DETERMINANT OF *BANK RUNS* IN INDONESIA: BAD LUCK OR FUNDAMENTAL?

Iskandar Simorangkir [1]

Abstract

This paper examine the determinant of bank runs in Indonesia that includes economic fundamental, bank performance, and self-fulfilling prophecy factors for all banks either in full sample periods between years 1990 – 2005 or in banking crisis periods between years 1997 – 1998. The bank runs determinant uses dynamic panel model from Arrelano-Bond. Estimation result shows that self-fulfilling prophecy, bank monetary performance which is rentability and fixed credit ratio and macroeconomic condition which is economic growth, inflation and real exchange rate influence bank runs in Indonesia. Bank runs determinant in banking crisis between year 1997 – 1998 also shows a result that is not really different from bank runs determinant during full sample periods between years 1990 – 2005.

Classification JEL: C29, C33, G21

Key Words: *Bank runs*, Banking Crisis, Arrelano Bond Dynamic Panel

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1 Head of Economi Research Bureau, Bank Indonesia and lecturer at Postgraduate Program University of Pelita Harapan Jakarta. The writer is grateful to Prof. Rustam Didong, Dr. Muliaman Hadad, and Dr. Sugiharso Safuan upon the ideas. All parts in this article are the subjective points of view of the writer

I. INTRODUCTION

Bank runs is a phenomenon where many customers withdraw their money in a great amount together and immediately in a bank because costumers do not believe that the bank is able to fully pay the money on time[2]. *Bank runs* occurring in a bank would become a crisis if it spreads to other banks (*contagious effect*). *Bank runs* and banking crisis have become a global phenomenon and occurred repeatedly in both developed and developing countries within the last decades. *Bank runs* and banking crisis even occurred frequently since monetary liberalization in 1980s and 1990s (Davis and Karim, 2007). Even in the middle 2007 until today, world money market is experiencing a global monetary crisis that came from *subprime mortgage* in United States (US).

In a modern banking history, banking crisis had happened long before the World War I, like *bank runs (bank panic)* and banking crisis occurred in United States in 1837, 1873, 1884, 1890, 1907, and 1933 (Calomiris, 2007). Research conducted by the IMF in 181 member countries shows that since 1980 until mid-1996, there were 133 *bank runs* and a serious banking crisis (Lindgren, Garcia and Saal, 1996). The next terrible banking crisis occurred in 1997/1998 in some of East Asian countries, including Indonesia, Thailand, Malaysia, Philippine and South Korea. The crisis started from the exchange rate crisis in Thailand and is contagious to Indonesia and other East Asian countries and further developed into a banking crisis and economic crisis (Bank Indonesia, 1998). The financial crisis occurred in the U.S. occurred again in 2007/2008 and has grown into a global financial crisis and its impact is still experienced until now.

In the case of Indonesia, *bank runs* also occurred repeatedly. In 1992, there was a *bank runs* on several national banks resulting liquidated Bank Summa. Subsequently, in the year 1997/1998 there was *bank runs* that evolved into the worst banking crisis ever in the banking history of Indonesia. The closure of 16 banks by the Government on November 1, 1997 has resulted in reduced customer trust for the banks, especially the private banks where public believed they had bad financial performance. The decline of trust for the banks encouraged customers to massively withdraw their funds (*bank runs*). Furthermore, withdrawal at a bank systemically[3] spread (contagion) to other banks so it evolved into a banking crisis.

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2 Definition of *bank runs* was expressed by George G. Kaufman on *The Concise Encyclopedia of Economics in website*http://www.econlib.org/library/Enc/BankRuns.html or in George G. Kaufman on "*Bank runs: Causes, Benefits and Costs.*" " *Cato Journal* 2, No. 3 (*Winter* 1988): 559-88.

