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Market discipline, financial crisis and regulatory changes: Evidence from Indonesian banks

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ABSTRACT

Following the 1997/1998 financial crisis, Indonesian banks experienced major regulatory changes, including the adoption of the blanket guarantee scheme (BGS) in 1998, a limited guarantee (LG) in 2005, and changes in capital regulation in 1998 and 2001. We examine the impact of these regulatory changes on market discipline during the period 1995–2009. The price of deposits is used to measure market discipline in a dynamic panel data methodology on a sample of 104 commercial banks. We find a weakening of market discipline following the introduction of the BGS. The result is consistent with the deposit insurance scheme being credible in the lower capital requirement environment. The adoption of LG in a recovering economy also mitigates the role of market discipline. However, market discipline is more pronounced in listed banks than unlisted banks and in foreign banks than domestic banks. These results have important implications for banking regulation and supervision, particularly during a crisis period.

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1. Introduction

The current global financial crisis suggests that banking authorities need to improve the effectiveness of all disciplining factors of bank risk taking. Gueyie and Lai (2003), for example, argue that the disciplining factors of bank risk taking include regulatory discipline, bank self discipline (charter value), and market discipline. Indeed, a number of studies have examined the role of market discipline in controlling bank risk and market discipline is one of the three pillars in the capital adequacy framework of the Basel Accord II.¹

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¹ The other two pillars are minimum capital standards, and supervisory review process. See Basel Committee on Banking Supervision (2001) for more information. The latest Basel Accord ("Basel III") also highlights the importance of market discipline through strengthening banks' transparency and disclosures (see <http://www.bis.org/bcbs/basel3.htm>).

Studies of market discipline on banks have been conducted in both developed and developing countries over different time periods. We continue the research by examining how market discipline was affected by regulatory changes following the 1997/1998 Asian financial crisis. Hence, our results provide important insights for banking authorities in developing policy responses to financial or economic crises.

The purpose of the current study is to investigate the presence of market discipline on Indonesian banks, and to evaluate whether regulatory changes affect market discipline. Indonesia provides a unique setting because following the 1997/1998 crisis, banks in this country experienced several regulatory changes including the adoption of the blanket guarantee scheme (BGS) in 1998, a limited guarantee scheme (LG) in 2005, and changes in capital regulation in 1998 and 2001. This setting provides an opportunity to examine the impact of regulatory changes on market discipline. Specifically, the simultaneous introduction of the BGS and lowering of the capital adequacy requirement allows an assessment of the credibility of the government's policy changes.

The present study contributes to the literature in several ways. First, there is a significant concern in the existing literature on

whether unsophisticated markets provide market discipline (e.g., Caprio and Honohan, 2004) and whether deposit insurance weakens market discipline (e.g., Demirgüç-Kunt and Huizinga, 2004; Martínez-Peria and Schmukler, 2001). By examining Indonesian banks, which are operating in an unsophisticated market environment and are protected by the blanket guarantee following the crisis, and then by a limited guarantee, this study increases our understanding of market discipline. Second, our study employs dynamic panel data methodology to determine the impact of regulatory changes on the market discipline. In particular, we use the Generalized Method of Moment (GMM) as suggested by Arellano and Bond (1991) and developed further by Arellano and Bover (1995) and Blundell and Bond (1998). Third, the present study also extends the existing literature by examining the extent of market discipline for different types of bank ownership (listed versus unlisted banks and foreign versus domestic banks).²

We find evidence of market discipline as higher deposit rates are associated with higher default risk and liquidity risk, and an inverse relation is found between depositor interest rates and government bank regulation. This is consistent with the insurance schemes being perceived as credible. We also find evidence that market discipline is more pronounced in listed and foreign banks.

2. Institutional background and regulatory environment

Following the 1997/1998 crisis, the Indonesian government, in January 1998, introduced a blanket guarantee scheme for domestic banks to restore confidence in the national banking system. The implementation of a BGS represents a major change in banking regulation because previously Indonesia did not have an explicit deposit insurance scheme. The guarantee applies to all commercial banks in Indonesia, except for the branch offices of foreign banks.³ Under the BGS, the government guarantees all bank liabilities, including off-balance sheet items. However, the guarantee is not applicable to loan capital, subordinated capital, unproved/illegal liabilities, liabilities to the bank's related parties, and derivative transactions (except for currency swaps). Each bank that participates in the BGS must pay a fixed-rate premium of 0.25% of deposits per year. The Indonesian Bank Restructuring Agency (IBRA) is responsible for administering the BGS.

In further response to the crisis, in November 1998, Bank Indonesia introduced a new capital regulation (No. 31/146/KEP/DIR dated 12 November 1998) that modified the minimum capital adequacy ratio (CAR) by temporarily reducing it from 8% of the risk weighted assets to 4%. However, in December 2001, Bank Indonesia amended this regulation by requiring all commercial banks to return to a minimum CAR of 8% by the end of 2001 (Regulation No. 3/21/PBI/2001 dated 13 December 2001).

Later, in September 2005, Indonesia replaced the BGS with a limited guarantee. Since then, a new deposit insurance agency, Lembaga Penjamin Simpanan (LPS) was established. The current official annual premium is 0.20% of deposits per year. Under the limited guarantee, all banks are insured, including joint venture banks and the branch offices of foreign banks. Initially, LPS only guaranteed deposits up to Rp100 million. However, to maintain public confidence in the domestic banking system and to prevent

capital flight during the recent global financial crisis, the maximum guarantee was increased in October 2008 to Rp2 billion.⁴

3. Literature review and hypotheses development

The existing literature suggests that market discipline is enforced by holders of uninsured deposits, such as large certificates of deposit (CDs), subordinated notes and debentures (SNDs), and large retail customer deposits. In the present study, since the data on CDs and SNDs in Indonesian banks are very limited, we focus more on market discipline from the customers' deposits point of view.

Research on the role of large deposits in disciplining banks can be divided into two groups. The first group examines the relation between bank risk and the amount of uninsured deposits (Goldberg and Hudgins, 1996; Khorassani, 2000; Jordan, 2000). The second group examines not only the relation between bank risk and the amount of uninsured deposits, but also the relation between bank risk and the interest rate paid to depositors (Park, 1995; Park and Peristiani, 1998; Demirgüç-Kunt and Huizinga, 2004; Martínez-Peria and Schmukler, 2001; Hosono, 2005; Hosono et al., 2005). In general, these studies demonstrate that, in the presence of market discipline, uninsured depositors punish riskier banks by withdrawing their money and/or by demanding higher interest rates.

