ABSTRACT

Bank runs and banking crises have become global phenomena occurring repeatedly in both developed and developing countries during the last few decades. Bank runs and banking crises have increased since financial liberalization in the 1980’s and 1990’s (Davis and Karim, 2007). In Indonesia, bank runs have also occurred repeatedly. In 1992, bank runs beset a few national banks triggering the liquidation of one of the country’s national private banks. Subsequently, in 1997/1998, bank runs developed into the worst banking crisis in the history of Indonesian banking. Empirical experience can demonstrate the magnitude of costs incurred due to bank runs and the banking crisis. In Indonesia’s case, the total fiscal cost involved for the recuperation of banks and output loss due to banking crises in Indonesia during the period of 1997-2002 were 55% and 39% of gross domestic product respectively (Hanson, 2005). Considering the extent of losses precipitated by bank runs and the banking crisis, extensive studies on the determinants of bank runs are urgently required to prevent future bank runs and banking crises.

This paper aims to comprehensively analyze the determinants of a bank runs, including macroeconomic conditions, bank fundamentals and the self-fulfilling prophecy factor for all banks, both during the sample period of 1990-2005 as well as during the banking crisis in 1997-1998. The study of bank run determinants uses the dynamic panel model of Arrelano-Bond.

Based on monthly bank data from 1990-2005, the Arrelano-Bond dynamic panel shows that the self-fulfilling prophecy factor (bad luck), bank fundamentals -including profitability and non-performing loans- as well as macroeconomic conditions such as economic growth, inflation and real interest rates affect bank runs in Indonesia. Bank run determinants during the crisis period in 1997-1998 also display similar results to bank run determinants for the extended sample period of 1990-2005.

JEL Classification: C33, C49, G21
Keywords: Bank Runs, Banking Crises, Arrelano-Bond’s Dynamic Panel.
1. Introduction

A run on a bank occurs when a large number of depositors, fearing that their bank will be unable to repay their deposits in full and on time, simultaneously try to withdraw their funds immediately.\(^1\) A run on a particular bank can lead to a banking crisis if it spreads to other banks, contagious effect. Bank runs and banking crises have become a global phenomenon and occurred repeatedly in established and emerging market countries in the past few decades. Banking crises have become more common since the era of financial liberalisation in the 1980s and 1990s (Davis and Karim, 2007). In fact, since the middle of 2007 until the present day, international financial markets have been beset by a global financial crisis that originated from a subprime mortgage fiasco in the United States (US).

In the history of modern banking, banking crises began long before the First World War, for instance the bank runs (bank panics) and banking crises experienced in the United States in 1837, 1873, 1884, 1890, 1907 and 1933 (Calomiris, 2007). Research conducted by the IMF in 181 member countries demonstrated that from the beginning of 1980 up until the middle of 1996, 133 serious bank runs and banking crises had occurred (Lindgren, Garcia and Saal, 1996). Subsequently, large-scale banking crisis events transpired during 1997/1998 in East Asian countries, including Indonesia, Thailand, Malaysia, the Philippines and South Korea. This crisis stemmed from an exchange rate crisis in Thailand and spread (contagious) to Indonesia and other East Asian countries, while developing and transforming into a banking and economic crisis (Bank Indonesia, 1998). A financial crisis repapered in the United States in 2007/2008 and has since developed into a global financial crisis, the impacts from which we continue to reel.

In the case of Indonesia, bank runs have also reoccurred time and again. In 1992, bank runs affected several national banks, subsequently precipitating the liquidation of Bank Summa. Then in 1997/1998, bank runs developed into the worst banking crisis ever witnessed in the banking history of Indonesia. The closure of 16 banks by the government on 1\(^{st}\) November 1997 undermined customer confidence in their banks, particularly private banks believed by the public to have the least favourable financial performance. A loss of confidence in the banks encouraged large swathes of the public to immediately withdraw their

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funds (bank runs). The subsequent bank runs spread systemically\(^2\) (contagion) to other banks, thus developing into a banking crisis.

Recurring bank runs and banking crises led to banks, an institution of trust, becoming vulnerable to large-scale withdrawals of funds by their customers. This vulnerability is the result of bank operations that have transformed from short-term liabilities like checking accounts, savings and term deposits to longer-term assets such as credit. Consequently, banks continuously face a maturity mismatch and are, hence, particularly vulnerable to bank runs due to limited liquid assets held by the bank.

Furthermore, bank runs can spur systemic risk, namely contagion, on other banks. Systemic risk occurs because the customers of other banks do not know the specific conditions of their own bank (asymmetric information). Consequently, they decide that the conditions of their own bank must be facing similar problems and they immediately flock to withdraw their funds. Therefore, similar runs occur on other banks until, ultimately, a banking crisis develops. The factors that cause bank runs which stem from customer concerns (belief) due to the absence of information about bank performance are known as the self-fulfilling prophecy. Bank runs triggered by the self-fulfilling prophecy are random events originating from asymmetric information received by the customer (agent). Diamond and Dybvig (1983) developed this widely influential theoretical model.

In addition to the self-fulfilling prophecy, other determinants of bank runs include fundamental factors, both macroeconomic fundamentals and bank fundamentals (Kindleberger (1978), Gup and Bartholomew (1999)). Shocks to economic fundamentals, like economic contraction, rising interest rates, exchange rate volatility, tumbling asset prices and mounting uncertainty in the financial sector can also have adverse effects on a bank’s business activity. An economic contraction/slowdown can exacerbate non-performing bank loans, leaving banks unable to repay their customers’ deposits because the majority of their customers’ funds are tied up in non-performing loans.

A number of research papers demonstrate that banking crises incur losses to the economy and the general public (Hoelscher and Quintyn, 2003 and Hanson, 2005). Impaired access to financing by the business community sparks an economic contraction or downturn.

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\(^2\) Systemic risk is when a run on a particular bank triggers subsequent runs on other banks, known in academic literature as contagion. The process of systemic risk or contagion occurs through a self-fulfilling prophecy.
thereby compounding unemployment. In addition, bank restructuring as a result of a crisis entails a large fiscal outlay, which ultimately becomes the burden of the taxpayer.

Output loss experienced by countries in a banking crisis varies depending upon the depth and duration of the crisis. Hanson (2005) conducted a study on output loss due to banking crises. The study found, among others, that Indonesia suffered an output loss of 35% to 39% of GDP, Thailand 26.7% - 40% of GDP and Korea 10% - 17% during the crisis period from 1997-2002. Furthermore, Japan endured an output loss of 4.5% to 48% of GDP from 1991-2005, México 10% - 14.5% of GDP from 1994-2000 and Hungary 14% - 36.4% of GDP from 1991-1995.