3 Systemic risk is a risk where a *bank runs* in a bank can trigger a *bank runs* to other banks or in academic literature it is always called as risk giving *contagion* effect. The process of systemic occurrence or the *contagion* happened through *self-fulfilling prophecy*

Repeated phenomenon of *bank runs* and banking crisis are caused by the nature of banks where they are the institutions that are vulnerable towards funds withdrawal by customers on a large scale. The vulnerability is an impact of the operations of banks that transform short-term liabilities, such as demand deposits, savings and time deposits into longer-term assets, such as credit. Under these conditions, banks have always faced problems of *maturity mismatch* so that it is very vulnerable to large-scale funds withdrawals (*bank runs*) by customers because of the limited liquid assets owned by banks.

Subsequently, *bank runs* on one bank can cause a systemic risk, which is spreading to other banks. Systemic risk occurs because customers at other banks do not know the information about the condition of his/her bank (*asymmetric information*) so that customers think that their banks also face the same problems, it makes customers massively withdraw their funds in the banks. The same *bank runs* process also occurs in other banks, so there are many banks would experience *bank runs* and ultimately lead to banking crises. Factors causing *bank runs* that come from the worriedness (belief) of the customers due to the absence of information about the bank's performance is often called as *self-fulfilling prophecy*. *Bank runs* caused by a *self-fulfilling prophecy* factor is a *random event* from the news that is not symmetrical (*asymmetric information*) received by the customers (*agent*). The widely influential theory models were developed by Diamond and Dybvig (1983).

Beside *self-fulfilling prophecy* factor, factors causing *bank runs* are fundamental factors, both derived from macroeconomic and bank fundamentals (Kindleberger (1978), Gup and Bartholomew (1999)). Shock that occurs in the economic fundamentals, such as the economic contraction, the increase of interest rates, the exchange rate volatility, the asset impairment and the increase of uncertainty in the financial sector, would encourage a negative effect on the business activities of banks. Contraction or weakening economy may lead to an increase in bad debts of banks and subsequently can lead to inability to pay the bank customer deposit withdrawals because most of customer funds are embedded in bad debts.

Some researches show that banking crises that occurred in a country have generated a huge loss for the economy and society (Hoelscher and Quintyn, 2003 and Hanson, 2005). The obstruction of access to financing for business world would lead to an economic decrease or contraction so it encourages an increase in unemployment. Besides, bank restructuring as an attempt to recover the impact of the banking crisis also requires a large fiscal costs and will ultimately be borne to the *tax payer*. The *output loss* experienced by the countries facing banking crisis is various depends on how deep and long it is. Hanson (2005) conducted a study of the *output loss* due to the banking crisis. The results of these studies argued that Indonesia suffered

the *output loss* by 35% to 39% of GDP, Thailand by 26.7% to 40% of GDP, Korea by 10% to 17% of GDP in the crisis periods 1997 -2002, Japan by 4.5% to 48% of GDP in the crisis periods in 1991-2005, Mexico by 10% to 14.5% of GDP in the crisis periods in 1994-2000 and Hungary by 14% to 36.4% of GDP in the crisis periods in 1991 - 1995.

In connection with the costs incurred by *bank runs* and banking crisis, then this paper will discuss the factors that affect the *bank runs*, fundamental factors or bad luck? Furthermore, the second session will discuss the concept of theory that affects

bank runs. Session 3 will discuss the development of *bank runs* in Indonesia and section 4 will describe the empirical model and data. Empirical results from the study will be explained in session 5, while the session 6 is the final part of the paper that will conclude the research results and policy implications.

II. THEORY

In terms of its determinant, there are two main theories that explain the *bank runs*. The first theory state that the *bank runs* occur due to the fundamental factors, both macroeconomic and bank fundamentals (Kindleberger, 1978). While the second theory state that *bank runs* is a *random event* because of the panic (*self-fulfilling prophecy*) of the customers due to imperfect information (*asymmetric information*) on the problem of bank's performance (Diamond and Dybvig, 1983).

In *fundamentalist* theory, banks and macroeconomic fundamentals worsening may lead to the occurrence of *bank runs*. Deteriorating bank fundamentals are, for instance, the decrease of *return on investment* and the *insolvency* issues, while the deteriorating economic fundamentals are, for instance, economic recession and high inflation. Kindleberger (1978) and Canova[4] (1994) expressed that *bank runs* are *endogenous* towards the economic process and tends to occur at the peak of expansion phase in the economic cycle. According to this theory, financial condition becomes vulnerable at the end of the period of economic expansion since the companies which are bank debtors have difficulty to pay their debts due to decline in corporate profits.