When market conditions are not well developed or in the presence of deposit insurance, it is often argued that market discipline does not exist. For example, Caprio and Honohan (2004) state that market discipline is unlikely to emerge in the absence of relevant market and information infrastructures. In addition, they argue that explicit or implicit government guarantees stifle the incentive for depositors, debt- and outside equity-holders, or information specialists to exercise such discipline. Several empirical studies also indicate that market discipline does not exist or is less evident under deposit insurance. For example, based on a cross-country study during the period 1990–1997, Demirgüç-Kunt and Huizinga (2004) find that explicit deposit insurance weakens market discipline. In addition, Önder and Özyildirim (2003) document that blanket guarantee schemes reduce market discipline in Turkish banks during the period 1988–2000. However, there is also the possibility that market discipline exists under deposit insurance. Based on an empirical study of Argentina, Chile and Mexico, Martínez-Peria and Schmukler (2001) argue that when a deposit insurance scheme is not credible, market discipline may exist.⁵

Several studies indicate that depositors in Indonesian banks exhibited a “flight to quality” behavior during and shortly after the 1997/1998 crisis. For example, Yudistira (2002) documents the flight to quality behavior as deposits being shifted from small banks to large banks. In this regard, depositors may implicitly assume that large banks will not be closed by the government due to the too-big-to-fail (TBTF) consideration. Other authors describe the flight to quality as deposits flowing from private banks to state-owned or foreign banks (e.g., Enoch et al., 2001).

² Studies on market discipline on Indonesian banks are very limited. Hosono (2005) and Hosono et al. (2005) focus on cross country evidence of bank market discipline in four crisis countries in Asia (Indonesia, Malaysia, South Korea and Thailand). In particular, Hosono et al. (2005) only examine the introduction of the BGS.

³ Although joint venture banks are eligible to join the BGS, in fact, none of these banks participate in this program (see Kusumaningtuti, 1998). Hence, both joint venture banks and the branch offices of foreign banks are uninsured banks under the BGS.

⁴ Many neighboring countries such as Australia, Singapore, and Hong Kong decided to adopt blanket guarantees during the global crisis. Hence, to avoid capital flight to these countries, Indonesia raised the limit of the guarantee. As the data points after October 2008 are limited, in this study, we do not explore the impact of this new policy on market discipline. Although the adoption of a blanket guarantee scheme or full-cover deposit insurance may somewhat protect the banking system from the global crisis, as noted by Hwang et al. (2009), it potentially leads to moral hazard problems.

⁵ Martínez-Peria and Schmukler (2001) indicate several reasons for the lack of credibility of deposit insurance programs. First, many governments have reneged on their promise in the past. Second, the deposit insurance schemes tend to be undercapitalized. Finally, depositors are concerned about the cost of repayment (typically in the form of delays) through the deposit insurance funds.

To bolster depositor confidence the government established an explicit insurance scheme (BGS) in 1998. Later in the year, to avoid bank closures, the capital adequacy requirements were reduced. The effect of these measures was to signal unambiguously that the existing banks were unlikely to be closed, but if they were closed, the BGS would protect depositors. In this environment market discipline becomes less relevant and interest rates for deposits would not reflect the risk of the bank. Over time as the crisis eased, the banks' financial positions improved. Government protection against bank failures became less necessary and deposits became less risky. Subsequently, the CAR was increased to 8% and the BGS was replaced by LG. The LG's credibility was enhanced as banks financial soundness improved and, accordingly, consistent with Demircüç-Kunt and Huizinga (2004) and Önder and Özyildirim (2003), we argue that market discipline plays a lesser role.

Moreover, we consider that bank ownership may affect the presence of market discipline. Here, we expect that market discipline will be more prevalent for listed banks than unlisted banks and for foreign banks than domestic banks. This is because listed banks are more transparent than unlisted banks and they are under greater public scrutiny. Similarly, foreign banks are supervised by the home and host regulators, and hence, they should have better governance than domestic banks. We believe that the greater transparency of listed banks and the better governance of foreign banks will allow market discipline to better function at these banks.

Taken together, we propose the following hypotheses:

H1: During the BGS and LG periods, market discipline does not exist in Indonesian banks.

H2: Market discipline does not exist during the minimum CAR of 4% period.

H3: There is no difference in market discipline between listed banks and unlisted banks.

H4: There is no difference in market discipline between foreign banks and domestic banks.

4. Data and methodology

4.1. Data and sample

The financial data are sourced from the banks' financial reports, particularly for the December or year-end position. Data for 1995–2000 are based on the banks' condensed published financial statements. These data were compiled by Bank Indonesia in a series of books entitled "Direktori Perbankan Indonesia [*The Indonesian Banking Directory*]" (1996–2001 Editions). The remaining financial data (2001–2009) are obtained from the banks' monthly reports to Bank Indonesia. Macroeconomic data such as the inflation rate, the gross domestic product (GDP) growth, the Rupiah/USD exchange rate come from the Annual Report of Bank Indonesia. Moreover, the data on market capitalisation are obtained from Bloomberg.

This study uses a sample of 104 commercial banks operating in Indonesia during 1995–2009. A balanced panel is adopted to ensure that the results would reflect the impact of regulatory changes. To explore the role of bank ownership in examining the presence of market discipline, our sample includes different type of banks, such as listed versus unlisted banks, and foreign versus domestic banks.

Listed banks are those are listed in the Jakarta Stock Exchange. Foreign banks refer to joint venture banks and the branch-offices of foreign banks. We classify joint venture banks as foreign banks because their majority shareholders are generally foreigners. Under the BGS, all foreign banks are uninsured banks. But, under the limited guarantee scheme all banks are insured.

4.2. Dynamic panel data methodology

We use a dynamic panel data methodology because market discipline varies over time and, intuitively, it should provide more accurate results than a static panel which uses the fixed and/or random effects models.⁶ Baltagi (2005) indicates that the dynamic relations are characterized by the presence of a lagged dependent variable among the regressors. The use of fixed and/or random effects models may give biased and inconsistent estimators because the error term may be correlated with the lagged variable. To deal with variables that may be correlated with the error term, instrumental variables are used. In order to better estimate the dynamic relations between dependent and independent variables, following Arellano and Bond (1991), we use the two-step Generalized Method of Moments (GMM) estimator. More specifically, the System GMM of Arellano and Bover (1995) and Blundell and Bond (1998), which is an extension of the standard GMM of Arellano and Bond (1991), is implemented to obtain an estimator with improved precision.

The standard GMM estimator (Arellano and Bond, 1991) uses the first difference of each variable in the regressions, and employs the lagged levels of the regressors as the instruments. However, the lagged levels can be a poor instrument for first-differenced variables, particularly if the variables are close to a random walk. To solve this issue Arellano and Bover (1995) and Blundell and Bond (1998) introduce the System GMM estimator. This estimator employs the levels equation to obtain a system of two equations: one differenced and one in levels. Here, lagged differences of the independent variables and of the dependent variable may also be valid instruments for the level equation. The estimation combines the set of moment conditions available for the first difference equation with the additional moment conditions implied for the level equation. Having examined a number of studies using the System GMM, Baltagi (2005) argues that this estimator gives reasonable and more precise estimates.

