 percent of the average growth, while the pre-crisis increment in safe assets-growth accounts for 219.5 percent of the average growth. These results show that the model seems to be overly sensitive to changes in the risk-based capital requirement.

The risk-based capital requirement which has been implemented in Indonesia since 1993 demands higher percentage of capital per risky assets than per safe assets. Our simulation results show that an increase in the capital requirement reduce growth in risky assets, but increases allocation in safe assets. The results are similar across sub-periods. The findings support the hypothesis that higher capital requirement provides incentives for banks to shift away their portfolio toward safer assets.

Our findings, which suggest that an increase in the regulatory capital ratio reduces bank risk-taking behavior are similar to those found in Hellmann, Murdock, and Stiglitz (2000) and Furfine (2001). Hellmann et al. (2000) constructs a dynamic banking model with moral hazard feature to study the interaction between financial liberalization and prudential regulation. Their findings show that capital requirements induce prudent practices by reducing gambling incentives. However, they argue that capital requirement needs to be implemented with additional policy (for example, deposit-rate control; risk-based deposit-insurance premium) to yield Pareto-efficient outcomes. Furfine (2001), which estimates a model based on panel data of large U.S. commercial

[5]Debt consists of securities issued and borrowings by banks

bank between December 1989 and December 1997, shows that a one percent increase in the risk-based capital ratio leads to 3.47 percent reduction in loan-growth (risky assets), but induces 35 percent higher growth in securities (safe assets).

3.5.3 Responses to reduction in loan demand (economic downturn)

We simulate the impact of economic downturn on bank portfolio allocation using the loan demand parameter, ρ. Figures 34 and 35 show that a reduction in loan demand induces banks to shift its portfolio away from risky assets. We find that the magnitude impact of this shock are similar between the pre-crisis and post-crisis periods. A one percent reduction in loan demand during the pre-crisis reduces risky asset growth by 0.138 percent, while increasing safe assets growth by 0.137 percent. Similar shock in the post-crisis period induces bank to decrease its risky asset by 0.122 percent, while raising safe asset growth by 0.107 percent. During both sub-periods, a reduction in loan demand negatively affect debt growth, however, the magnitude of its impact is negligible. The finding shows that reduced loan demand which represent an economic downturn has the expected effects on bank portfolio adjustments. Facing an economic downturn, bank perceives an increase in the risk of default thus shifting its portfolio allocation in risky assets towards safe assets.

Given a sign of economic downturn, in the post-crisis period banks have deeper relative reduction in risky assets than in the pre-crisis period. In response to a one percent reduction in loan demand, the post-crisis reduction risky assets-growth represents 13.6 percent of the average growth, while the pre-crisis reduction in growth of risky assets only explains 4.9 percent of the average growth. In contrast, we find no compelling differences on the relative impact of economic downturn in the growth of safe assets across two sample periods. Given a one percent reduction in loan demand, in the post-crisis period increment in the growth of safe assets represents 2.1 percent of the average growth, while the pre-crisis increment in safe assets-growth accounts for 2.4 percent of the average growth.

3.6 Conclusion

We construct a banking model to explain how bank adjusts its portfolio allocation in risky assets, safe assets, and debt in response to changes in the reserve rate, capital requirement, and loan demand. In particular we examine whether the 1997 Asian crisis created a structural break in bank behavior. We also examine the role of bank debt in affecting bank decisions to adjust their portfolios.

We estimate the model's parameters using nonlinear least squares method on a balanced panel of 22,528 observations from 88 banks during the period of April 1993 to July 2014. We divide the dataset into two sub-samples which represent the period before and after the 1997 Asian crisis. We obtain two set of parameters which define banking system in the pre and post crisis period. Given the estimated parameters, we find the solutions of the models and conduct simulation to estimate how bank alters its portfolio in risky assets, safe assets, and debt during the pre-crisis and post-crisis periods.

Our findings suggest that the 1997 Asian crisis created a structural break in bank behavior, marked a shift in the structure of bank balance sheets in Indonesia, and was the impetus to significant changes in the banking system in general. We find that during both sub-periods, an increase in the reserve rate has the intended effects on curbing risky assets growth. However, we find that during the post-crisis period a similar shock generates much larger contractionary effects on risky assets allocation than those in the pre-crisis period. In addition, we show that an increase in the risk-based capital ratio reduces risky assets growth, but increases the growth of safe assets, thus providing evidence that the risk-based capital requirement induces banks to shift their portfolio away from risky assets toward safer assets.

Our findings also show that a reduction in loan demand which represent an economic downturn has the expected effects on bank portfolio adjustments. Facing an economic downturn, bank perceives an increase in the risk of default thus shifting its portfolio allocation in risky assets towards safe assets. Given a sign of economic downturn, in the post-crisis period banks have deeper relative reduction in risky assets than in the pre-crisis period, but we find no compelling differences on the impact of economic downturn in the growth of safe assets across two sample periods.

Tables

Table 1: The Composition of Bank Balance Sheet
(April 1993 - July 2014)

	Mean	Min.	Max.	Std. Dev.
Assets				
Reserves	15.72	0.00	96.59	16.00
Loans	54.61	0.00	489.10	21.41
Securities	6.52	0.00	92.29	11.20
Net Interbank	8.88	-74.91	91.68	16.84
Liabilities				
Deposits	68.15	0.00	162.41	21.39
Capital	13.63	-170.98	99.61	13.48
Debt	7.93	0.00	207.93	18.56

Note:

Presented as percentage of total assets

Number of observations = 22,528

Net Interbank = Interbank Claims - Interbank Liabilities

Table 2: The Composition of Bank Balance Sheet by Sub Sample Periods

	Pre-crisis I (n = 4664)				Crisis I (n = 2904)				Post Crisis I/Pre-crisis II (n = 7920)			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.
Loans	60.78	1.20	97.08	17.99	46.97	2.98	210.73	22.91	49.64	0.00	489.10	24.29
Reserves	2.81	0.00	43.79	3.10	17.04	0.01	92.98	19.34	22.33	0.05	96.59	17.57
Excess Reserves	0.80	-4.42	43.37	3.16	12.58	-5.53	89.73	19.35	16.79	-9.49	96.59	17.61
Securities	2.02	0.00	69.61	5.56	2.54	0.00	75.07	8.82	8.01	0.00	83.52	13.54
Deposits	57.02	1.22	94.58	24.05	60.02	1.91	162.41	26.48	74.95	0.00	150.06	16.14
Capital	14.45	-43.37	86.77	12.12	9.89	-170.98	80.26	19.72	12.41	-125.57	99.61	11.17
Excess Capital	7.82	-49.65	79.31	12.03	4.44	-184.28	78.85	20.09	6.64	-149.20	99.34	11.70
Debt	17.72	0.00	88.42	24.72	20.93	0.00	207.93	30.32	2.47	0.00	85.19	8.97

	Crisis II (n = 1672)				Post Crisis II (n = 5368)			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.
Loans	55.52	0.00	94.98	18.48	60.42	0.00	93.13	15.72
Reserves	22.26	0.55	95.11	15.93	14.44	0.64	95.16	10.20
Excess Reserves	16.81	-2.89	94.69	16.09	8.80	-10.49	94.77	10.35
Securities	6.67	0.00	65.67	10.02	10.34	0.00	92.29	10.58
Deposits	70.95	2.25	92.11	19.08	71.34	0.00	94.52	17.80
Capital	16.35	-1.66	94.89	15.01	15.88	-1.58	95.82	12.36
Excess Capital	10.64	-7.71	94.75	15.65	9.60	-7.78	95.64	12.63
Debt	1.23	0.00	22.48	2.86	2.55	0.00	45.16	5.86

As percentage of total assets

Pre-crisis I (April 1993-August 1997); Crisis I (September 1997-May 2000); Post Crisis I/Pre-crisis II (June 2000-Nov 2007)

Crisis II (December 2007-June 2009); Post Crisis (July 2009-July 2014)

n = number of obervations

Table 3: The Composition of Balance Sheet of Banks by Asset Size (April 1993-July 2014)

Small Banks (n = 11520)				
	Mean	Min.	Max.	Std. Dev.
Loans	54.33	0.00	489.10	24.01
Reserves	17.53	0.00	96.59	18.07
Excess Reserves	12.80	-10.49	96.59	17.69
Securities	4.52	0.00	92.29	9.13
Deposits	69.83	0.00	130.75	20.78
Capital	17.70	-170.98	99.61	14.89
Excess Capital	11.75	-184.28	99.34	15.34
Debt	3.90	0.00	207.93	13.96
Medium Banks (n = 8192)				
	Mean	Min.	Max.	Std. Dev.
Loans	54.79	4.72	118.06	18.35
Reserves	15.22	0.03	84.29	14.64
Excess Reserves	10.74	-7.29	83.34	14.01
Securities	5.50	0.00	61.94	8.11
Deposits	65.72	1.65	97.62	23.13
Capital	10.11	-49.39	80.26	7.07
Excess Capital	4.11	-59.16	78.85	7.06
Debt	11.73	0.00	112.12	22.95
Large Banks (n = 2816)				
	Mean	Min.	Max.	Std. Dev.
Loans	55.22	3.27	146.02	18.16
Reserves	9.78	0.01	56.55	6.32
Excess Reserves	5.00	-6.55	53.66	5.82
Securities	17.66	0.00	83.52	18.12
Deposits	68.35	11.72	162.41	17.58
Capital	7.21	-141.24	25.27	16.00
Excess Capital	0.81	-148.85	22.68	16.06
Debt	13.37	0.00	107.06	16.99

As percentage of total assets

n = number of observations

Table 4: The Composition of Balance Sheet of Banks by Asset Size - Prior and Post Crisis I (as percentage of total assets)

	Pre-crisis I				Crisis I				Post Crisis I/Pre-crisis II			
Small Banks	n = 2385				n = 1485				n = 4050			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.
Loans	58.68	1.20	96.77	20.06	45.23	2.98	210.73	24.04	52.10	0.00	489.10	28.97
Reserves	2.21	0.00	43.79	2.37	18.60	0.18	92.98	21.41	24.85	0.05	96.59	19.65
Excess Reserves	0.05	-4.42	43.37	2.32	13.61	-4.67	89.73	21.29	19.23	-9.49	96.59	19.89
Securities	2.70	0.00	69.61	7.22	1.56	0.00	45.35	4.92	3.25	0.00	79.28	7.07
Deposits	61.68	1.22	94.58	22.56	66.57	1.91	113.02	22.53	75.94	0.00	130.75	17.16
Capital	19.24	-13.01	86.77	14.43	15.99	-170.98	69.74	14.24	14.93	-112.85	99.61	13.22
Excess Capital	12.40	-20.05	79.31	14.44	10.37	-184.28	62.56	14.81	9.38	-149.20	99.34	14.00
Debt	8.52	0.00	88.42	20.00	8.85	0.00	207.93	24.83	1.42	0.00	85.19	6.94
Medium Banks	n = 1696				n = 1056				n = 2880			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.
Loans	61.43	8.10	97.08	16.51	47.00	4.72	118.06	19.19	48.92	8.84	93.32	18.33
Reserves	3.02	0.03	41.06	3.71	16.82	0.09	84.29	18.27	22.58	1.25	76.19	15.62
Excess Reserves	1.16	-3.96	39.73	3.82	13.10	-5.53	83.34	18.52	17.19	-7.29	70.44	15.34
Securities	0.86	0.00	30.77	2.22	1.49	0.00	23.46	4.13	6.20	0.00	55.44	8.70
Deposits	53.32	1.65	90.45	27.68	50.73	2.02	97.62	27.81	73.23	11.11	95.50	16.26
Capital	9.37	-43.37	39.20	6.50	8.94	-49.39	80.26	9.90	10.16	-20.71	69.94	7.68
Excess Capital	2.93	-49.65	31.95	6.49	3.70	-59.16	78.85	9.99	4.41	-25.71	67.54	7.67
Debt	26.82	0.00	87.00	29.18	31.55	0.00	112.12	33.38	3.38	0.00	81.54	11.09
Large Banks	n = 583				n = 363				n = 990			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.
Loans	67.45	29.37	82.29	9.39	54.02	3.27	146.02	26.55	41.65	4.84	80.95	14.79
Reserves	4.63	0.97	27.24	3.05	11.27	0.01	56.55	10.25	11.29	0.16	36.90	5.72
Excess Reserves	2.82	-1.10	26.74	2.96	6.86	-4.93	53.66	10.39	5.66	-6.55	30.31	5.56
Securities	2.65	0.00	20.11	3.69	9.56	0.00	75.07	20.43	32.77	0.00	83.52	18.10
Deposits	48.68	22.55	72.95	10.87	60.28	11.72	162.41	29.29	75.85	30.58	150.06	9.89
Capital	9.62	3.61	22.95	2.97	-12.25	-141.24	24.76	36.81	8.59	-125.57	25.27	7.46
Excess Capital	3.33	-2.06	16.50	2.82	-17.69	-148.85	22.68	37.53	1.93	-131.49	18.83	7.48
Debt	28.85	9.52	65.41	8.16	39.44	9.19	107.06	18.03	4.12	0.00	60.99	8.89

Table 5: The Composition of Balance Sheet of Banks by Asset Size - Prior and Post Crisis II (as percentage of total assets)

	Post Crisis I/Pre-crisis II				Crisis II				Post Crisis II			
Small Banks	n = 4050				n = 855				n = 2745			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.
Loans	52.10	0.00	489.10	28.97	54.13	0.00	94.98	20.42	58.82	0.00	93.13	17.33
Reserves	24.85	0.05	96.59	19.65	26.02	0.55	95.11	17.52	16.81	0.76	95.16	12.08
Excess Reserves	19.23	-9.49	96.59	19.89	20.82	-2.89	94.69	17.97	11.25	-10.49	94.77	12.37
Securities	3.25	0.00	79.28	7.07	4.52	0.00	65.67	10.60	9.59	0.00	92.29	12.12
Deposits	75.94	0.00	130.75	17.16	67.35	2.25	91.83	22.19	70.44	0.00	94.52	19.70
Capital	14.93	-112.85	99.61	13.22	22.58	-0.10	94.89	18.58	19.84	-0.78	95.82	15.74
Excess Capital	9.38	-149.20	99.34	14.00	17.24	-7.48	94.75	19.33	13.70	-7.26	95.64	16.11
Debt	1.42	0.00	85.19	6.94	1.22	0.00	22.48	3.30	1.72	0.00	24.13	3.77
Medium Banks	n = 2880				n = 608				n = 1952			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.
Loans	48.92	8.84	93.32	18.33	56.19	14.19	85.30	17.61	61.45	11.44	84.91	14.78
Reserves	22.58	1.25	76.19	15.62	20.59	0.60	71.35	14.06	12.42	0.64	58.59	7.60
Excess Reserves	17.19	-7.29	70.44	15.34	14.90	-2.47	64.40	13.58	6.79	-4.53	51.97	7.41
Securities	6.20	0.00	55.44	8.70	6.45	0.00	42.07	7.94	10.38	0.00	61.94	8.91
Deposits	73.23	11.11	95.50	16.26	74.16	15.81	92.11	15.86	70.90	18.10	90.86	17.48
Capital	10.16	-20.71	69.94	7.68	9.86	-1.66	21.84	4.59	11.36	-1.58	31.14	4.88
Excess Capital	4.41	-25.71	67.54	7.67	3.94	-7.71	16.34	4.60	4.98	-7.78	25.02	4.79
Debt	3.38	0.00	81.54	11.09	0.94	0.00	10.35	1.81	3.58	0.00	45.16	8.34
Large Banks	n = 990				n = 209				n = 671			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.
Loans	41.65	4.84	80.95	14.79	59.27	29.51	80.24	10.22	64.02	28.90	79.80	9.33
Reserves	11.29	0.16	36.90	5.72	11.72	3.15	27.58	4.73	10.63	2.41	26.52	4.25
Excess Reserves	5.66	-6.55	30.31	5.56	5.90	-2.27	20.95	4.47	4.60	-3.00	19.87	4.17
Securities	32.77	0.00	83.52	18.10	16.08	3.12	33.38	7.26	13.30	0.44	40.30	7.27
Deposits	75.85	30.58	150.06	9.89	76.33	33.83	87.65	7.48	76.27	32.79	87.80	5.73
Capital	8.59	-125.57	25.27	7.46	9.69	4.17	15.44	2.05	12.83	4.34	19.87	2.50
Excess Capital	1.93	-131.49	18.83	7.48	3.10	-1.32	9.13	2.19	6.27	-0.72	13.72	2.56
Debt	4.12	0.00	60.99	8.89	2.11	0.00	13.70	3.18	2.97	0.00	13.16	2.95

Table 6: The Composition of Balance Sheet of Banks by Capital Level
(April 1993-July 2014)

Low-Capitalized Banks (n = 2304)				
	Mean	Min.	Max.	Std. Dev.
Loans	52.43	0.41	146.02	21.91
Reserves	11.86	0.15	88.13	9.11
Excess Reserves	7.79	-10.49	80.61	9.04
Securities	11.82	0.00	61.94	14.36
Deposits	57.22	3.51	162.41	23.13
Capital	2.56	-141.24	22.95	15.85
Excess Capital	-3.75	-148.85	16.50	15.91
Debt	19.06	0.00	112.12	26.12
Adequately-Capitalized Banks (n = 1024)				
	Mean	Min.	Max.	Std. Dev.
Loans	52.68	3.27	115.57	18.51
Reserves	12.22	0.01	41.56	8.16
Excess Reserves	7.09	-4.93	35.86	7.31
Securities	18.22	0.25	73.61	19.49
Deposits	74.78	25.88	127.07	13.77
Capital	7.09	-124.52	16.59	9.78
Excess Capital	0.90	-130.99	9.22	9.67
Debt	8.78	0.00	78.85	13.57
Highly-Capitalized Banks (n = 19200)				
	Mean	Min.	Max.	Std. Dev.
Loans	54.97	0.00	489.10	21.48
Reserves	16.37	0.00	96.59	16.85
Excess Reserves	11.68	-9.49	96.59	16.39
Securities	5.26	0.00	92.29	9.49
Deposits	69.11	0.00	130.75	21.10
Capital	15.30	-170.98	99.61	12.58
Excess Capital	9.32	-184.28	99.34	12.89
Debt	6.55	0.00	207.93	17.20

As percentage of total assets

n = number of observations

Table 7: The Composition of Balance Sheet of Banks by Capital Level - Prior and Post Crisis I (as percentage of total assets)

	Pre-crisis I				Crisis I				Post Crisis I/Pre-crisis II			
Low-Capitalized Banks	n = 477				n = 297				n = 810			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.
Loans	72.91	27.45	95.04	9.43	61.39	18.85	146.02	21.00	38.45	0.41	80.95	17.73
Reserves	5.06	0.15	24.78	4.30	17.54	1.22	62.22	13.77	13.41	1.25	49.28	8.05
Excess Reserves	3.68	-1.10	24.59	4.28	13.99	-4.09	60.41	14.66	8.41	-7.29	44.23	8.25
Securities	0.82	0.00	4.88	0.93	1.12	0.00	59.25	6.11	20.52	0.00	59.39	17.62
Deposits	35.30	4.15	57.49	14.54	48.46	3.51	162.41	34.63	67.14	18.68	150.06	15.94
Capital	5.56	-0.58	22.95	5.13	-14.86	-141.24	21.13	36.40	3.41	-125.57	13.20	7.49
Excess Capital	-0.89	-7.94	16.50	4.94	-20.05	-148.85	14.76	37.24	-3.17	-131.49	6.75	7.50
Debt	45.70	9.52	88.42	20.48	55.20	21.17	112.12	18.75	5.39	0.00	81.54	14.45
Adequately-Capitalized Banks	n = 212				n = 132				n = 360			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.
Loans	64.41	43.89	79.40	9.87	48.88	3.27	115.57	20.68	40.60	4.84	90.60	19.77
Reserves	4.20	1.06	13.06	2.37	10.32	0.01	37.45	7.75	16.88	2.95	41.56	8.67
Excess Reserves	2.07	-2.03	9.90	2.15	5.56	-4.93	31.51	7.31	10.89	-0.98	35.86	8.51
Securities	4.40	0.25	20.11	5.45	15.38	0.61	73.61	24.48	31.27	0.92	72.44	21.54
Deposits	61.27	35.48	83.79	15.47	65.09	25.88	127.07	18.07	80.49	48.69	97.64	7.50
Capital	9.23	5.39	16.59	2.50	-4.99	-124.52	9.79	21.64	6.87	-21.76	11.93	4.89
Excess Capital	2.86	-1.24	9.22	2.10	-10.83	-130.99	3.63	21.55	0.73	-28.10	5.90	4.94
Debt	22.56	3.09	44.41	12.19	23.63	2.14	78.85	17.39	2.23	0.00	34.24	5.91
Highly-Capitalized Banks	n = 3975				n = 2475				n = 6750			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.
Loans	59.13	1.20	97.08	18.52	45.14	2.98	210.73	22.63	51.46	0.00	489.10	24.72
Reserves	2.46	0.00	43.79	2.82	17.34	0.09	92.98	20.27	23.69	0.05	96.59	18.37
Excess Reserves	0.39	-4.42	43.37	2.83	12.79	-5.53	89.73	20.20	18.11	-9.49	96.59	18.44
Securities	2.04	0.00	69.61	5.84	2.02	0.00	75.07	6.76	5.27	0.00	83.52	9.91
Deposits	59.40	1.22	94.58	24.03	61.14	1.91	113.02	25.36	75.59	0.00	130.75	16.21
Capital	15.79	-43.37	86.77	12.50	13.66	-170.98	80.26	13.17	13.78	-112.85	99.61	11.19
Excess Capital	9.13	-49.65	79.31	12.44	8.19	-184.28	78.85	13.58	8.13	-149.20	99.34	11.71
Debt	14.11	0.00	87.00	23.47	16.67	0.00	207.93	29.34	2.13	0.00	85.19	8.15