In this model, *bank runs* are part of a cycle that can affect both the banking and real sectors of economy. This theory expresses that under conditions of increasing economic cycle (*upturn*); banks will increase lending (*credit*) to the real sector with basic expectations of better

4 Canova (1994) concluded Mitchell theory (1913), Fischer (1933), and Minsky (1977). See Fabio Canova"*Were Financial Crises Predictable?"*. *Journal of Money, Credit and Banking. Volume* 26, *Issue* 1 (Feb. 1994), 102-124.

economic growth in the future. Furthermore, banks will have a great credit (*highly leveraged*) and if the cycle of economic declines, the debtor cannot repay the loan. These conditions generated banks liquidity problems and makes those banks do not have sufficient reserves to cover losses.

The causes of *bank runs* can also be derived from bank fundamental factors (Gorton, 1988). Banks will have difficulty in providing liquidity to meet its customers fund withdrawals if the banks have poor financial performance. The occurrence of losses, poor solvency, and poor current asset quality generate retention of customer funds on bad current assets, such as bad credit loans. Furthermore, these conditions resulted in the lack of liquidity available at banks, so banks are always vulnerable to *bank runs*.

Meanwhile, the second theory states that *bank runs* occur due to *random events* caused by bank customers panic (*agent*) and is not always related to economic fundamentals. Theory model of the second group that is widely influential was developed by Diamond and Dybvig (1983). This model explains that the *bank runs* that occur are a rational response of *belief* of the agent due to *asymmetric information* about bank performance. If the customer (*agent*) thinks that the banks do not have sufficient funds to meet the customer fund withdrawal, then *bank runs* will occur. A bank will face massive withdrawal if many individuals believe that other customers will massively withdraw their funds or often refer to *self-fulfilling prophecy*.

In this group, including' Calomiris and Gorton (1991), they expressed a combination factors between *self-fulfilling prophecy* and the *shock* of banking assets is the cause *bank runs*. Besides that, Chen (1999) expresses that beside *self-fulfilling prophecy* and liquidity factors, the moral hazard also contributes to the occurrence of *bank runs*. Contagion in the discussion of *bank runs* is often interpreted as a factor that is equal to the *self-fulfilling prophecy* because contagion means that *bank runs* on a bank will affect the *bank runs* on other banks. The influencing process from one bank to another occurred through a withdrawal transmission mechanism of customers (*self-fulfilling prophecy*). Thus according to this theory, *bank runs* is mainly due to bad luck instead of fundamental factors. From the empirical side, studies of *bank runs* and determinants of banking crises have been a lot done. For example, Canova (1994) conducted a study on the determinants of banking crises in the period 1864-1914 in the U.S. with a *probit* model. The results of these studies indicate that the banking crisis in U.S. in that period was caused by the impact of economic factors. Further research also concluded that there would be a seasonal banking crisis that is influenced by economic cycles.

Research on the determinants of banking crisis as a whole by using data panel of developing and developed countries is conducted by Demirgüç-Kunt and Detragiache (1998). The model

used is a *multivariate logit* with the conclusion result that shows banking crises can occur if the macroeconomic condition is weak (low economic growth and high inflation), high interest rates, *sudden capital outflow* and high credit loan. Eichengreen and Rose (1998) conducted a study of external shocks (*international shock*) towards banking crisis in OECD countries and the results show that interest rates have a major influence, while economic growth has little influence on the vulnerability of the banking crisis.

The above determinants of banking crises study is done using aggregate data from each country (*cross country*) so there is the possibility of aggregation problems, such as denying each other out factors among the banks that are aggregating. Concerning to these weaknesses, McCandless, Gabrielli and Rouillet (2003) used individual bank data and dynamic data panel model to determine the determinants of *bank runs* and banking crises in Argentina which occurred in 2001. The research findings indicate that the determinant of *bank runs* that occurred in Argentina is the factor of *self-fulfilling prophecy*, macroeconomic *shock* and worsening bank fundamentals condition.