To check the appropriateness of the GMM estimator, we employ several specification tests. These include the Wald statistics to test joint significance of the dependent variables, the Arellano–Bond test for zero autocorrelation in first-differenced errors, and the Sargan test for the over-identifying restrictions.⁷ Basically, the GMM estimator is consistent if there is no second order serial correlation between error terms of the first-differenced equation, and when the Sargan statistics are insignificant.

4.3. Dependent and independent variables

The literature review indicates that to examine market discipline one can explore the relation between bank risk and the amount of uninsured deposits and/or between bank risk and the interest rates on uninsured deposits. Because we do not have specific data on the interest expense paid by banks on uninsured deposits, following Martínez-Peria and Schmukler (2001) and Demircüç-Kunt and Huizinga (2004), we use an implicit interest rate. The implicit interest rate is determined by dividing total interest expense by total deposits (INTDEP).

For measures of bank risk (the independent variables), as in Martínez-Peria and Schmukler (2001) and Demircüç-Kunt and Huizinga (2004), we use several accounting ratios. These include

⁶ For example, Maechler and McDill (2003) use dynamic panel data in examining the presence of depositor discipline in the US banking sector during 1987–2000. De Mendonça and Loures (2009) also use the same methodology in addition to a static panel data (the fixed and random effects) in investigating market discipline in the Brazilian banking industry during 2001–2007.

⁷ As stated earlier, we use the two-step GMM estimators. Arellano and Bond (1991) argue that the estimates from the first step are more efficient, while the estimates from the second step are more robust. Hence, we use the results from the second step for the Sargan test and the Arellano–Bond tests.

the ratio of loan-loss-reserves-to-gross-loans (LLRGL), a proxy for credit risk; and the ratio of liquid-assets-to-total-assets (LIQATA), a proxy for liquidity risk. We also include Z-score (ZSCORE) as a measure of bank risk, particularly as a proxy for insolvency risk.⁸ Consistent with the argument that, in the presence of market discipline, uninsured depositors punish riskier banks by demanding higher interest rates, we expect a positive sign for LLRGL and a negative sign for LIQATA and ZSCORE. During normal economic conditions, all three risk measures are comparable for assessing bank risk. However, during crisis periods, even though bank regulators can mitigate credit and insolvency risk, the restructuring process may delay depositor payment and liquidity risk is not alleviated.

Following previous studies, we include control variables for bank size and general macroeconomic conditions.⁹ Flannery and Sorescu (1996) suggest that the relation between bank size and interest rates is negative, and this may reflect a market perception that large banks remain too-big-to-fail or they are better diversified. In this study, we use total assets as a proxy for bank size (SIZE), and also expect a negative sign.

Flannery and Sorescu (1996) and Park and Peristiani (1998) use year dummy variables to control for general macroeconomic conditions. Martínez-Peria and Schmukler (2001) employ time-specific effects to control for macroeconomic and banking sector development. However, in the present study, we use the Gross Domestic Product growth rate (GDPGR), the inflation rate (INFLRT), and the annual average of rupiah/USD exchange rate (EXCHRT) to control for general macroeconomic conditions. As Indonesia faced volatile economic conditions during the study period, the expected specific signs for these macroeconomic variables are ambiguous.

Other control variables include: (1) a market structure variable (concentration ratio of the top five banks based on total assets of the banking industry (CR5)), (2) a banking sector competition variable (the Lerner Index (LINDEX)),¹⁰ (3) a market capitalization over GDP (MCGDP) variable to control for the impact of capital market competition, (4) ownership variables (listed banks versus unlisted banks (LISTED), and foreign banks versus domestic banks (FOREIGN)),¹¹ and (5) regulatory variables (the BGS, LG and the minimum CAR of 4% (CAR4)).¹² Again, we do not expect a specific sign for these other control variables, except for those of regulatory variables.

⁸ Following Boyd et al. (2006), Z-score is calculated as the sum of return on assets (ROA) and capitalization, divided by an estimate of earnings volatility. In particular, we calculate Z-score as the sum of average ROA and the equity-to-total assets ratio (EQTA), divided by the standard deviation of ROA. A three-year moving windows is used to estimate the average and the standard deviation of ROA. In an earlier version of this paper, we use the ratio of total debt-to-total-assets (DEBTA) as a proxy for leverage risk. Since Z-score has already included EQTA, which is an inverse of DEBTA, we drop DEBTA from the models to avoid multicollinearity.

⁹ We need to take into account macroeconomic factors because prior studies such as Männasoo and Mayes (2009) and Bonfim (2009) have shown that a macroeconomic shock is the typical precursor of bank distress or default. In addition, the current global crisis also suggests that we should have a better understanding of the impact of macroeconomic shocks on the resilience of the banking system. To explore this issue one can perform macroeconomic stress testing (see for example, Dovern et al., 2010).

¹⁰ The index refers to the difference between price and marginal cost as a fraction of price. The index is also called the price-cost margin. To calculate the index, we follow De Guevara et al. (2005). The index has been widely used in banking studies, see for example Ariss (2010) and Fonseca and González (2010).

¹¹ Ownership is expressed in form of dummy variables. LISTED is an ownership dummy variable that denotes 1 for listed banks or 0 otherwise. FOREIGN is an ownership dummy variable that denotes 1 for foreign banks or 0 otherwise.

¹² We use time dummy variables to reflect the regulatory changes. To examine the impact of the changes in deposit insurance regulation, we use two time dummy variables, namely BGS (1 = 1998–2004 and 0 otherwise), and limited guarantee or LG (1 = 2005–2009 or 0 otherwise). Moreover, to examine the impact of the changes in capital regulation, we use a time dummy variable (CAR4) that denotes 1 for a period when the minimum CAR of 4% is implemented (1 = 1998–2000), or 0 otherwise. The country is during a crisis when the BGS is implemented and under a deep crisis when the minimum CAR of 4% is adopted.