In relation to the magnitude of costs incurred as a result of bank runs and banking crises, this paper discusses factors that affect bank runs: fundamental factors or bad luck? The concept theory that influences bank runs is elaborated on in Section 2, while Section 3 focuses on the development of bank runs in Indonesia and Section 4 summarises the empirical model and data. The empirical results are presented in Section 5, and Section 6 contains the conclusion and policy implications.

2. Brief bank run theory

Two principal theories can explain the determinants of bank runs when viewed in terms of the contributing factors. The first theory proposes that bank runs are the result of fundamental factors, namely macroeconomic fundamentals as well as bank fundamentals (Kindleberger, 1978). Meanwhile, the second theory postulates that bank runs are random events due to customer panic (self-fulfilling prophecy) stemming from imperfect information (asymmetric information) concerning bank performance (Diamond and Dybvig, 1983).

According to fundamentalist theory, a deterioration in bank fundamentals and macroeconomic fundamentals will instigate bank runs. A decline in bank fundamentals, among others, would include a lower return on investment and insolvency, while a breakdown in economic fundamentals would encompass an economic recession and high inflation. Kindleberger (1978) and Canova\(^3\) (1994) opined that bank runs are endogenous to the economic process and tend to emerge at the peak of the expansionary phase of the economic cycle. According to this theory, financial conditions become vulnerable at the end of an

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expansionary economic phase because firms, which are bank debtors, experience debt repayment difficulties due to a decline in corporate profits.

In this model, bank runs are a part of a cycle that affects the banking and real sectors of the economy. This theory suggests that during an economic upturn, banks will expand their allocation of credit to the real sector with the basic expectation that stronger economic growth is around the corner. Banks are subsequently exposed to large amounts of credit (highly leveraged) and if the economic cycle slumps then borrowers cannot repay their loans. Such conditions cause banks to suffer liquidity shortfalls and have insufficient reserves to cover the losses.

Bank runs can also originate from fundamental bank factors (Gorton, 1988). Banks will suffer liquidity shortfalls when trying to meet customer withdrawals if the bank is financially inept. The incurrence of loss, solvency problems and poor-quality earning assets lead to customers’ funds tied up in bad assets, like non-performing loans. Eventually, such conditions result in insufficient bank liquidity and the bank becomes vulnerable to a run.

Both theories posit that bank runs occur due to random events because of customer panic (agent) and are not always associated with economic fundamentals. Diamond and Dybvig (1983) developed this widely influential theoretical model. The model finds that bank runs are a rational response brought about by the belief of an agent due to asymmetric information regarding the performance of their bank. If the customer (agent) thinks that their bank has insufficient funds to repay customer deposits then a bank run will transpire. A bank will face large-scale withdrawals if enough individuals believe that other customers are going to withdraw their funds, for which the term self-fulfilling prophecy was coined.

This group also includes Calomiris and Gorton (1991), who found a combination of self-fulfilling prophecy and bank asset shocks caused bank runs. In addition, Chen (1999) found that in addition to the self-fulfilling prophecy and liquidity factors, moral hazard also contributes to the occurrence of bank runs. Meanwhile, Aharony and Swary (1983) as well as Allen and Gale (2000) discovered bank runs due to contagion. Contagion in the context of bank runs often means the same as the self-fulfilling prophecy because contagion implies that a run on one bank will instigate runs on other banks. The process of spreading from one bank to another is through the customer withdrawal transmission mechanism (self-fulfilling prophecy). Nonetheless, according to this theory, bank runs are more commonly attributable to bad luck than fundamental factors.
Empirically, an abundance of research on bank runs and the determinants of bank crises has been conducted. For instance, Canova (1994) researched the determinants of banking crises for the period from 1864-1914 in the United States using a probit model. The results of this research indicated that banking crises in the United States during that period were caused by economic factors. The research also concluded that banking crises are seasonal and influenced by the economic cycle.

Demirgüç-Kunt and Detragiache (1998) performed research on the overall determinants of banking crises using panel data from developed and developing countries. A multivariate logit model was used and it was concluded that banking crises occur if macroeconomic conditions are weak (sluggish economic growth and high inflation), interest rates are high, sudden capital outflows occur and lending is widespread. Eichengreen and Rose (1998) researched the effect of international shocks on banking crises in OECD countries and found that interest rates have a large impact, while economic growth has little influence on vulnerability to banking crises.

Research in the determinants of banking crises has often used aggregate data, which could have led to possible aggregation problems, such as factors that could negate one another among disaggregated data. Due to this weakness, McCandless, Gabrielli and Rouillet (2003) used individual bank data and dynamic panel data models to investigate the determinants of bank runs and banking crises in Argentina that occurred in 2001. The findings indicated that the determinants of bank runs in Argentina are factors of the self-fulfilling prophecy, macroeconomic shocks and a deterioration in bank fundamentals.

3. Banking Development in Indonesia

At its onset, the crisis that befell the Indonesian economy in 1997 was triggered by a rupiah exchange rate crisis. Intense depreciatory pressures on the rupiah emerged due to contagion from the baht exchange rate crisis in Thailand in July 1997. The effect of contagion not only materialised in Indonesia but it also rapidly spread to other Asian countries like the Philippines, Malaysia and South Korea. As depreciatory pressures escalated on the rupiah, Indonesia was forced to abandon its managed floating exchange rate regime and institute a free-floating exchange rate on 14th August 1997. Striving to protect the national economy from a deepening crisis due to rupiah depreciation and capital outflows the government promulgated an economic policy package in September 1997. Subsequently, this program was expanded and became an economic stabilisation and reform package formally supported by
the IMF, World Bank and ADB in November 1997. As part of the financial sector reformation program to recover the banking system from the brink of collapse, 16 national private banks were closed on 1st November 1997.

The closure of 16 banks triggered runs on other banks that the general public perceived unsound. The policy to close the banks, which should have saved the national banking industry, actually caused the opposite with large-scale withdrawals from non-state-owned banks as the result. Widespread withdrawals occurred due to a collapse of public confidence in banks brought about by the closure of 16 banks. As the bank runs spread the financial performance of all banks suffered, non-performing loans increased and bank earnings declined due to business management failing to follow the principles of good governance (Warjiyo, 2001 and Bank Indonesia, 1998). In addition, rapid rupiah depreciation led to swollen foreign debt denominated in rupiah and conditions deteriorated again due to the absence of a blanket guarantee scheme. The lack of a guarantee scheme and insufficient information regarding bank conditions (asymmetric information) prompted bank customers, in particular private bank customers, to withdraw their funds and divert them to banks considered more sound with more secure assets (currency).

In the one month following the closure of 16 banks (December 1997), the total amount of deposits held at national private commercial banks dropped by Rp22.9 trillion (11.94%). Fund withdrawals, in general, began immediately after the bank closures and peaked in December 1997 and January 1998. Withdrawals began to subside when the government introduced a blanket guarantee scheme in January 1998. However, when social unrest erupted in May 1998, bank runs returned.

