

# Deposit structure, market discipline, and ownership type

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**Submission date:** 17-Mar-2021 03:16AM (UTC-0700)

**Submission ID:** 1535266749

**File name:** NAL\_Deposit\_structure,\_market\_discipline,\_and\_ownership\_type.pdf (253.27K)

**Word count:** 9561

**Character count:** 44729



ELSEVIER

13

Contents lists available at ScienceDirect

Economic Systems

journal homepage: [www.elsevier.com/locate/ecosys](http://www.elsevier.com/locate/ecosys)

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## Deposit structure, market discipline, and ownership type: Evidence from Indonesia



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### ARTICLE INFO

#### Keywords:

Deposit structure  
Market discipline  
Banking stability index  
Ownership  
Indonesia

### ABSTRACT

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In this paper, we extend the literature on the discipline imposed by depositors on banks by disentangling the impact of macro risk and micro risk. We also take advantage of a unique dataset in which depositors are split into different categories of deposit size in different types of banks (bank ownership structure). We consider the Banking Stability Index, which is used by the Indonesia Deposit Insurance Corporation as a dashboard to monitor banking stability at the country level as well as individual stability measures such as the Z-score. Using monthly data from 2005 to 2013, our findings show that both macro and micro levels of risk are considered by depositors to discipline banks. Large uninsured depositors are more effective at disciplining banks, highlighting the credibility of the insurance system that is in place. Bank ownership type also matters in explaining the difference in market discipline by depositors.

### 1. Introduction

It is widely known that banking is a highly regulated industry, as banks collect funds from society in the form of deposits. Specifically, banks collect funds from surplus spending units/depositors and channel it to deficit spending units/borrowers. This means that banks are much more leveraged than non-financial firms. Market discipline by depositors has been extensively studied in the banking literature, with depositors taking action depending on the risk level of banks. When banks pose more risk, depositors may withdraw their money or require a higher interest rate on deposits (Nys et al., 2015). Depositors' power can also push banks to be more efficient in utilizing inputs (Uchida and Satake, 2009). Some empirical papers also reveal that the strength of depositor disciplining efforts depends on the deposit insurance system that is in place (e.g. Hadad et al., 2011; Nys et al., 2015). Arguably, the more generous the deposit insurance system, the less incentive it creates for depositors to monitor banks. Some studies also show that depositors are more careful with their funds during a crisis, so market discipline by depositors works better during crises (Hasan et al., 2013).

Most of the studies stress the micro-level of bank risk, considering that depositors look at micro factors. More recently, some

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<https://doi.org/10.1016/j.ecosys.2020.100758>

Received 7 October 2018; Received in revised form 5 March 2019; Accepted 4 May 2019

Available online 08 May 2020

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studies also introduce contingency factors that influence the magnitude of disciplining efforts of depositors. Our present paper takes a different perspective. Rather than considering contingency factors in explaining the degree of market discipline, we focus on the different sources of risk depositors are concerned with. Which matters more to depositors, micro or macro risk? First, because macroeconomic risk can also affect the behavior of bank depositors, we consider how macro-level risk matters. The effect of macroeconomic factors beyond bank-specific characteristics can worsen macroeconomic conditions and directly threaten the value of market participants' assets (bank deposits) (Levy-Yeyati et al., 2010). We introduce the Banking Stability Index (BSI) to measure the macro-level risk. It is a comprehensive index developed by the Indonesia Deposit Insurance Corporation (IDIC) to monitor banking stability at the country level. By employing the BSI, we can also test whether this measure is credible in representing the level of banking stability. Second, micro-level (bank-level) factors are also included to test the sensitivity of depositors to bank risk. A set of standard measures is taken into account. We also take into consideration the role of ownership type, following the work of Hadad et al. (2011) and Nys et al. (2015). Hadad et al. (2011) argue that there is a flight to quality (deposits moving) from private banks to state-owned banks in periods of crisis. Nys et al. (2015) reveal that state-owned banks in Indonesia are less disciplined by depositors because they are perceived to be safer and less risky than private banks. This may be explained by the fact that state-owned banks are dominated by insured depositors, while foreign and private domestic banks are widely exposed to large deposits (see Table 1). In this paper, we argue that bank risk for state-owned banks is less impacted, at both micro and macro levels, than for foreign and private domestic banks. To do so, we split the sample based on ownership type.

We study market discipline by depositors in the context of Indonesian banking for several reasons. First, banks are still the main financial intermediaries in this country (Trinugroho et al., 2014). The Indonesian financial system has traditionally been bank-oriented with bank assets representing 77.9 % of the total assets of the financial system in 2013 (Shaban and James, 2018). Second, Indonesia is a prominent emerging market with a GDP of USD 1.016 trillion in 2017, according to the World Bank. With a population of over 260 million, Indonesia is one of the world's biggest potential banking markets. Bank interest margins in Indonesia are also substantially higher than in other ASEAN countries (Trinugroho et al., 2014).

We contribute to the existing literature in several ways. First, we take into consideration both macro and micro risk measures to assess market discipline in the banking industry. Second, we use a comprehensive and contextual index, the banking stability index, as a proxy of macro-level risk. Third, we look into the effect of market discipline exerted by depositors across bank ownership types and across depositor size. In general, we find that both macro and micro risk levels are considered by depositors to discipline banks. Moreover, as expected, small and insured depositors are less effective in disciplining banks. Going deeper, our empirical results show that bank ownership type also matters in explaining the difference in market discipline by depositors. More particularly, we provide evidence that depositors of state-owned banks exert stronger monitoring and discipline than those of other types of banks. Our results are robust when we estimate the empirical model using a dynamic panel approach.

The rest of the paper is organized as follows. Section 2 reviews the literature on market discipline and depositor behaviors with a specific focus on Indonesia; Section 3 introduces the data and empirical strategy; Section 4 discusses the empirical findings; Section 5 presents robustness checks; and Section 6 concludes.

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## 2. Market discipline by depositors

Our paper extends the literature on depositor behavior in monitoring banks by disentangling the sources of risk considered by depositors, deposit structure and ownership types. Generally, previous empirical studies confirm that depositors discipline banks in various ways. For instance, Park (1995) showed that riskier banks in the US during the 1985–1992 period pay a higher interest rate on deposits; however, deposit growth is slower. In a seminal paper, Martinez-Peria and Schmukler (2001), studying three countries in Latin America during the 1980s and the 1990s, found that depositors punish risky banks by withdrawing their deposits and requiring higher interest rates on deposits. Likewise, Murata and Hori (2006) documented that depositor discipline mechanisms are effective in small banking institutions in Japan. Similarly, Ugan et al. (2008) provided evidence that well-capitalized and more liquid banks in Russia have higher deposit growth. In recent years, most empirical studies still examined the existence of market discipline by depositors. Some studies, however, shifted to the importance of market discipline by creditors more generally (e.g. Bennett et al., 2015; Tovar-García, 2017).