4.4. Empirical model

Based on the discussions of the dependent and independent variables, we test the following two general models¹³:

$$\begin{aligned} \text{INTDEP} = & \alpha_1 \text{INTDEP}_{(t-1)} + \alpha_2 \text{LLRGL} + \alpha_3 \text{LIQATA} + \alpha_4 \text{ZSCORE} \\ & + \alpha_5 \text{SIZE} + \alpha_6 \text{GDPGR} + \alpha_7 \text{INFLRT} + \alpha_8 \text{EXCHRT} \\ & + \alpha_9 \text{CR5} + \alpha_{10} \text{LINDEX} + \alpha_{11} \text{MCGDP} + \alpha_{12} \text{LISTED} \\ & + \alpha_{13} \text{FOREIGN} + \alpha_{14} \text{BGS} + \alpha_{15} \text{LG} + \text{error} \end{aligned} \quad (1)$$

$$\begin{aligned} \text{INTDEP} = & \beta_1 \text{INTDEP}_{(t-1)} + \beta_2 \text{LLRGL} + \beta_3 \text{LIQATA} + \beta_4 \text{ZSCORE} \\ & + \beta_5 \text{SIZE} + \beta_6 \text{GDPGR} + \beta_7 \text{INFLRT} + \beta_8 \text{EXCHRT} \\ & + \beta_9 \text{CR5} + \beta_{10} \text{LINDEX} + \beta_{11} \text{MCGDP} + \beta_{12} \text{LISTED} \\ & + \beta_{13} \text{FOREIGN} + \beta_{14} \text{CAR4} + \text{error} \end{aligned} \quad (2)$$

To examine the impact of the regulatory changes on the extent of market discipline, we interact the regulatory variables (BGS and LG, or CAR4) with the bank risk variables (LLRGL, LIQATA and ZSCORE). Market discipline is present when the dummy interaction with LLRGL shows a positive sign, or when the dummy interaction variables with LIQATA and ZSCORE show a negative sign. The same interpretation applies when examining the impact of ownership on market discipline by interacting the ownership variables (LISTED and FOREIGN) with the bank risk variables.

5. Empirical results

5.1. Descriptive statistics

Table 1 presents the descriptive statistics for the raw variables. The dependent variable, INTDEP, has a mean (median) of 11.33% (8.41%). Meanwhile, the first bank risk variable, LLRGL, has a mean (median) of 5.85% (2.51%). The other risk variables, LIQATA and ZSCORE have a mean (median) of 21.38% (16.82%) and 38.11% (20.92%), respectively. With regard to SIZE, the smallest bank in this study has total assets of Rp9.75 billion, whereas the largest bank has total assets of Rp318.45 trillion. In general, unlisted banks and foreign banks tend to be smaller than listed banks and domestic banks, respectively. It appears that the unlisted banks are reasonably similar to the listed banks on the variables of credit risk, liquidity risk, and insolvency risk. For foreign banks, credit risk is approximately twice that of the domestic and listed banks' credit risk. We conjecture that the lower risk of the domestic banks arises from the government initiative of acquiring bad loans from the domestic banks as conducted by IBRA following the crisis.

The three macroeconomic variables (GDPGR, INFLRT and EXCHRT) reflect both crisis and normal periods. In particular, their minimum and maximum values suggest the volatility of the country's economy during the study period. For example, during the deep crisis in 1998 the GDP growth was –13.13% and the inflation rate was 77.63%. Also the rupiah values declined sharply from Rp2310/USD at the end of 1995 to Rp8030 at the end of 1998.¹⁴ Furthermore, the highest GDP growth was in 1995 (8.22%) and the lowest inflation rate was in 1999 (2.01%).

Moreover, the market structure variable (CR5) shows that the mean (median) share of the top five banks in the industry is moderate, around 34.47% (37.16%), indicating that the industry

¹³ Since we use the GMM estimator, all variables are in their first difference form. In the regressions, we treat all regressors as predetermined.

¹⁴ At the peak of the 1997/1998 crisis, the Rp/USD exchange rate was more than Rp15,000. However, at the end of 1998, the exchange rate was Rp8030, but still very high compare to the level before the crisis.

Table 1
Descriptive statistics.

Variables	Mean	Median	Standard deviation	Minimum	Maximum	Skewness
<i>Panel A: Full sample (N = 1560 bank years)</i>						
INTDEP	11.33	8.41	10.51	0.36	119.20	4.37
LLRGL	5.85	2.51	8.83	0.18	61.45	3.17
LIQATA	21.38	16.82	18.12	0.20	94.76	1.09
ZSCORE	38.11	20.92	83.45	-4.35	1839.54	11.15
SIZE (Rp billion)	8740.59	1211.01	25,684.68	9.75	318,446.60	6.30
GDPGR	3.92	4.92	4.86	-13.13	8.22	-2.80
INFLRT	12.96	8.98	17.69	2.01	77.63	3.21
EXCHRT	7.99	9.02	2.64	2.31	10.95	-1.23
CR5	34.47	37.16	5.23	23.63	40.59	-0.81
LINDEX	0.21	0.26	0.43	-6.17	0.81	-7.46
MCGDP	28.95	28.88	10.37	14.53	50.35	0.33
<i>Panel B: Listed versus unlisted banks</i>						
Listed banks (N = 243 bank years)						
INTDEP	10.61	8.31	9.15	3.07	111.48	6.37
LLRGL	5.73	2.59	9.11	0.63	60.35	3.74
LIQATA	26.74	23.68	18.18	1.30	81.38	0.58
ZSCORE	37.07	22.52	44.78	-4.35	319.36	2.45
SIZE (Rp billion)	35,587.44	13,245.26	54,713.85	542.97	318,446.60	2.55
Unlisted banks (N = 1317 bank years)						
INTDEP	11.46	8.46	10.74	0.36	119.20	4.13
LLRGL	5.87	2.51	8.78	0.18	61.45	3.05
LIQATA	20.39	15.32	17.94	0.20	94.76	1.21
ZSCORE	38.31	20.63	88.77	-3.55	1839.54	10.92
SIZE (Rp billion)	3787.07	775.90	8566.11	9.75	104,742.39	5.31
<i>Panel C: Foreign versus domestic banks</i>						
Foreign banks (N = 285 bank years)						
INTDEP	10.19	6.79	12.02	0.79	118.86	4.99
LLRGL	10.67	6.07	11.92	0.32	58.73	1.70
LIQATA	14.25	11.49	11.74	1.30	56.56	0.92
ZSCORE	23.92	12.18	48.23	-2.23	620.51	7.94
SIZE (Rp billion)	7278.28	3203.64	9688.88	276.03	53,502.52	2.38
Domestic banks (N = 1275 bank years)						
INTDEP	11.58	8.73	10.13	0.36	119.20	4.16
LLRGL	4.77	2.35	7.57	0.18	61.45	3.99
LIQATA	22.97	18.48	18.90	0.20	94.76	0.98
ZSCORE	41.28	22.64	89.15	-4.35	1839.54	10.84
SIZE (Rp billion)	9067.46	787.56	28,031.59	9.75	318,446.60	5.88