III. PROGRESS OF BANKING CRISIS IN INDONESIA

At first the crisis that hits Indonesia's economy since 1997 is mainly triggered by the crisis of the rupiah. The huge depreciation pressure of the rupiah exchange rate is mainly derived from the factor of *contagion* from the crisis of the exchange rate of Thai Baht in July 1997. Effect of contagion did not only hit Indonesia but also rapidly expanded into other Asian countries, such as the Philippines, Malaysia and South Korea. Increasingly heavy pressure on the rupiah depreciation forced Indonesia to remove managed floating exchange rate regime (*managed floating*) to free floating exchange rate system on August 14, 1997. In order to avoid the national economy from a deeper crisis as a result of the pressure of depreciation and capital outflow, the government decided a package of economic policy in September 1997. Furthermore, the program expanded to stabilization and economic reform programs supported by IMF, World Bank, and ADB formally in November 1997. As the implementation of financial sector reform program in order to make better banking system, then on 1 November 1997, 16 private banks were closed.

Closure of 16 banks led to *bank runs* on banks where according to public perception quite unreliable. Banks closure policy that should have been intended to recover the national banking precisely resulted in a massive withdrawal of funds on non-government banks. Large-scale withdrawal is due to the ruin of public trust towards banks due to bank closures policy. The more widespread *bank runs* are also caused by the weak financial performance of banks,

such as the increase in bad credit loans and declining banks rentability as the impact of management of businesses that did not fully follow the nature of good governance. (Warjiyo, 2001 and Bank Indonesia, 1998[5]). Besides, the rapid depreciation of rupiah resulted in ballooning bank foreign debt denominated in rupiah. The condition was further aggravated by the absence of guarantee program. During the absence of guarantee program and information about the condition of banks (*asymmetric information*), bank customers, particularly private bank customers, massively withdraw their funds and transfer them to a bank that considered better and safer assets (*fiat money*) .

One month after the closure of 16 banks mentioned above (December 1997), the amount of third party funds in national commercial private banks (BUSN) decreased by Rp 22.9 trillion (11.94%). Withdrawal of funds started from the closure of banks and reached the highest withdrawal in December 1997 and January 1998. The massive withdrawal declined since the government provided a guarantee (*blanket guarantee*) in January 1998. However, when the massive chaos occurred in May 1998, the number of banks experienced *bank runs* again.

In the period of banking crisis in 1997/1998, a large-scale withdrawals (*bank runs*) commonly occurred in non-foreign[6] exchange BUSN, frozen bank activities[7], and frozen bank operations[8]. Peak massive withdrawals on non-foreign exchange BUSN occurred in December 1997, January 1998, and May 1998. As an illustration, in December 1997, from 45 non-foreign exchange BUSN, 25 bank experienced a decrease of third party's funds by 10%, 17 banks decreased by 20%, 13 experienced funds decline by 40%, 11 banks declined by 60%, and 6 banks experienced decreasing funds by 80% of the total amount of the previous month.

As in non-foreign exchange BUSN,' *bank runs* also occurred in frozen business bank (BBKU) and frozen operation bank (BBO). The highest withdrawal occurred during November 1997 until January 1998, and March until May 1998. For instance, in November 1998, 26 banks from 40 BBKU experienced third party funds decline by 10% from the total of previous month third party funds, 14 banks experienced decline by 20% from the previous month amount, and 2 banks experienced decline by 40% from the previous month amount. *Bank runs* on BBO is not much different from BBKU. In January 1998, from 10 BBO, 6 banks experienced third party funds decline by 20% and 4 banks decline by 40%.

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5 Annual report of Bank Indonesia in 1997/1998

6 Non-foreign exchange BUSNs is national private banks that are not allowed to conduct foreign exchange activities in their business activities.