Some developments regarding market discipline by depositors in recent years are found in the literature. For example, in the context of Central European banking, Hasan et al. (2013) found that during the crisis, depositor behavior was more affected by negative rumors released by the media concerning parent companies of banks. Barajas and Catalán (2015) documented that the market disciplining role of pension funds as large depositors was more pronounced for banks without connections to the pension fund industry. Hou et al. (2016) found that internet finance development contributed to changing the level of market discipline by depositors. Cubillas et al. (2017), in a cross-country study, revealed that large banks were less disciplined by depositors, more so in countries that did not have any experience with deposit losses in the past. Government actions also play a role in reducing market discipline. Berger and Turk-Ariss (2015) found there was significant depositor discipline in the U.S. and EU prior to the crisis, but the effects were stronger in the U.S. for large institutions, which is consistent with the fact that a government bailout of large organizations is more likely to happen in the EU.

Market discipline by depositors is also extensively associated with the deposit insurance scheme that is in place. Arguably, disciplining efforts of depositors would be decreased in a country with generous deposit insurance. Many papers discuss the effect of deposit insurance on market discipline by depositors using either cross-country analysis, single-country analysis, or even case studies of single banks<sup>1</sup> (e.g. Martinez-Peria and Schmukler, 2001; Davenport and McDill, 2006; Fueda and Konishi, 2007; Hadad et al., 2011). In the context of Indonesia, where formal deposit insurance was implemented at the end of 2004, Hadad et al. (2011)

**Table 1**  
Deposit structure of Indonesian Banks 2013–2016<sup>2</sup>.  
Source: Indonesia Deposit Insurance Corporation

Banks	Account < 100 million	Nominal < 100 million	Account 100 million - 1 billion	Nominal 100 million - 1 billion	Account 1 - 5 billion	Nominal 1 - 5 billion	Account > 5 billion	Nominal > 5 billion
State	72 %	61 %	45 %	40 %	33 %	33 %	38 %	53 %
Foreign	2 %	4 %	8 %	10 %	15 %	15 %	20 %	18 %
Private	26 %	35 %	47 %	50 %	52 %	52 %	42 %	30 %

**Table 2**  
Descriptive statistics.

Variables	Definition	N	sd	mean	min	max
<b>Dependent</b>						
account100mill	Growth of account under 100 million IDR	9099	0.034	0.011	-0.060	0.109
depo100mill	Growth of total deposit of account under 100 million IDR	9099	0.061	0.013	-0.114	0.172
acc100to1bill	Growth of account above 100 million IDR to 1 Billion IDR	9095	0.081	0.017	-0.154	0.256
dep100to1bill	Growth of total deposit of account above 100 million to 1 billion IDR	9095	0.106	0.024	-0.177	0.355
acc1to5bill	Growth of account above 1 billion to 5 billion IDR	9074	0.122	0.024	-0.222	0.368
dep1to5bill	Growth of total deposit of account above 1 billion to 5 billion IDR	9074	0.118	0.023	-0.215	0.338
accountmore5b	Growth of account that holds more than 5 billion IDR	8830	0.146	0.024	-0.272	0.400
depmore5b	Growth of total deposit of account that hold more than 5 billion IDR	8831	0.202	0.032	-0.378	0.560
<b>Risk variables</b>						
zscore_3	$(ROA_3 + EQTA_3) / sd_{ROA_3}$ . 3 moving average	6547	254.195	211.062	14.310	980.744
BSI	Banking stability index. Calculated by Indonesia Deposit Insurance Corporation	10080	1.101	99.809	97.617	103.288
intdep	Interest on deposit	6779	0.022	0.035	0.006	0.084
<b>Control variables</b>						
ROA	Return on Assets	6793	0.009	0.011	0.000	0.031
EQTA	Equity to total assets	6781	0.241	0.276	0.069	0.813
CIR	Cost-to-income ratio	6793	0.109	0.360	0.187	0.599
LnTA	Natural logarithm total asset	6781	1.705	15.656	12.841	18.962
LTR	Liquidity transformation ratio. Illiquid assets/illiquid liabilities	6781	0.431	1.132	0.561	2.155
sob	Dummy variable for State-owned banks (sobs). 1 if sob, 0 otherwise	10080	0.437	0.257	0	1
foreign	Dummy variable for foreign banks. 1 if foreign bank, 0 otherwise	10080	0.414	0.219	0	1

**Table 3**  
Correlation matrix.

	intdep	zscore_3	BSI	ROA	EQTA	CIR	LnTA	LTR	sob	foreign
intdep	1									
zscore_3	0.1792	1								
BSI	-0.034	0.1398	1							
ROA	0.201	-0.1878	-0.0205	1						
EQTA	-0.0432	0.6114	0.1235	0.0168	1					
CIR	-0.1501	0.2007	-0.0113	-0.1206	0.2029	1				
LnTA	-0.2085	-0.2046	0.01	0.22	-0.083	0.0082	1			
LTR	-0.169	-0.436	-0.1196	0.2736	-0.5381	0.0781	0.2399	1		
sob	-0.1429	-0.3154	-0.0031	0.3961	-0.2244	-0.0859	0.2899	0.4091	1	
foreign	-0.1148	0.0411	-0.005	-0.0659	0.0506	0.0521	0.0421	-0.0759	-0.3255	1

presented a comprehensive picture of the impact of deposit insurance systems on depositors' discipline using data covering three episodes of deposit insurance regimes in Indonesia (no deposit insurance system, blanket guarantee, and formal deposit insurance with limited coverage). According to their study, market discipline by depositors was weaker in the period of blanket guarantee because all deposits were insured during that period and there was less incentive for depositors to discipline banks. By introducing the role of banks' political connections, Nys et al. (2015) and Tandelilin et al. (2015) confirmed the findings of Hadad et al. (2011). Nys et al. (2015) found robust evidence that the effect of political connections in attracting deposits was stronger in the period of the limited guarantee system. Hence, according to their findings, shifting from blanket guarantee to limited guarantee creates incentives for depositors to monitor banks. Likewise, Tandelilin et al. (2015) disentangled depositors' behavior under different insurance coverage. They found that the deposit insurance system with limited coverage in Indonesia was credible when there was no bail-out commitment, which led depositors to improve their monitoring efforts of banks. More specifically, by categorizing depositors into different levels under the different insurance schemes, they found that large depositors played a more important role in disciplining

<sup>1</sup> A more comprehensive literature review on market discipline by depositors is included in the paper by Tandelilin et al. (2015).