This table presents summary statistics of the raw variables included in this study. The study uses annual observations of Indonesian commercial banks over the period 1995–2009. The dependent variable is INTDEP (the ratio of total interest expense to total deposits). The independent variables include: LLRGL is the ratio of loan-loss-reserves-to-gross-loans, a proxy for credit risk; LIQATA is the ratio of liquid-assets-to-total-assets, a proxy for liquidity risk; ZSCORE is a proxy for insolvency risk; and SIZE is total assets. Control variables for general macroeconomic conditions include: GDPGR as the growth rate in GDP; INFLRT as the inflation rate; and EXCHRT as the annual average of exchange rate Rp/USD (scaled in Rp000). CR5 is the concentration ratio using the largest five banks. LINDEX is the Lerner Index, a measure of bank sector competition and market capitalization over GDP (MCGDP) controls for the impact of capital market competition.

is not highly concentrated. With the mean and median of 0.21% and 0.26% respectively, the Lerner Index (LINDEX) indicates that competition within the Indonesian banking market is relatively low.¹⁵ On the other hand, the impact of capital market competition is also limited. This can be seen from the mean (median) value of the market capitalization over GDP (MCGDP) ratio, which is 28.95% (28.88%), suggesting that the role of market capitalization is less than one-third of the GDP. Overall, these measures suggest that Indonesian banks operate in a less concentrated and less competitive market than banks in more developed countries.

The values of the dependent and independent variables indicate that, in general, our data are skewed. To approximate normality, we transform all variables using the natural logarithmic transformation before their use in the analyses.

¹⁵ Due to the 1997/1998 crisis, several banks have a negative Lerner Index (LINDEX). In particular, these banks experiencing extremely high marginal cost as compared to their price. As shown in Table 2, the minimum value of LINDEX is -7.46, whereas the maximum value is 0.81.

5.2. Correlation structure

Table 2 reports the Pearson correlation coefficients during the study period.¹⁶ The top row of this table shows the correlations between the dependent variable of INTDEP and each independent variable excluding the dummy variables. We find that, although the correlations are not very strong, the three independent variables of bank risk (LLRGL, LIQATA and SIZE) are significantly correlated with the dependent variable in the expected direction. Overall, these results indicate the presence of market discipline on Indonesian banks.

The correlation between SIZE and INTDEP is significant in the expected direction, but it is not strong. Other control variables are also significantly correlated with INTDEP, even though a strong correlation (above 50%) is only shown by CR5 and GDPGR with a negative direction.

The correlations among the independent variables appear in the lower rows of Table 2. Almost all correlations are statistically sig-

¹⁶ Like the regressions, the correlation tests are conducted on the first-differences of the variables.

Table 2
Correlation matrix.

	A	B	C	D	E	F	G	H	I	J	K	L
A. INTDEP	1	-0.152***	0.296***	-0.150***	-0.085***	-0.134***	-0.555***	0.342***	0.257***	-0.592***	-0.256***	-0.213***
B. INTDEP _(t-1)		1	0.168***	-0.144***	-0.073***	-0.102***	0.168***	-0.477***	-0.170***	0.021	0.010	0.449***
C. LLRGL			1	-0.042	-0.254***	-0.122***	-0.422***	0.173***	0.321***	-0.372***	-0.336***	-0.064***
D. LIQATA				1	-0.047	-0.013	0.044	0.094***	0.147***	0.302***	0.061**	-0.125***
E. ZSCORE					1	-0.004	0.248***	-0.117***	-0.281***	0.153***	0.190***	0.099***
F. SIZE						1	-0.025	0.094***	0.080***	0.020	0.118***	-0.096***
G. GDPGR							1	-0.763***	-0.537***	0.813***	0.263***	0.430***
H. INFLRT								1	0.669***	-0.535***	-0.142**	-0.787***
I. EXCHRT									1	-0.317***	-0.113***	-0.673***
J. CR5										1	0.276***	0.178***
K. LINDEX											1	0.039
L. MCGDP												1

This table presents the correlations between the variables included in this study. Annual observations of Indonesian commercial banks over the period 1995–2009 are used. The dependent variable is INTDEP (the ratio of total interest expense to total deposits). The independent variables include: LLRGL is the ratio of loan-loss-reserves-to-gross-loans, a proxy for credit risk; LIQATA is the ratio of liquid-assets-to-total-assets, a proxy for liquidity risk; ZSCORE is a proxy for insolvency risk; and SIZE is total assets. Control variables for general macroeconomic conditions include: GDPGR as the growth rate in GDP; INFLRT as the inflation rate; and EXCHRT as the annual average of exchange rate Rp/USD (scaled in Rp000). CR5 is the concentration ratio using the largest five banks. LINDEX is the Lerner Index, a measure of bank sector competition and market capitalization over GDP (MCGDP) controls for the impact of capital market competition. All variables are transformed using the natural logarithmic transformation.

* Indicate statistical significance at the 10% level (2-tailed).

** Indicate statistical significance at the 5% level (2-tailed).

*** Indicate statistical significance at the 1% level (2-tailed).

nificant. However, a strong correlation is generally exhibited between GDPGR and other control variables excluding LINDEX and MCGDP, and between INFLRT and other control variables excluding LINDEX. To ensure that these correlations will not lead to multicollinearity, we proceed with the variance inflation test (VIF). The VIFs of the regressions are below 10, indicating that multicollinearity is not a serious problem.¹⁷

5.3. Regression results

We test for the presence of market discipline in Indonesian banks by employing the System GMM estimator. We employ six models to test our hypotheses. All models satisfy the requirement of the GMM, including the Wald test, the Sargan test and the Arellano–Bond test for zero autocorrelation in first-differenced errors. The regression results are reported in Table 3.

We begin by examining whether market discipline exists in Indonesian banks during the study period (Model 1). The result suggests the presence of market discipline, as shown by the positive and significant sign of LLRGL and the negative and significant sign of LIQATA. Hence, in Indonesia, depositors discipline the banks by requiring higher interest rates from banks with higher credit risk and liquidity risk. This result confirms that unsophisticated markets still provide market discipline. However, the regulatory change variables of BGS and LG are both significantly negative, indicating the market is requiring a lower rate of interest when the guarantee schemes are in place, suggesting a weakening of market discipline. This result is consistent even when we employ different time dummy variables to control for the regulatory changes as shown in Models 3, 4 and 6.¹⁸

Model 2 explores the impact of the BGS and LG on market discipline by interacting these variables with alternative bank risk measures. Five of the six interaction variables exhibit insignificant coefficients indicating a lack of market discipline. However, the dummy interaction BGS*LIQATA shows the expected sign and is significant, indicating that the introduction of the BGS encourages

depositors to exert market discipline because, although the funds may be forthcoming, the timing of the funds is uncertain, consistent with liquidity risk. Accordingly, referring to the Martínez-Peria and Schmukler (2001) argument that market discipline exists when deposit insurance is not credible, our results indicate that the BGS is less than perfectly credible.