During the banking crisis in 1997/1998, most bank runs occurred on non foreign exchange banks, banks with frozen business activity and banks with frozen operations. Runs on non foreign exchange banks peaked in December 1997, January 1998 and May 1998. As an illustration, in December 1997, of the 45 non foreign exchange banks, 25 experienced declines in deposits of up to 10%, 17 of up to 20%, 13 up to 40%, 11 to 60% and 6 experienced an 80% decline in deposits compared to total funds the month previous.

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5 Non foreign exchange banks are national private banks that are not permitted to conduct foreign exchange activities.
6 Banks with frozen business activity are not permitted to conduct business activities for a specified period of time.
7 Banks with frozen operations are banks that have had their operational activities frozen for a specified amount of time.
Similarly, bank runs also affected banks with frozen business activity (BBKU) and banks with frozen operations (BBO). Most withdrawals occurred from November 1997 to January 1998, and March to May 1998. For instance, in November 1998, of the 40 BBKU, as many as 26 experienced declines in deposits of up to 10% of total deposits one month prior, 14 suffered declines of up to 20%, and 2 of up to 40%. Bank runs on BBO followed a similar trend to those on BBKU. In January 1998, of the 10 BBO, 6 experienced a decline of up to 20% and 4 up to 40%.

In contrast, during the period of November 1997 to January 1998, deposits at state-owned banks increased by 9.6% in November 1997. Withdrawals from foreign banks followed a similar trend to those at state-owned banks. In November 1997, only one bank experienced a decline in deposits, however, from December 1997 to January 1998 deposits increased by 6.8% in November 1997.

Consequently, the share of deposits held at state-owned banks and foreign banks increased respectively by 42.8% and 7.2% in December 1997 to 47.7% and 9.3% at the end of January 1998. Conversely, the share of deposits at foreign exchange banks and non foreign exchange banks declined respectively by 43.2% and 2.2% in December 1997 to 36.9% and 1.5% in January 1998 (Table 1). Accordingly, a transfer of funds occurred from private banks to state-owned and foreign banks.

### Table 1 Share of Bank Deposits

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<tbody>
<tr>
<td>Commerical banks:</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1. Stated-owned banks</td>
<td></td>
<td>36.0</td>
<td>42.8</td>
<td>47.7</td>
<td>47.0</td>
<td>46.6</td>
</tr>
<tr>
<td>2. Foreign exchange banks</td>
<td></td>
<td>49.7</td>
<td>43.2</td>
<td>30.9</td>
<td>37.1</td>
<td>37.0</td>
</tr>
<tr>
<td>3. Non-foreign exchange banks</td>
<td></td>
<td>5.5</td>
<td>2.2</td>
<td>1.5</td>
<td>1.9</td>
<td>2.3</td>
</tr>
<tr>
<td>4. Regional development banks</td>
<td></td>
<td>2.8</td>
<td>2.2</td>
<td>1.6</td>
<td>1.7</td>
<td>1.6</td>
</tr>
<tr>
<td>5. Joint-venture banks</td>
<td></td>
<td>1.7</td>
<td>2.4</td>
<td>3.0</td>
<td>3.0</td>
<td>2.8</td>
</tr>
<tr>
<td>6. Foreign Banks</td>
<td></td>
<td>4.1</td>
<td>7.2</td>
<td>9.3</td>
<td>9.3</td>
<td>9.2</td>
</tr>
<tr>
<td>Rural Banks*)</td>
<td></td>
<td>0.5</td>
<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
</tr>
</tbody>
</table>

*Share against commercial banks
Source: Bank Indonesia

In addition to diverting deposits to more sound banks (flight to quality), funds were also diverted into currency, as reflected by the 31.8% increase in currency during January
1998 (Rp9.045 trillion) compared to the previous month. This increase was outside the bounds of normal demand for currency based on data for the two years prior to the crisis, which indicated normal growth of 9.5% per annum.

**Figure 1 Currency and the Exchange Rate**

The banking crisis was exacerbated further by extreme rupiah depreciation. In the month of January 1997, the rupiah was at a position of Rp2,396 against the US dollar. The exchange rate position, however, toppled from Rp2,599 per US dollar in July 1997 to Rp4,650 in December. In 1998 the exchange rate position declined dramatically to Rp10,525 per US dollar in May 1998 and subsequently to its nadir in June 1998 at Rp14,900. From this position the rupiah rebounded and appreciated to Rp8,025 per US dollar in December 1998, while in 1999 the rupiah fluctuated to a position of Rp7,100 in December 1999. Severe rupiah depreciation from January 1997 until December 1998 caused foreign bank debt denominated in rupiah to swell exponentially. Additionally, the majority of foreign debt was in the form of rupiah denominated loans (non-export); hence a currency mismatch strained the banks’ balance sheet.

Widespread fund withdrawals by customers from the banks, coupled with rapid rupiah depreciation, placed additional pressures on the banks’ balance sheet. Consequently, national bank performance as a whole deteriorated in terms of all financial aspects, namely capital adequacy, earning asset quality, earnings and liquidity. Capital adequacy ratio (CAR) declined sharply during the crisis for all banks from 9.19% at the end of December 1997 to –15.68% at yearend 1998. Accordingly, the quality of earning assets, measured as a comparison between earning assets classified substandard and total earning assets,
deteriorated rapidly from 4.80% at the end 1997 to 42.39% at yearend 1998, before improving to 12.74% at the end of 1999 as a result of diverting non-performing bank loans to the Indonesian Bank Restructuring Agency (IBRA).

In harmony with the decline in earning asset quality, earnings, which is measured as a comparison between profit and assets (ROA), slumped from 1.37% in 1997 to –18.76% in 1998 and –6.14% in 1999. Nearly all banks incurred losses due to the high cost of funds, with interest on term deposits skyrocketing to 70% in September 1998. Meanwhile, the quality of earning assets declined and the amount of credit extended declined in congruence with the economic downturn and escalating business risk due to social and political instability and the degenerating security situation. As a result of less credit, the bank loan to deposit ratio (LDR) also plummeted from 86.42% at yearend 1997 to 72.37% at the end of 1998 and to just 26.16% at the end of 1999.

4. Empirical Model and Data

This study utilises a dynamic panel model, intended to capture the behaviour of customers at one bank on the behaviour of customers at another banks through changes in deposits. Limited customer information about their respective bank (imperfect information) causes a significant decline in deposits, which is construed by the customers as the bank experiencing difficulties, thus triggering a run on the bank (self-fulfilling prophecy). The self-fulfilling prophecy factor, institutionally, can also influence runs of other banks (systemic risk), known as contagion\(^8\). Therefore, the dynamic panel model used in this paper can concomitantly reveal the determinants of bank runs that stem from a self-fulfilling prophecy, macroeconomic fundamentals and the financial performance of a bank.