Table 8: The Composition of Balance Sheet of Banks by Capital Level - Prior and Post Crisis II (as percentage of total assets)

	Post Crisis I/Pre-crisis II				Crisis II				Post Crisis II			
Low-Capitalized Banks	n = 810				n = 171				n = 549			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.
Loans	38.45	0.41	80.95	17.73	46.85	1.71	80.24	20.67	52.16	5.09	79.80	19.94
Reserves	13.41	1.25	49.28	8.05	12.40	0.60	37.35	5.93	12.26	0.64	88.13	7.91
Excess Reserves	8.41	-7.29	44.23	8.25	7.48	-2.17	31.76	5.93	7.12	-10.49	80.61	7.89
Securities	20.52	0.00	59.39	17.62	12.28	0.00	42.07	7.82	14.18	0.01	61.94	9.19
Deposits	67.14	18.68	150.06	15.94	64.56	15.81	90.80	18.47	64.07	18.10	94.52	16.32
Capital	3.41	-125.57	13.20	7.49	5.54	-1.66	16.14	4.63	7.19	-1.58	15.94	5.51
Excess Capital	-3.17	-131.49	6.75	7.50	-1.09	-7.71	8.95	4.42	0.89	-7.78	9.42	5.40
Debt	5.39	0.00	81.54	14.45	1.45	0.00	13.70	3.53	2.04	0.00	13.16	3.35
Adequately-Capitalized Banks	n = 360				n = 76				n = 244			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.
Loans	40.60	4.84	90.60	19.77	56.23	37.18	77.42	12.94	61.28	41.13	79.65	8.70
Reserves	16.88	2.95	41.56	8.67	15.69	7.08	28.05	5.54	12.26	3.83	30.40	5.34
Excess Reserves	10.89	-0.98	35.86	8.51	9.47	0.60	21.88	5.47	5.84	-2.92	23.26	5.25
Securities	31.27	0.92	72.44	21.54	15.54	1.62	33.38	11.89	13.33	0.44	40.30	8.46
Deposits	80.49	48.69	97.64	7.50	81.41	73.30	87.41	3.67	81.25	73.10	88.84	3.66
Capital	6.87	-21.76	11.93	4.89	8.90	6.03	11.32	1.45	11.52	6.38	15.23	2.14
Excess Capital	0.73	-28.10	5.90	4.94	2.68	-0.26	4.98	1.50	5.24	-0.77	8.72	2.14
Debt	2.23	0.00	34.24	5.91	0.95	0.01	2.83	0.80	0.89	0.00	3.59	0.82
High-Capitalized Banks	n = 6750				n = 1425				n = 4575			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.
Loans	51.46	0.00	489.10	24.72	56.52	0.00	94.98	18.19	61.37	0.00	93.13	15.14
Reserves	23.69	0.05	96.59	18.37	23.79	0.55	95.11	16.60	14.82	0.76	95.16	10.59
Excess Reserves	18.11	-9.49	96.59	18.44	18.32	-2.89	94.69	16.81	9.16	-4.53	94.77	10.76
Securities	5.27	0.00	83.52	9.91	5.52	0.00	65.67	9.68	9.72	0.00	92.29	10.72
Deposits	75.59	0.00	130.75	16.21	71.15	2.25	92.11	19.36	71.68	0.00	90.86	18.10
Capital	13.78	-112.85	99.61	11.19	18.04	2.85	94.89	15.55	17.16	2.44	95.82	12.79
Excess Capital	8.13	-149.20	99.34	11.71	12.47	-1.55	94.75	16.18	10.87	-4.11	95.64	13.11
Debt	2.13	0.00	85.19	8.15	1.22	0.00	22.48	2.84	2.70	0.00	45.16	6.22

Table 9: The Composition of Balance Sheet of Banks by Ownership (April 1993-July 2014)

Domestic Banks (n = 18432)				
	Mean	Min.	Max.	Std. Dev.
Loans	53.65	0.00	146.02	19.33
Reserves	16.32	0.00	95.16	16.66
Excess Reserves	11.32	-9.49	94.77	16.20
Securities	6.52	0.00	92.29	11.38
Deposits	73.96	0.00	162.41	15.58
Capital	14.16	-170.98	95.82	13.43
Excess Capital	8.20	-184.28	95.64	13.71
Debt	3.87	0.00	107.06	9.07
Foreign Banks (n = 4096)				
	Mean	Min.	Max.	Std. Dev.
Loans	58.92	0.00	489.10	28.60
Reserves	13.00	0.03	96.59	12.26
Excess Reserves	9.96	-10.49	96.59	12.15
Securities	6.53	0.00	79.53	10.38
Deposits	42.04	0.00	119.95	24.31
Capital	11.23	-135.14	99.61	13.44
Excess Capital	4.92	-152.00	99.34	13.71
Debt	26.21	0.00	207.93	33.41

As percentage of total assets

n = number of observations

Table 10: The Composition of Balance Sheet of Banks by Ownership - Prior and Post Crisis I (as percentage of total assets)

	Pre-crisis I				Crisis I				Post Crisis I/Pre-crisis II			
Domestic Banks	n = 3816				n = 2376				n = 6480			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.
Loans	58.75	1.20	97.08	18.42	43.94	2.98	146.02	20.77	48.19	2.16	135.92	19.41
Reserves	2.67	0.00	43.79	2.75	16.68	0.01	92.98	20.42	23.34	0.05	93.04	18.05
Excess Reserves	0.40	-4.42	43.37	2.79	11.52	-5.53	89.73	20.36	17.48	-9.49	88.27	18.08
Securities	2.29	0.00	69.61	6.07	3.07	0.00	75.07	9.66	8.41	0.00	83.52	14.22
Deposits	65.41	10.53	94.58	16.65	69.41	9.38	162.41	18.49	79.38	11.43	150.06	11.00
Capital	15.62	-43.37	86.77	12.77	11.30	-170.98	80.26	20.70	12.24	-125.57	84.19	9.43
Excess Capital	8.86	-49.65	79.31	12.72	5.74	-184.28	78.85	21.03	6.70	-131.49	78.21	9.98
Debt	7.37	0.00	67.93	11.27	9.05	0.00	107.06	17.01	1.75	0.00	43.47	4.31
Foreign Banks	n = 848				n = 528				n = 1440			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.
Loans	69.91	27.45	95.04	12.31	60.62	18.85	210.73	26.81	56.16	0.00	489.10	38.71
Reserves	3.41	0.03	27.24	4.31	18.65	0.09	62.22	13.40	17.76	1.25	96.59	14.36
Excess Reserves	2.62	-0.69	26.74	3.98	17.35	-0.48	60.41	12.94	13.68	-7.29	96.59	14.95
Securities	0.81	0.00	12.09	1.54	0.14	0.00	2.92	0.35	6.21	0.00	57.84	9.76
Deposits	19.23	1.22	56.94	13.70	17.79	1.91	53.40	11.69	54.99	0.00	119.95	20.04
Capital	9.19	-0.58	28.74	6.34	3.58	-135.14	23.81	12.73	13.16	-112.85	99.61	16.90
Excess Capital	3.15	-7.94	24.07	6.50	-1.43	-152.00	19.85	13.71	6.37	-149.20	99.34	17.48
Debt	64.31	28.80	88.42	11.68	74.40	40.52	207.93	16.09	5.70	0.00	85.19	18.61

Table 11: The Composition of Balance Sheet of Banks by Ownership - Prior and Post Crisis II
(as percentage of total assets)

	Post Crisis I/Pre-crisis II				Crisis II				Post Crisis II			
Domestic Banks	n = 6480				n = 1368				n = 4392			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.
Loans	48.19	2.16	135.92	19.41	55.85	0.00	92.28	17.97	61.85	0.00	93.13	14.03
Reserves	23.34	0.05	93.04	18.05	24.29	0.55	95.11	16.63	15.16	1.42	95.16	10.49
Excess Reserves	17.48	-9.49	88.27	18.08	18.57	-2.56	94.69	16.98	9.18	-3.65	94.77	10.77
Securities	8.41	0.00	83.52	14.22	6.43	0.00	65.67	10.16	9.30	0.00	92.29	9.77
Deposits	79.38	11.43	150.06	11.00	74.38	2.25	92.11	17.69	75.71	0.00	90.86	13.99
Capital	12.24	-125.57	84.19	9.43	17.43	2.85	94.89	15.83	16.25	2.44	95.82	12.44
Excess Capital	6.70	-131.49	78.21	9.98	11.93	-1.10	94.75	16.49	10.00	-4.11	95.64	12.78
Debt	1.75	0.00	43.47	4.31	1.48	0.00	22.48	3.10	1.91	0.00	24.13	3.28
Foreign Banks	n = 1440				n = 304				n = 976			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.
Loans	56.16	0.00	489.10	38.71	54.02	1.71	94.98	20.60	54.03	1.20	88.59	20.57
Reserves	17.76	1.25	96.59	14.36	13.11	0.60	37.35	6.94	11.22	0.64	88.13	8.05
Excess Reserves	13.68	-7.29	96.59	14.95	8.86	-2.89	32.09	7.00	7.07	-10.49	80.61	7.96
Securities	6.21	0.00	57.84	9.76	7.74	0.00	42.07	9.30	15.05	0.01	79.53	12.63
Deposits	54.99	0.00	119.95	20.04	55.52	14.16	90.80	17.42	51.66	2.28	94.52	19.74
Capital	13.16	-112.85	99.61	16.90	11.45	-1.66	52.02	9.09	14.23	-1.58	85.50	11.82
Excess Capital	6.37	-149.20	99.34	17.48	4.83	-7.71	46.70	9.15	7.77	-7.78	78.96	11.76
Debt	5.70	0.00	85.19	18.61	0.07	0.00	1.65	0.31	5.43	0.00	45.16	11.43

Table 12: The Aggregate Policy Impact on Bank Portfolio Allocation

	Loans	Securities	Interbank	Deposits
BI Rate	-0.030*	-0.010	-0.063*	0.026
	(0.015)	(0.006)	(0.037)	(0.025)
BI Rate_1	0.082**	-0.006	-0.065*	(0.046)
	(0.018)	(0.007)	(0.037)	(0.028)
BI Rate_2	-0.009	-0.016**	0.024	-0.095**
	(0.019)	(0.008)	(0.035)	(0.027)
BI Rate_3	-0.132**	0.026**	0.076**	0.164**
	(0.026)	(0.010)	(0.034)	(0.027)
BI Rate*Pre-Crisis97	0.001	-0.030	0.187	0.002
	(0.088)	(0.033)	(0.163)	(0.126)
BI Rate*Post-Crisis97	0.366**	0.001	-0.065	0.004
	(0.113)	(0.047)	(0.122)	(0.092)
Reserve Rate	0.036	0.028	-0.623**	-0.052
	(0.168)	(0.088)	(0.179)	(0.142)
Reserve Rate_1	-0.103	-0.043	0.118	-0.400**
	(0.102)	(0.048)	(0.125)	(0.110)
Reserve Rate_2	-0.136	-0.017	-0.011	-0.537**
	(0.309)	(0.049)	(0.304)	(0.226)
Reserve Rate_3	-0.303**	-0.009	0.289	0.518**
	(0.093)	(0.052)	(0.459)	(0.251)
Reserve Rate*Pre-Crisis97	-0.339	0.201*	0.062	-0.549
	(0.219)	(0.119)	(0.524)	(0.376)
Number of observations	22176	22176	22176	22176
R^2	0.143	0.044	0.088	0.501

Standard errors in parentheses

* indicates significance at the 10 percent level; ** indicates significance at the 5 percent level

Reference group for BI rate's impact is the crisis period

Reference group for reserve rate's impact is the post-crisis period

The regression controls for macroeconomic variables (economic growth, and inflation rate) and bank's individual characteristics (excess reserves, asset growth, binding reserve requirement)

Full regression results are available upon request

Table 13: The Policy Impact on Bank Portfolio Allocation - Bank by Size of Assets

	Loans	Securities	Interbank	Deposits
BI Rate	-0.029*	-0.010	-0.062*	0.026
	(0.016)	(0.007)	(0.037)	(0.025)
BI Rate_1	0.082**	-0.006	-0.065*	-0.046
	(0.018)	(0.007)	(0.037)	(0.029)
BI Rate_2	-0.009	-0.016**	0.023	-0.095**
	(0.019)	(0.008)	(0.036)	(0.027)
BI Rate_3	-0.141**	0.022*	0.115**	0.113**
	(0.027)	(0.011)	(0.040)	(0.029)
BI Rate*Pre-Crisis97	0.127	-0.045	0.021	-0.036
	(0.136)	(0.049)	(0.218)	(0.160)
BI Rate*Post-Crisis97	0.418**	0.008	-0.150	0.004
	(0.173)	(0.068)	(0.187)	(0.139)
BI Rate*Medium Bank	-0.005	0.013*	-0.083**	0.111**
	(0.027)	(0.007)	(0.037)	(0.032)
BI Rate*Large Bank	0.081	-0.005	-0.073**	0.088**
	(0.063)	(0.031)	(0.034)	(0.038)
BI Rate*Medium Bank*Pre-Crisis97	-0.201	0.021	0.475	0.161
	(0.195)	(0.066)	(0.359)	(0.280)
BI Rate*Large Bank*Pre-Crisis97	-0.149	0.058	-0.067	-0.188
	(0.180)	(0.064)	(0.250)	(0.351)
BI Rate*Medium Bank*Post-Crisis97	0.060	-0.109	0.146	-0.087
	(0.257)	(0.084)	(0.265)	(0.224)
BI Rate*Large Bank*Post-Crisis97	-0.499**	0.257	0.260	0.251
	(0.240)	(0.184)	(0.234)	(0.180)
Reserve Rate	-0.096	0.028	-0.621**	-0.050
	(0.115)	(0.088)	(0.180)	(0.143)
Reserve Rate_1	-0.095	-0.043	0.122	-0.396**
	(0.103)	(0.048)	(0.126)	(0.112)
Reserve Rate_2	-0.125	-0.017	-0.007	-0.533**
	(0.309)	(0.049)	(0.306)	(0.227)
Reserve Rate_3	-0.786**	-0.050	0.047	1.155**
	(0.166)	(0.077)	(0.858)	(0.420)
Reserve Rate*Pre-Crisis97	0.606**	0.240	0.084	-1.068*
	(0.262)	(0.208)	(0.963)	(0.621)
Reserve Rate*Medium Bank	0.522**	0.046	0.536	-1.217**
	(0.193)	(0.117)	(0.938)	(0.507)
Reserve Rate*Large Bank	0.344*	0.194	0.376	-1.560**
	(0.204)	(0.126)	(0.913)	(0.474)
Reserve Rate*Medium Bank*Pre-Crisis97	-0.139	-0.040	0.088	1.268
	(0.425)	(0.260)	(1.067)	(0.788)
Reserve Rate*Large Bank*Pre-Crisis97	0.285	-0.199	-0.353	0.551
	(0.355)	(0.268)	(1.140)	(0.775)
Number of observations	22176	22176	22176	22176

R^2	0.144	0.046	0.089	0.504

Standard errors in parentheses

* indicates significance at the 10 percent level; ** indicates significance at the 5 percent level

Reference group is small bank in the crisis period

The regression controls for macroeconomic variables (economic growth, and inflation rate) and bank's individual characteristics (excess reserves, asset growth, binding reserve requirement)

Full regression results are available upon request

Table 14: The Policy Impact on Bank Portfolio Allocation - Bank by Level of Capital

	Loans	Securities	Interbank	Deposits
BI Rate	-0.029*	-0.010	-0.063*	0.027
	(0.016)	(0.007)	(0.037)	(0.025)
BI Rate_1	0.082**	-0.006	-0.065*	-0.046
	(0.018)	(0.007)	(0.037)	(0.029)
BI Rate_2	-0.009	-0.016**	0.024	-0.095**
	(0.019)	(0.008)	(0.036)	(0.027)
BI Rate_3	-0.137**	0.030**	0.087**	0.157**
	(0.025)	(0.012)	(0.036)	(0.028)
BI Rate*Pre-Crisis97	0.009	-0.032	0.254	0.010
	(0.096)	(0.036)	(0.186)	(0.134)
BI Rate*Post-Crisis97	0.454**	-0.052	-0.042	0.027
	(0.122)	(0.051)	(0.132)	(0.092)
BI Rate*Low Bank	-0.009	-0.006	-0.073**	0.057
	(0.056)	(0.009)	(0.029)	(0.055)
BI Rate*Adequate Bank	0.115	-0.063	-0.072**	0.029
	(0.132)	(0.072)	(0.022)	(0.055)
BI Rate*Low Bank*Pre-Crisis97	0.196	-0.005	-0.588**	-0.091
	(0.281)	(0.083)	(0.251)	(0.520)
BI Rate*Adequate Bank*Pre-Crisis97	0.121	0.047	-0.180	-0.064
	(0.185)	(0.107)	(0.234)	(0.184)
BI Rate*Low Bank*Post-Crisis97	-0.192	0.379**	-0.251	-0.328
	(0.275)	(0.146)	(0.456)	(0.538)
BI Rate*Adequate Bank*Post-Crisis97	-1.257**	0.308**	0.070	0.240
	(0.574)	(0.128)	(0.146)	(0.286)
Reserve Rate	-0.096	0.028	-0.622**	-0.048
	(0.115)	(0.088)	(0.180)	(0.143)
Reserve Rate_1	-0.095	-0.044	0.120	-0.394**
	(0.103)	(0.048)	(0.126)	(0.111)
Reserve Rate_2	-0.124	-0.017	-0.009	-0.531**
	(0.309)	(0.049)	(0.306)	(0.227)
Reserve Rate_3	-0.536**	0.001	0.017	0.630**
	(0.118)	(0.049)	(0.494)	(0.270)
Reserve Rate*Pre-Crisis97	0.535**	0.191	0.205	-0.565
	(0.213)	(0.137)	(0.586)	(0.417)
Reserve Rate*Low Bank	-0.169	-0.272	2.510	-0.744
	(0.317)	(0.248)	(1.768)	(0.987)
Reserve Rate*Adequate Bank	0.018	0.407*	0.344	-0.799**
	(0.174)	(0.225)	(0.499)	(0.394)
Reserve Rate*Low Bank*Pre-Crisis97	0.399	0.227	-1.358	0.296
	(0.400)	(0.307)	(1.792)	(1.394)
Reserve Rate*Adequate Bank*Pre-Crisis97	0.350	-0.319	0.036	0.052
	(0.368)	(0.209)	(0.637)	(0.836)
Number of observations	22176	22176	22176	22176

R^2	0.143	0.046	0.089	0.503

Standard errors in parentheses

* indicates significance at the 10 percent level; ** indicates significance at the 5 percent level

Reference group is high-capitalized bank in the crisis period

The regression controls for macroeconomic variables (economic growth, and inflation rate) and bank's individual characteristics (excess reserves, asset growth, binding reserve requirement)

Full regression results are available upon request

Table 15: The Policy Impact on Bank Portfolio Allocation - Bank by Type of Ownership

	Loans	Securities	Interbank	Deposits
BI Rate	-0.030*	-0.010	-0.062*	0.027
	(0.015)	(0.007)	(0.037)	(0.025)
BI Rate_1	0.082**	-0.006	-0.065*	-0.046
	(0.018)	(0.007)	(0.037)	(0.029)
BI Rate_2	-0.009	-0.017**	0.023	-0.096**
	(0.019)	(0.008)	(0.036)	(0.027)
BI Rate_3	-0.112**	0.021**	0.081**	0.130**
	(0.024)	(0.009)	(0.036)	(0.024)
BI Rate*Pre-Crisis97	0.019	-0.036	0.261	0.046
	(0.098)	(0.035)	(0.189)	(0.135)
BI Rate*Post-Crisis97	0.176	0.027	-0.098	0.108
	(0.118)	(0.050)	(0.103)	(0.090)
BI Rate*Foreign Bank	-0.114**	0.032**	-0.027	0.191**
	(0.033)	(0.010)	(0.028)	(0.036)
BI Rate*Foreign Bank*Pre-Crisis97	0.106	0.023	-0.420	-0.277
	(0.209)	(0.086)	(0.272)	(0.315)
BI Rate*Foreign Bank*Post-Crisis97	1.108**	-0.147	0.187	-0.572*
	(0.265)	(0.133)	(0.481)	(0.323)
Reserve Rate	-0.099	0.029	-0.621**	-0.047
	(0.114)	(0.088)	(0.180)	(0.143)
Reserve Rate_1	-0.102	-0.042	0.122	-0.390**
	(0.103)	(0.048)	(0.126)	(0.111)
Reserve Rate_2	-0.131	-0.015	-0.007	-0.527**
	(0.308)	(0.050)	(0.306)	(0.228)
Reserve Rate_3	-0.648**	0.056	0.000	0.595**
	(0.102)	(0.047)	(0.508)	(0.276)
Reserve Rate*Pre-Crisis97	0.650**	0.202	0.163	-0.465
	(0.211)	(0.143)	(0.605)	(0.432)
Reserve Rate*Foreign Bank	0.529*	-0.361**	1.586	-0.430
	(0.271)	(0.177)	(1.177)	(0.677)
Reserve Rate*Foreign Bank*Pre-Crisis97	-0.415	0.020	-0.501	-0.313
	(0.493)	(0.221)	(1.201)	(0.914)
Number of observations	22176	22176	22176	22176
R^2	0.146	0.045	0.089	0.504