7 Frozen bank activities (BBKU) is bank where its business activities is frozen or is not allowed to have any business activities temporarily or in a certain period

8 Frozen bank operation (BBO) is a bank where operational activities is frozen temporarily

During November 1997 until January 1998 periods, on the contrary, third-party funds in government banks increased by 9.6% in November 1997. Withdrawal of funds from foreign banks is not much different from government banks. In November 1997, only one bank experienced declined of third-party funds. Meanwhile, during December 1997 to January 1998, it showed an increase by 6.8% in November 1997.

With these developments, the third party funds of firm banks and foreign banks increased from respectively 42.8% and 7.2% in December 1997 to respectively 47.7% and 9.3% in late January 1998. Instead, In contrast, the third party funds of foreign exchange BUSN and non-foreign exchange BUSN decreased from respectively 43.2% and 2.2% in December 1997 to respectively 36.9% and 1.5% in January 1998 (Table 1). These developments indicated the presence of the transfer of funds from private banks to government banks and foreign banks.

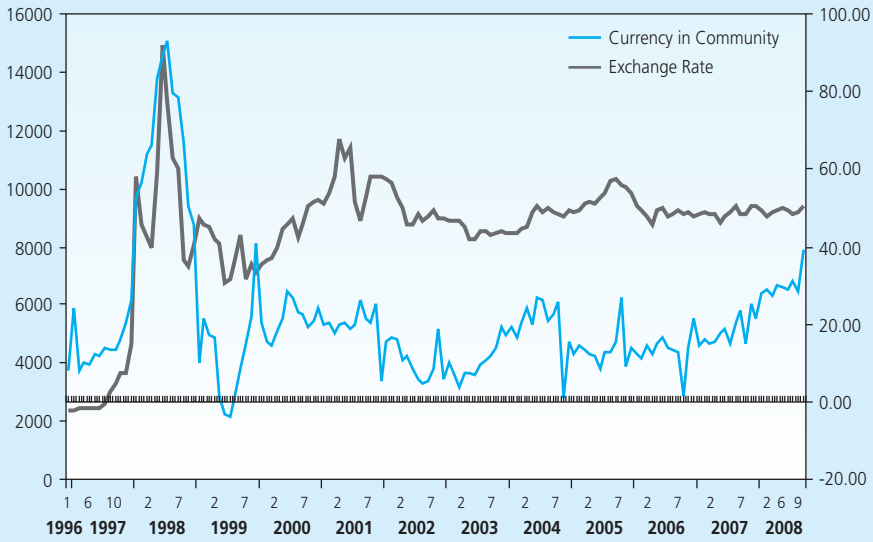
Table 1.
Percentage of Banking Third Party Funds

Group of Bank	Dec-96	Dec-97	Jan-98	Feb-98	Mar-98
	Share (%)				
Commercial Bank					
1. State-owned Bank	36.0	42.8	47.7	47.0	46.6
2. Foreign Exchange Bank	49.7	43.2	36.9	37.1	37.6
3. Non-foreign Exchange Bank	5.5	2.2	1.5	1.9	2.3
4. Regional Development Bank	2.8	2.2	1.6	1.7	1.6
5. Joint Bank	1.7	2.4	3.0	3.0	2.8
6. Foreign Bank	4.1	7.2	9.3	9.3	9.2
Rural Bank*)	0.5	0.4	0.3	0.3	0.3

* Share of commercial bank
Source : Bank Indonesia

Beside third-party funds transfer to banks categorized as healthy (*flight to quality*), there was also a transfer of funds into fiat money (*currency*), as reflected by the increase of fiat money in January 1998 by 31.8% (Rp 9.045 trillion) compared to the previous month. The increase is beyond the normal pattern of demand for fiat money, which is based on two years latest data before the crisis, the average growth of currency was only 9.5% per year.