**Table 4**  
Baseline regression.

	account100mill	depo100mill	acc100to1bill	dep100to1bill	acc1to5bill	dep1to5bill	accountmore5b	depmore5b
intdep	0.109 (1.35)	0.0955 (1.04)	0.232* (1.93)	0.159 (1.18)	0.00372 (0.02)	-0.0812 (-0.45)	-0.867*** (-3.79)	-1.658*** (-4.77)
zscore_3	0.00000638 (0.13)	0.00000245 (0.48)	-0.00000908* (-1.87)	-0.00000894 (-1.33)	0.00000420 (0.57)	0.00000437 (0.59)	0.0000248** (2.07)	0.0000489** (2.54)
BSI	-0.0280*** (-3.32)	-0.0188* (-1.92)	-0.0445*** (-2.94)	-0.203*** (-9.96)	-0.0469** (-1.97)	-0.0622*** (-2.78)	-0.0529** (-2.06)	-0.0540 (-1.34)
ROA	0.0271 (0.21)	0.530*** (2.91)	1.034*** (3.74)	0.845** (2.51)	1.170*** (3.65)	0.834*** (2.83)	-0.882** (-2.55)	-2.741*** (-4.01)
EQTA	-0.0339*** (-3.26)	-0.0249** (-2.29)	-0.0264*** (-2.62)	-0.0160 (-1.31)	-0.0196 (-1.23)	-0.00983 (-0.61)	-0.0118 (-0.62)	-0.0466 (-1.61)
CIR	-0.00768 (-0.64)	0.0121 (1.09)	0.0537*** (4.21)	0.0525*** (3.42)	0.0679*** (3.63)	0.0545*** (3.20)	-0.00171 (-0.08)	-0.102*** (-3.05)
LnTA	-0.000369 (-0.68)	-0.000700 (-1.28)	-0.00190*** (-2.90)	-0.00275*** (-3.75)	-0.00357*** (-4.42)	-0.00270*** (-3.50)	-0.00207** (-2.12)	-0.00240 (-1.31)
LTR	-0.00648*** (-2.84)	-0.00693*** (-3.22)	-0.00818*** (-2.64)	-0.00738* (-1.71)	-0.0104** (-2.21)	-0.0121*** (-2.72)	-0.0196*** (-3.23)	-0.0269*** (-2.65)
sob	0.00478** (2.06)	0.00630*** (2.70)	0.00294 (0.97)	0.00518 (1.64)	0.000388 (0.11)	0.00157 (0.49)	0.000711 (0.17)	0.0138* (1.75)
foreign	0.00379 (1.04)	0.00510 (1.33)	0.00483 (1.10)	0.00533 (1.24)	-0.00178 (-0.40)	-0.00210 (-0.50)	-0.0147*** (-3.59)	-0.0130** (-2.16)
_cons	2.881*** (3.34)	1.939* (1.94)	4.554*** (2.96)	20.68*** (9.99)	4.845** (2.01)	6.389*** (2.81)	5.491** (2.10)	5.677 (1.38)
N	6308	6308	6308	6308	6303	6303	6132	6133
N_g	81	81	81	81	81	81	81	81
r2	0.0400	0.0799	0.129	0.204	0.107	0.0984	0.0443	0.0889
t-statistics in parentheses								
** p < 0.1    ** p < 0.05    *** p < 0.01*								

**Table 5**  
Market discipline in state-owned banks.

	account100mill	depo100mill	acc100to1bill	dep100to1bill	acc1to5bill	dep1to5bill	accountmore5b	depmore5b
intdep	-0.0419 (-0.57)	-0.205 (-1.36)	0.0885 (0.41)	0.150 (0.54)	-0.126 (-0.41)	-0.158 (-0.44)	-0.963*** (-3.17)	-0.985* (-1.82)
zscore_3	-0.000000526 (-0.06)	-0.00000608 (-0.29)	-0.0000460** (-2.28)	-0.0000645** (-2.49)	-0.0000106 (-0.42)	0.0000225 (0.63)	0.0000550** (2.31)	0.00017** (2.06)
BSI	-0.0677*** (-6.71)	-0.0837*** (-4.32)	-0.178*** (-6.39)	-0.234*** (-6.56)	-0.234*** (-5.21)	-0.188*** (-4.22)	-0.0314 (-0.79)	0.207*** (3.36)
ROA	-0.104 (-0.53)	0.0430 (0.12)	0.629 (1.43)	0.735 (1.30)	0.418 (0.79)	0.537 (1.07)	-1.293** (-2.43)	-2.559** (-2.49)
EQTA	-0.00206 (-0.13)	0.0209 (1.15)	0.0232 (1.18)	0.00642 (0.24)	-0.0330 (-1.04)	-0.0518 (-1.14)	-0.00575 (-0.25)	-0.0263 (-0.53)
CIR	-0.0134 (-1.42)	-0.00691 (-0.49)	0.0372 (1.55)	0.0346 (1.16)	0.0144 (0.42)	0.0195 (0.60)	-0.0427** (-1.99)	-0.170*** (-3.26)
LnTA	-0.00231*** (-2.91)	-0.00186** (-2.52)	-0.00154 (-1.55)	-0.00117 (-1.09)	-0.00297* (-1.82)	-0.00199 (-1.23)	-0.00642*** (-3.45)	-0.00810** (-2.27)
LTR	-0.00230 (-0.93)	-0.00207 (-0.66)	-0.00103 (-0.28)	-0.00140 (-0.27)	-0.00303 (-0.56)	-0.00619 (-1.05)	-0.0122** (-2.10)	0.00531 (0.69)
N	1970	1970	1970	1970	1970	1970	1968	1968
N_g	27	27	27	27	27	27	27	27
r2	0.231	0.333	0.469	0.477	0.350	0.281	0.111	0.306
t-statistics in parentheses								
** p < 0.1    ** p < 0.05    *** p < 0.01*								

banks' behavior. This behavior was more pronounced in private banks when the maximum insurance coverage was reduced. However, Trinugroho et al. (2016) showed that reducing the maximum coverage also reduced bank risk-taking, as shown by the increasing proportion of liquid assets held by banks. This indicates that banks were engaging in efforts of self-discipline following the regulatory change.

In the current literature, there is no clear picture of which type of risk, macro or micro, is considered more important by depositors monitoring banks. We hence consider macroeconomic risk as an important factor that affects depositors' behaviors. Indeed, Levy-Yeyati et al. (2010) found that macro-level risk can influence depositor reactions, both regardless of and through bank-specific characteristics. They argued that depositors might flee from domestic banks, irrespective of individual bank fundamentals, if convertibility to foreign currency was not an option. This provides evidence that macro-level risk should be taken into account along