Standard errors in parentheses

* indicates significance at the 10 percent level; ** indicates significance at the 5 percent level

Reference group is domestic bank in the crisis period

The regression controls for macroeconomic variables (economic growth, and inflation rate) and bank's individual characteristics (excess reserves, asset growth, binding reserve requirement)

Full regression results are available upon request

Table 16: The Islands and Provinces' Selected Indicators

Islands	Provinces	Land Area (km^2)	Population in 2010 (thousand)	2012 GRP per capita (thousand Rupiah)	Share to Total 2012 GDP (%)
Java		**129,307**	**136,610,590**	**15,458.11**	**61.39**
	West Java (WJAV)	45,944	53,685,898	8,306.46	18.48
	Jakarta (DKIJ)	740	9,607,787	45,565.70	17.91
	East Java (EJAV)	46,690	37,476,757	10,348.78	15.69
	Central Java (CJAV)	32,800	32,382,657	6,464.08	8.39
	Yogyakarta (DIY)	3,133	3,457,491	6,605.54	0.93
Sumatra		**446,687**	**50,630,931**	**9,179.21**	**20.93**
	RIAU	87,844	7,217,530	19,756.05	6.10
	North Sumatra (NSMT)	72,428	12,982,204	10,135.62	5.35
	South Sumatra (SSMT)	76,727	8,673,690	9,519.92	3.35
	West Sumatra (WSMT)	42,225	4,846,909	8,824.30	1.75
	Lampung (LMPG)	45,819	7,608,405	5,581.43	1.73
	Aceh (NAD)	56,501	4,494,410	7,928.10	1.45
	Jambi (JAMB)	45,348	3,092,265	6,270.13	0.81
	Bengkulu (BGKL)	19,795	1,715,518	5,418.15	0.38
Kalimantan		**502,412**	**13,787,831**	**14,366.99**	**8.33**
	East Kalimantan (EKLT)	194,849	3,553,143	31,383.69	4.76
	West Kalimantan (WKLT)	120,114	4,395,983	7,605.67	1.35
	South Kalimantan (SKLT)	33,884	3,626,616	9,128.23	1.37
	Central Kalimantan (CKLT)	153,565	2,212,089	9,350.36	0.85
Sulawesi		**193,847**	**17,371,782**	**7,085.07**	**5.00**
	South Sulawesi (SSLW)	62,904	9,193,427	6,930.33	2.61
	North Sulawesi (NSLW)	26,096	3,310,760	7,230.05	0.98
	Southeast Sulawesi (EWSLW)	36,757	2,635,009	5,140.79	0.56
	Central Sulawesi (CSLW)	68,090	2,232,586	9,039.12	0.84
Nusa Bali		**71,296**	**13,074,796**	**5,046.75**	**2.67**
	Bali (BAL)	5,449	3,890,757	8,083.23	1.32
	West Nusa Tenggara (NTB)	19,709	4,500,212	4,173.68	0.77
	East Nusa Tenggara (NTT)	46,138	4,683,827	2,883.34	0.57
Papua		**511,811**	**6,165,396**	**5,984.57**	**1.79**
	Papua (PAP)	424,501	3,593,803	8,900.19	1.46
	Maluku (MALK)	87,310	2,571,593	3,068.95	0.33

Table 17: The Island's Industrial Mix (2012 Regional GDP)

Island	Agri	Mining	Mfg	Electricity	Construction	Trade	Transport	Finance	Services
Java	14.86	1.46	25.88	1.08	6.53	21.96	6.50	10.65	11.09
Sumatra	25.92	15.40	15.75	0.45	5.21	15.33	6.66	4.42	10.86
Kalimantan	23.43	15.59	20.13	0.36	5.36	15.89	7.08	4.43	7.73
Sulawesi	33.16	5.23	8.90	0.69	8.79	14.04	7.80	6.54	14.85
Nusa Bali	31.93	6.48	5.10	0.62	6.52	20.24	8.12	5.33	15.65
Papua	25.37	23.37	9.82	0.38	5.72	14.80	6.19	3.53	10.82

Table 18: The Average Share of Small Firms' Output to Regional GDP

	Percent
Java	29.29
Sumatra	16.06
Kalimantan	11.72
Sulawesi	28.38
Nusa Bali	59.20
Papua	16.06

Less than 19 employees

Table 19: Data Availability

Variable Name	Type	Start date	End date	Coverage	Notes
Real GDP per capita	Regional	1993Q2	2012Q4	26 provinces	-
Bank loans	Regional	1993Q2	2012Q4	26 provinces	-
Bank deposits	Regional	1993Q2	2012Q4	26 provinces	-
Inflation rate	Regional	1993Q2	2012Q4	66 Cities	26 provinces represented
Housing Prices Index	Regional	2006Q2	2012Q4	14 Cities	12 provinces represented
Consumer Expectation Index	Regional	2001Q2	2012Q4	18 Cities	12 provinces represented
Regional Trade Openness	Regional	2000Q1	2012Q4	26 provinces	-
BI Rate	Aggregate	1993Q2	2012Q4	National	-
Inflation rate	Aggregate	1993Q2	2012Q4	National	-
Exchange rate	Aggregate	1993Q2	2012Q4	National	-

Table 20: Regional (islands) responses to monetary policy shocks (%)

	Bank Loans			Bank Deposits			GDP per capita		
	Cumulative	Impact	Q2[1]	Cumulative	Impact	Q2[2]	Cumulative	Q2[3]	Q3[4]
Aggregate (Panel)	-3.243	-0.586	-0.895	0.515	-0.043	-0.587	-0.797	-0.018	-0.183
Java	-3.405	-0.464	-1.037	-0.133	-0.116	-0.532	-0.843	-0.007	-0.208
Sumatra	-2.172	-0.594	-0.379	1.174	0.016	-0.548	-0.598	0.036	-0.157
Kalimantan	-3.428	-1.120	-0.786	0.477	-0.232	-0.373	-0.173	0.099	-0.138
Sulawesi	-2.464	-0.823	-0.051	0.426	-0.071	-0.231	-0.754	0.058	-0.192
Nusa Bali	-1.769	0.023	-0.111	0.475	-0.233	-0.402	-0.167	0.085	-0.152
Papua	-7.538	-2.814	-1.193	0.080	-0.546	-0.306	-0.115	0.068	-0.020
Mean	-3.431	-0.911	-0.636	0.431	-0.175	-0.426	-0.492	0.046	-0.150
Minimum	-7.538	-2.814	-1.193	-0.133	-0.546	-0.587	-0.843	-0.018	-0.208
Maximum	-1.769	0.023	-0.051	1.174	0.016	-0.231	-0.115	0.099	-0.020
Standard Deviation	1.923	0.908	0.455	0.409	0.188	0.134	0.328	0.045	0.062

[1]The trough period of aggregate loans response (2nd quarter after the initial shocks)

[2]The trough period of aggregate deposits response (2nd quarter after the initial shocks)

[3]The lagged impact of MP shocks on GDP per capita

[4]The trough period of aggregate GDP per capita response (3rd quarter after the initial shocks)

Table 21: Provincial responses to monetary policy shocks (%)

	Bank Loans			Bank Deposits			GDP per capita		
	Cumulative	Impact	Q2[1]	Cumulative	Impact	Q2[2]	Cumulative	Q2[3]	Q4[4]
West Java	-4.973	-0.467	-0.776	1.346	0.299	-0.076	-0.718	-0.041	-0.089
Jakarta	-2.679	-0.038	-1.038	-0.426	-0.150	-0.246	-0.572	-0.128	0.038
Yogyakarta	-0.258	-0.307	0.052	0.553	-0.098	-0.074	-0.415	-0.019	-0.060
Central Java	-1.557	0.022	-0.506	1.246	0.109	-0.115	-0.832	-0.018	-0.157
East Java	-2.337	-0.406	-0.478	1.231	0.143	-0.314	-1.001	-0.050	-0.096
Bengkulu	-2.465	-0.531	-0.284	0.511	0.222	0.408	-0.496	-0.027	-0.058
Jambi	-3.835	-1.058	-0.417	1.093	-0.148	0.176	-0.193	0.055	0.001
Aceh	-3.748	-2.160	-0.066	0.812	-0.271	-0.499	0.074	0.034	0.227
North Sumatra	-2.009	-0.149	-0.340	0.961	0.158	-0.566	-0.602	0.071	-0.075
West Sumatra	-0.055	-0.113	0.073	0.900	0.358	-0.303	-0.325	-0.043	-0.068
Riau	-0.622	0.582	-0.026	1.839	-0.071	-0.555	-0.473	0.058	-0.013
South Sumatra	-1.640	-0.711	-0.648	-0.369	-0.381	-0.534	-0.279	-0.004	-0.035
Lampung	-3.805	-1.578	-0.034	0.392	-0.122	0.039	-0.194	0.029	-0.040
South Kalimantan	-2.376	-0.875	-0.987	-0.505	-0.370	-0.364	-0.222	-0.010	0.012
West Kalimantan	-7.291	-1.192	-0.799	1.723	-0.297	0.174	-0.741	0.079	-0.062
East Kalimantan	-2.390	-0.562	-1.084	1.155	0.055	-0.579	0.191	0.129	0.105
Central Kalimantan	-3.467	-1.238	0.319	0.903	0.149	-0.094	-0.910	0.109	-0.020
Central Sulawesi	-1.005	-0.579	-0.076	1.285	0.056	0.587	-0.659	-0.046	0.005
South Sulawesi	-3.835	-0.642	0.085	1.339	-0.102	-0.376	-0.733	-0.044	-0.097
North Sulawesi	-2.787	-0.168	-0.467	0.817	0.318	-0.502	-0.816	0.072	-0.107
Southeast Sulawesi	-0.879	-0.442	0.198	0.676	0.306	0.149	-0.620	0.001	-0.047
West Nusa Tenggara	-2.051	-0.287	0.073	1.009	-0.295	-0.046	0.566	0.063	-0.015
Bali	-2.494	-0.029	-0.356	1.061	0.029	-0.451	-1.064	0.034	-0.082
East Nusa Tenggara	-0.755	-0.019	0.410	0.682	-0.130	-0.111	-0.395	0.074	-0.038
Maluku	-14.710	-3.451	-1.301	0.308	-0.420	0.482	-2.167	-0.005	0.028
Papua	-4.425	-1.431	-1.644	0.395	-0.554	-0.471	-0.046	0.247	0.010
Mean	-3.017	-0.686	-0.389	0.805	-0.046	-0.164	-0.525	0.024	-0.028
Minimum	-14.710	-3.451	-1.644	-0.505	-0.554	-0.579	-2.167	-0.128	-0.157
Maximum	-0.055	0.582	0.410	1.839	0.358	0.587	0.566	0.247	0.227
Standard deviation	2.824	0.802	0.515	0.583	0.249	0.333	0.498	0.073	0.074

[1]The trough period of aggregate loans response (2nd quarter after the initial shocks)

[2]The trough period of aggregate deposits response (2nd quarter after the initial shocks)

[3]The lagged impact of MP shocks on GDP per capita

[4]The trough period of aggregate GDP per capita response (4th quarter after the initial shocks)

Table 22: The top 10 cumulative loan responses to MP shock (%)

	Provinces	Cumulative
1	Maluku (MALK)	-13.369
2	West Kalimantan (WKLT)	-8.174
3	Lampung (LMPG)	-7.587
4	Papua (PAP)	-7.562
5	West Java (WJAV)	-5.339
6	Aceh (NAD)	-5.089
7	South Sumatra (SSMT)	-4.699
8	South Sulawesi (SSLW)	-3.919
9	Jambi (JAMB)	-3.774
10	East Java (EJAV)	-3.745

Table 23: The top 10 cumulative deposit responses to MP shock (%)

	Provinces	Cumulative
1	Jakarta (DKIJ)	-0.079
2	Bali (BAL)	0.242
3	East Nusa Tenggara (NTT)	0.334
4	South Kalimantan (SKLT)	0.463
5	West Nusa Tenggara (NTB)	0.551
6	South Sumatra (SSMT)	1.057
7	West Sumatra (WSMT)	1.198
8	North Sulawesi (NSLW)	1.236
9	Maluku (MALK)	1.332
10	Yogyakarta (DIY)	1.472

Table 24: The top 10 cumulative GDP responses to MP shock (%)

	Provinces	Cumulative
1	Maluku (MALK)	-2.135
2	East Java (EJAV)	-1.877
3	Aceh (NAD)	-1.303
4	North Sumatra (NSMT)	-1.173
5	West Java (WJAV)	-1.107
6	Southeast Sulawesi (SESLW)	-1.085
7	Central Kalimantan (CKLT)	-1.073
8	Yogyakarta (DIY)	-1.030
9	North Sulawesi (NSLW)	-1.026
10	Bali (BAL)	-0.987

Table 25: Housing Prices and Consumer Expectation Responses to MP (island level) (%)

	Housing Price			Consumer Expectation		
	Cumulative	Impact	Q9[1]	Cumulative	Impact	Q6[1]
Aggregate (Panel)	0.322	0.134	-0.027	-0.061	0.182	-0.147
Java	0.358	0.109	-0.004	-0.349	-0.152	-0.252
Sumatra	-1.954	0.048	-0.114	-1.476	1.019	0.078
Kalimantan	0.424	0.237	0.003	-0.109	-0.498	-0.187
Sulawesi	-0.061	-0.148	0.011	0.436	1.041	-0.007
Nusa Bali	0.227	0.468	-0.051	-0.627	-0.592	-0.097
Mean	-0.114	0.142	-0.030	-0.364	0.167	-0.102
Minimum	-1.954	-0.148	-0.114	-1.476	-0.592	-0.252
Maximum	0.424	0.468	0.011	0.436	1.041	0.078
Standard Deviation	0.917	0.205	0.047	0.648	0.722	0.121

[1]The trough period of aggregate housing price response (9th quarter after the initial shocks)
[2]The trough period of aggregate CE response (6th quarter after the initial shocks)
Papua's data are not available

Table 26: Housing Prices and Consumer Expectation Responses to MP (provincial level) (%)

	Housing Price			Consumer Expectation		
	Cumulative	Impact	Q5[1]	Cumulative	Impact	Q5[2]
West Java	0.445	0.242	-0.093	-0.133	0.081	0.195
Jakarta	0.394	0.135	0.075	-0.383	-0.671	0.116
Central Java	0.085	0.051	0.008	-0.448	-0.616	0.173
East Java	0.402	0.078	-0.104	-0.253	-0.406	0.260
North Sumatra	-0.608	-0.170	-0.193	-0.367	-0.308	0.881
West Sumatra	0.236	0.394	0.018	-0.252	0.739	-0.228
South Sumatra	0.023	-0.061	-0.021	-0.324	0.798	-0.331
Lampung	0.286	0.110	0.107	0.041	-0.156	0.179
South Kalimantan	0.424	0.237	0.032	-0.109	-0.498	-0.382
South Sulawesi	-0.385	-0.216	-0.137	-0.059	0.436	0.038
North Sulawesi	-0.441	0.019	0.377	0.113	-0.462	0.588
Bali	0.227	0.468	-0.087	-0.627	-0.592	-0.555
Mean	0.091	0.107	-0.001	-0.233	-0.138	0.078
Minimum	-0.608	-0.216	-0.193	-0.627	-0.671	-0.555
Maximum	0.445	0.468	0.377	0.113	0.798	0.881
Standard Deviation	0.370	0.207	0.149	0.214	0.529	0.410

[1]The trough period of aggregate housing price response (5th quarter after the initial shocks)
[2]The trough period of aggregate CE response (5th quarter after the initial shocks)

Table 27: Explaining the Asymmetric Responses to MP Shock (1)

Dependent variable: The (absolute value) cumulative responses of GDP per capita

	Model(1)	Model(2)	Model(3)	Model(4)
Constant	-0.1002	-0.0276	-0.8808	-0.3211
	(0.5337)	(0.5280)	(0.6860)	(0.5017)
Share of manufacturing sector	0.0038	0.0038	0.0088	0.0025
	(0.0083)	(0.0081)	(0.0096)	(0.0109)
Share of mining sector	0.0011	0.0044	0.0072	0.0118
	(0.0094)	(0.0090)	(0.0105)	(0.0096)
Share of trade, hotel, and restaurant sector	0.0511	0.0517	0.0752^{**}	0.0587^{**}
	(0.0326)	(0.0321)	(0.0320)	(0.0266)
Share of small firms	0.0011	-0.0008	0.0046	0.0032
	(0.0030)	(0.0036)	(0.0055)	(0.0045)
Border		-0.3752^{*}		-1.5371^{**}
		(0.2044)		(0.3032)
Sumatra island			0.1859	-0.0695
			(0.2567)	(0.2454)
Kalimantan island			-0.0718	1.2400^{**}
			(0.2640)	(0.3532)
Sulawesi island			0.5074	0.2510
			(0.2929)	(0.2308)
Nusa Bali island			-0.2126	-0.3532
			(0.3915)	(0.3596)
Papua island			0.5123	0.9431^{**}
			(0.5438)	(0.2332)
Number of observations	26	26	26	26
Adj. $\bar{R}^2$	0.2308	0.2949	0.2868	0.4757

*** $p< 0.01$, ** $p< 0.05$, * $p< 0.1$

Border (dummy) for province neighboring with another country

Island (dummy) for province located on the corresponding island

The reference group is Java island

Table 28: Explaining the Asymmetric Responses to MP Shock (2)

Dependent variable: The (absolute value) 4th quarter responses of GDP per capita

	Model(1)	Model(2)	Model(3)	Model(4)
Constant	-0.0286	-0.0167	-0.0471	-0.0804
	(0.0650)	(0.0631)	(0.1062)	(0.1256)
Share of manufacturing sector	0.0014	0.0014	-0.0006	-0.0003
	(0.0011)	(0.0010)	(0.0015)	(0.0015)
Share of mining sector	0.0008	0.0013	0.0031^{**}	0.0028^{*}
	(0.0011)	(0.0010)	(0.0014)	(0.0014)
Share of trade, hotel, and restaurant sector	0.0050	0.0051	0.0090^{**}	0.0100^{**}
	(0.0037)	(0.0036)	(0.0036)	(0.0043)
Share of small firms	-0.0001	-0.0005	0.0001	0.0002
	(0.0005)	(0.0005)	(0.0008)	(0.0008)
Border		-0.0615^{**}		0.0913^{**}
		(0.0207)		(0.0419)
Sumatra island			-0.0291	-0.0139
			(0.0481)	(0.0514)
Kalimantan island			-0.0934^{*}	-0.1714^{**}
			(0.0461)	(0.0381)
Sulawesi island			-0.0150	0.0002
			(0.0544)	(0.0606)
Nusa Bali island			-0.1083	-0.0999
			(0.0641)	(0.0709)
Papua island			-0.1094^{*}	-0.1350^{**}
			(0.0620)	(0.0479)
Number of observations	26	26	26	26
Adj. $\bar{R}^2$	0.0945	0.2474	0.4282	0.4502

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Border (dummy) for province neighboring with another country
Island (dummy) for province located on the corresponding island
The reference group is Java island

Table 29: The Composition of Bank Balance Sheet by Sub Sample Periods

	Pre-crisis				Crisis				Post Crisis			
	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.	Mean	Min.	Max.	Std. Dev.
Loans	60.78	1.20	97.08	17.99	46.97	2.98	210.73	22.91	49.64	0.00	489.10	24.29
Reserves	2.81	0.00	43.79	3.10	17.04	0.01	92.98	19.34	22.33	0.05	96.59	17.57
Excess Reserves	0.80	-4.42	43.37	3.16	12.58	-5.53	89.73	19.35	16.79	-9.49	96.59	17.61
Securities	2.02	0.00	69.61	5.56	2.54	0.00	75.07	8.82	8.01	0.00	83.52	13.54
Deposits	57.02	1.22	94.58	24.05	60.02	1.91	162.41	26.48	74.95	0.00	150.06	16.14
Capital	14.45	-43.37	86.77	12.12	9.89	-170.98	80.26	19.72	12.41	-125.57	99.61	11.17
Excess Capital	7.82	-49.65	79.31	12.03	4.44	-184.28	78.85	20.09	6.64	-149.20	99.34	11.70
Debt	17.72	0.00	88.42	24.72	20.93	0.00	207.93	30.32	2.47	0.00	85.19	8.97

As percentage of total assets

Pre-crisis (May 1993 - July 1997), crisis (August 1997 - May 2000), and post crisis (June 2000 - July 2014)

Table 30: The calibrated model's parameters

Parameters	Description	Pre-crisis	Post-crisis
r^R	Rate of return on risky assets	0.194636	0.144562
r^X	Rate of return on safe assets	0.109182	0.073116
r^B	Rate of return on debt	0.126682	0.090616
r^D	Rate of return on deposit	0.163911	0.090586
w_r	Weight of risky assets	0.99	0.99
w_s	Weight of safe assets	0.01	0.01
β	Discount factor	0.975	0.975

Pre-crisis (May 1993 - July 1997); post crisis (June 2000 - July 2014)

Table 31: The estimated model's parameters

Parameters	Description	Pre-crisis	Post-crisis
γ^R	Regulatory monitoring cost	0.622957	0.182994
η_1	Parameter of functional form $g()$ in the capital adjustment costs	0.001307	0.000349
α	Parameter of the loan adjustment cost	0.000498	0.000059
θ	Parameter of the debt adjustment cost	0.020518	0.003102

Pre-crisis (May 1993 - July 1997); post crisis (June 2000 - July 2014)