The panel model used in this research is the Arrelano-Bond dynamic model utilised to anticipate problems in the fixed effects model (FEM) and random effects model (REM). Correlation between the lagged dependent variable and the individual effect leads to the FEM and REM Ordinary Least Squares estimator becoming biased and inconsistent, thus the model is no longer robust to estimate the determinants of banks runs in this paper. The dynamic formal data panel model used can be expressed as follows:

\[
\Delta \text{Dep}_t = \alpha + \beta_1 \Delta \text{Dep}_{t-1} + \sum_{k=1}^{K} \delta_k B_{k,t} + \sum_{h=1}^{H} \gamma_h F_{h,t} + \epsilon_t
\]  

\(\text{(1)}\)

\(^{8}\) Several authors like D’Amato, Grubisic and Powell (1997) and Allen and Gale (2000) used contagion to mean self-fulfilling prophecy.
where $\Delta Dep_i$ is the dependent variable representing the monthly percentage change in deposits at each respective individual bank used as a proxy for bank runs. A positive percentage change in deposits indicates no occurrence of a bank run. Conversely, a negative change in deposits denotes a bank run, the magnitude of which depends on the amount of deposits. Using $\Delta Dep_i$ as a proxy of bank runs is congruous with the research conducted by D’Amato, Grubisic and Powell (1997) and McCandless, Gabrielli and Rouillet (2003), which demonstrated that using a percentage change in deposits is robust as a proxy of bank runs. $\Delta Dep_{i-1}$ is a lag regressor of the dependent variable representing the percentage change in deposits at a bank, which captures the influence of the self-fulfilling prophecy on the occurrence of bank runs. With limited information available to customers concerning the condition of their bank (asymmetric information) a decline in deposits at one bank or a run on another bank in the previous period (t-1) will trigger a bank run in the current period (t). The lagged change in deposits was used by D’Amato, Grubisic and Powell (1995) and McCandless, Gabrielli and Rouillet (2003) as a proxy for the self-fulfilling prophecy in their research, which generated robust results.

$B_k$ is the dependent variable k of financial bank performance. Financial performance is a combination of values for soundness used by Bank Indonesia as part of CAMELS\(^9\). $F_h$ is the dependent variable h of macroeconomic fundamentals with the variable macro economy.

An instrumental variable is used in the estimation process of the model developed by Arrelano and Bond (1991) in order to ensure robust estimation results. The first difference of all variables is used in the dynamic panel model with variable lag k as an independent variable. First difference ensures that specific effects from the banks are eliminated, but serial correlation will occur between the lagged variables with a difference residual. In order to overcome these problems Arrelano and Bond proposed using a lagged explanatory variable at a level, including a lagged dependent variable as an instrument.

The GMM estimation is consistent if the lag of the explanatory variable at a level is a valid instrument for the explanatory variable in the form of difference. This can transpire if the residual does no correlate (serial correlation) and the respective independent variables are exogenous. Both these characteristics will be evaluated through second order serial

\(^9\) Bank Indonesia defines CAMELS as criteria to evaluate the level of soundness, namely C is for capital, A is asset quality, like non-performing loans (NPL), M is management, E is earnings, L is liquidity, and S is systemic risk. In connection with studies related to the financial performance of banks, the components used are Capital, Asset Quality, Earnings and Liquidity, while Management and Systemic risk are not used. This is in line with the previous research mentioned.
correlation tests and the Sargan test to identify excessive restrictions. The Sargan test can evaluate the specifications of the model as well as the validity of the instruments.

The data used is monthly panel data from 94 banks for the period January 1990 to December 2005. The sample of 94 banks includes 7 state-owned banks, 42 private foreign exchange banks, 35 private non foreign exchange banks and 10 foreign banks. The entire panel data is processed from the monthly reports of individual commercial banks from Bank Indonesia. A comprehensive explanation of the data is presented in the following two tables.

<table>
<thead>
<tr>
<th>Name of Variable</th>
<th>Measurement Method</th>
<th>Basic Theoretical Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Adequacy Ratio (CA)</td>
<td>Ratio of total capital (paid up capital + retained earnings + net profit for the current year) to total assets.</td>
<td>A measure of bank solvency. Greater solvency leads to higher resilience to bank runs (positive coefficient).</td>
</tr>
<tr>
<td>Ratio of profit to total assets (ROA)</td>
<td>Ratio of profit in the current year after tax to total assets.</td>
<td>A measure of bank earnings. Higher earnings indicate better financial performance and, subsequently, greater resilience to bank runs (positive coefficient).</td>
</tr>
<tr>
<td>Ratio of profit to own capital (ROE)</td>
<td>Ratio of profit in the current year after tax to own capital (own capital = paid up capital + retained earnings + net profit for the current year).</td>
<td>A measure of bank earnings. Higher earnings indicate better financial performance and, subsequently, greater resilience to bank runs (positive coefficient).</td>
</tr>
<tr>
<td>Ratio of liquid assets to total assets (LIQ)</td>
<td>Ratio of liquidity (cash and SBI) to total assets.</td>
<td>A measure of bank liquidity. Higher liquidity denotes more liquid assets held by the bank and, in turn, greater bank ability to overcome the problem of bank runs (positive coefficient).</td>
</tr>
<tr>
<td>Ratio of loans to deposits (LDR)</td>
<td>Ratio of total credit to total deposits.</td>
<td>A measure of liquidity. A higher LDR indicates more credit allocation compared to deposits held at the bank and, hence, less liquidity available and, in turn greater vulnerability to bank runs (negative coefficient).</td>
</tr>
<tr>
<td>Monthly credit growth (GKREDIT)</td>
<td>Current monthly growth in total credit (t) compared to total credit one month previous (t-1).</td>
<td>Similar to LDR, stronger credit growth indicates less liquidity and, thus, greater vulnerability to bank runs (negative coefficient).</td>
</tr>
<tr>
<td>Non-Performing Loans (NPL)</td>
<td>Ratio of total non-performing loans (substandard (SS), doubtful (D) and loss (L)) to total credit.</td>
<td>A measure of earning asset quality (KAP). Lower KAP signifies more deposits tied up in non-performing loans, thus undermining earning asset quality and, thereby increasing vulnerability to bank runs (negative coefficient).</td>
</tr>
</tbody>
</table>
The macroeconomic indicators \( F_{hit} \) used include inflation, economic growth (LGDP), interest rate of 1-month SBI (SBI), exchange rate (LNT), growth in base money (GM2), growth in net foreign assets (GNFA), the JSX composite (IHSG) and real interest rate (RSBUNGA) as presented in Table 3. Quarterly GDP data was interpolated to monthly data.