**Table 6**  
Market discipline in private banks.

	account100mill	depo100mill	acc100to1bill	dep100to1bill	acc1to5bill	dep1to5bill	accountmore5b	depmore5b
intdep	0.0799 (0.82)	0.0422 (0.49)	0.0392 (0.41)	-0.0760 (-0.70)	-0.178 (-0.91)	-0.208 (-1.06)	-0.641** (-2.04)	-1.585*** (-3.51)
zscore_3	0.00000217 (0.42)	0.00000536 (1.07)	-0.00000312 (-0.63)	-0.00000619 (-0.91)	0.0000121* (1.82)	0.00000968 (1.46)	0.0000281** (2.18)	0.0000382** (2.19)
BSI	-0.00456 (-0.39)	0.00569 (0.51)	0.00973 (0.71)	-0.200*** (-7.19)	0.0267 (1.21)	-0.00989 (-0.43)	-0.0597* (-1.75)	-0.150*** (-3.26)
ROA	-0.213 (-1.19)	-0.0602 (-0.33)	-0.149 (-0.62)	-0.521* (-1.76)	0.132 (0.52)	-0.00454 (-0.02)	-0.538 (-1.29)	-1.398** (-2.20)
EQTA	-0.0205 (-1.28)	-0.0111 (-0.67)	0.00183 (0.12)	0.0115 (0.65)	0.0113 (0.53)	0.0182 (0.96)	-0.0235 (-0.88)	-0.0797* (-1.94)
CIR	-0.0123 (-0.86)	-0.0107 (-0.86)	0.00881 (0.77)	0.00566 (0.41)	0.0332 (1.64)	0.0267 (1.46)	0.0161 (0.65)	-0.0193 (-0.54)
LnTA	0.00118* (1.73)	0.000711 (1.01)	-0.0000163 (-0.02)	-0.00111 (-1.26)	-0.00190** (-2.09)	-0.00122 (-1.35)	-0.00123 (-0.86)	-0.00143 (-0.69)
LTR	-0.0113** (-2.57)	-0.0101*** (-2.92)	-0.0116** (-2.38)	-0.00983 (-1.47)	-0.0151* (-1.85)	-0.0166** (-2.22)	-0.0261** (-2.21)	-0.0542*** (-2.89)
_cons	0.472 (0.39)	-0.565 (-0.49)	-0.958 (-0.69)	20.40*** (7.21)	-2.645 (-1.18)	1.051 (0.45)	6.155* (1.78)	15.46*** (3.29)
N	4338	4338	4338	4338	4333	4333	4164	4165
N_g	5469	54	54	54	54	54	54	54
r2	0.169	0.210	0.273	0.722	0.0669	0.0644	0.0597	0.0102
t-statistics in parentheses								
=** p < 0.1    ** p < 0.05    *** p < 0.01*								

**Table 7**  
Market discipline in foreign banks.

	account100mill	depo100mill	acc100to1bill	dep100to1bill	acc1to5bill	dep1to5bill	accountmore5b	depmore5b
intdep	0.285* (1.86)	0.292 (0.98)	0.135 (0.51)	-0.107 (-0.36)	-0.210 (-0.58)	-0.248 (-0.71)	-0.581 (-1.51)	-2.187*** (-3.63)
zscore_3	-0.00000378 (-0.51)	-0.00000603 (-0.86)	-0.00000763 (-1.01)	-0.00000286 (-0.22)	-0.0000104 (-0.63)	-0.0000102 (-0.77)	0.0000324 (1.30)	0.0000507 (1.05)
BSI	0.00707 (0.45)	0.0291 (1.40)	0.0212 (0.88)	-0.183*** (-3.65)	-0.0267 (-0.75)	-0.0226 (-1.08)	-0.0214 (-0.56)	-0.108** (-2.10)
ROA	0.108 (0.38)	-0.0412 (-0.12)	-0.384 (-0.89)	-0.454 (-0.89)	-0.390 (-0.74)	-0.457 (-0.86)	-0.760 (-1.25)	-2.495*** (-2.65)
EQTA	-0.0173 (-1.42)	0.0176 (0.72)	0.0559** (2.13)	0.0571 (1.64)	-0.000293 (-0.01)	0.0128 (0.38)	0.0127 (0.35)	-0.0360 (-0.49)
CIR	0.0451*** (3.74)	0.0520*** (3.08)	0.0618*** (3.41)	0.0769*** (3.46)	0.0363* (1.75)	0.0328* (1.86)	-0.00662 (-0.25)	-0.0809* (-1.86)
LnTA	-0.00621* (-1.72)	-0.00679 (-1.44)	-0.00738 (-1.39)	-0.00839* (-1.66)	-0.00729** (-2.07)	-0.00632* (-1.86)	0.00,173 (0.50)	0.00315 (0.61)
LTR	-0.00267 (-0.49)	-0.00691 (-1.06)	-0.00712 (-0.74)	-0.0130 (-1.15)	-0.0249 (-1.37)	-0.0234 (-1.35)	-0.0212* (-1.90)	-0.0561*** (-2.84)
_cons	-0.614 (-0.38)	-2.843 (-1.32)	-2.037 (-0.83)	18.82*** (3.68)	2.846 (0.78)	2.453 (1.15)	2.152 (0.55)	11.13** (2.12)
N	1187	1187	1187	1187	1187	1187	1176	1177
N_g	13	13	13	13	13	13	13	13
r2	0.151	0.0989	0.109	0.191	0.125	0.123	0.114	0.145
t-statistics in parentheses								
=** p < 0.1    ** p < 0.05    *** p < 0.01*								

with micro-level risk. Specifically, this paper attempts to tackle the issue of which factors matter more, macro or micro, by empirically examining the combined effect of micro- and macro-level risks on depositor behavior in the context of Indonesian banking.

In this paper, we also look at the interaction between market discipline by depositors and bank ownership type. We argue that the magnitude of market discipline by depositors may be different across bank ownership types as depositors may perceive the ownership type as a source of risk. Arnold et al. (2016) revealed that the level of depositors' disciplining efforts varied across different types of bank governance, with commercial banks less disciplined by depositors than saving and co-operative banks. Although their papers do not necessarily discuss ownership type, Disli et al. (2013) and Nys et al. (2015) found that banks having connections with political power, through ownership or management, were perceived as less risky by depositors. This implies that depositors discipline these banks with a weaker intensity.

**Table 8**  
The interaction between Z-score and ownership.

	account100mill	depo100mill	acc100to1bill	dep100to1bill	acc1to5bill	dep1to5bill	accountmore5b	depmore5b
intdep	0.109 (1.35)	0.0942 (1.02)	0.228* (1.91)	0.156 (1.16)	0.00,160 (0.01)	-0.0827 (-0.46)	-0.867*** (-3.79)	-1.655*** (-4.74)
zscore_3	0.00000174 (0.32)	0.00000413 (0.72)	-0.00000871 (-1.61)	-0.00000878 (-1.17)	0.00000728 (1.04)	0.00000732 (0.99)	0.0000251** (2.08)	0.0000483*** (2.69)
BSI	-0.0275*** (-3.22)	-0.0165* (-1.66)	-0.0404*** (-2.66)	-0.199*** (-9.67)	-0.0429* (-1.80)	-0.0588*** (-2.65)	-0.0523** (-2.03)	-0.0593 (-1.46)
ROA	0.0370 (0.29)	0.558*** (3.00)	1.069*** (3.80)	0.872** (2.56)	1.218*** (3.80)	0.876*** (2.96)	-0.876** (-2.49)	-2.784*** (-4.05)
EQTA	-0.0333*** (-3.12)	-0.0220* (-1.91)	-0.0213** (-2.03)	-0.0119 (-0.94)	-0.0149 (-0.95)	-0.00594 (-0.37)	-0.0110 (-0.59)	-0.0537* (-1.90)
CIR	-0.00769 (-0.65)	0.0111 (1.00)	0.0513*** (3.95)	0.0506*** (3.27)	0.0664*** (3.56)	0.0534*** (3.12)	-0.00186 (-0.09)	-0.0999*** (-3.02)
LnTA	-0.000383 (-0.68)	-0.000800 (-1.43)	-0.00210*** (-3.16)	-0.00292*** (-3.87)	-0.00373*** (-4.65)	-0.00283*** (-3.65)	-0.00210** (-2.10)	-0.00214 (-1.17)
LTR	-0.00603** (-2.57)	-0.00515** (-2.37)	-0.00530* (-1.75)	-0.00507 (-1.18)	-0.00737 (-1.57)	-0.00953** (-2.15)	-0.0192*** (-3.18)	-0.0303*** (-2.87)
sob	0.00357 (1.59)	0.00126 (0.54)	-0.00537* (-1.67)	-0.00151 (-0.46)	-0.00809** (-2.08)	-0.00557 (-1.48)	-0.000380 (-0.08)	0.0235** (2.50)
foreign	0.00,507 (1.41)	0.00698* (1.67)	0.00,507 (1.19)	0.00537 (1.28)	0.00169 (0.31)	0.00124 (0.25)	-0.0143** (-2.53)	-0.0137 (-1.54)
zscore_sob	0.0000141* (1.65)	0.0000551*** (3.43)	0.0000879*** (4.73)	0.0000705*** (3.29)	0.0000930*** (4.36)	0.0000788*** (3.48)	0.0000119 (0.61)	-0.000104*** (-2.60)
zscore_foreign	-0.00000571 (-0.66)	-0.00000869 (-0.72)	-0.00000196 (-0.20)	-0.000000889 (-0.08)	-0.0000160 (-0.87)	-0.0000153 (-0.87)	-0.00000173 (-0.07)	0.00000475 (0.15)
_cons	2.827*** (3.24)	1.698* (1.69)	4.142*** (2.69)	20.34*** (9.71)	4.439* (1.84)	6.050*** (2.68)	5.431** (2.08)	6.222 (1.50)
N	6308	6308	6308	6308	6303	6303	6132	6133
N_g	81	81	81	81	81	81	81	81
r2	0.0423	0.0837	0.133	0.205	0.109	0.0999	0.0443	0.0895