Table 32: The steady-state values

Variables	Description	Pre-crisis	Post-crisis
$\bar{l}$	Growth rate of risk-weighted assets	3.24%	1.71%
$\bar{k}^R$	Risk-based capital ratio	13.55%	16.90%
$\bar{b}$	Debts to weigthed assets ratio	16.89%	4.28%

Pre-crisis (May 1993 - July 1997); post crisis (June 2000 - July 2014)

Figures

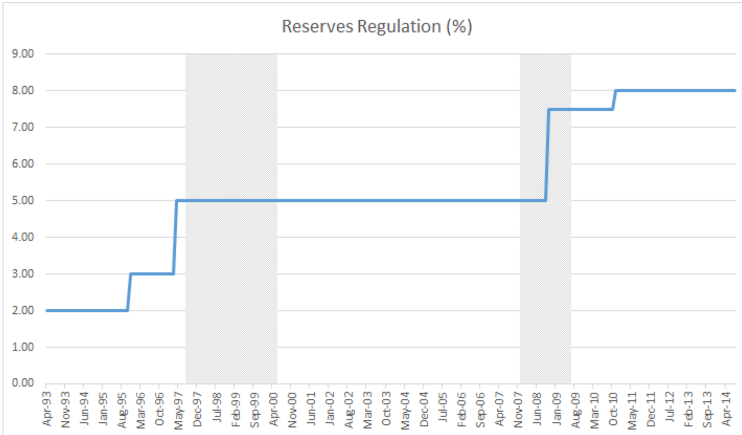


Figure 1: Reserve Regulation in Indonesia 1993-2012

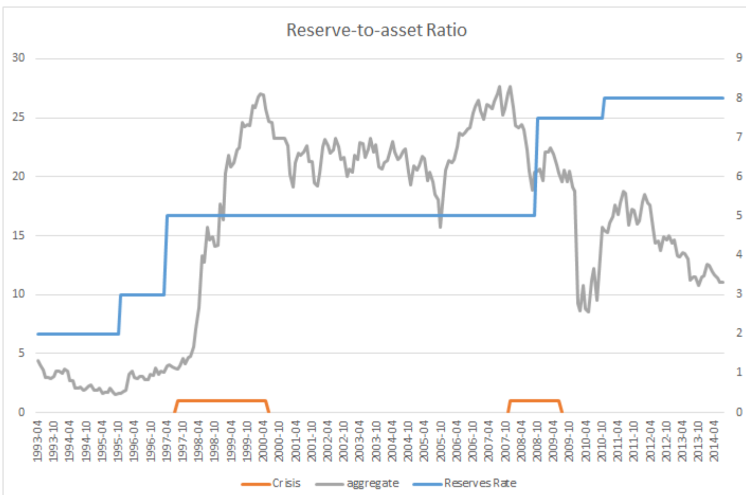


Figure 2: The average of aggregate banks' reserve-to-asset ratio (in percentage)

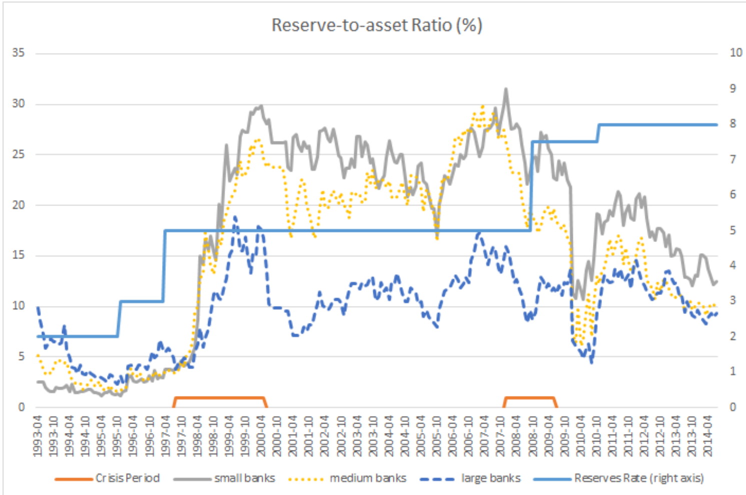


Figure 3: The average of reserve-to-asset ratio by asset size (in percentage)

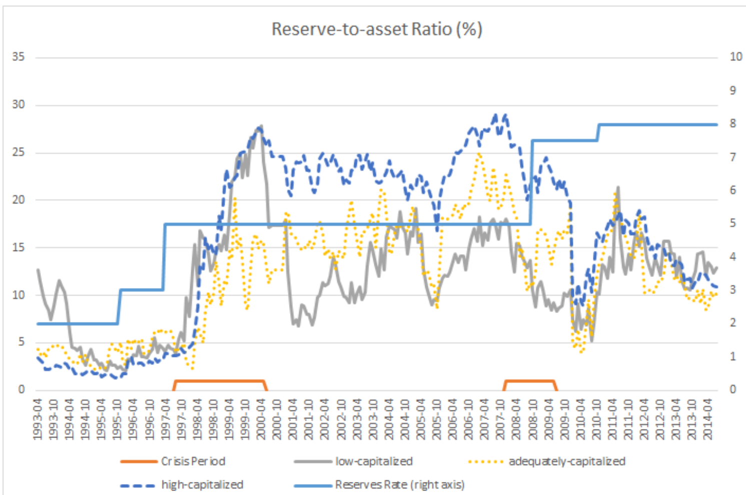


Figure 4: The average of reserve-to-asset ratio by capital level (in percentage)

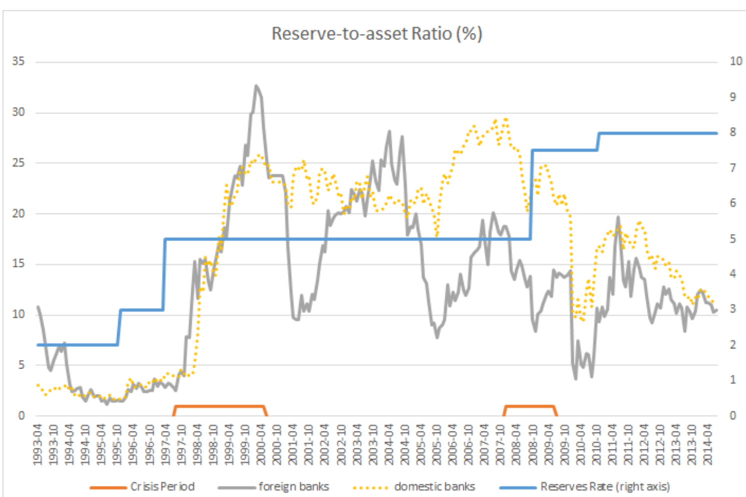


Figure 5: The average of reserve-to-asset ratio by type of ownership (in percentage)

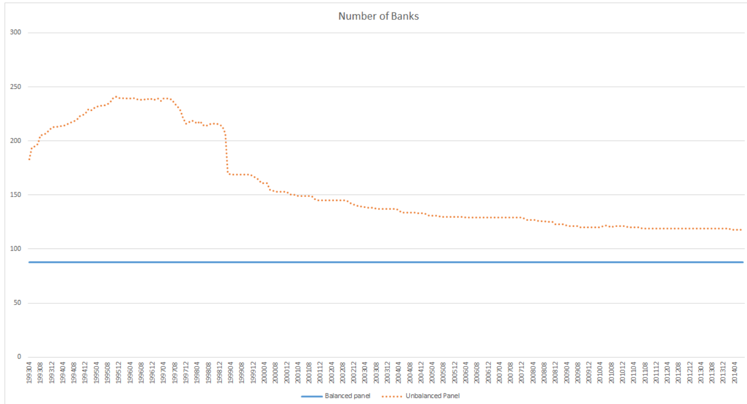


Figure 6: Comparing number of banks to the original dataset (unbalanced panel)

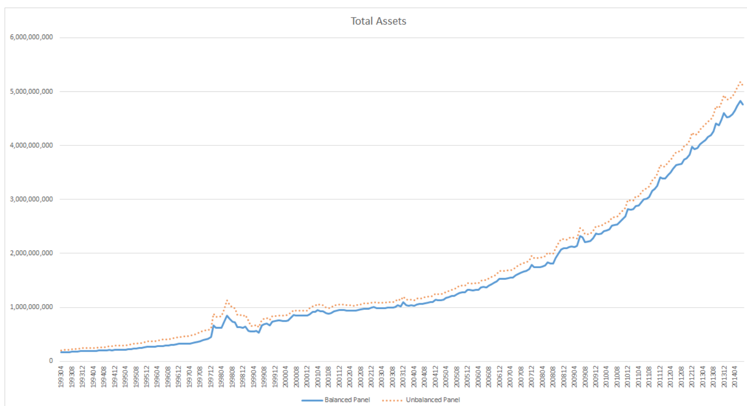


Figure 7: Comparing total assets to the original dataset (unbalanced panel)

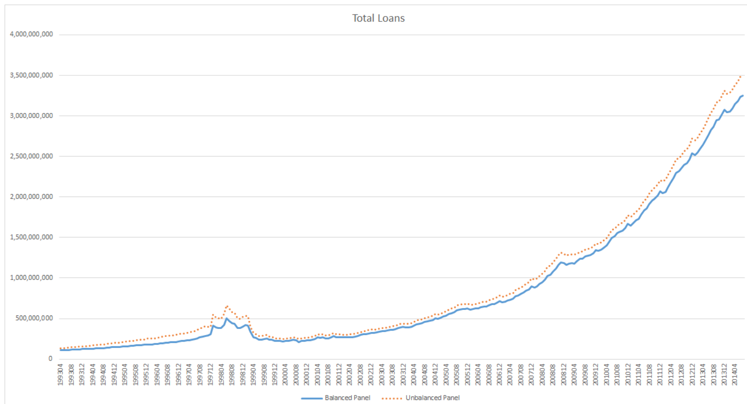


Figure 8: Comparing total loans to the original dataset (unbalanced panel)

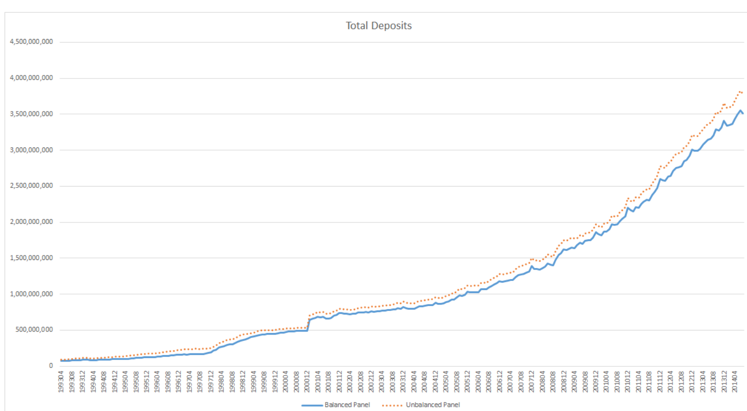


Figure 9: Comparing total deposits to the original dataset (unbalanced panel)

Banks by Size

The panel data contain 88 banks which then group into three size category: small, medium and large banks. Small banks which consist of 45 banks have total assets below the 75th percentile and 11 banks belong to large group are those above 95th percentile. Medium category include banks with assets between 75th and 95th percentile.

The obvious concern with the analysis using this type of grouping is that the result may be highly affected by the fact that banks drift across categories. Overtime, banks may switch categories thus it may affect the results. The transitions probabilities in table 33 suggest that our banks group by size is relatively consistent overtime. Banks that once belong to small group would stay within the same group 98.6 percent of the time. Large banks consistently in the same group 96.8 percent of the time. While medium banks switch categories to higher category in less than 1 percent of the time and move down to small categories 7.8 percent of the time.

Table 33: Transition Probabilities of Banks by Size

Bank Size	Small	Medium	Large	Total
Small				
#Obs.	1,372	20	0	1,392
%	**98.56**	1.44	0	100
Medium				
#Obs.	26	305	1	332
%	7.83	**91.87**	0.3	100
Large				
#Obs.	0	4	120	124
%	0	3.23	**96.77**	100
Total				
#Obs.	1,398	329	121	1,848
%	75.65	17.8	6.55	100

Banks by Capital Level

The bank group by capital level are constructed in reference to the 8 percent capital minimum requirement of Basel Accord. We divide banks into three groups: (1) Low-capitalized banks are those with less than 8 percent capital-to-asset ratio; (2) Adequately-capitalized banks are those with capital-to-asset ratio between 8 and 10 percent; (3) High-capitalized banks are those with capital-to-asset ratio more than 10 percent.

Table 34 show the transition probabilities for each categories. Banks in the high-capitalized category maintain their capital-to-asset ratio more than 10 percent 94.17 percent of the time. Banks with capital-to-asset ratio between 8 and 10 percent stay within the same categories with 40.35 percent probability. Thus these banks are more likely switching categories to either high or low-capitalized. Banks in low category maintain their capital under 8 percent with 72.34 percent probability over the sample period.

Table 34: Transition Probabilities of Banks by Capital Level

Banks Capital	Low	Adequate	High	Total
Low				
#Obs.	170	38	27	235
%	**72.34**	16.17	11.49	100
Adequate				
#Obs.	29	69	73	171
%	16.96	**40.35**	42.69	100
High				
#Obs.	28	56	1,357	1,441
%	1.94	3.89	**94.17**	100
Total				
#Obs.	227	163	1,457	1,847
%	12.29	8.83	78.88	100

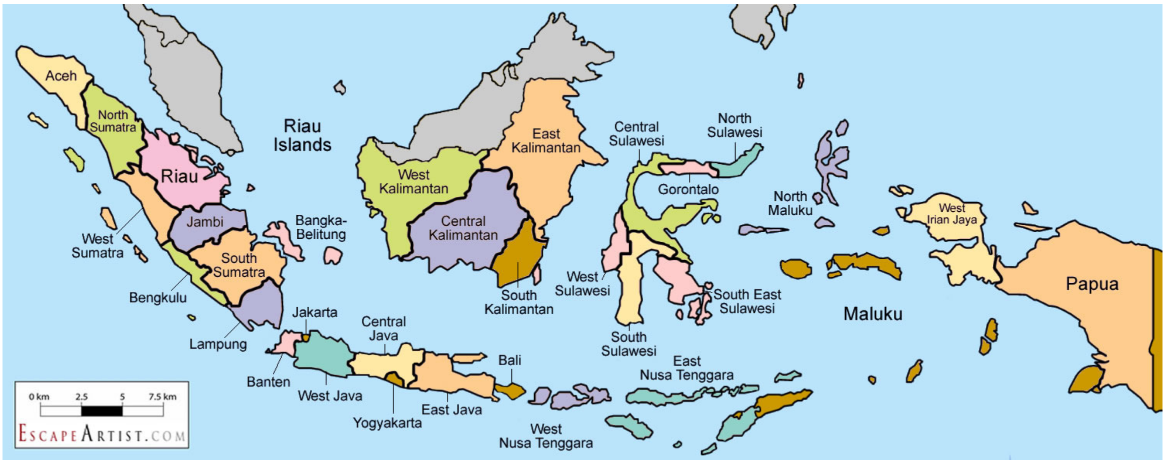
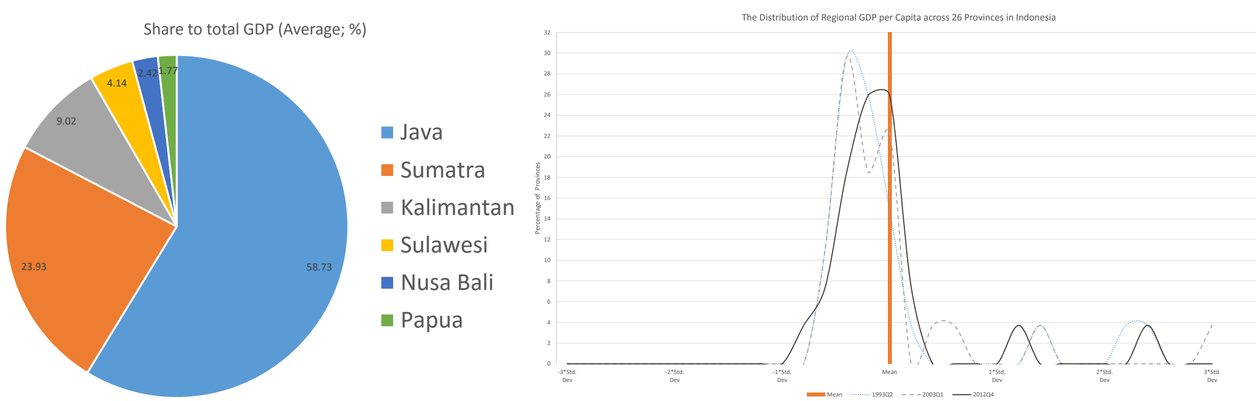


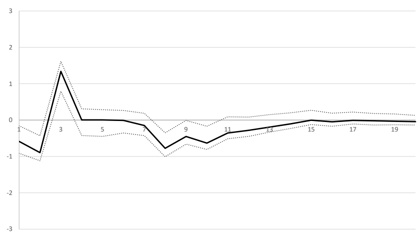
Figure 10: Indonesian Provinces



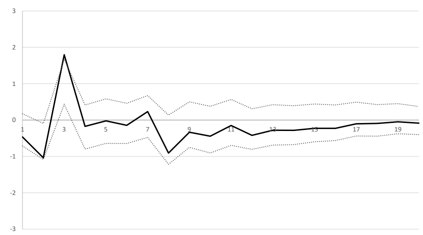
(a) The share of regional GDP

(b) The distribution of regional GDP per capita

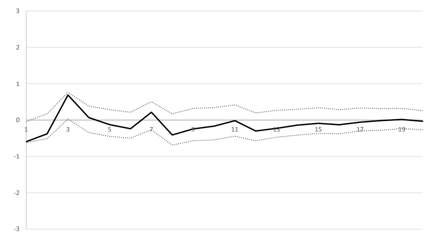
Figure 11: GDP per capita across provinces in Indonesia



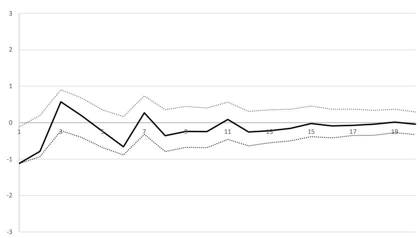
(a) Aggregate



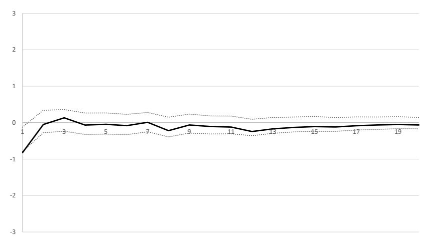
(b) Java



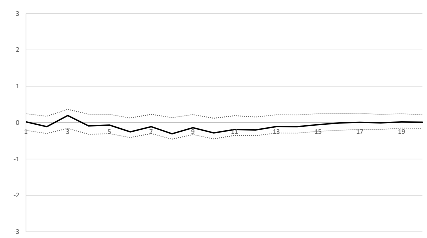
(c) Sumatra



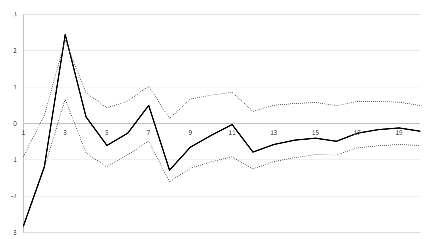
(d) Kalimantan



(e) Sulawesi

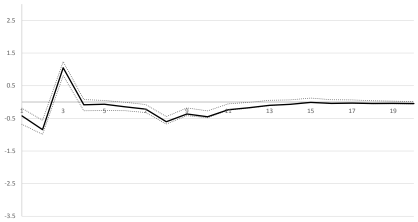


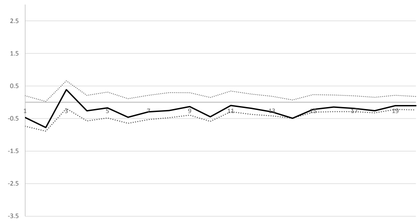
(f) Nusa Bali

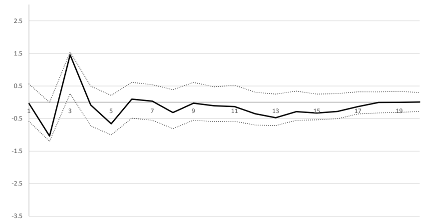


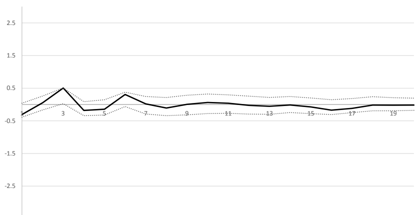
(g) Papua

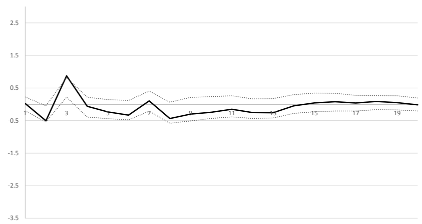
Figure 12: The islands' IRFs of bank loans to one standard deviation increase in the BI rate