### Table 3 Macroeconomic Variables

<table>
<thead>
<tr>
<th>Name of Variable</th>
<th>Measurement Method</th>
<th>Basic Theoretical Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>INFLASI</td>
<td>Annual inflation rate during the month concerned.</td>
<td>Higher inflation leads to economic uncertainty and greater tendency for bank runs (negative coefficient).</td>
</tr>
<tr>
<td>LGDP</td>
<td>Economic growth calculated from the logarithm of monthly gross domestic product. Monthly data is interpolated from quarterly data using the quadratic method in the EViews software program.</td>
<td>Slower economic growth increase credit defaults and tends to increase bank runs (positive coefficient).</td>
</tr>
<tr>
<td>SBI</td>
<td>One-month SBI interest rate.</td>
<td>A higher interest rate indicates lower customer repayment capacity (non-performing loans increase) and a tendency for more bank runs (negative coefficient).</td>
</tr>
<tr>
<td>LNT</td>
<td>Percentage change in monthly rupiah/USD exchange rate calculated from the rupiah/USD exchange rate logarithm.</td>
<td>Higher exchange rate volatility leads to greater uncertainty, which can trigger bank runs (negative coefficient).</td>
</tr>
<tr>
<td>GM2</td>
<td>Monthly growth in base money (M2).</td>
<td>More base money indicates a looser monetary policy stance and more liquidity in the banking system, which reduces vulnerability to bank runs (positive coefficient).</td>
</tr>
<tr>
<td>GNFA</td>
<td>Monthly growth in net foreign assets (NFA)</td>
<td>NFA is a factor that affects M2. Larger NFA indicates stronger M2 growth, which will increase liquidity on the money market and in the banking system, thereby, reducing vulnerability to bank runs (positive coefficient).</td>
</tr>
<tr>
<td>IHSG</td>
<td>Percentage change in the Jakarta stock market composite index</td>
<td>A lower share price index indicates lower asset prices and potential vulnerability to bank runs (negative coefficient).</td>
</tr>
<tr>
<td>RSBUNGA</td>
<td>Real interest rate calculated by subtracting the one-month SBI rate from annual inflation</td>
<td>Higher interest rates raise the cost of funds for debtors and, hence, exacerbate non-performing loans and, in turn, increase vulnerability to bank runs (negative coefficient).</td>
</tr>
</tbody>
</table>

5. **Empirical Results**

5.1. **Aggregate Determinants of Bank Runs (1990-2005)**

Equation 1 is used to estimate the determinants of bank runs incorporating a dummy variable for bank runs (dcrisis) during the banking crisis in 1997/1998.
\[
\Delta \text{Dep}_{it} = \alpha + \beta_1 \Delta \text{Dep}_{it-1} + \sum_{k=1}^{K} \delta_k B_{it} + \sum_{h=1}^{H} \gamma_h F_{hit} + \alpha \text{crisis} + \epsilon_{it} \tag{2}
\]

A dummy variable was included to capture any occurrence of a structural break in the data of percentage change in deposits as a proxy variable of bank runs. A structural break in the data during the banking crisis in 1997/1998 could lead to inefficient estimation results. In harmony with the research of D’Amato, Grubisic and Powell (1995) and McCandless, Gabrielli and Rouillet (2003) as summarised in Section 4, a positive percentage change in deposits would imply an absence of bank runs. Oppositely, a negative percentage change in deposits would indicate the presence of a bank run, with its severity determined by the magnitude of deposit withdrawals.

A GMM model was also used to enable analysis of model robustness by observing moment conditions. In order to observe the robustness of the model, Arrelano and Bond (1991) recommended using a serial correlation test and the Sargan test to avoid the problem of over identification in the dynamic model as described in Section 4.

The results of the Arrelano-Bond dynamic panel model using the one-step approach evidenced a problem in the dynamic panel model (model 1), namely auto correlation and over-identification. Therefore, indicators of financial performance and macroeconomic indicators that displayed multicollinearity were discarded in order to avoid inaccuracies in model specification and serial correlation. Of the financial indicators, ROE was not used due to the availability of ROA. In addition, the two variables are closely related and, thus, multicollinearity is present. Similarly, the variable of credit growth (gkredit) was discarded due to its correlation with the loan-to-deposit ratio (LDR). Of the macroeconomic indicators, monthly growth in net foreign assets (GNFA) was not used because GNFA affects growth in base money (GM2). Furthermore, the variables of inflation, the nominal interest rate of 1-month SBI and real interest rate (RSBUNGA) were separated into their own models. The variables were separated in order to avoid the close correlation between inflation and the interest rate. Taking into consideration multicollinearity, model 1 was not used to analyse the determinants of bank runs but model 2 (model 1 with SBI subtracted by ROE, GKREDIT, GNFA, INFLASI and rsbunga), model 3 (model 1 with INFLASI subtracted by ROE, GKREDIT, GNFA, SBI and rsbunga) and model 4 (model 1 with RSBUNGA subtracted by ROE, GKREDIT, GNFA, SBI and INFLASI) were.

Results of the one-step models 2, 3 and 4 were also not robust because, based on the results of the Arrelano-Bond serial correlation test, the models displayed signs of serial
correlation and the Sargan test evidenced over-identifying restrictions. In order to overcome these constraints, a regression two-step approach was used for the Arrelano-Bond dynamic panel model. The results of which were robust (accurate), as reflected by the Arrelano-Bond test that showed no evidence of serial correlation and the Sargan test that could not prove over-identifying restrictions. Moreover, the F statistics from the three models were statistically significant at $\alpha = 1\%$, which indicates that the model rejected $H_0$: all independent variable coefficients were equal to zero. Therefore, all independent variables equally and significantly affected the dependent variable (monthly percentage change in deposits), which is the proxy for bank runs.

Results of the two-step Arrelano-Bond dynamic panel model were robust and are presented in Table 4. The lag coefficient of deposits (GDPK(-1)), which was used as a proxy for the self-fulfilling prophecy was positive in line with expectations, namely that a decline in deposits in the previous period would precipitate a corresponding decline in deposits in the current period. From its significance, the parameter coefficient (GDPK(-1)) was significant in models 2, 3 and 4 as reflected by the $p$-value of 0.000, which is less than $\alpha=1\%$. Therefore, results of statistical tests reject $H_0$: $\beta_1 = 0$, denoting that $\beta_1$ is statistically significant. The significance of this variable coefficient shows that information pertaining to a decline in funds or bank runs at one bank will encourage customers to withdraw their funds, which will instigate a run on another bank. The results of this research are in agreement with the research conducted by D’Amato, Grubisic and Powell (1995) and McCandless, Gabrielli and Rouillet (2003), which argue that the self-fulfilling prophecy was one cause of bank runs in Argentina in 1995 and 2001.

The determinants of bank runs originating from the bank’s financial performance, like ROA, LDR, LIQ, NPL and CA can be explained as follows: The coefficient of ROA is positive and, thus, in accordance with theory as presented in Table 2 and Table 3, namely higher bank earnings indicate better performance that can alleviate bank vulnerability to a run. The corresponding $p$-value of the ROA coefficient is 0.000, which denotes that at $\alpha=1\%$ ROA significantly influences bank runs, in this case using a proxy for bank runs, namely changes in bank deposits (GDPK).