t-statistics in parentheses.

\*p < 0.1, \*\*p < 0.05, \*\*\*p < 0.01.

### 3. Data and methodology

We focus on the market discipline mechanism by depositors in Indonesian banks by considering macro and micro risks, using a monthly dataset which spans from November 2005 to December 2013 covering different levels of deposit insurance coverage. We take advantage of a detailed dataset of depositors' groups based on size, including the number of accounts in a group. The bank-level as well as macro-level data are provided by the Indonesia Deposit Insurance Corporation. Given the different levels of deposit insurance coverage in our sample period, our dataset also enables us to split the sample based on the maximum insurance coverage in place.

To investigate the effect of banking stability on depositors' behavior, we follow Levy-Yeyati et al. (2010) and use standard panel estimates using monthly data. Our baseline panel specification is as follows:

$$DA_{i,t} = \alpha_i + \beta_1 Risk_{i,t} + \beta_2 Ownership_i + \beta' BC_{i,t} + \varepsilon_{i,t}$$

where  $i$  is the bank and  $t$  is the period (month). DA stands for the growth of deposits and account in bank  $i$  at time  $t$ . Risk stands for banking stability; we use two measures of banking stability, the Z-score and the Bank Stability Index (BSI). Ownership is a dummy variable to account for bank ownership. We create three dummy variables for state-owned, private and foreign. We use private as a benchmark. BC stands for bank-specific characteristics; it is a matrix of bank-level data of Ln total assets to capture bank size, return on assets (ROA) to measure profitability, cost to income ratio (CIR) to reflect efficiency, equity to total assets (EQTA) to account for capitalization, and liquidity transformation ratio (LTR) as a proxy of liquidity. We also control all the regressions with a time-effect dummy to capture macroeconomic factors.

Following Berger and Turk-Ariss (2015), we use the random effects method to estimate the model. The random effects model has the benefit of taking into account time-invariant variables that are omitted when using a fixed effects model. Therefore, using the fixed effects model is inefficient in estimating variables with limited variance (such as ownership). Moreover, the robust Hausman test indicates that the random effects model is more appropriate in our regression.

Table 2 provides descriptive statistics of all the variables that we estimate. Our dependent variables are the growth of deposit, and account of deposit group. The nominal of deposit can be subject to window dressing, which is very often the case (Berger and Turk-Ariss, 2015). Our detailed data enable us to investigate the behavior of depositors by the size of deposits. We use the growth of deposits of accounts under 100 million Rupiah (IDR hereafter), 100 million to 1 billion IDR, 1 billion IDR to 5 billion IDR, and more than 5 billion. We also use the growth of the number of accounts for each group of deposits.

For our risk variables, we employ the Z-score and the Bank Stability Index (BSI). The Z-score will be used as a primary proxy for

**Table 9**  
Interaction of the Banking Stability Index and ownership.

	account100mill	depo100mill	acc100to1bill	dep100to1bill	acc1to5bill	dep1to5bill	accountmore5b	depmore5b
intdep	0.112 (1.38)	0.0980 (1.07)	0.228* (1.88)	0.153 (1.12)	-0.00112 (-0.01)	-0.0833 (-0.46)	-0.869*** (-3.80)	-1.661*** (-4.77)
zscore_3	0.00000102 (0.20)	0.00000301 (0.58)	-0.00000959** (-1.97)	-0.00000970 (-1.45)	0.00000353 (0.47)	0.00000427 (0.57)	0.0000246** (2.04)	0.0000483** (2.51)
BSI	-0.0280*** (-3.32)	-0.0194** (-1.98)	-0.0450*** (-2.98)	-0.204*** (-9.97)	-0.0473** (-1.98)	-0.0630*** (-2.80)	-0.0530*** (-2.05)	-0.0526 (-1.31)
ROA	0.0293 (0.23)	0.536*** (2.93)	1.034*** (3.73)	0.845** (2.52)	1.168*** (3.61)	0.838*** (2.82)	-0.883** (-2.54)	-2.752*** (-4.01)
EQTA	-0.0334*** (-3.20)	-0.0244** (-2.24)	-0.0272*** (-2.67)	-0.0172 (-1.39)	-0.0205 (-1.30)	-0.0102 (-0.64)	-0.0121 (-0.64)	-0.0472 (-1.61)
CIR	-0.00776 (-0.65)	0.0123 (1.11)	0.0540*** (4.19)	0.0531*** (3.42)	0.0682*** (3.61)	0.0549*** (3.21)	-0.00157 (-0.08)	-0.102*** (-3.06)
LnTA	-0.000341 (-0.62)	-0.000677 (-1.23)	-0.00196*** (-2.96)	-0.00284*** (-3.85)	-0.00363*** (-4.48)	-0.00274*** (-3.51)	-0.00210** (-2.14)	-0.00240 (-1.31)
LTR	-0.00652*** (-2.86)	-0.00693*** (-3.22)	-0.00806*** (-2.58)	-0.00718* (-1.65)	-0.0102** (-2.15)	-0.0120*** (-2.66)	-0.0195*** (-3.21)	-0.0270*** (-2.66)
sob	-0.190** (-2.28)	-0.194** (-1.96)	0.344* (1.89)	0.517** (2.32)	0.396 (1.27)	0.174 (0.61)	0.161 (0.47)	0.170 (0.39)
foreign	0.0465 (0.44)	-0.194 (-1.22)	-0.284 (-1.29)	-0.467* (-1.83)	-0.229 (-0.66)	-0.392 (-1.24)	-0.120 (-0.31)	0.590 (1.08)
BSI_sob	0.00196** (2.32)	0.00201** (2.02)	-0.00342* (-1.88)	-0.00514** (-2.29)	-0.00397 (-1.26)	-0.00173 (-0.60)	-0.00161 (-0.47)	-0.00157 (-0.36)
BSI_foreign	-0.000428 (-0.40)	0.00199 (1.25)	0.00290 (1.32)	0.00473* (1.86)	0.00227 (0.66)	0.00391 (1.24)	0.00105 (0.27)	-0.00604 (-1.10)
_cons	2.875*** (3.34)	1.988** (2.00)	4.613*** (3.01)	20.77*** (10.01)	4.889** (2.02)	6.474*** (2.83)	5.506** (2.10)	5.538 (1.36)
N	6308	6308	6308	6308	6303	6303	6132	6133
N_g	81	81	81	81	81	81	81	81
r2_w	0.0410	0.0802	0.130	0.205	0.108	0.0988	0.0444	0.0891