However, the adoption of LG in 2005 seems to achieve credibility and hence, there is no market discipline during the LG period. This can be seen from the result of Model 2, which indicates that none of the dummy interactions with LG (i.e., LG*LLRGL, LG*LIQATA and LG*ZSCORE) are significant. Overall, our findings based on Model 2 provide support for Hypothesis 1.

During normal economic conditions, a lower capital requirement would encourage depositors to exert market discipline by requiring higher interest rates for banks with higher insolvency risk. However, during the 1998–2000 period for Indonesia, regulators reduced capital adequacy requirements concurrent with a credible insurance scheme.¹⁹ This is consistent with regulators closely monitoring the level of insolvency risks of the banks. It can be seen in Model 5 that none of the three interaction variables exhibit coefficients with a high degree of significance. This indicates a lack of market discipline, and therefore, is in line with Hypothesis 2.

Now we examine the role of bank ownership in market discipline. For listed banks, the coefficient is insignificant in Models 1–5, but is significant in Model 6, which includes the CAR4 variable and the interactions of the listed/unlisted dummy variables. Overall, the interaction terms in Model 6 are insignificant, but the significant coefficient on the ZSCORE, a measure of insolvency risk is indicative of market discipline.

For Models 4–6, the results indicate that foreign banks pay lower rates to depositors than do domestic banks. This suggests foreign banks are viewed as being less risky, possibly because their loan portfolio is diversified across different countries. Moreover, the interaction terms in Model 6 indicate that market discipline is more pronounced in foreign banks than domestic banks especially in relation to liquidity risk, and in listed banks than unlisted banks particularly for insolvency risk.

¹⁷ Gujarati (2003) indicates that the VIF cut-off is 10. If the calculated VIF is more than 10, it can be an indication of multicollinearity.

¹⁸ In Model 1, we use the BGS and LG as the time dummy variables to control the impact of the regulatory changes. In Model 4 we substitute the BGS and LG with CAR4 to consider the effects of the changes in capital regulation. Models 1 and 4 reflect the first and the second general models, respectively.

¹⁹ To reflect this concurrent issue, in Model 3 we include all time dummy variables in one regression. The results show that the coefficients of BGS and CAR4 are consistently negative and significant. Again, this suggests a weakening of market discipline. However, the coefficient of LG now becomes insignificant.

Table 3
Regression results.

Dependent variable	Independent variables	Expected signs	INTDEP		
			Model 1	Model 2	Model 3
INTDEP _(t-1)			0.557*** (0.043)	0.549*** (0.045)	0.639*** (0.065)
LLRGL	+		0.100*** (0.025)	0.133*** (0.056)	0.141*** (0.029)
LIQATA	–		–0.127*** (0.033)	0.130 (0.102)	–0.129*** (0.035)
ZSCORE	–		0.019 (0.023)	0.069* (0.037)	–0.016 (0.023)
SIZE	–		–0.100* (0.059)	–0.075 (0.061)	–0.170*** (0.064)
GDPGR			–0.452*** (0.045)	–0.422*** (0.048)	–0.491*** (0.049)
INFLRT			0.016 (0.023)	0.015 (0.026)	0.019 (0.026)
EXCHRT			–0.215*** (0.075)	–0.347*** (0.090)	–0.166** (0.080)
CR5			1.442*** (0.313)	1.299*** (0.325)	1.594*** (0.344)
LINDEX			0.170 (0.291)	0.116 (0.265)	0.259 (0.320)
MCGDP			–0.280*** (0.031)	–0.345*** (0.039)	–0.236*** (0.033)
LISTED			–0.020 (0.195)	0.006 (0.171)	–0.103 (0.199)
FOREIGN			0.055 (0.146)	0.077 (0.151)	0.226 (0.179)
BGS			–0.577*** (0.108)	0.397 (0.314)	–0.551*** (0.123)
LG			–0.186* (0.109)	0.171 (0.343)	–0.089 (0.128)
CAR4					–0.251*** (0.075)
BGS * LLRGL	+			–0.081 (0.060)	
BGS * LIQATA	–			–0.300*** (0.105)	
BGS * ZSCORE	–			–0.074 (0.051)	
LG * LLRGL	+			0.043 (0.086)	
LG * LIQATA	–			–0.136 (0.110)	
LG * ZSCORE	–			–0.075 (0.057)	
Wald test			Chi ² (15) = 13,840 [0.000]***	Chi ² (21) = 16,460 [0.000]***	Chi ² (16) = 7040 [0.000]***
Sargan test			Chi ² (102) = 103.2 [0.477]	Chi ² (103) = 102.2 [0.504]	Chi ² (103) = 102.2 [0.503]
Arellano–Bond test for AR(1)			N(0, 1) = –4.765 [0.000]***	N(0, 1) = –4.644 [0.000]***	N(0, 1) = –4.390 [0.000]***
Arellano–Bond test for AR(2)			N(0, 1) = 1.164 [0.244]	N(0, 1) = 1.113 [0.266]	N(0, 1) = 1.190 [0.234]
N			1456	1456	1456
			Model 4	Model 5	Model 6
INTDEP _(t-1)			0.575*** (0.058)	0.576*** (0.055)	0.544*** (0.057)
LLRGL			0.071*** (0.026)	–0.045 (0.032)	0.112*** (0.029)
LIQATA			–0.137*** (0.031)	–0.131*** (0.036)	–0.120*** (0.036)
ZSCORE			0.021 (0.023)	0.028 (0.022)	0.017 (0.025)
SIZE			0.068* (0.036)	0.050 (0.038)	0.067* (0.038)
GDPGR			–0.246*** (0.022)	–0.248*** (0.034)	–0.243*** (0.021)
INFLRT			0.155*** (0.022)	0.155*** (0.022)	0.147*** (0.024)
EXCHRT			–0.360*** (0.082)	–0.347*** (0.072)	–0.379*** (0.085)
CR5			0.386 (0.240)	0.452** (0.226)	0.400* (0.238)
LINDEX			0.126 (0.290)	0.124 (0.293)	0.145 (0.287)
MCGDP			–0.092*** (0.030)	–0.096*** (0.031)	–0.103*** (0.030)

Table 3 (continued)