The indicator of financial performance LDR was positive and, thus, incongruent with expectations. The LDR coefficient should be negative because a higher loan-to-deposit ratio implies less bank liquidity available and, hence, greater vulnerability to bank runs. However, the LDR coefficient was statistically significant with a $p$-value of 0.0000. The LIQ coefficient
was also negative and statistically significant, thereby discordant with expectations. An explanation for the contradictory signs of these two coefficients was due to problems of limited information for the customers regarding bank performance (asymmetric information). As a result of limited information, customers tend to pay more attention to earnings as published in the bank’s financial statements when deciding whether to withdraw their funds, as reflected by the expected sign of coefficient ROA. Meanwhile, LDR and LIQ were not sensitive to fund withdrawals.

Regarding the indicators of financial performance, NPL was negative in line with expectations. Statistically the NPL coefficient significantly affected bank runs with a p-value of 0.000. The coefficient of CA (capital adequacy ratio) was negative, which was not in line with expectations but was statistically significant. Similar to LDR and LIQ, the conflicting signs of coefficient were due to limited customer information taken from the bank’s published financial statements; hence, changes in deposits were not sensitive to capital adequacy (CA). The significance of this variable indicated that the more financially sound a bank is the smaller the risk of bank runs tends to be.

The determinants of bank runs stemming from macroeconomic conditions, namely LGDP, LNT, GM2, IHSG, SBI, INFLASI and RSBUNGA can be described as follows. In all models, the coefficient of economic growth (LGDP) was positive, which is in line with expectations, and statistically significant at $\alpha = 1\%$. The exchange rate did not significantly influence bank runs in any of the models. In model 2, a change in the JSX composite (IHSG) significantly influenced bank runs at $\alpha = 5\%$, but not significantly in models 3 and 4. In addition, the independent variables IHSG and LNT were separated and inputted respectively in models 2, 3 and 4. The variables were separated in order to detect multicollinearity between IHSG and LNT. The results of dynamic panel models after separating the two variables indicated similar findings, namely that ISHG still significantly influences bank runs in model 2 and the correlation remains negative but not significant in model 3 and 4. The coefficient of IHSG was negative, which is in contrast to expectations. The negative sign of IHSG indicates that fund placements by customers at a bank are substituted by funds on the stock market. Another significant macroeconomic indicator was growth in base money M2 (GM2) with a p-value of 0.000 in all three models.

The variables of SBI, INFLASI and RSBUNGA were estimated using their own models in order to avoid multicollinearity. SBI used model 2, INFLASI model 3 and RSBUNGA model 4. The coefficient of SBI in model 2 was negative in line with expectations
and with a significant influence on bank runs at $\alpha = 1\%$. The negative sign of this coefficient indicated that higher interest rates increase the cost of funds to the debtor and, thus, aggravate non-performing loans, subsequently leaving banks more vulnerable to a run. The coefficient of INFLASI in model 3 did not significantly influence bank runs. Meanwhile, the coefficient of the real interest rate (RSBUNGA) was statistically significant at $\alpha = 1\%$ and was negative in harmony with expectations. The significance of this coefficient indicated that a higher real interest rate increases the cost of funds to the debtor, thus, aggravating non-performing loans and, subsequently leaving banks more vulnerable to a run. These results are in agreement with the research conducted by D’Amato, Grubisic and Powell (1995) as well as McCandless, Gabrielli and Rouillet (2003), which found that high interest rates and inflation were one cause of bank runs in Argentina in 1995 and 2001. This is also in accord with the theory proposed by Mishkin (1994), namely that higher inflation and interest rates provoke widespread economic uncertainty and increase the possibility of bank runs.

Meanwhile, the dummy variable for the banking crisis in 1997-1998 (dcrisis) indicated that the coefficient does not significantly affect the independent variable bank runs in any of the models. This implies that there were no structural breaks in the data of percentage change in deposits, hence, without the dummy variable the estimation model of the determinants of bank runs in this paper is robust.

Table 4 Results of the Two-Step Dynamic Panel Arrelano-Bond Model for all Banks (1990-2005)

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Expected Sign*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gdplk(-1)</td>
<td>.0499097 (0.000)</td>
<td>.0558145 (0.000)</td>
<td>.0546436 (0.000)</td>
<td>.0568486 (0.000)</td>
<td>+</td>
</tr>
<tr>
<td>roa</td>
<td>.0003161 (0.000)</td>
<td>.0003511 (0.000)</td>
<td>.0003656 (0.000)</td>
<td>.0003308 (0.000)</td>
<td>+</td>
</tr>
<tr>
<td>roe</td>
<td>8.69e-07 (0.000)</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>ldr</td>
<td>1.51e-07 (0.000)</td>
<td>1.51e-07 (0.000)</td>
<td>1.51e-07 (0.000)</td>
<td>1.50e-07 (0.000)</td>
<td>-</td>
</tr>
<tr>
<td>liq</td>
<td>-.0045987 (0.010)</td>
<td>-.0039085 (0.000)</td>
<td>-.0037416 (0.029)</td>
<td>-.004143 (0.017)</td>
<td>+</td>
</tr>
<tr>
<td>gkredit</td>
<td>2.91e-07 (0.124)</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>npl</td>
<td>-.0000752 (0.000)</td>
<td>-.0000744 (0.000)</td>
<td>-.000075 (0.000)</td>
<td>-.0000741 (0.000)</td>
<td>-</td>
</tr>
<tr>
<td>ca</td>
<td>-8.32e-09 (0.000)</td>
<td>-9.43e-09 (0.000)</td>
<td>1.07e-08 (0.000)</td>
<td>-9.85e-08 (0.000)</td>
<td>+</td>
</tr>
<tr>
<td>inflasi</td>
<td>.010806 (0.523)</td>
<td></td>
<td>-.0127267 (0.582)</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>lgdp</td>
<td>55.58811 (0.000)</td>
<td>57.0019 (0.000)</td>
<td>67.051549 (0.000)</td>
<td>59.29535 (0.000)</td>
<td>+</td>
</tr>
<tr>
<td>int</td>
<td>-1.721723 (0.794)</td>
<td>-2.942458 (0.525)</td>
<td>-5.001888 (0.447)</td>
<td>-8.2788 (0.092)</td>
<td>-</td>
</tr>
<tr>
<td>gm2</td>
<td>.6664031 (0.000)</td>
<td>.815951 (0.000)</td>
<td>.8681422 (0.000)</td>
<td>.9139102 (0.000)</td>
<td>+</td>
</tr>
<tr>
<td>gnfa</td>
<td>.0346286 (0.022)</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>sbi</td>
<td>-.1413058 (0.000)</td>
<td>-.1250546 (0.000)</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>rsbunga</td>
<td></td>
<td></td>
<td></td>
<td>.0192167 (0.388)</td>
<td>-</td>
</tr>
<tr>
<td>ihsg</td>
<td>-.0146106 (0.000)</td>
<td>-.0090919 (0.041)</td>
<td>-.003091 (0.369)</td>
<td>-.0060853 (0.080)</td>
<td>+</td>
</tr>
<tr>
<td>dcrisis</td>
<td>9.268824 (0.607)</td>
<td>-.27.51757 (0.367)</td>
<td>-22.13916 (0.341)</td>
<td>-10.05823 (0.642)</td>
<td>-</td>
</tr>
<tr>
<td>_cons</td>
<td>-.2951076 (0.299)</td>
<td>-.4164169 (0.088)</td>
<td>-.4883353 (0.026)</td>
<td>-.3563791 (0.135)</td>
<td>-</td>
</tr>
</tbody>
</table>
5.2. Determinants of Bank Runs during the 1997-1998 Banking Crisis