t-statistics in parentheses  
 =\*\* p < 0.1    \*\* p < 0.05    \*\*\* p < 0.01\*

stability. This measure is very popular in the empirical banking literature because it only uses accounting data and provides an easy interpretation. Following Beck et al. (2013) and Fu et al. (2014), the Z-score is therefore calculated as follows:

$$Z = \frac{(ROA + EQTA)}{SDROA}$$

where ROA is the return on assets, EQTA is the ratio of equity to total assets, and SDROA is the standard deviation of ROA. The Z-score measures the number of standard deviations the bank return has to diminish in order to deplete equity (Fu et al., 2014; Schaeck and Cihak, 2014). Therefore, a higher value of the Z-score indicates higher banking stability. Following the work of Laeven and Valencia (2012), which uses the currency pressures index as the proxy of financial stability, we rely on the Banking Stability Index, which is created and utilized by the Indonesia Deposit Insurance Corporation, as a dashboard to monitor banking stability at the country level as a measure of macro-level risk. The values of BSI range from 99 to 104, with 99 indicating a normal situation and 104 a crisis.

To examine the impact of ownership on the depositors' behavior, we examine the relationship between the dummy variables state-owned bank (sob) and foreign banks with the risk variables (Z-score and BSI). We expect market discipline to be weaker in a foreign bank than in a state-owned bank. The specification is as follows:

$$DA_{i,t} = \alpha_i + \beta_1 Risk_{i,t} + \beta_2 Ownership_i + \beta_3 Risk \times Ownership_{i,t} + \beta' BC_{i,t} + \varepsilon_{i,t}$$

#### 4. Empirical results

We study the monitoring efforts of depositors in Indonesian banking by considering two levels of risks, which are macro and micro. Table 3 presents the correlation matrix of our variables. Table 4 shows the results of the baseline regression (effect of risk (stability) on the growth of deposits), while Tables 5, 6, 7 present the regression results for state-owned banks, private domestic banks, and foreign banks, respectively. Finally, Tables 8 and 9 show the results by considering the interaction between risk and ownership type.

Table 4 clearly shows that the banking stability index is negatively associated with the growth of deposits in bank accounts at all levels. It means that when the banking environment (macro level) is unstable, depositors, both small and large, will either withdraw their money from banks or deposit lower amounts. The Banking Stability Index hence appears to be a credible proxy for macro-level risk. Demirgüç-Kunt and Huizinga (2004) also find that macro-economic factors, reflected by inflation, growth rate of GDP per capita



**Table 10**  
GMM baseline.

	account100mill	depo100mill	acc100to1bill	dep100to1bill	acc1to5bill	dep1to5bill	accountmore5b	depmore5b
intdep	0.0240 (0.18)	0.223*** (2.77)	0.621*** (5.58)	0.763*** (5.20)	0.602*** (3.27)	0.524*** (3.26)	-0.121 (-0.22)	-0.751* (-1.82)
zscore_3	0.00000444 (0.04)	0.0000266 (0.54)	-0.0000279 (-0.51)	0.0000369 (0.44)	0.000208** (2.35)	0.0000216** (1.98)	0.0000624*** (2.79)	0.0000919*** (3.04)
BSI	-0.000668 (-0.14)	-0.00308* (-1.95)	0.00228 (1.28)	0.00181 (0.73)	-0.00360 (-1.12)	-0.00395 (-1.37)	-0.00752* (-1.94)	-0.0177*** (-4.16)
ROA	-0.0384 (-0.14)	0.874*** (3.67)	1.954*** (4.40)	2.311*** (4.26)	2.716*** (3.88)	2.515*** (4.70)	0.734 (0.72)	-1.792 (-0.89)
EQTA	-0.00870 (-1.00)	-0.0210*** (-3.44)	-0.0317*** (-3.76)	-0.0257*** (-2.44)	-0.0596*** (-4.07)	-0.0554*** (-3.80)	-0.0806*** (-2.93)	-0.100** (-2.43)
CIR	-0.00551 (-0.21)	0.0325** (2.35)	0.0867*** (4.18)	0.0958*** (3.44)	0.119*** (3.94)	0.113*** (3.49)	0.0506* (1.83)	-0.0515 (-1.00)
LnTA	0.000,324 (0.08)	-0.000403 (-0.50)	-0.00130 (-1.35)	-0.00199 (-1.47)	-0.00264* (-1.90)	-0.00209* (-1.86)	0.000655 (0.45)	0.00299 (1.37)
LTR	-0.00510 (-0.77)	-0.00892*** (-2.96)	-0.0128*** (-2.97)	-0.0143** (-2.25)	-0.0254*** (-2.70)	-0.0269*** (-3.47)	-0.0342*** (-3.17)	-0.0444** (-2.23)
sob	0.00709 (0.70)	0.00606** (2.42)	0.000784 (0.19)	0.00,392 (0.77)	-0.00285 (-0.44)	-0.00302 (-0.68)	-0.00349 (-0.35)	0.0160 (1.01)
foreign	0.00259 (0.25)	0.00605 (1.33)	0.00806 (1.55)	0.00900 (1.51)	0.00224 (0.44)	0.00218 (0.36)	-0.0112 (-1.52)	-0.00690 (-0.83)
L.account100mill	-0.0626 (-0.39)							
L.depo100mill		-0.0156 (-0.52)						
L.acc100to1bill			-0.0343 (-1.12)					
L.dep100to1bill				-0.213*** (-5.97)				
L.acc1to5bill					-0.0398 (-1.03)			
L.dep1to5bill						-0.0571 (-1.30)		
L.accountmore5b							-0.0405 (-0.72)	
L.depmore5b								-0.0338 (-1.11)
_cons	0.0801 (0.15)	0.310* (1.95)	-0.241 (-1.34)	-0.189 (-0.76)	0.373 (1.15)	0.406 (1.35)	0.794** (2.01)	1.871*** (4.38)
Obs	6303	6303	6302	6302	6297	6297	6096	6097
Banks <sup>18</sup>	81	81	81	81	81	81	81	81
AR2 test p-value	0.809	0.509	0.216	0.009	0.717	0.871	0.552	0.106
Hansen-J test P-value	0.908	0.895	0.913	0.913	0.901	0.87	0.882	0.928
N_inst	104	104	104	104	104	104	104	104
t-statistics in parentheses								
= ** p < 0.1      ** p < 0.05      *** p < 0.01*								

and GNP/capita, matter in explaining deposit growth. The effect of macro-economic conditions on depositor behavior is also revealed by Hadad et al. (2011) and Nys et al. (2015). The latter argue that the deposit market is affected by macro-economic factors both in supply (inflation and business cycle) and demand (interest rate).