Banking crisis was aggravated again by the great depreciation of rupiah. In January 1997, the rupiah against the U.S. dollar (U.S.) was in the position of Rp 2.396. The position of the exchange rate continuously declined. In July 1997, the exchange was rate recorded in the position of Rp 2599 per U.S. dollar, and in December 1997 by Rp 4650 per U.S. dollar. In 1998 the position of the exchange rate decreased drastically reaching the position of Rp 10,525 per



Source : Bank Indonesia. processed

Figure 1.
Development of Fiat Money and Exchange Rates

U.S. dollar in May 1998 and continued to weaken to a peak in June 1998 on the position of Rp 14,900 per U.S. dollar. From that position rupiah began to appreciate in December 1998 in the position of Rp 8025 per U.S. dollar. Meanwhile, in 1999, the position of the exchange rate tends to fluctuate and eventually rose in December 1999 by Rp 7100 per U.S. dollar.

Depreciation that occurred from January 1997 to December 1998 resulted in swelling of the bank's external debt obligations denominated in rupiah. Meanwhile, on the other hand most of the foreign loans were invested in credit that generated rupiah (non-export), resulting mismatch that aggravated the balance sheet of banks.

Withdrawal of bank funds on a large scale by the customer and the great depreciation of the rupiah put a pressure on bank balance sheet. These conditions resulted in bad national banking system performance. Banking performance degradation occurred in all financial aspects of the banks, which includes the capital, asset quality, profitability, and liquidity. Performance of capital (CAR) declined sharply since the crisis, as reflected by lower CAR of all banks from 9.19% at end December 1997 to -15.68% at the end of December 1998. Likewise the performance quality of productive assets (KAP), which is measured by the ratio of productive assets classified as non-current assets with the total productive assets, increased from 4.80%

at the end of 1997 to 42.39% at the end of 1998, before decreased by 12.74% at the end of 1999 as the impact of the transfer of troubled bank loans to BPPN.

In line with the worsening KAP, then rentability performance, which is measured by the ratio of profit to average assets (ROA), decreased from 1.37% in 1997 to -18.76% in 1998 and -6.14% in 1999. Losses experienced by almost all banks were due to the high costs borne by the banks, with a one-month deposit interest rate reached by 70% in September 1998. While on the other hand, the KAP increases and the amount of credit granted decreased along with the economic contraction (13.1% in 1998) and the increase of business risk due to social, political, and security instability. In line with the decline in credit loan, the *loan to deposit ratio* (LDR) of the bank also declined sharply from 86.42% at the end of 1997 to 72.37% at the end of 1998 and only amounted to 26.16% at the end of 1999.

IV. METHODOLOGY

This study uses a dynamic panel model to analyze the influence of certain bank customer's behavior towards other bank customers through the changes on their saving on the bank. Because of the limited information about his/her banks (imperfect information), when a large decrease in third party funds occurred, the customer will interprete the bank is in trouble hence trigger them to withdraw their funds (*self-fulfilling prophecy*). Institutionally *self-fulfilling prophecy* can affect *bank runs* on other banks (*systemic risk*) or often referred to contagion[9]. Thus the dynamic panel model that will be used in this paper can analyze simultaneously the determinant of *bank runs* coming from the *self-fulfilling prophecy*, macroeconomic fundamentals and financial performance of banks factor.

Dynamic panel model used in this study is Arrelano-Bond dynamic panel. Arrelano-Bond model is used to overcome the problem of dynamic models on the fixed effect model (MET) and the random effect model (MER). The correlation between lagged *dependent variable* and the influence of individual effects can lead the use of MET and MER OLS estimators to be bias and inconsistent, hence not *robust*. Formal model of dynamic data panel used to analyze the determinants of *bank runs* in this paper is:

$$\Delta Dep_{it} = \alpha + \beta_1 \Delta Dep_{it-1} + \sum_{k=1}^{K} \delta_k B_{kit} + \sum_{h=1}^{H} \gamma_h F_{hit} + \varepsilon_{it} \quad (1)$$

Where ΔDep_{it} is the *dependent variable* in the form of monthly percentage changes in third-party funds of each individual bank as a proxy for bank runs.