The determinants of bank runs were revealed by the results of regressing the panel data using monthly data from 1990 until 2005. However, as is well documented in 1997 and 1998 bank runs occurred in Indonesia, thus triggering a national banking crisis. Against this unpropitious backdrop, this research also seeks to discover the determinants of bank runs from January 1997 to December 1998. In addition, the analysis of determinants of bank runs for the period of 1997-1998 is a control variable for the use of changes in deposits as a proxy for bank runs. As elaborated upon in Section 4, the control variable is required considering that changes in deposits are not always followed by bank runs.

Multicollinearity was present among the independent variables, hence additional models were used to analyse the determinants of bank runs during the banking crisis of 1997-1998, namely model 2, 3 and 4. Results of the dynamic panel data model developed by Arellano-Bond using a one-step approached evidenced bias due to serial correlation and over-identifying restrictions. Consequently, an alternative robust model was sought using a two-step dynamic panel model developed by Arellano-Bond, for which the results are presented in Table 5. The results of the GMM regression indicate that the relationship between the dependent variable and independent variables is statistically significant, as reflected by the value of the F statistic at $\alpha = 1\%$.

Based on the GMM regression, the three models show that the lag in deposits, used as a proxy of the self-fulfilling prophecy, is positive and statistically significant with a p-value of 0.000; or $\alpha$ is less than 1%. The significance of this coefficient implies that news of a decline in deposits at one bank or indeed a run on a separate bank will cause customers to flock to their bank and withdraw their funds (bank runs). The findings of this research are congruous with the research conducted on bank runs in Argentina by D’Amato, Grubisic and Powell.

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Bank runs began when the government decided to abandon its managed floating exchange rate regime and institute a free floating exchange rate on 14th August 1997, with a subsequent wave of bank runs triggered by the closure of 16 banks in November 1997, which ultimately petered out in August 1998.
and McCandless, Gabrielli and Rouillet (2003), which postulated that the self-fulfilling prophecy was one contributing factor to bank runs in Argentina.

The variable ROA was positive in line with expectations and significant at $\alpha = 1\%$ with a $p$-value of 0.003. The coefficient of LDR was negative, which was in harmony with expectations, and significant at $\alpha = 1\%$. Conversely, the coefficients of LIQ, NPL and CA were not as expected, with LIQ negative, NPL positive and capital adequacy negative. The unexpected coefficient signs could be due to limited customer information gleaned from the bank’s financial statements, thereby the three variables would prove insensitive to customer fund withdrawals. The significance of these three variables shows that as a bank’s financial conditions improve the possibility of a bank run declines.

The macroeconomic variables, consisting of economic growth (LGDP), the exchange rate (LNT) and growth in base money (M2), had coefficients as expected in the three models and significantly influenced bank runs at $\alpha = 1\%$. The significance of the LGDP coefficient implied that as economic conditions improve the potential for bank runs decreases. Meanwhile, the significance of LNT showed that rupiah depreciation compounds a bank’s foreign loans denominated in rupiah and ultimately raises the possibility of bank runs. The significance of GM2 indicates that more base money increases bank liquidity and, therefore, reduces the potential for a bank run. These findings are in line with the research performed by Demirguc-Kunt and Detragiache (1998), Hardy and Pazarbasiouglu (1999) and Ho (2004), which proposed that economic growth and the exchange rate affect bank runs and banking crises.

Other macroeconomic variables that significantly affected bank runs at $\alpha = 1\%$ and for which the signs of coefficient were in agreement with bank run theory included one-month SBI in model 2, INFLASI in model 3 and real interest rates (RSBUNGA) in model 4. The significance of inflation, SBI rates and the real interest rate was in accord with the theory proposed by Mishkin (1994) and the research by D’Amato, Grubisic and Powell (1995) and McCandless, Gabrielli and Rouillet (2003), which found that interest rates and inflation are contributing factors to bank runs.

Meanwhile, the variable IHSG was significant in the three models at $\alpha = 1\%$, but the coefficient was negative and, thus, unexpected as presented in Table 2 and Table 3. The negative coefficient of IHSG indicates that bank deposits are a substitution for stock.
### Table 5  Results of the Two-Step Dynamic Panel Arrelano-Bond Model for all Banks (1997-1998)

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Expected Sign*</th>
</tr>
</thead>
<tbody>
<tr>
<td>gdpk(-1)</td>
<td>.2974066 (0.000)</td>
<td>.3010486 (0.000)</td>
<td>.298317 (0.000)</td>
<td>+</td>
</tr>
<tr>
<td>roa</td>
<td>3.765414 (0.000)</td>
<td>3.520904 (0.000)</td>
<td>3.705551 (0.000)</td>
<td>+</td>
</tr>
<tr>
<td>ldr</td>
<td>-.0238338 (0.000)</td>
<td>-.0244307 (0.000)</td>
<td>-.239372 (0.000)</td>
<td>-</td>
</tr>
<tr>
<td>liq</td>
<td>-7.481348 (0.000)</td>
<td>-7.839653 (0.000)</td>
<td>-7.53001 (0.000)</td>
<td>+</td>
</tr>
<tr>
<td>npl</td>
<td>.1041378 (0.000)</td>
<td>.0986703 (0.000)</td>
<td>.107883 (0.000)</td>
<td>-</td>
</tr>
<tr>
<td>ca</td>
<td>-.0627725 (0.010)</td>
<td>.001975 (0.952)</td>
<td>-.0647577 (0.013)</td>
<td>+</td>
</tr>
<tr>
<td>inflasi</td>
<td>.5976495 (0.000)</td>
<td>.5976495 (0.000)</td>
<td>.5976495 (0.000)</td>
<td>-</td>
</tr>
<tr>
<td>lgdp</td>
<td>6.666501 (0.000)</td>
<td>3.044591 (0.000)</td>
<td>11.35838 (0.000)</td>
<td>+</td>
</tr>
<tr>
<td>int</td>
<td>-8.495236 (0.000)</td>
<td>-14.44655 (0.000)</td>
<td>-8.50948 (0.000)</td>
<td>-</td>
</tr>
<tr>
<td>gm2</td>
<td>.6948838 (0.000)</td>
<td>.7581463 (0.000)</td>
<td>.682149 (0.000)</td>
<td>+</td>
</tr>
<tr>
<td>rsbunga</td>
<td>-.1088567 (0.000)</td>
<td>-.1088567 (0.000)</td>
<td>-.1088567 (0.000)</td>
<td>-</td>
</tr>
<tr>
<td>sbi</td>
<td>-.04066 (0.000)</td>
<td>-.032471 (0.000)</td>
<td>-.0430248 (0.000)</td>
<td>+</td>
</tr>
<tr>
<td>ihsg</td>
<td>-.4034315 (0.000)</td>
<td>-.482142 (0.000)</td>
<td>-.4471285 (0.000)</td>
<td>-</td>
</tr>
<tr>
<td>_cons</td>
<td>.35357 (p-value)</td>
<td>.3533 (p-value)</td>
<td>.3350 (p-value)</td>
<td></td>
</tr>
</tbody>
</table>