As for the coefficient of the Z-score, as the proxy of bank risk at the micro level, it is found to be positive and significant for large depositors only. The results hence indicate that because they are normally uninsured, only large depositors take action when banks exhibit higher default risk. Small depositors are not effective in monitoring banks. Thus, deposit insurance appears to credibly operate by posing a threat to depositors whose accounts are above the coverage limit (credibility of non-insurance above the limit). This finding is in line with Nys et al. (2015), who show that deposit insurance in Indonesia is, to some extent, credible. Our results are also in line with most previous studies showing that depositors do discipline banks (Park, 1995; Martinez Peria and Schmukler, 2001; Murata and Hori, 2006; Ungan et al., 2008; Hadad et al., 2011; Hasan et al., 2013; Nys et al., 2015; Cubillas et al., 2017).

When we split the sample into different types of bank ownership, we find that depositors in state-owned banks do consider macro-level risk to discipline banks, while micro-level risk, again, is only considered by large depositors. For private domestic banks, only depositors with large stakes consider both macro- and micro-level risks to monitor banks. No evidence is found that small depositors are disciplining private domestic banks. Lastly, depositors of foreign banks are less effective in disciplining banks. Only a small portion of depositors take into account banking stability to monitor banks.

The depositors of domestic banks are worried about macro risk because most deposits are in Indonesian Rupiah (IDR). Therefore they might not be afraid of bank failure but more worried about the value of their deposits as caused by depreciation of the local currency. On the contrary, foreign banks are less sensitive because most of their deposits are in hard currency (USD and EUR) these

**Table 11**  
GMM interaction BSI ownership.

	account100mill	depo100mill	acc100to1bill	depl00to1bill	acc1to5bill	deplto5bill	accountmore5b	depmore5b
intdep	0.0250 (0.55)	0.204*** (2.61)	0.604*** (5.55)	0.806*** (5.58)	0.577*** (2.74)	0.495*** (3.38)	-0.0675 (-0.30)	-0.710* (-1.70)
zscore_3	0.00000109 (0.30)	0.00000260 (0.56)	-0.00000310 (-0.54)	0.00000627 (0.73)	0.0000206** (2.32)	0.0000220** (2.48)	0.0000601*** (3.37)	0.0000925*** (3.18)
BSI	-0.000628 (-0.59)	-0.00421 (-1.55)	0.00272 (0.47)	-0.00350 (-0.25)	-0.00397 (-0.78)	-0.00341 (-1.14)	-0.0107 (-1.11)	-0.0174*** (-3.86)
ROA	-0.0587 (-0.51)	0.834*** (3.58)	1.976*** (4.41)	2.162*** (3.66)	2.844*** (3.52)	2.466*** (4.91)	0.752 (0.86)	-2.121 (-0.96)
EQTA	-0.00821* (-1.78)	-0.0191*** (-3.17)	-0.0326*** (-3.89)	-0.0241** (-2.12)	-0.0617*** (-3.78)	-0.0545*** (-4.43)	-0.0811*** (-3.82)	-0.0962** (-2.26)
CIR	-0.00563 (-0.60)	0.0290* (1.95)	0.0913*** (3.93)	0.0939*** (3.23)	0.124*** (4.00)	0.103*** (3.88)	0.0637** (2.44)	-0.0616 (-1.16)
LnTA	0.000,430 (0.60)	-0.000494 (-0.64)	-0.00128 (-1.28)	-0.00181 (-1.34)	-0.00269* (-1.86)	-0.00208* (-1.65)	0.000249 (0.17)	0.00,286 (1.27)
LTR	-0.00486** (-2.34)	-0.00880*** (-2.87)	-0.0136*** (-3.07)	-0.0124** (-2.00)	-0.0271*** (-2.62)	-0.0261*** (-3.40)	-0.0350*** (-4.44)	-0.0409** (-1.98)
sob	(omitted)	(omitted)	0.762 (0.80)	-0.351 (-0.16)	-0.0335 (-0.03)	(omitted)	(omitted)	(omitted)
foreign	(omitted)	-0.579 (-0.49)	-0.539 (-0.35)	-1.473 (-0.34)	(omitted)	(omitted)	-1.908 (-0.51)	(omitted)
BSI_sob	0.0000688*** (2.85)	0.0000656*** (2.88)	-0.00763 (-0.80)	0.00358 (0.17)	0.000302 (0.02)	-0.0000241 (-0.49)	-0.0000282 (-0.34)	0.000187 (1.06)
BSI_foreign	0.0000254 (0.65)	0.00586 (0.49)	0.00549 (0.35)	0.0149 (0.34)	0.0000257 (0.49)	0.0000169 (0.31)	0.0190 (0.51)	-0.0000548 (-0.60)
L.account100mill	-0.0540 (-1.18)							
L.depo100mill		-0.0186 (-0.62)						
L.acc100to1bill			-0.0367 (-1.20)					
L.depl00to1bill				-0.213*** (-6.04)				
L.acc1to5bill					-0.0341 (-0.90)			
L.deplto5bill						-0.0573 (-1.37)		
L.accountmore5b							-0.0366 (-0.67)	
L.depmore5b								-0.0255 (-0.84)
_cons	0.0741 (0.70)	0.425 (1.56)	-0.286 (-0.49)	0.335 (0.24)	0.411 (0.82)	0.355 (1.16)	1.113 (1.15)	1.845*** (4.02)
Obs	6303	6303	6302	6302	6297	6297	6096	6097
Banks <sub>9</sub>	81	81	81	81	81	81	81	81
AR2 test p-value	0.564	0.544	0.207	0.009	0.784	0.865	0.516	0.075
Hansen-J test P-value	0.876	0.926	0.935	0.911	0.872	0.889	0.914	0.926
BSI + BSI_foreign	-0.0006025	0.0016469	0.0082078	0.0113691	-0.003943	-0.0033934	0.0083028	-0.0174941***
BSI + BSI_sob	-0.000559	-0.0041456	-0.0049116	0.0000743	-0.0036666	-0.0034344	-0.0107333	-0.0172528***
N_inst	106	106	106	106	106	106	106	106
t-statistics in parentheses								
=** p < 0.1      ** p < 0.05      *** p < 0.01*								

banks rely on support from outside.

When we turn to the results of the interaction variables between risk (stability) and ownership type to confirm those of the split sample, we find the same results. Depositors of state-owned banks show more discipline in monitoring and disciplining banks, as shown by the significant coefficients of the interaction variables between the Z-score and the dummy variable for state-owned banks, and between BSI and the dummy of state-owned banks. This is quite different from the results of Nys et al. (2015), in which state-owned banks are less disciplined by their depositors.