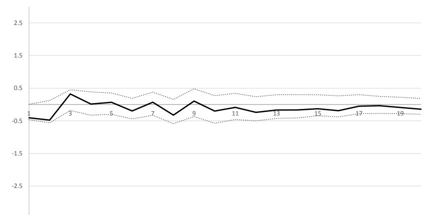

(a) Aggregate

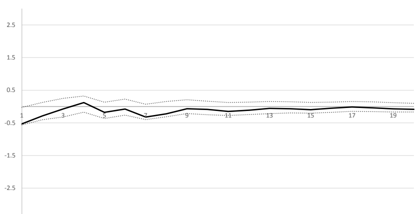

(b) West Java

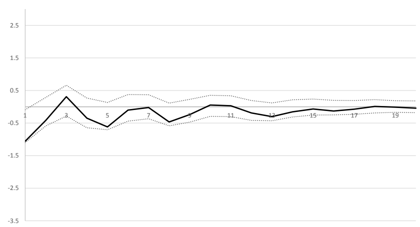

(c) Jakarta

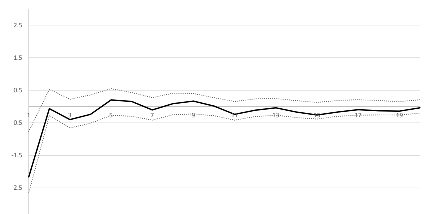

(d) Yogyakarta

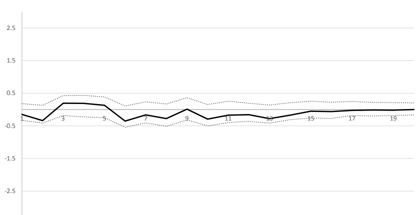

(e) Central Java

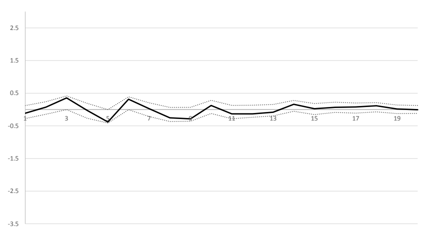

(f) East Java

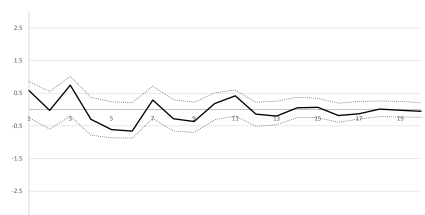

(g) Bengkulu

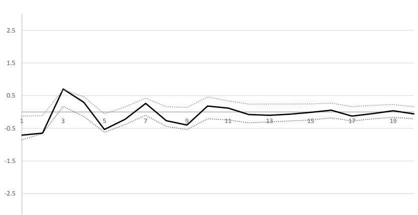

(h) Jambi

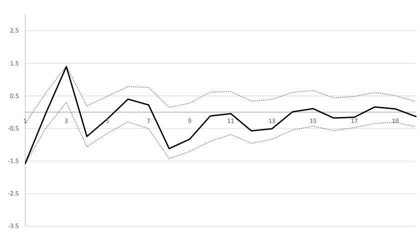

(i) Aceh


(j) North Sumatra


(k) West Sumatra


(l) Riau


(m) South Sumatra


(n) Lampung

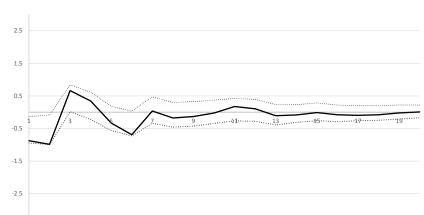
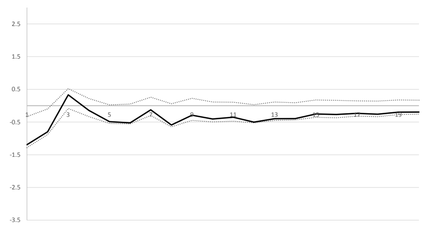
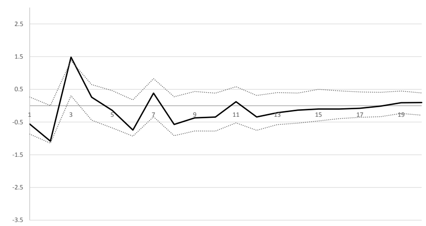

(o) South Kalimantan

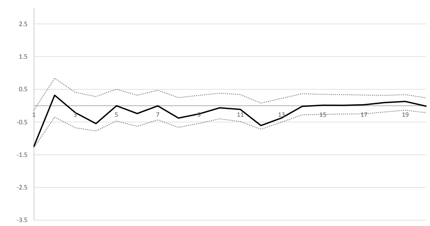
Figure 13: The impulse response functions of bank loans to one standard deviation increase in the BI rate



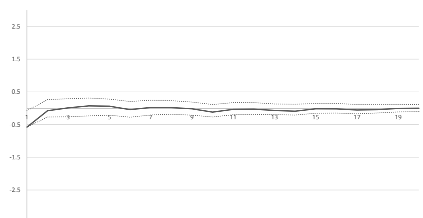
(p) West Kalimantan



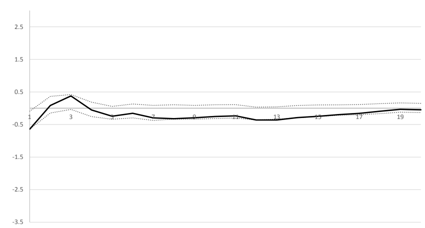
(q) East Kalimantan



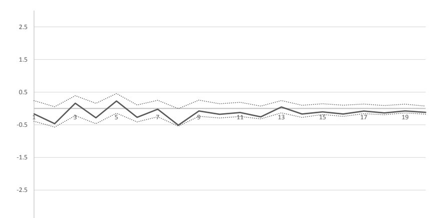
(r) Central Kalimantan



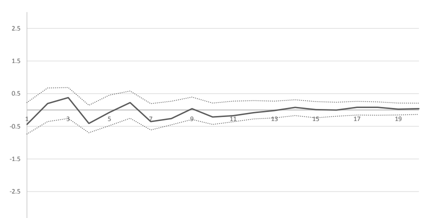
(s) Central Sulawesi



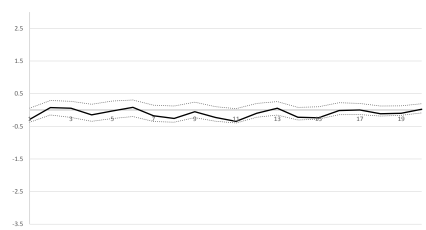
(t) South Sulawesi



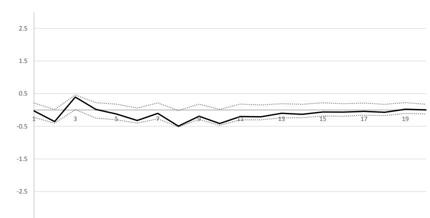
(u) North Sulawesi



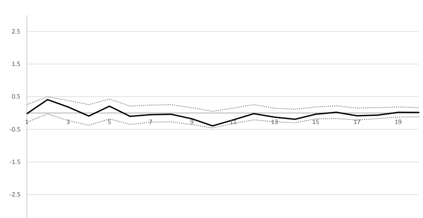
(v) Southeast Sulawesi



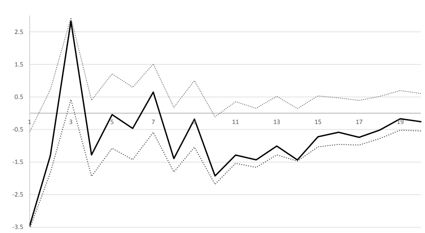
(w) West Nusa Tenggara



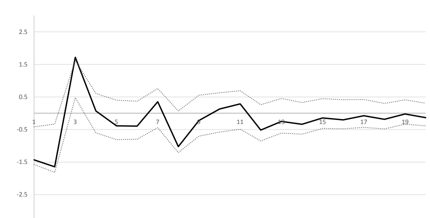
(x) Bali



(y) East Nusa Tenggara

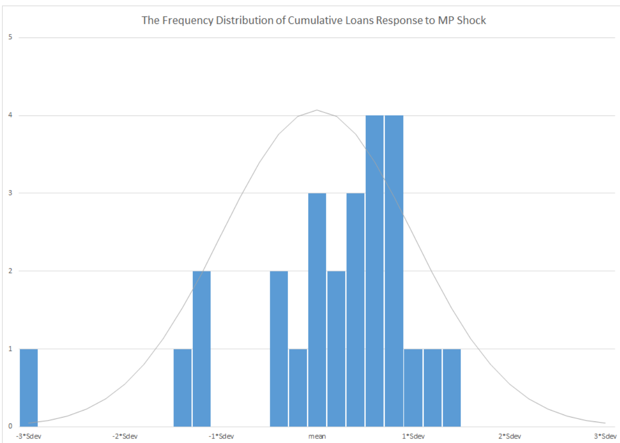


(z) Maluku

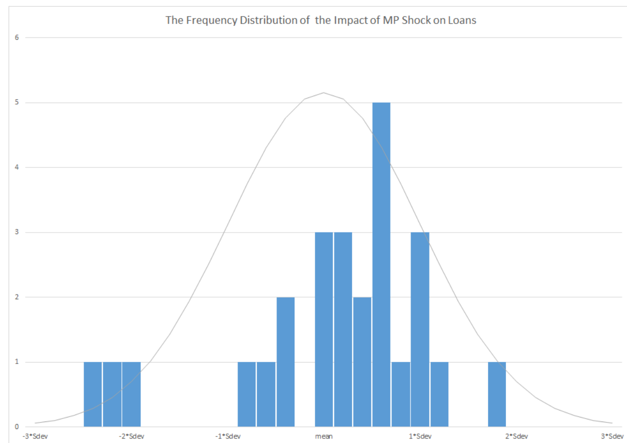


(aa) Papua

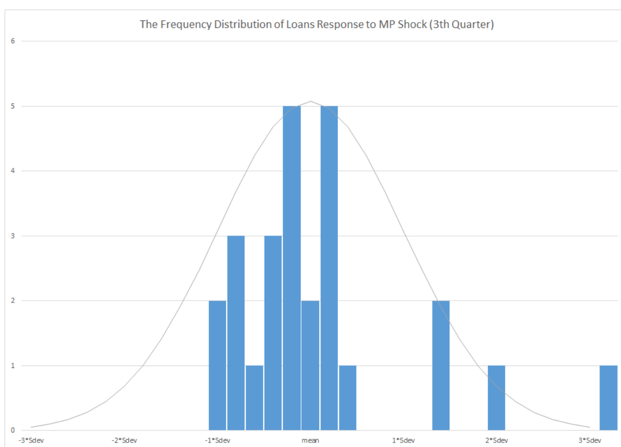
Figure 13: The impulse response functions of bank loans to one standard deviation increase in the BI rate



(a) The provincial cumulative bank loans' responses

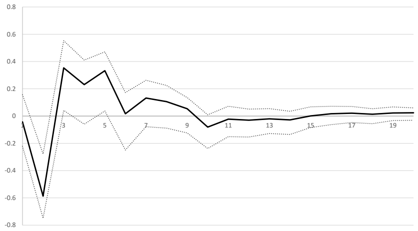


(b) The provincial immediate bank loans' responses

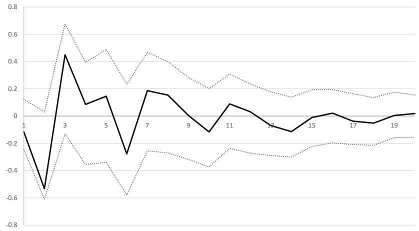


(c) The provincial aggregate maximum bank loans' responses

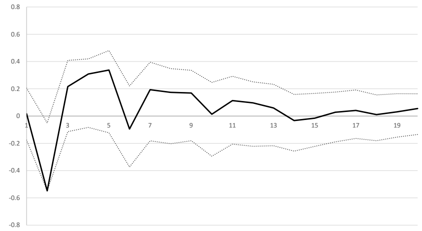
Figure 14: The frequency distribution of cumulative bank loan responses



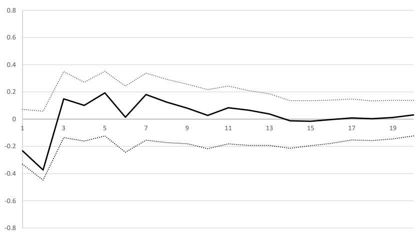
(a) Aggregate



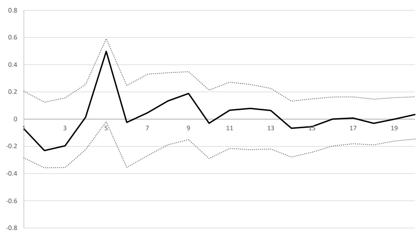
(b) Java



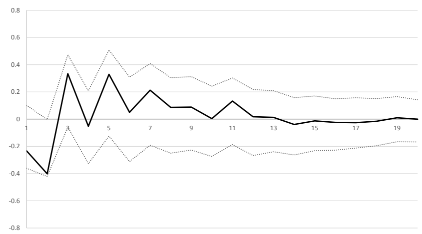
(c) Sumatra



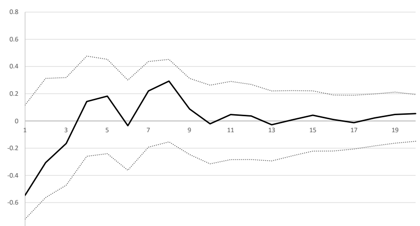
(d) Kalimantan



(e) Sulawesi

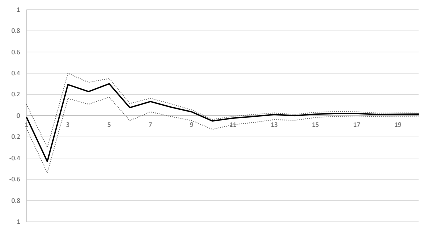


(f) Nusa Bali

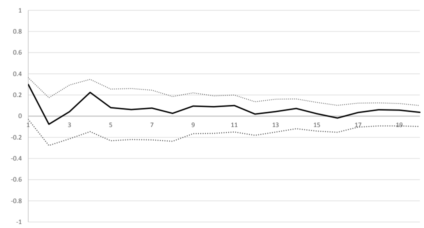


(g) Papua

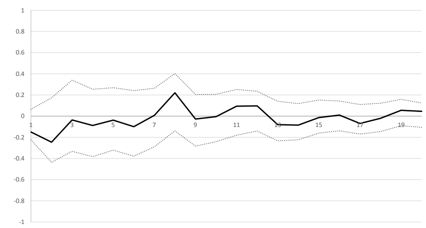
Figure 15: The regions' impulse response function of bank deposits to one standard deviation increase in the policy rate



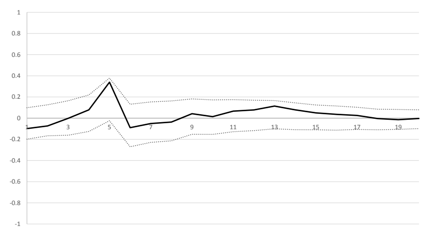
(a) Aggregate



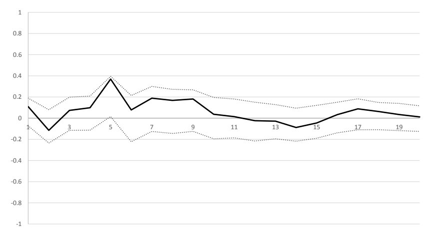
(b) West Java



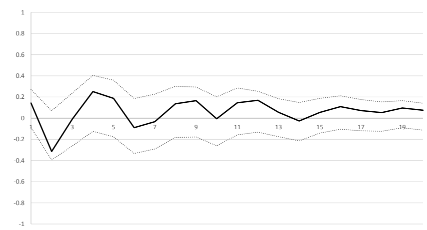
(c) Jakarta



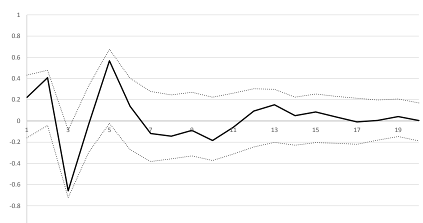
(d) Yogyakarta



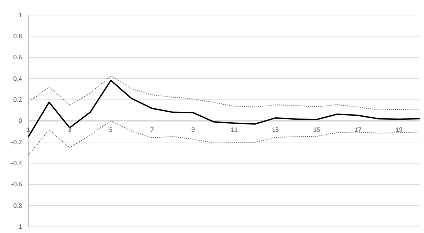
(e) Central Java



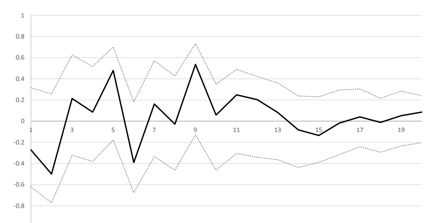
(f) East Java



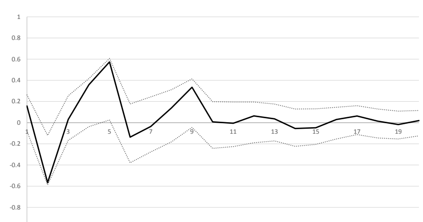
(g) Bengkulu



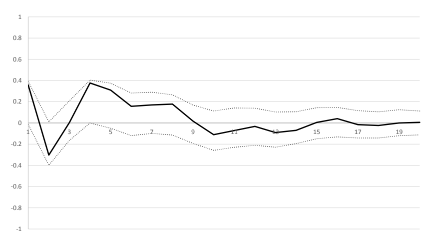
(h) Jambi



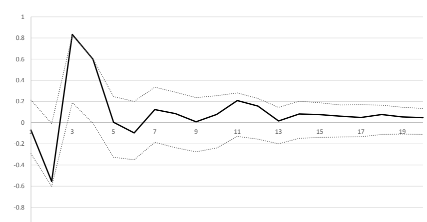
(i) Aceh



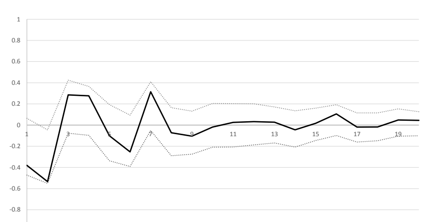
(j) North Sumatra



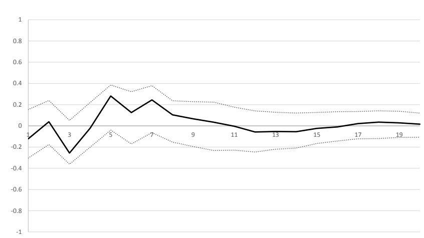
(k) West Sumatra



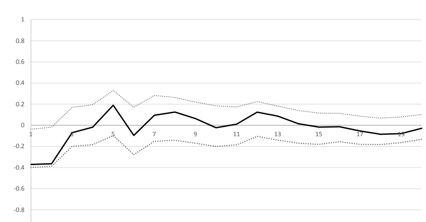
(l) Riau



(m) South Sumatra

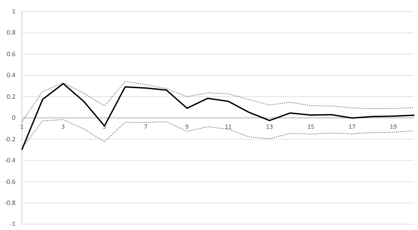


(n) Lampung

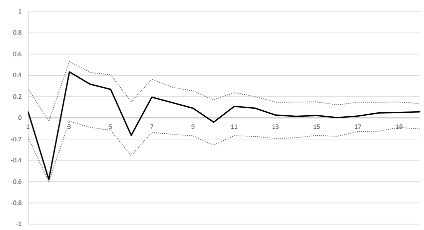


(o) South Kalimantan

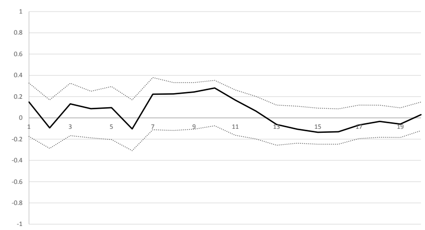
Figure 16: The impulse response functions of bank deposits to one standard deviation increase in the BI rate