F-statistik            1.10e+09    1.35e+09    1.11e+09    

Tes Serial Korelasi
- Order 1 0.3382 (p-value) 0.3357 (p-value) 0.3389 (p-value)
- Order 2 0.33547 (p-value) 0.3533 (p-value) 0.3350 (p-value)

Tes Sargan 0.0538 (p-value) 0.0545 (p-value) 1.0000 (p-value)

Notes: Values in parenthesis indicate the p-value
*) For the expected theoretical coefficient signs refer to Table 2 and Table 3

### 6. Conclusions and Policy Implications

Based on the study results elaborated upon in previous sections the following conclusions can be drawn:

1. Based on monthly data for all banks from 1990 - 2005, the results of the Arrelano-Bond dynamic panel model indicate that the self-fulfilling prophecy significantly affects bank runs. Accordingly, the news of a decline in deposits or the occurrence of a run on one bank will significantly influence runs on other banks. These findings are in harmony with the research conducted by D’Amato, Grubisic and Powell (1995) and McCandless, Gabrielli and Rouillet (2003), which argue that the self-fulfilling prophecy was a contributing factor to bank runs in Argentina in 1995 and 2001.

2. All variables of bank financial performance, consisting of earnings (ROA), liquidity (LIQ) and non-performing loans (NPL) are statistically significant in their affect on bank runs. The positive coefficient of ROA implies that as a bank’s earnings increase, customers tend to invest more funds at the bank and bank runs become less likely. Oppositely, the
negative coefficient of non-performing loans (NPL) indicates that as non-performing loans increase more funds become tied up in them, thus, exacerbating the bank’s vulnerability to bank runs. These results are also in line with previous research, like that undertaken by D’Amato, Grubisic and Powell (1995), McCandless, Gabrielli and Rouillet (2003) and Ho (2004).

3. The macroeconomic variables that significantly affect bank runs are economic growth, growth in base money M2, inflation and interest rates. The positive coefficient of economic growth indicates that stronger economic growth leads to greater interest in depositing funds at a bank and lower non-performing loans, hence, a smaller tendency for bank runs. The positive coefficient of base money means that more base money reduces the occurrence of bank runs.

4. The negative and significant variables of inflation and the real interest rate denote that higher interest rates lead to a more expensive cost of funds, thereby, increasing non-performing loans and reducing bank liquidity, which eventually heightens vulnerability to bank runs. The significance of these variables is in line with the research conducted by Demirguc-Kunt and Detragiache (1998), Hardy and Pazarbasiouglu (1999), McCandless, Gabrielli and Rouillet (2003) and Ho (2004), which found that inflation as well as the real and nominal interest rates significantly affected runs on banks and banking crises.

5. The determinants of bank runs during the banking crisis of 1997-1998 also demonstrated that the self-fulfilling prophecy also affects bank runs. This also confirmed that news of a decline in deposits or a run on a bank will influence customer expectations and prompt further bank runs. These results substantiate the research on bank runs in Argentina conducted by D’Amato, Grubisic and Powell (1995) and McCandless, Gabrielli and Rouillet (2003), which suggested that the self-fulfilling prophecy was one cause of bank runs in Argentina.

6. All variables on bank financial performance significantly affected bank runs during the banking crisis in 1997-1998. The coefficients of earnings (ROA) and loan-to-deposit ratio (LDR) were in line with theory, namely positive for ROA and negative for LDR. The positive coefficient of ROA intimates that as more customers deposit funds due to greater confidence in the bank’s increased earnings there is less chance of a bank run. The negative coefficient of LDR signals that less liquidity available to repay customer withdrawals leads to a more frequent occurrence of bank runs. The significance of ROA and LDR in affecting bank runs found in this research concurs with the studies conducted
by D’Amato, Grubisic and Powell (1995) and McCandless, Gabrielli and Rouillet (2003), which concluded that financial performance was a contributing factor to bank runs in Argentina in 1995 and 2001.

7. In terms of macroeconomic conditions, the coefficients of economic growth (LGDP), the exchange rate (LNT) and base money growth (M2) were all positive as expected and significantly affected bank runs during the banking crisis in 1997-1998. Similarly, the coefficients of the one-month SBI interest rate, inflation and real interest rate were negative and significantly influenced bank runs. The significance of these variables as determinants of bank runs conforms to the research performed by Demirguc-Kunt and Detragiache (1998), Hardy and Pazarbasioğlu (1999), McCandless, Gabrielli and Rouillet (2003) and Ho (2004), which found that economic growth, the exchange rate and interest rates influence bank runs and banking crises.

The results of the dynamic panel model proved that the self-fulfilling prophecy significantly affects bank runs in Indonesia. The policy implications of these findings indicate that information pertaining to the occurrence of bank runs or notable deposit withdrawals at a bank can influence customer expectations and lead to a subsequent run on another bank. In this context, under a framework of risk-based bank supervision, supervisory authorities are required to map banks that are sensitive to the self-fulfilling prophecy. Sensitivity mapping of banks should be included in the regular cycle of banking supervision in order to assess individual bank risk and avoid contagion of bank runs from one bank to the next. Furthermore, reliable communication management is required to restore public expectations. Building customer confidence in national banks requires government support as an emergency source of funding when a bank run involves systemic risk. Support can come in the form of enhanced supervisory coordination between Bank Indonesia and the Government through the existing financial system stability forum.

**Caveat**

This research utilises a lagged dependent variable (percentage change in deposits) as a proxy of bank runs. The use of this variable is robust in capturing factors of the self-fulfilling prophecy, but it would not be impossible to find a more robust proxy to investigate the self-fulfilling prophecy.
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