## 5. Robustness checks

We conduct some robustness checks to ensure that our results are consistent. Instead of using a static panel model, we employ a 2-step GMM to estimate the empirical model. We include the lag of deposit growth in a group. Using GMM estimation allows variable deposit growth to adjust to a possible desired long-run level slowly, over time (Berger et al., 2008). As shown in Tables 10, 11, 12, the results are robust, as the coefficients of our variables of interest (Z-score, BSI and the interaction variables) have the same direction

**Table 12**  
GMM interaction Z-score ownership.

	account100mill	depo100mill	acc100to1bill	dep100to1bill	acc1to5bill	dep1to5bill	accountmore5b	depmore5b
intdep	0.0307 (0.60)	0.210*** (2.69)	0.575*** (5.24)	0.733*** (4.71)	0.437* (1.93)	0.448** (2.41)	0.0752 (0.33)	-0.831* (-1.78)
zscore_3	-0.0000179** (-2.09)	-0.0000132 (-0.89)	-0.00000805 (-0.42)	-0.00000430 (-0.10)	-0.0000394 (-1.02)	-0.0000313 (-0.79)	-0.0000391 (-0.62)	0.000130** (2.25)
BSI	0.000629 (0.77)	-0.00156 (-1.26)	0.000529 (0.32)	0.000245 (0.11)	-0.00293 (-0.99)	-0.00256 (-1.11)	0.00119** (2.35)	-0.00879** (-2.32)
ROA	-0.136 (-0.97)	0.686** (2.36)	1.832*** (4.02)	2.177*** (3.05)	2.717*** (2.92)	2.380*** (2.98)	-0.275 (-0.24)	-1.213 (-0.55)
EQTA	-0.00562 (-0.99)	-0.0157** (-2.17)	-0.0309*** (-3.13)	-0.0262** (-2.04)	-0.0555*** (-2.94)	-0.0544*** (-3.46)	-0.0611** (-2.46)	-0.113*** (-2.59)
CIR	-0.0141 (-1.15)	0.0106 (0.71)	0.0765*** (3.11)	0.0886*** (2.94)	0.0723** (2.17)	0.0775** (2.37)	0.00849 (0.18)	-0.0257 (-0.48)
LnTA	-0.000779 (-0.85)	-0.00164* (-1.70)	-0.00251** (-1.99)	-0.00289 (-1.55)	-0.00737*** (-3.35)	-0.00496** (-2.54)	-0.00289 (-1.29)	0.00513* (1.71)
LTR	-0.000718 (-0.22)	0.00121 (0.28)	-0.00449 (-0.86)	-0.00587 (-0.73)	-0.00258 (-0.20)	-0.0137 (-1.19)	-0.0154 (-0.95)	-0.0586** (-2.41)
sob	-0.00630 (-1.00)	-0.0237*** (-2.79)	-0.0282*** (-3.37)	-0.0232 (-1.44)	-0.0909*** (-4.69)	-0.0524** (-2.38)	-0.0407 (-1.41)	0.0609** (2.13)
foreign	-0.0127 (-1.48)	-0.00177 (-0.12)	0.0151 (0.85)	0.00880 (0.21)	-0.0324 (-0.81)	-0.0403 (-1.26)	-0.0951 (-1.60)	0.00983 (0.17)
Zscore_sob	0.000123** (2.23)	0.000290*** (3.61)	0.000295*** (3.91)	0.000262** (2.06)	0.000792*** (4.50)	0.000424** (2.08)	0.000276 (0.98)	-0.000441* (-1.79)
Zscore_foreign	0.0000688** (2.25)	0.0000349 (0.54)	-0.0000345 (-0.45)	0.000000180 (0.00)	0.000135 (0.86)	0.000181 (1.29)	0.000389 (1.47)	-0.0000803 (-0.32)
Laccount100mill	-0.0540 (-1.14)							
Ldepo100mill		-0.0123 (-0.40)						
Lacc100to1bill			-0.0297 (-0.90)					
Ldep100to1bill				-0.209*** (-5.69)				
Lacc1to5bill					-0.0591 (-1.40)			
Ldep1to5bill						-0.0618 (-1.47)		
Laccountmore5b							-0.0549 (-0.91)	
Ldepmore5b								-0.0343 (-1.14)
_cons	-0.0295 (-0.35)	0.179 (1.39)	-0.0491 (-0.29)	-0.0206 (-0.10)	0.396 (1.32)	0.330 (1.42)	0 (.)	0.945** (2.50)
Obs	6303	6303	6302	6302	6297	6297	6096	6097
Banks	81	81	81	81	81	81	81	81
AR2 test p-value	0.394	0.581	0.288	0.015	0.492	0.721	0.83	0.11
Hansen-J test P-value	0.924	0.969	0.936	0.912	0.915	0.898	0.386	0.919
Zscore + Zscore_foreign	0.0000509*	0.0000217	-0.0000425	-0.00000412	0.0000953	0.0001496	0.0003497*	0.0000501
Zscore + Zscore_sob	0.0001052**	0.000277***	0.0002867***	0.0002572**	0.0007531***	0.0003922**	0.000237	-0.0003106
N_inst	106	106	106	106	106	106	106	106
t-statistics in parentheses								
** p < 0.1	** p < 0.05	*** p < 0.01*						

and significance levels, although BSI only turns out to be significant for the largest deposits.

## 6. Conclusion

We extended the literature on depositor behaviors in monitoring banks by disentangling the sources of risk considered by depositors (macro or micro), deposit structure and ownership types. We considered that macro-level risk matters in explaining depositors' behavior, along with bank risk characteristics, by relying on the Banking Stability Index, which was created and utilized by the Indonesia Deposit Insurance Corporation as a dashboard to monitor banking stability at the country level. We studied Indonesian banks using a monthly dataset over the 2005–2013 period covering different levels of deposit insurance coverage. We found that both macro- and micro-risk levels are considered by depositors to discipline banks. Large uninsured depositors were found to be more effective in disciplining banks than small insured depositors, which indicates that the insurance system that is in place appears to be credible by actually threatening depositors of not being insured above the insurance coverage ceiling. The ownership type of banks also matters in explaining the differences in market discipline by depositors. Our findings have several policy implications. Because

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small (insured) depositors in state-owned banks appear to be more reactive to changes in overall banking conditions and macro-economic stability than those of private and foreign banks, more efforts should be made to gain their confidence. Furthermore, because of the absence of effective private monitoring (discipline imposed by depositors), foreign banks should be supervised more closely by regulators (regulatory monitoring).

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### Acknowledgements

44 This research was partially supported by the Indonesia Ministry of Research, Technology and Higher Education through the WCP Program 2018 with contract no. 123.31/D2.3/KP/2018. This research was done when Mochammad Duddy Ariefianto was at the Indonesia Deposit Insurance Corporation. The views expressed in this paper are the authors' only and do not necessarily reflect those of the Indonesia Deposit Insurance Corporation. All errors, of course, remain with us.

### Appendix A. Supplementary data

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Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.ecosys.2020.100758>.

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