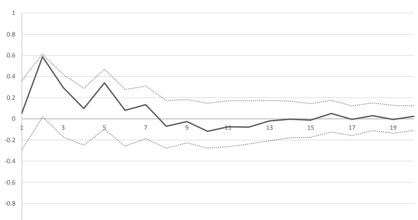
(p) West Kalimantan



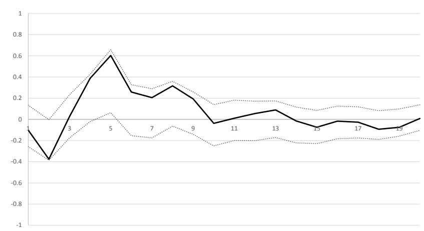
(q) East Kalimantan



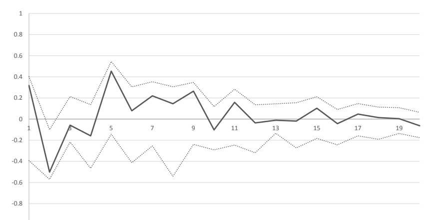
(r) Central Kalimantan



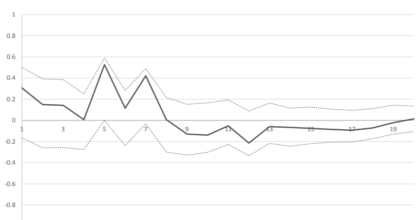
(s) Central Sulawesi



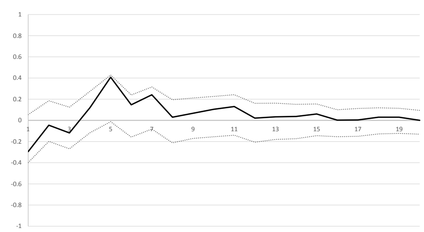
(t) South Sulawesi



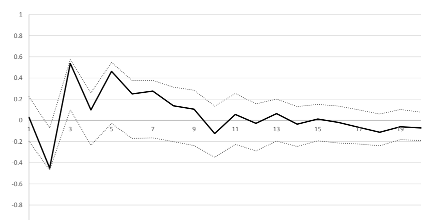
(u) North Sulawesi



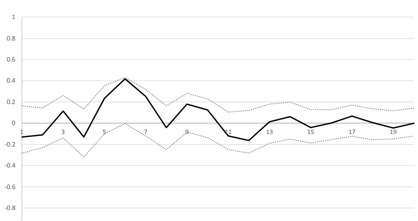
(v) Southeast Sulawesi



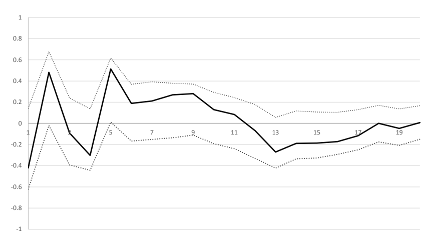
(w) West Nusa Tenggara



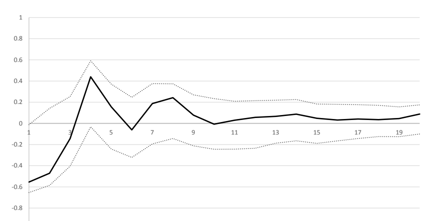
(x) Bali



(y) East Nusa Tenggara

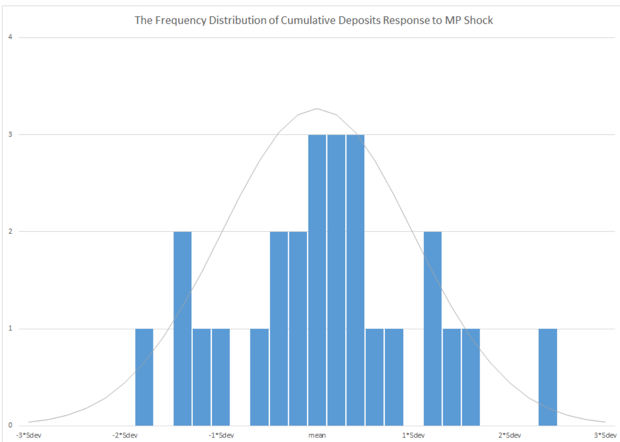


(z) Maluku

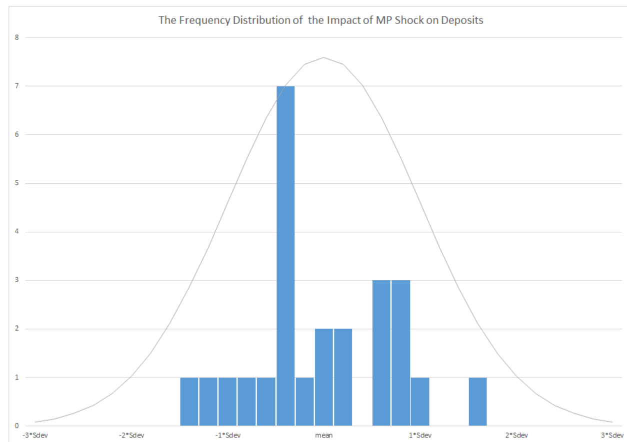


(aa) Papua

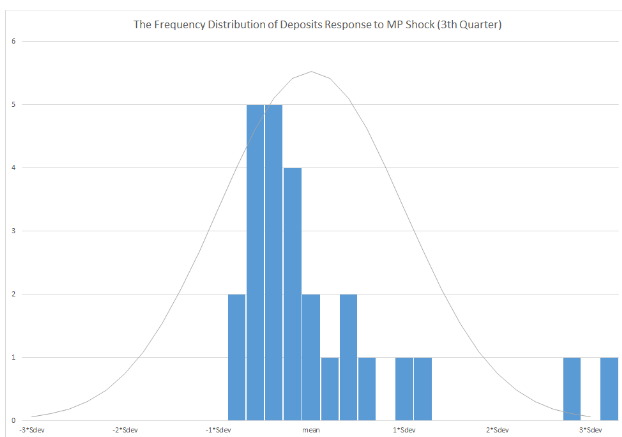
Figure 16: The impulse response functions of bank deposits to one standard deviation increase in the BI rate



(a) The provincial cumulative bank deposits' responses

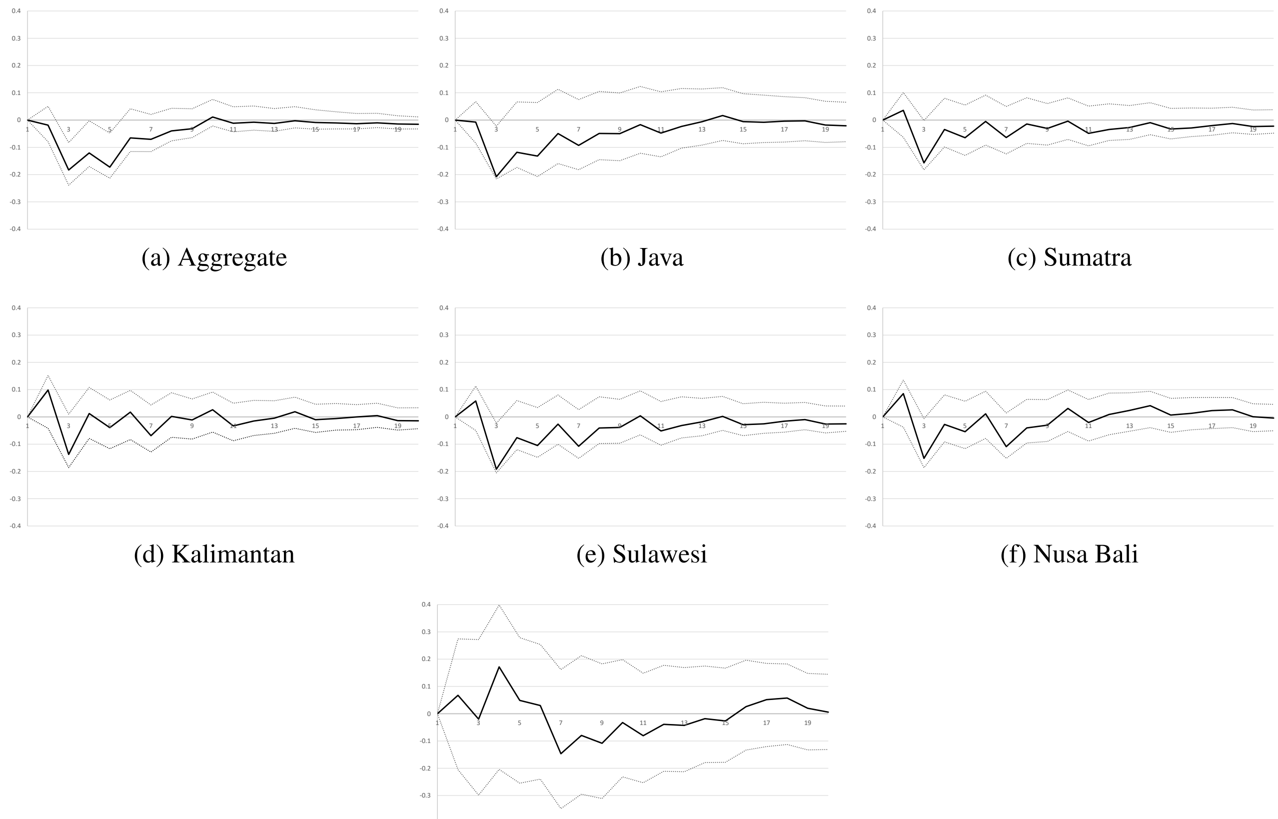


(b) The provincial immediate bank deposits' responses



(c) The provincial aggregate maximum bank deposits' responses

Figure 17: The frequency distribution of cumulative bank deposit responses

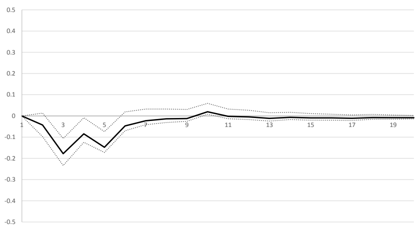


(a) Aggregate (b) Java (c) Sumatra

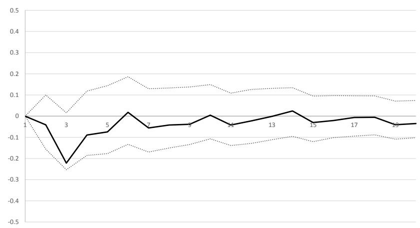
(d) Kalimantan (e) Sulawesi (f) Nusa Bali

(g) Papua

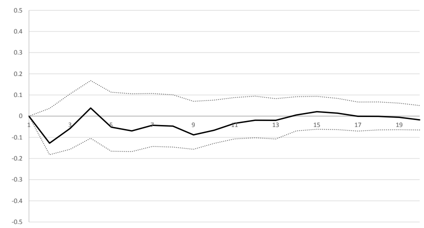
Figure 18: The islands' IRFs of real GDP per capita to one standard deviation increase in the policy rate



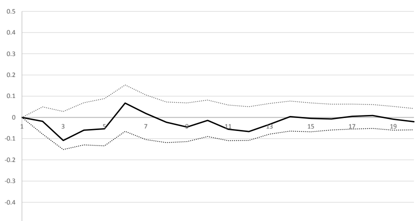
(a) Aggregate



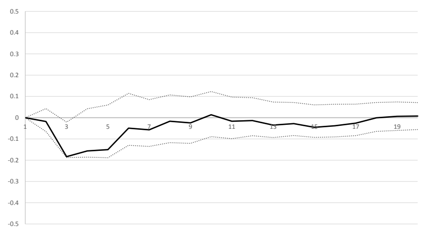
(b) West Java



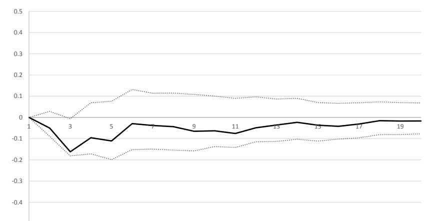
(c) Jakarta



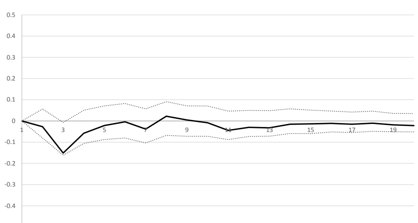
(d) Yogyakarta



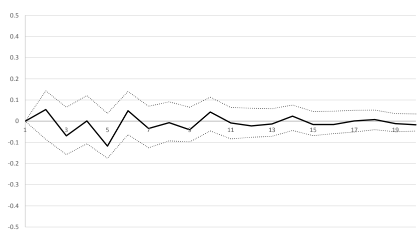
(e) Central Java



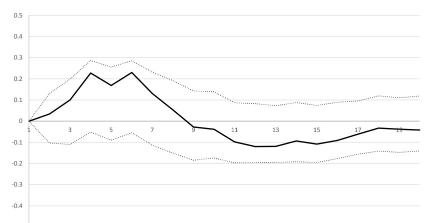
(f) East Java



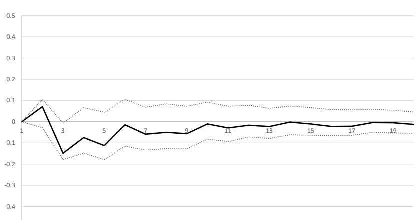
(g) Bengkulu



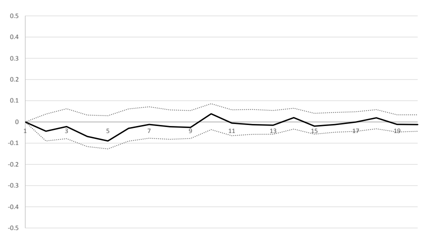
(h) Jambi



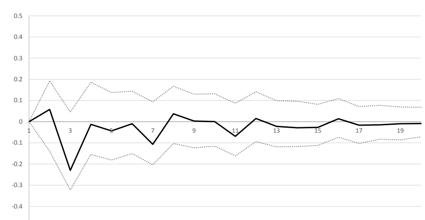
(i) Aceh



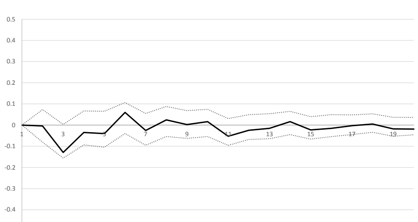
(j) North Sumatra



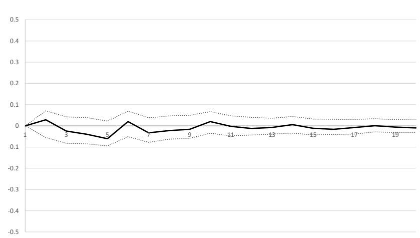
(k) West Sumatra



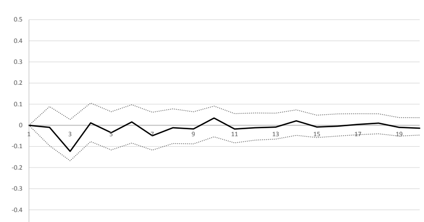
(l) Riau



(m) South Sumatra

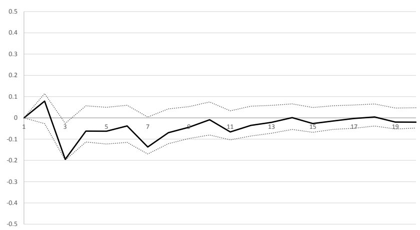


(n) Lampung

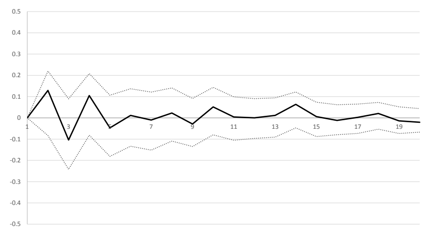


(o) South Kalimantan

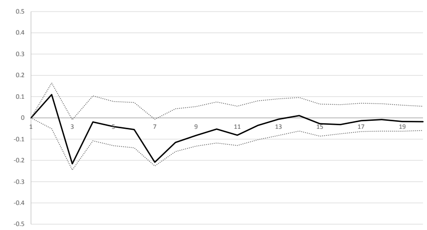
Figure 19: The impulse response functions of real GDP per capita to one standard deviation increase in the BI rate



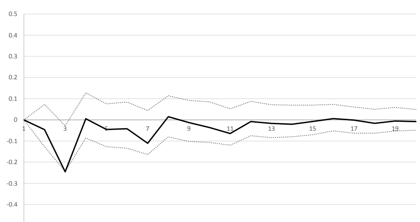
(p) West Kalimantan



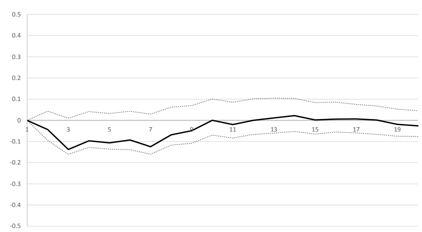
(q) East Kalimantan



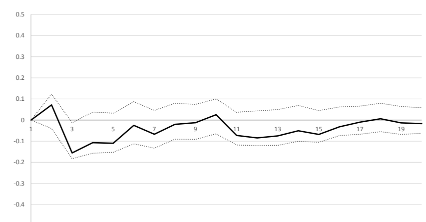
(r) Central Kalimantan



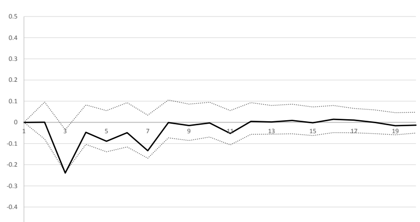
(s) Central Sulawesi



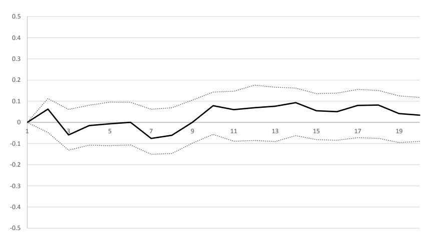
(t) South Sulawesi



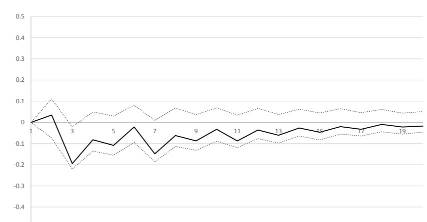
(u) North Sulawesi



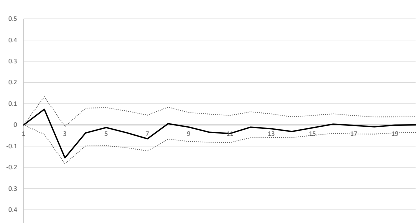
(v) Southeast Sulawesi



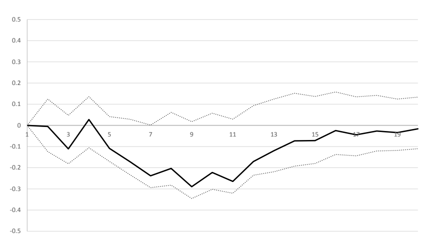
(w) West Nusa Tenggara



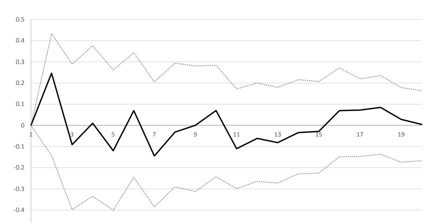
(x) Bali



(y) East Nusa Tenggara

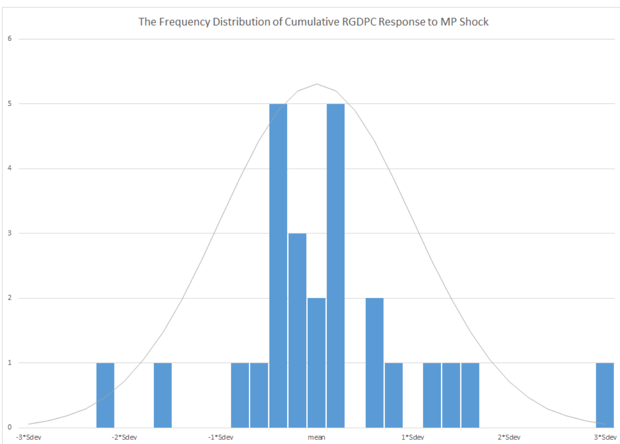


(z) Maluku

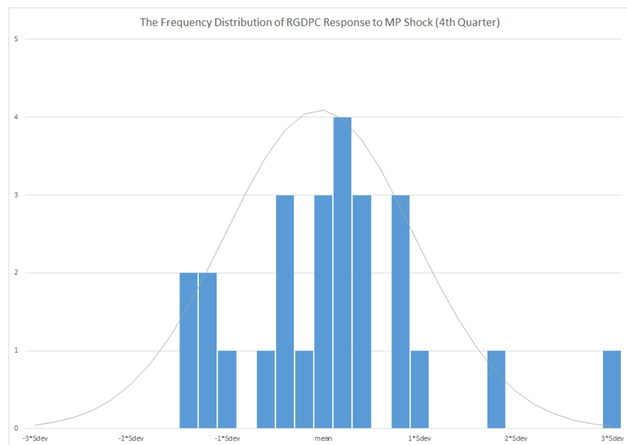


(aa) Papua

Figure 19: The impulse response functions of real GDP per capita to one standard deviation increase in the BI rate

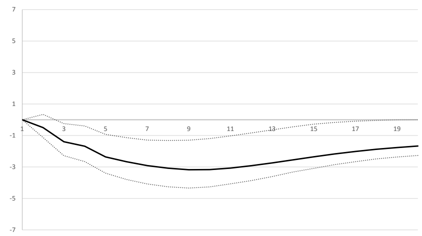


(a) The provincial cumulative real GDP responses

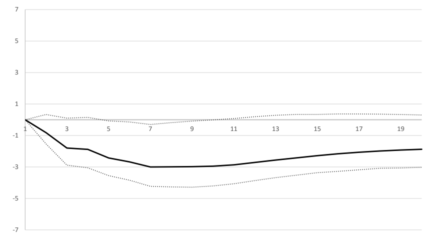


(b) The provincial aggregate maximum real GDP responses

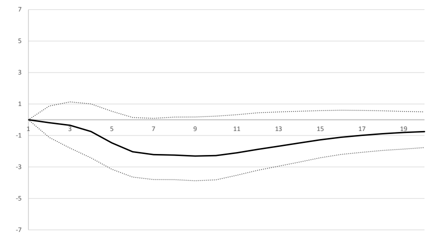
Figure 20: The frequency distribution of cumulative GDP responses