		Model 4	Model 5	Model 6
LISTED		0.136 (0.189)	0.097 (0.188)	0.776*** (0.264)
FOREIGN		−0.309*** (0.108)	−0.275*** (0.111)	−0.407* (0.232)
CAR4		−0.146**	−0.146	−0.135**
CAR4 * LLRGL	+	0.065	(0.206) 0.045	(0.061)
CAR4 * LIQATA	−		(0.037) −0.014	
CAR4 * ZSCORE	−		(0.053) −0.013	
LISTED * LLRGL	+		(0.070)	−0.066 (0.054)
LISTED * LIQATA	−			−0.080 (0.065)
LISTED * ZSCORE	−			−0.090** (0.039)
FOREIGN * LLRGL	+			−0.053 (0.048)
FOREIGN * LIQATA	−			−0.091* (0.054)
FOREIGN * ZSCORE	−			0.139** (0.067)
Wald test		Chi ² (14) = 21,540 [0.000]***	Chi ² (17) = 28,220 [0.000]***	Chi ² (20) = 17,670 [0.000]***
Sargan test		Chi ² (103) = 103.1 [0.478]	Chi ² (103) = 103.2 [0.475]	Chi ² (103) = 102.6 [0.492]
Arellano–Bond test for AR(1)		N(0, 1) = −4.583 [0.000]***	N(0, 1) = −4.550 [0.000]***	N(0, 1) = −4.747 [0.000]***
Arellano–Bond test for AR(2)		N(0, 1) = 0.073 [0.942]	N(0, 1) = −0.147 [0.883]	N(0, 1) = 0.188 [0.851]
N		1456	1456	1456

This table presents the results from the two-step Generalized Method of Moments System estimations. Coefficients and standard errors (in parentheses) are from the first step. The Sargan and Arellano–Bond tests are from the second. The estimation uses annual observations of Indonesian commercial banks over the period 1995–2009. The dependent variable is INTDEP (the ratio of total interest expense to total deposits). The independent variables include: LLRGL (the ratio of loan-loss-reserves-to-gross-loans); LIQATA (the ratio of liquid-assets-to-total-assets); ZSCORE is a proxy for insolvency risk; and SIZE is total assets. Control variables for general macroeconomic conditions include: GDPGR (the growth rate in GDP); INFLRT (the inflation rate); and EXCHRT (the annual average of exchange rate Rp/USD scaled in Rp000). CR5 is the concentration ratio using the largest five banks. LINDEIX is the Lerner Index, a measure of bank sector competition and MCGDP (market capitalization over GDP) controls for the impact of capital market competition. All variables are transformed using the natural logarithmic transformation. Three time dummy variables are BGS (1 = 1998–2004 and 0 otherwise), LG (1 = 2005–2009 and 0 otherwise), and CAR4 (1 = 1998–2000 and 0 otherwise). Also, dummy variables LISTED (1 if listed and 0 otherwise) and FOREIGN (1 if foreign and 0 otherwise) are used.

* Indicate statistical significance at the 10% level (2-tailed).

** Indicate statistical significance at the 5% level (2-tailed).

*** Indicate statistical significance at the 1% level (2-tailed).

Inconsistent with our expectation, the first control variable (SIZE) shows a mixed result. In particular, bank size shows a negative and significant relation with INTDEP in Models 1 and 3, but a positive and significant relation in Models 4 and 6. However, the control variables of GDPGR, EXCHRT and MCGDP are significantly negative in all models. This indicates that during the crisis and subsequent recovery, an inverse relation existed between the interest rate on deposits and GDPGR, the rupiah/USD exchange rate, and market capitalization to GDP. Interestingly, INFLRT is significant and positive in the CAR4 models, but insignificant in the BGS/LG models. Also, CR5 is significant and positive in the BGS/LG models, but insignificant in the CAR4 models. Finally, the banking sector competition variable (LINDEIX) is not significant in any regressions, and this may partially explain why the extent of market discipline tends to be limited, particularly after the regulatory changes.

5.4. Robust examination

As a robustness check for our previous analyses, we run regressions excluding several independent variables that are highly correlated. We exclude INFLRT and CR5 from the regressions since very strong correlations (above 75%) exist between GDPGR and INFLRT, GDPGR and CR5, and INFLRT and MCGDP. In general, the results are consistent with our findings that the BGS is less credible than LG, and a lower capital requirement discourages market discipline (see Table 4). However, we observe that by excluding the highly correlated explanatory variables, LIQATA no longer has the

expected negative and significant sign in Models 1 and 3, but SIZE and LINDEIX show a positive and significant sign in all regressions. In addition, the results from Models 1–3 provide further confirmation that foreign banks pay lower rates to depositors than do domestic banks. Moreover, the interaction terms in Model 6 provide additional and consistent evidence that market discipline is not only more pronounced in foreign banks than domestic banks, but also in listed banks than unlisted banks.

We also check our results by employing the growth of the deposits (GRDEP) as an alternative dependent variable. Here, the expected signs should be opposite to when the interest rate of deposits (INTRDEP) is used as the dependent variable. The regression results (not reported) indicate that for the full period (Models 1 and 4), only LLRGL shows the expected sign and is significant. Hence, credit risk remains the main driver of market discipline. However, the regulatory variables do not have any significant impact on market discipline. Overall, these results suggest that market discipline in Indonesian banks is reflected more in the price of deposits than in the quantity of deposits.

For comparative purposes, we also analyze the data employing static panel data procedures. We find that the results using INTDEP as the dependent variable are consistent with the dynamic panel data methods, except for the impact of LG. Under the static panel model, market discipline exists under the limited guarantee regime. However, our confidence in these results is lower than with the dynamic panel data analysis because the nature of the data makes the latter methodology more appropriate.

Table 4
Regression results – robustness examination.