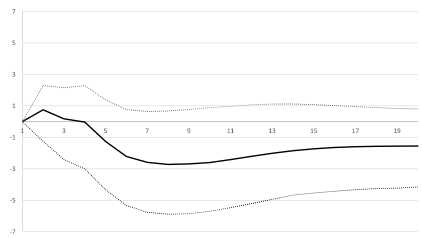
(a) Aggregate



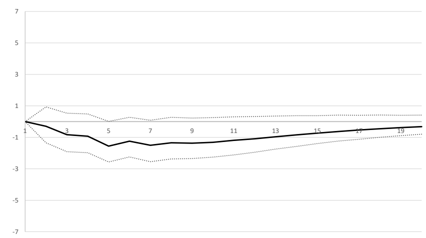
(b) Java



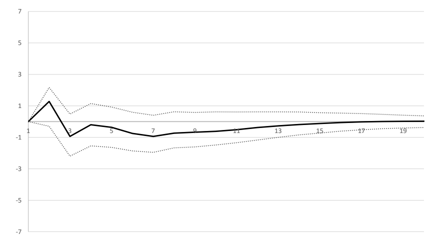
(c) Sumatra



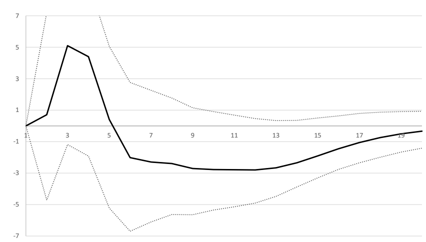
(d) Kalimantan



(e) Sulawesi

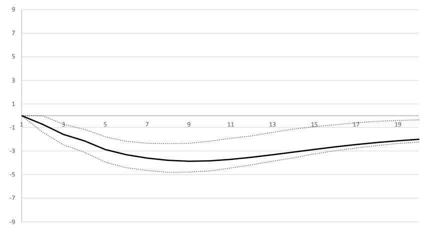


(f) Nusa Bali

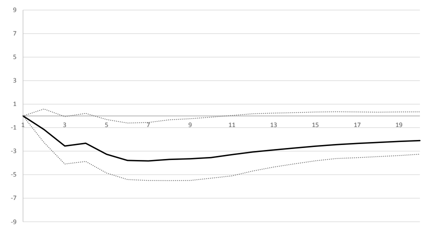


(g) Papua

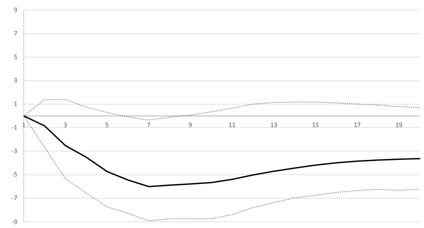
Figure 21: The island IRFs of trade openness to one standard deviation increase in the BI rate



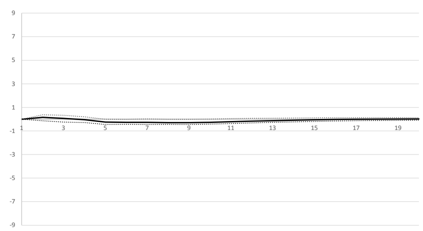
(a) Aggregate



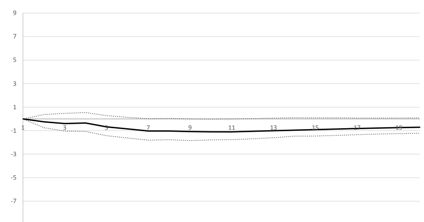
(b) West Java



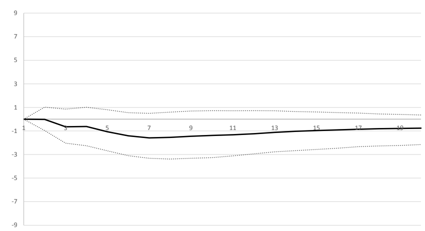
(c) Jakarta



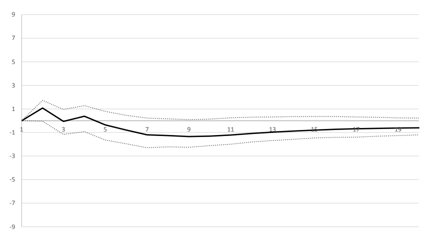
(d) Yogyakarta



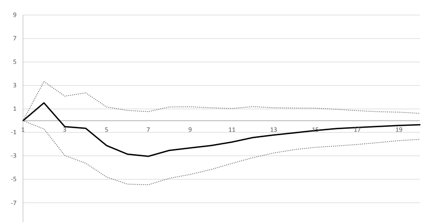
(e) Central Java



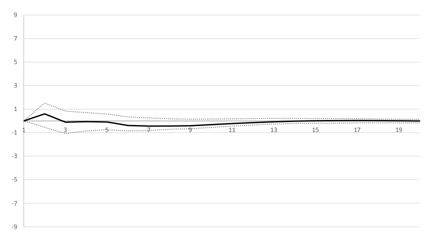
(f) East Java



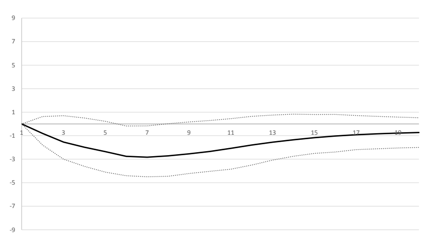
(g) Bengkulu



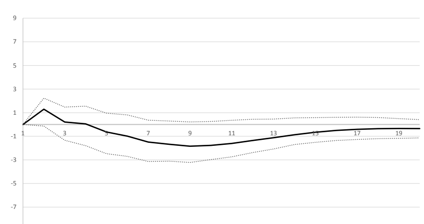
(h) Jambi



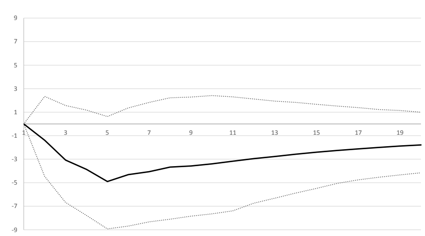
(i) Aceh



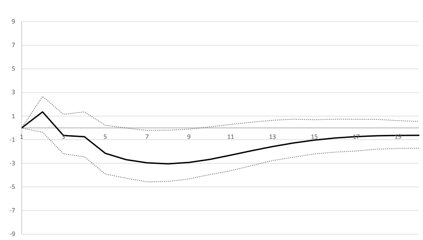
(j) North Sumatra



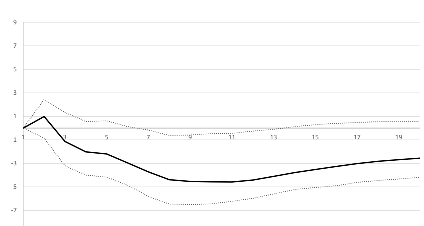
(k) West Sumatra



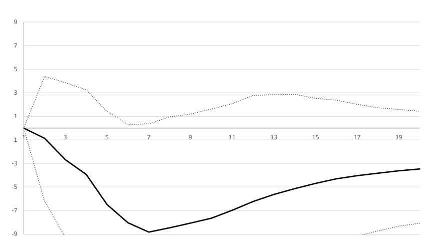
(l) Riau



(m) South Sumatra

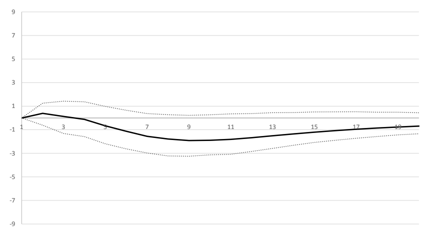


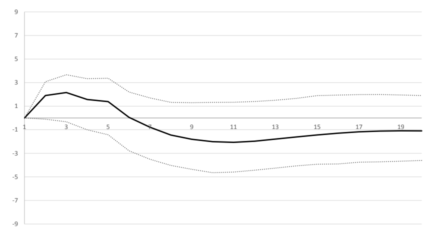
(n) Lampung

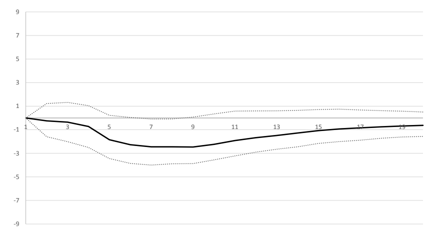


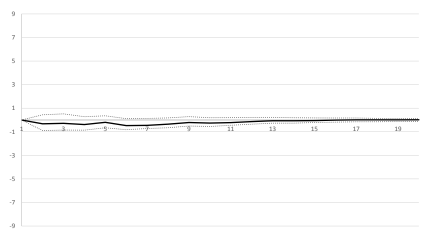
(o) South Kalimantan

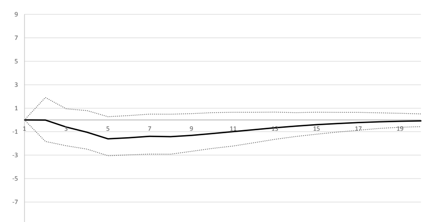
Figure 22: The provincial IRFs of trade openness to one standard deviation increase in the BI rate

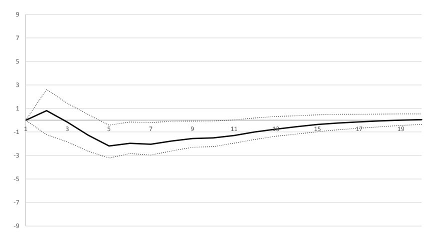

(p) West Kalimantan

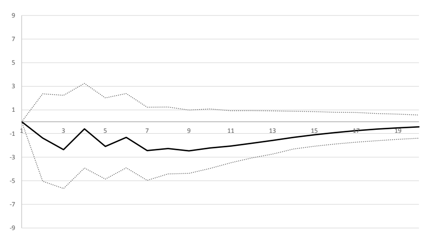

(q) East Kalimantan

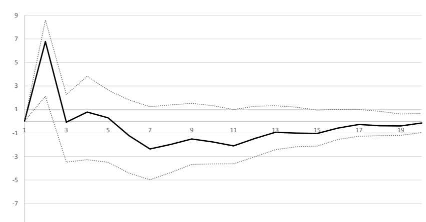

(r) Central Kalimantan

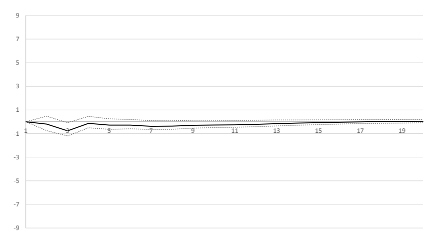

(s) Central Sulawesi

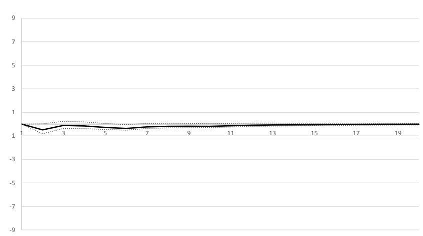

(t) South Sulawesi

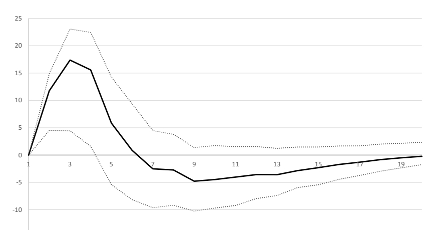

(u) North Sulawesi


(v) Southeast Sulawesi


(w) West Nusa Tenggara


(x) Bali


(y) East Nusa Tenggara


(z) Maluku

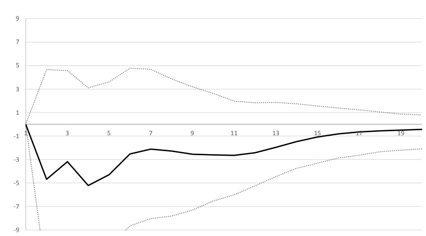
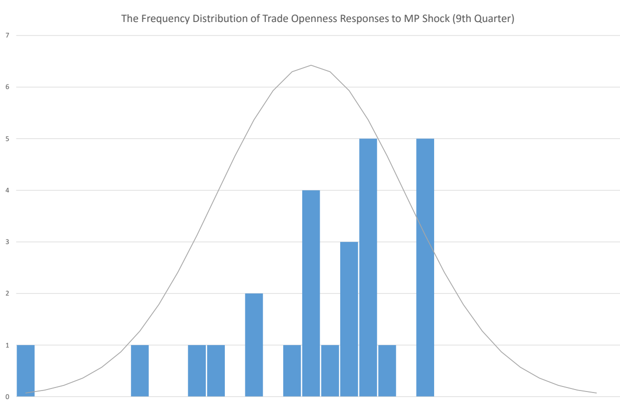
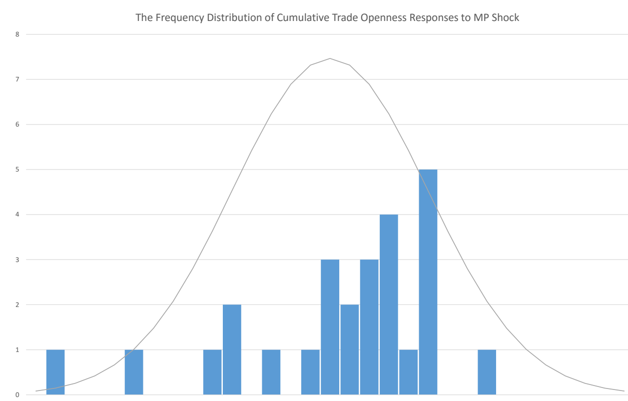

(aa) Papua

Figure 22: The provincial IRFs of trade openness to one standard deviation increase in the BI rate

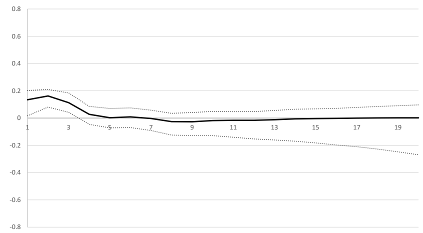


(a) The provincial cumulative trade openness' responses

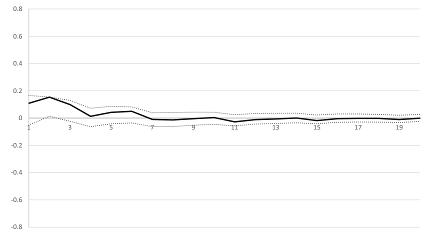


(b) The provincial aggregate maximum trade openness' responses

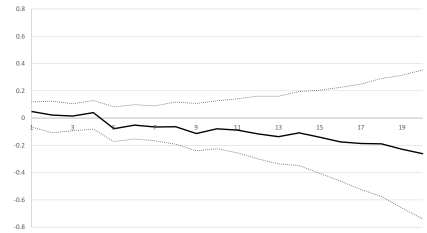
Figure 23: The frequency distribution of trade openness' responses



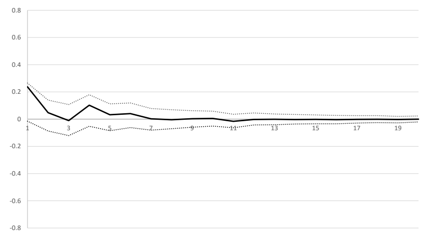
(a) Aggregate



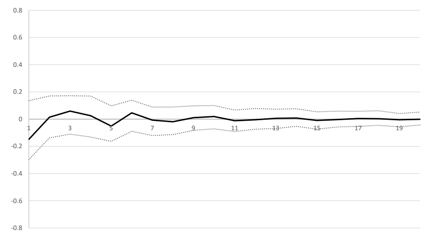
(b) Java



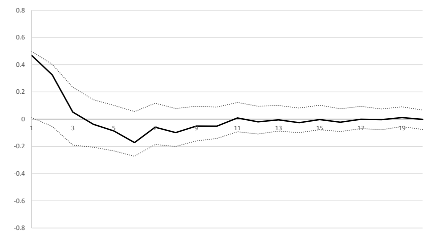
(c) Sumatra



(d) Kalimantan

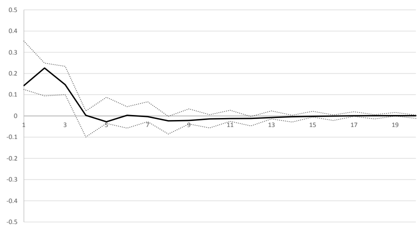


(e) Sulawesi

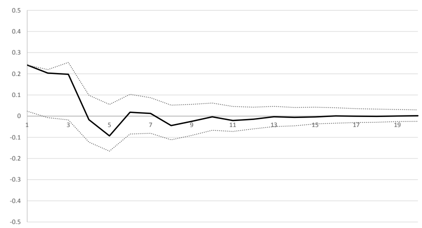


(f) Nusa Bali

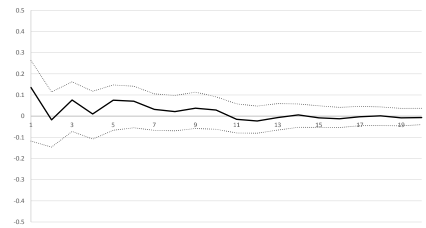
Figure 24: The islands' IRFs of housing prices to one standard deviation increase in the policy rate



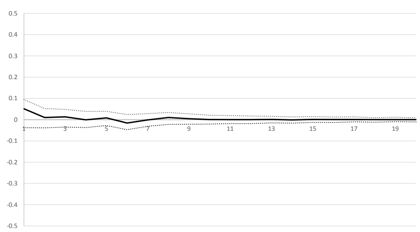
(a) Aggregate



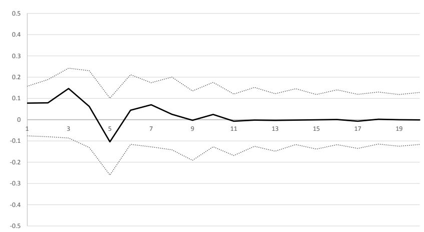
(b) West Java



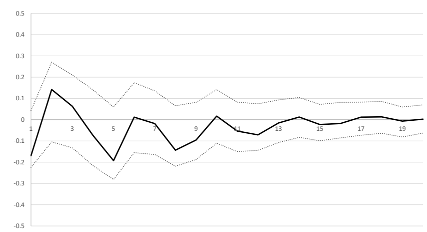
(c) Jakarta



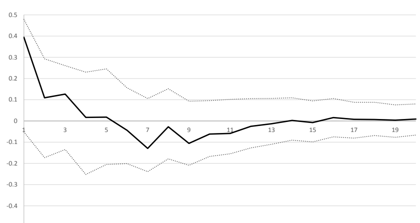
(d) Central Java



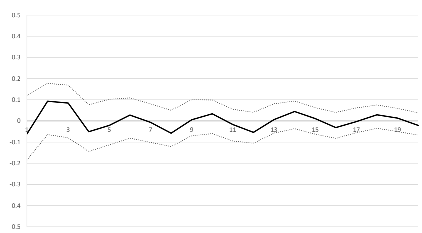
(e) East Java



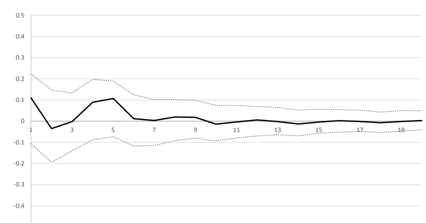
(f) North Sumatra



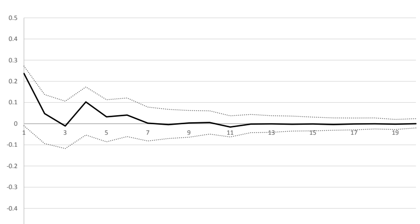
(g) West Sumatra



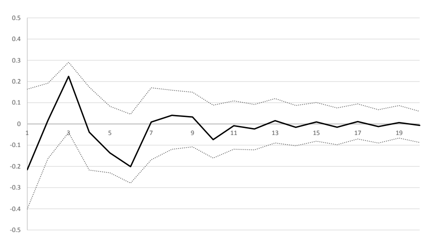
(h) South Sumatra



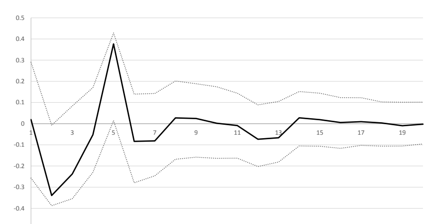
(i) Lampung



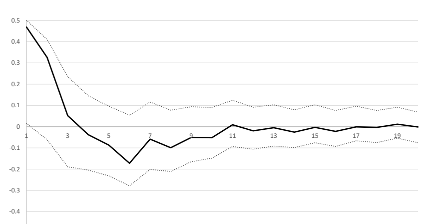
(j) South Kalimantan



(k) South Sulawesi

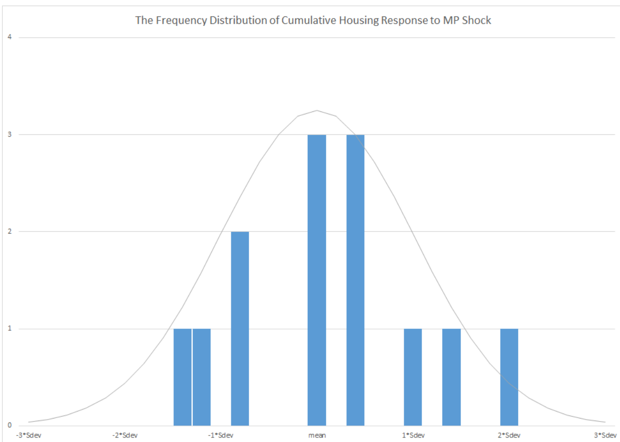


(l) North Sulawesi

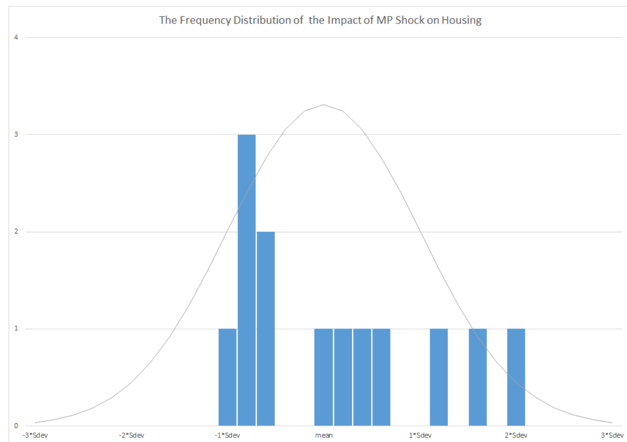


(m) Bali

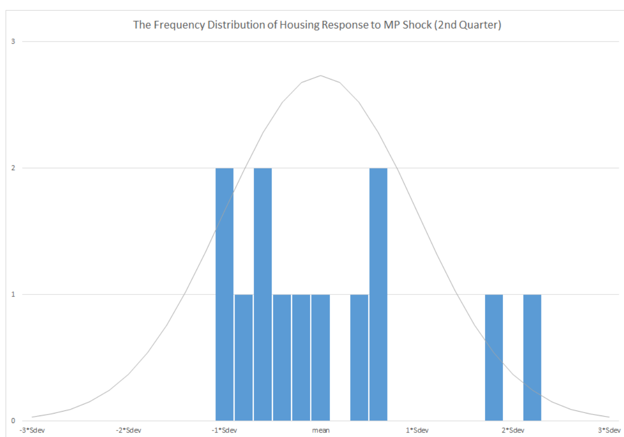
Figure 25: The impulse response functions of housing prices to one standard deviation increase in the BI rate