Dependent variable		INTDEP		
Independent variables	Expected signs	Model 1	Model 2	Model 3
INTDEP _(t-1)		0.550*** (0.044)	0.538*** (0.047)	0.610*** (0.068)
LLRGL	+	0.126*** (0.027)	0.157*** (0.060)	0.159*** (0.029)
LIQATA	–	–0.045 (0.039)	0.235** (0.109)	–0.040 (0.040)
ZSCORE	–	0.008 (0.025)	0.139*** (0.048)	–0.019 (0.026)
SIZE	–	0.153*** (0.054)	0.145*** (0.045)	0.122** (0.063)
GDPGR		–0.354*** (0.025)	–0.333*** (0.025)	–0.376*** (0.022)
EXCHRT		–0.191** (0.084)	–0.347*** (0.099)	–0.152* (0.082)
LINDEX		0.881** (0.389)	0.659* (0.359)	1.004** (0.433)
MCGDP		–0.323*** (0.035)	–0.392*** (0.043)	–0.295*** (0.032)
LISTED		–0.181 (0.205)	–0.030 (0.186)	–0.261 (0.200)
FOREIGN		–0.470** (0.205)	–0.361** (0.182)	–0.386* (0.228)
BGS		–0.596*** (0.119)	0.878*** (0.297)	–0.581*** (0.131)
LG		–0.374** (0.161)	0.413 (0.355)	–0.319* (0.189)
CAR4				–0.186** (0.085)
BGS * LLRGL	+		–0.104 (0.065)	
BGS * LIQATA	–		–0.336*** (0.108)	
BGS * ZSCORE	–		–0.188*** (0.059)	
LG * LLRGL	+		0.108 (0.097)	
LG * LIQATA	–		–0.173 (0.112)	
LG * ZSCORE	–		–0.178*** (0.062)	
Wald test		Chi ² (13) = 8970 [0.000]***	Chi ² (19) = 10,430 [0.000]***	Chi ² (14) = 11,610 [0.000]***
Sargan test		Chi ² (103) = 103.3 [0.474]	Chi ² (103) = 101.6 [0.521]	Chi ² (103) = 101.0 [0.538]
Arellano–Bond test for AR(1)		N(0, 1) = –4.781 [0.000]***	N(0, 1) = –4.734 [0.000]***	N(0, 1) = –4.497 [0.000]***
Arellano–Bond test for AR(2)		N(0, 1) = 0.419 [0.675]	N(0, 1) = 0.363 [0.716]	N(0, 1) = 0.668 [0.504]
N		1456	1456	1456
		Model 4	Model 5	Model 6
INTDEP _(t-1)		0.503*** (0.058)	0.519*** (0.051)	0.466*** (0.056)
LLRGL	+	0.082*** (0.029)	0.085*** (0.043)	0.134*** (0.030)
LIQATA	–	–0.126*** (0.031)	–0.166*** (0.036)	–0.094*** (0.036)
ZSCORE	–	0.043* (0.026)	0.052** (0.024)	0.050* (0.029)
SIZE	–	0.178*** (0.050)	0.162*** (0.057)	0.163*** (0.045)
GDPGR		–0.341*** (0.018)	–0.366*** (0.027)	–0.329*** (0.019)
EXCHRT		–0.443*** (0.091)	–0.345*** (0.085)	–0.453*** (0.091)
LINDEX		0.812*** (0.294)	0.827*** (0.327)	0.854*** (0.251)
MCGDP		–0.272*** (0.041)	–0.232*** (0.035)	–0.270*** (0.040)
LISTED		–0.271 (0.230)	–0.299 (0.222)	1.013*** (0.298)
FOREIGN		–0.591*** (0.197)	–0.575*** (0.202)	–0.398 (0.266)
CAR4		–0.116* (0.050)	–0.288 (0.050)	–0.110* (0.050)
CAR4 * LLRGL	+		0.021 (0.050)	
CAR4 * LIQATA	–		0.096* (0.050)	

Table 4 (continued)

		Model 4	Model 5	Model 6
CAR4 * ZSCORE	–		(0.055) –0.073 (0.074)	
LISTED * LLRGL	+			–0.042 (0.081)
LISTED * LIQATA	–			–0.193*** (0.078)
LISTED * ZSCORE	–			–0.164*** (0.039)
FOREIGN * LLRGL	+			–0.104** (0.048)
FOREIGN * LIQATA	–			–0.107** (0.054)
FOREIGN * ZSCORE	–			0.098 (0.071)
Wald test		Chi ² (12) = 8078 [0.000]***	Chi ² (15) = 9361 [0.000]***	Chi ² (18) = 7292 [0.000]***
Sargan test		Chi ² (103) = 102.8 [0.486]	Chi ² (103) = 102.8 [0.487]	Chi ² (103) = 102.3 [0.501]
Arellano–Bond test for AR(1)		N(0, 1) = –4.431 [0.000]***	N(0, 1) = –4.536 [0.000]***	N(0, 1) = –4.591 [0.000]***
Arellano–Bond test for AR(2)		N(0, 1) = –0.427 [0.670]	N(0, 1) = –0.754 [0.451]	N(0, 1) = –0.176 [0.861]
N		1456	1456	1456

This table presents the results from the two-step Generalized Method of Moments System estimations. Coefficients and standard errors (in parentheses) are from the first step. The Sargan and Arellano–Bond tests are from the second. The estimation uses annual observations of Indonesian commercial banks over the period 1995–2009. The dependent variable is INTDEP (the ratio of total interest expense to total deposits). The independent variables include: LLRGL (the ratio of loan-loss-reserves-to-gross-loans); LIQATA (the ratio of liquid-assets-to-total-assets); ZSCORE is a proxy for insolvency risk; and SIZE is total assets. Control variables for general macroeconomic conditions include: GDPGR (the growth rate in GDP); and EXCHRT (the annual average of exchange rate Rp/USD scaled in Rp000). LINDEXT is the Lerner Index, a measure of bank sector competition and market capitalization over GDP (MCGDP) controls for the impact of capital market competition. All variables are transformed using the natural logarithmic transformation. Three time dummy variables are BGS (1 = 1998–2004 and 0 otherwise), LG (1 = 2005–2009 and 0 otherwise), and CAR4 (1 = 1998–2000 and 0 otherwise). Also, dummy variables LISTED (1 if listed and 0 otherwise) and FOREIGN (1 if foreign and 0 otherwise) are used.

* Indicate statistical significance at the 10% level (2-tailed).

** Indicate statistical significance at the 5% level (2-tailed).

*** Indicate statistical significance at the 1% level (2-tailed).

6. Conclusions and policy implications

We test for the presence of market discipline on Indonesian banks during 1995–2009, and the impact of three major regulatory changes. Using a balanced panel of 104 commercial banks, we find evidence of market discipline as higher deposit rates are associated with higher default risk and liquidity risk.

We find an inverse relation between depositor interest rates and BGS and CAR. This is consistent with the insurance scheme being perceived as credible and the lower CAR signaling reduced likelihood of bank closures resulting in a weakening of market discipline.²⁰ These two complementary signals reduce the need for market discipline. In the subsequent LG environment, improved economic conditions and the strengthening of banks mitigated the need for market discipline. Therefore, our study is consistent with Martínez-Peria and Schmukler (2001), Önder and Özyildirim (2003), and Demirgüç-Kunt and Huizinga (2004), who argue that government guarantees reduce market discipline, particularly if the guarantees are perceived to be credible. However, our findings are inconsistent with Hosono et al. (2005) who argue that the BGS in Indonesia did not achieve credibility. Also, we document that the evidence of market discipline is more pronounced in listed banks than unlisted banks, and in foreign banks than domestic banks.

Our findings have several important policy implications for banking regulation and supervision during a crisis period, at least in the Indonesian context. The effectiveness of market discipline is reduced and bank regulators need to compensate by strengthen-

ing their supervisory function. Moreover, since we observe evidence that market discipline is more pronounced in listed banks and foreign banks, regulators should encourage more domestic and foreign banks to be listed in the capital markets. In general, however, our results suggest that during a crisis period, as in the current global financial crisis, integrating market discipline with regulatory discipline is crucial.

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²⁰ Nevertheless, our result strongly indicates that the BGS encourages market discipline for liquidity risk. This is an important finding because the current global crisis is indeed a liquidity crisis and many countries have decided to implement the BGS to cope with the crisis. Future studies may explore whether these countries also experience the same phenomenon following the BGS adoption.

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