(a) The provincial cumulative housing prices' responses

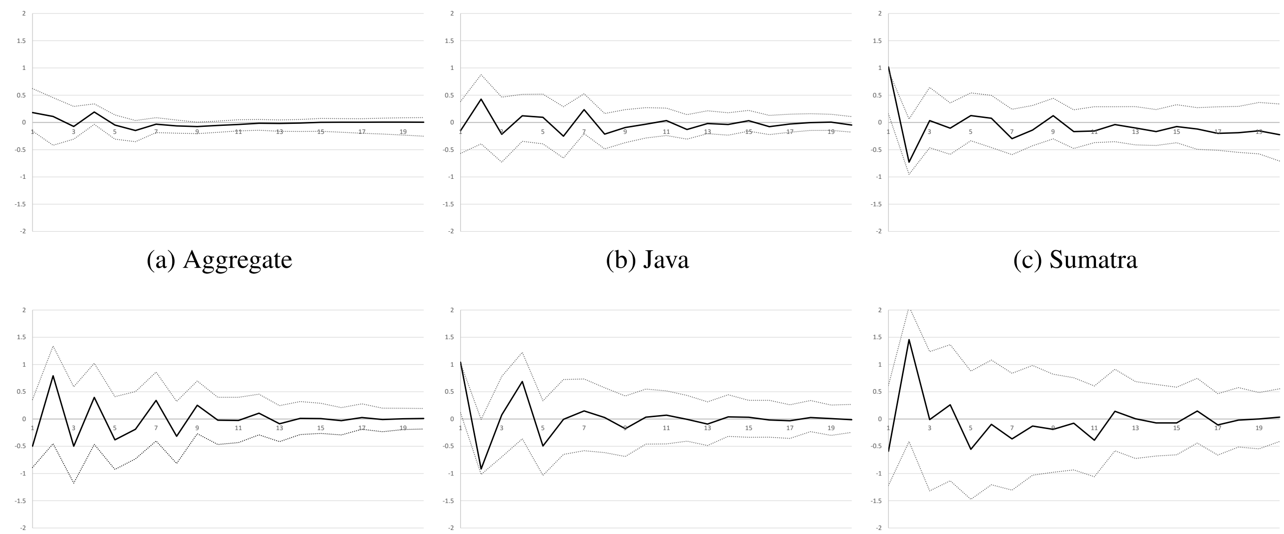


(b) The provincial immediate housing prices' responses



(c) The provincial aggregate maximum housing prices' responses

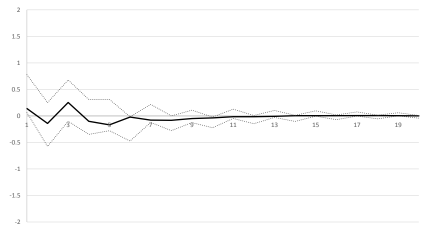
Figure 26: The frequency distribution of housing prices responses



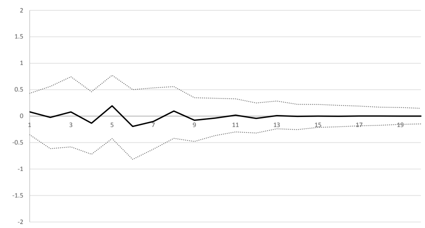
(a) Aggregate (b) Java (c) Sumatra

(d) Kalimantan (e) Sulawesi (f) Nusa Bali

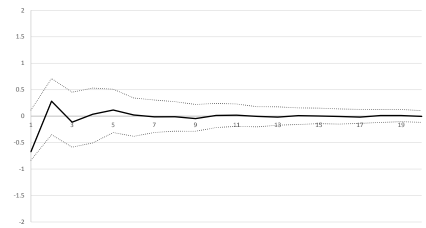
Figure 27: The islands' IRFs of consumer expectation to one standard deviation increase in the policy rate



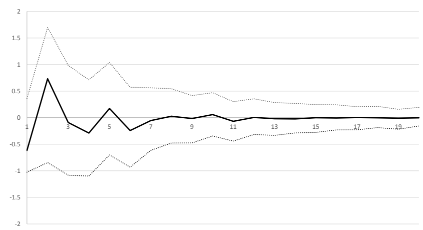
(a) Aggregate



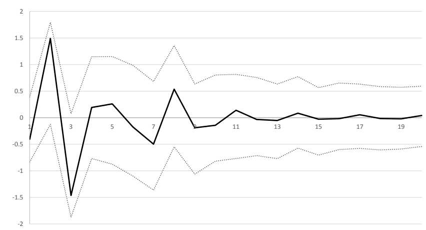
(b) West Java



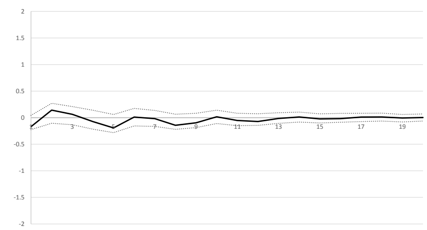
(c) Jakarta



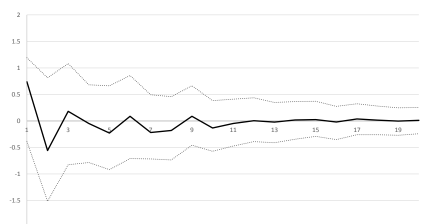
(d) Central Java



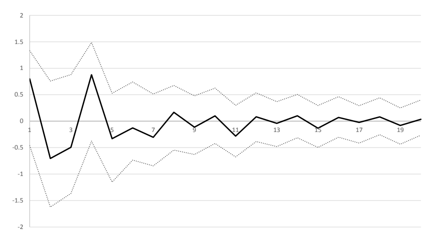
(e) East Java



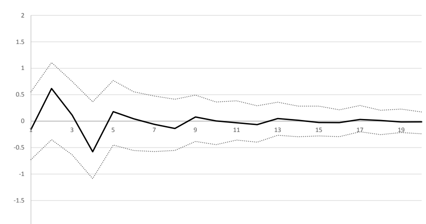
(f) North Sumatra



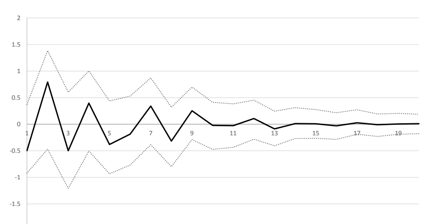
(g) West Sumatra



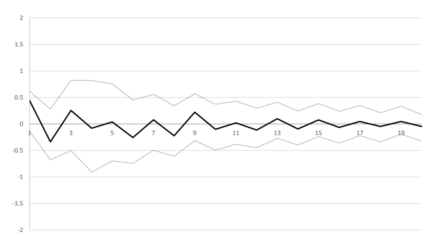
(h) South Sumatra



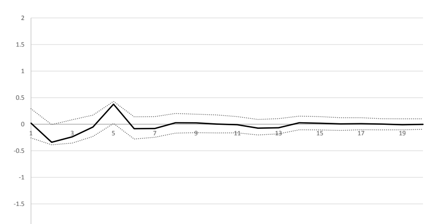
(i) Lampung



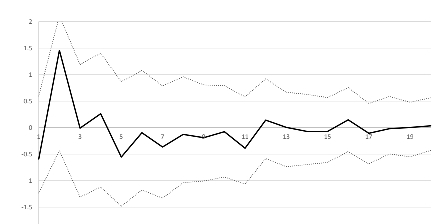
(j) South Kalimantan



(k) South Sulawesi

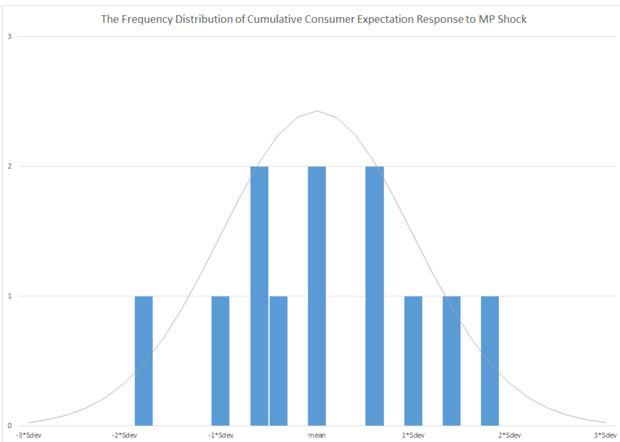


(l) North Sulawesi

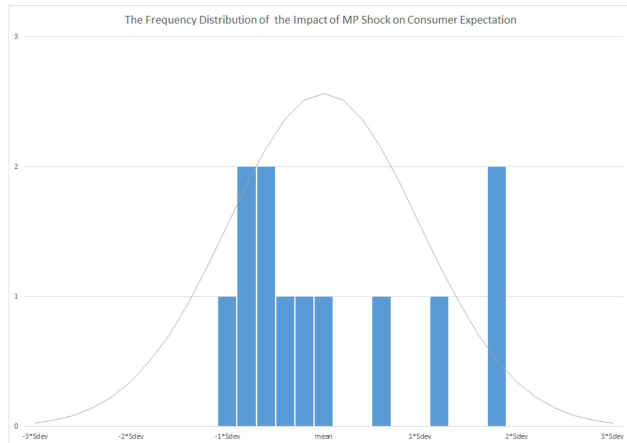


(m) Bali

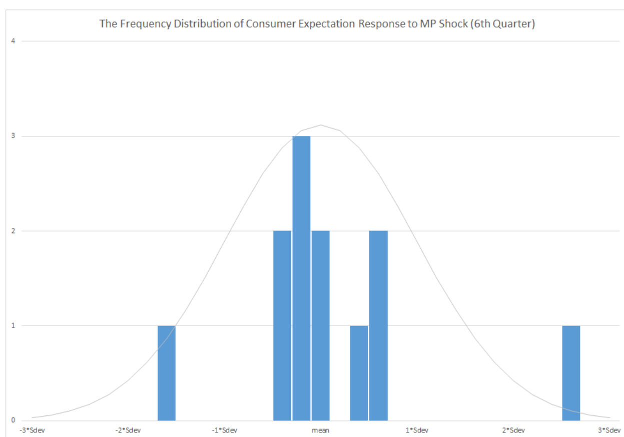
Figure 28: The impulse response functions of consumer expectation to one standard deviation increase in the BI rate



(a) The provincial cumulative consumer expectation's responses

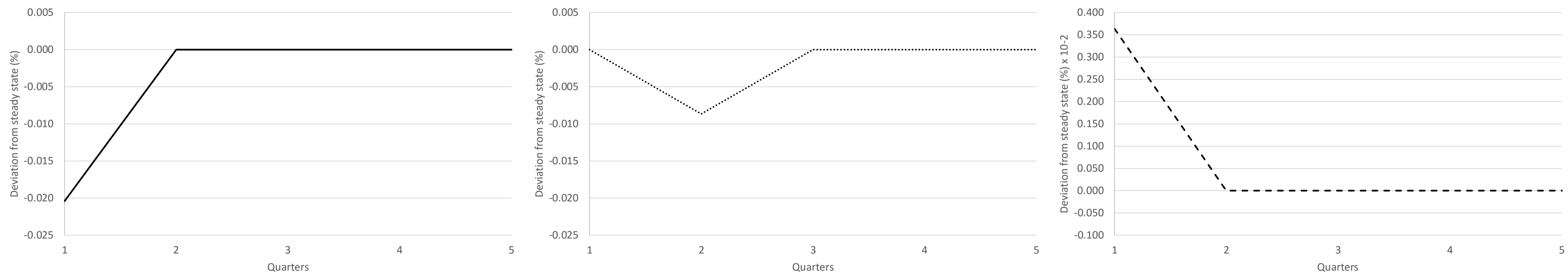


(b) The provincial immediate consumer expectation's responses



(c) The provincial aggregate maximum consumer expectation's responses

Figure 29: The frequency distribution of consumer expectation's responses

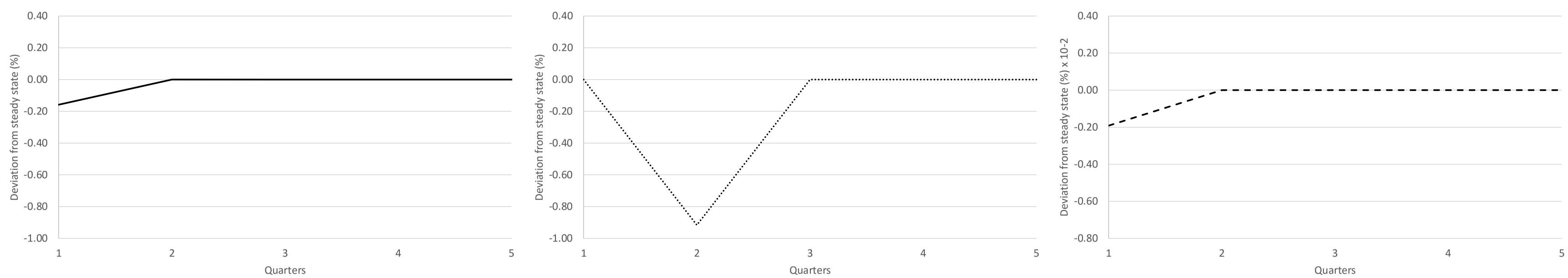


(a) Risky assets

(b) Safe assets

(c) Debt

Figure 30: Pre-crisis period - Changes in bank portfolio allocation given one percent increase in the reserve rate

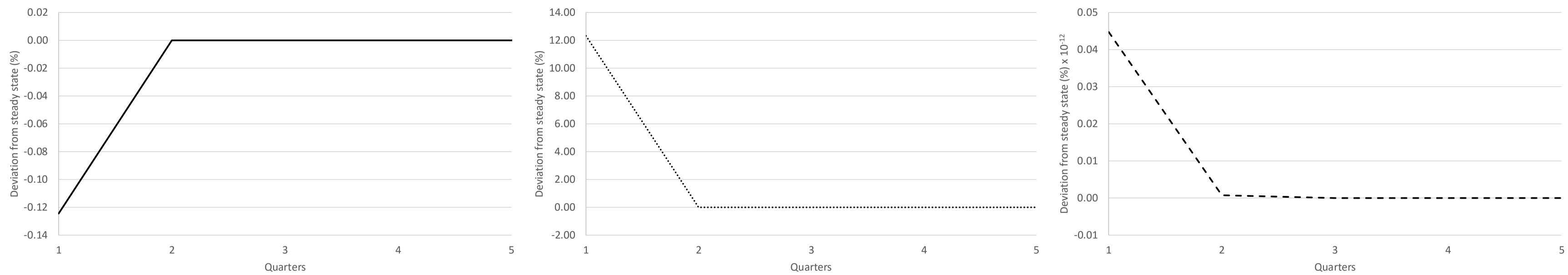


(a) Risky assets

(b) Safe assets

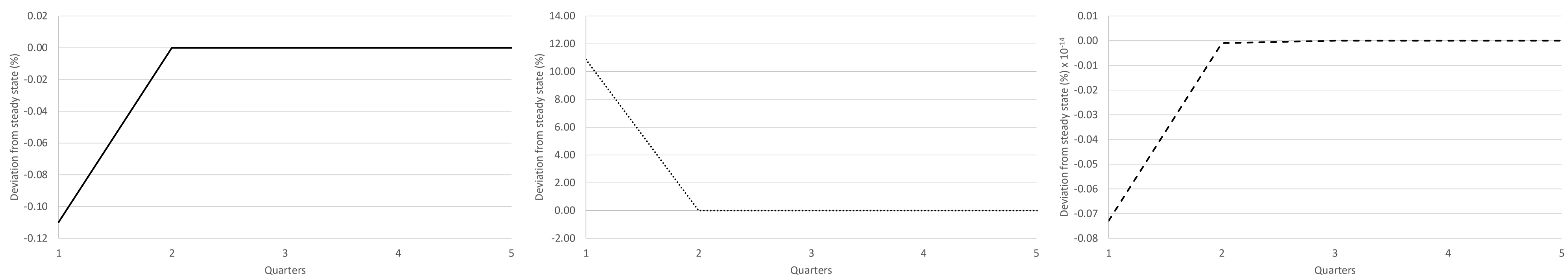
(c) Debt

Figure 31: Post-crisis period - Changes in bank portfolio allocation given one percent increase in the reserve rate



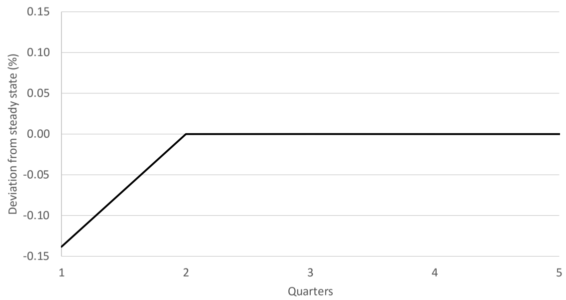
(a) Risky assets (b) Safe assets (c) Debt

Figure 32: Pre-crisis period - Changes in bank portfolio allocation given one percent increase in the risk-based capital requirement

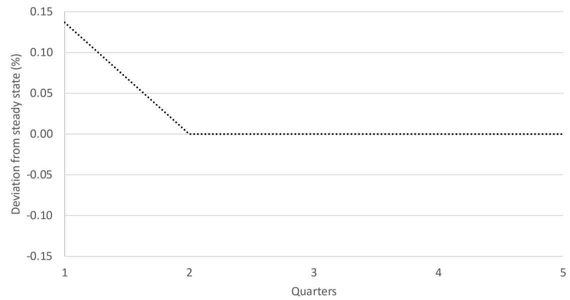


(a) Risky assets (b) Safe assets (c) Debt

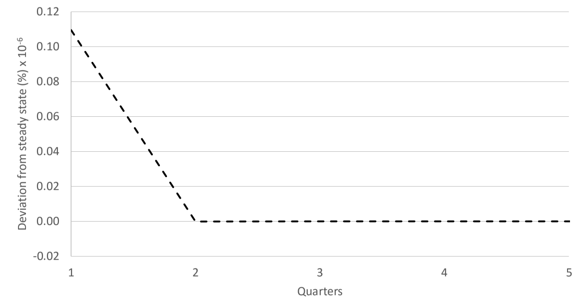
Figure 33: Post-crisis period - Changes in bank portfolio allocation given one percent increase in the risk-based capital requirement



(a) Risky assets

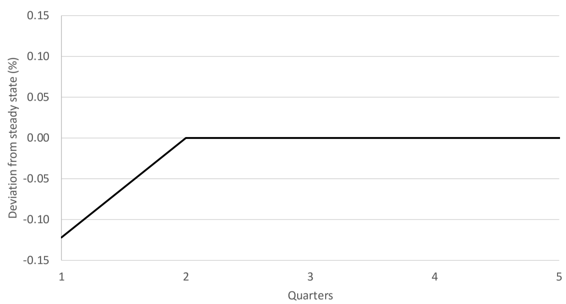


(b) Safe assets

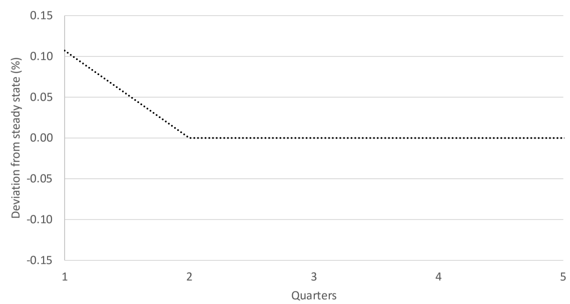


(c) Debt

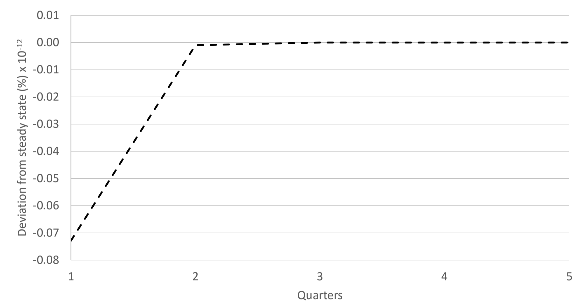
Figure 34: Pre-crisis period - Changes in bank portfolio allocation given one percent reduction in loan demand



(a) Risky assets



(b) Safe assets



(c) Debt

Figure 35: Post-crisis period - Changes in bank portfolio allocation given one percent reduction in loan demand

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