9 Some writers, such as D'Amato, Grubisic, and Powell (1997) and Allen and Gale (2000) use' *contagion* term to *self-fulfilling prophecy*

Percentage change in a positive third-party funds means no bank run occurs, while the negative one means there is a *bank runs*, where the size depends the on size of third party funds. The use of ΔDep_{it} as a proxy for *bank runs* in line with D'Amato, Grubisic and Powell (1997) and McCandless, Gabrielli and Rouillet (2003). They show the percentage change in third party funds is robust as a proxy for *bank runs*. ΔDep_{it} is the lag one of dependent variable, which serves to capture the influence of *self-fulfilling* of *bank runs* occurrence. With the limited information obtained by customers about his/her banks (*asymmetric information*), a decline of third party funds in their bank in the previous periods $(t\text{-}1)$ will encourage customers to a massive withdrawals or *bank runs* in the current period (t). This proxy are also used by D'Amato, Grubisic and Powell (1995) and McCandless, Gabrielli and Rouillet (2003) on their research and showed *robust* results. $\mathrm{B_k}$ is the k independent variables of the bank's financial performance. Financial performance used is a combination of the health rating of Bank Indonesia in the form of CAMELS[10]. $\mathrm{F_h}$ is h dependent variable from macroeconomic fundamental condition with macroeconomic variable.

In the estimation process of Arrelano and Bond (1991) model, we use instrumental variables (IV) to obtain a robust result. In this dynamic panel model, we use k *lag* variable as *independent variable.* By using first *difference* then specific effect from the banks can be eliminated, however with *first difference* there would be a serial correlation between *lag variable* and *difference* residual. To overcome this problem, Arrelano and Bond proposed to use *lag explanatory variable* in level, including *dependent variable* as the instrument.

GMM estimation would be consistent if lag of the *explanatory variable* in level is a valid instrument for *explanatory variable* in *difference form.* However, this is possible when the residual is not correlated (no *serial correlation*) and each of *independent variable* is exogenous. These two condition will be evaluated by *second order correlation test* and Sargan *test* to identify any excessive restriction. With Sargan *test*, it can evaluate the joint model specification and instrument validity.

Panel data covers 94 banks with monthly periods started from January 1990 until December 2005. This 94 banks consist of 7 government banks, 42 non-foreign exchange private banks, and 10 foreign banks. The overall data panel of those banks was obtained from conventional bank monthly report (LBU) of bank individual from Bank Indonesia. A complete explanation of the data can be seen in the two tables below.

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10 Bank Indonesia determined that CAMELS as the criteria of health rate assessment, which is C is *capital*, A is *asset quality* such as *non-performing loans* (NPL), M is management, E is earnings or rentability, L is liquidity, and S is *systemic risk*. In connection with the research focusing on bank performance, then finance performance used are *Capital, Asset Quality, Earnings, and Liquidity,* meanwhile *Management* and *Systemic* risk are not used. It is in line with the previous research as mentioned above.

Table 2.
Variables of Bank Performance

Variables Name	Measurement Method	Basic Consideration Theory
Capital Adequacy Ratio (CA)	The ratio between total capital (paid-in capital + retained earnings + net income of the current year) with total asset	The size of bank solvability. The better bank solvability, the higher the resistance towards *bank runs* (positive coefficient sign)
The ratio of profit to total assets (ROA)	Ratio between the current year profit after tax and total assets	The greater the rentability, the better the financial performance of banks and the subsequent higher resistance against *bank runs* (positive coefficient sign).
The ratio of profit to equity (ROE)	Ratio between the current year profit after tax to equity (equity = paid-in capital + Retained earnings + net income of the current year)	The size of Bank Rentability. The greater the rentability, the better the financial performance of banks and the subsequent higher resistance against bank run bank (positive coefficient sign).
Ratio of Liquid Tool to Total Assets (LIQ)	Ratio between liquidity (Cash and SBI) and total current assets	The size of bank liquidity. The greater the liquidity, the greater the liquid tool owned by banks and further enhances the ability of banks to tackle the problem of *bank runs* (positive coefficient sign).
Ratio of Credit to Third Party Funds (LDR)	Ratio between total credit and the third party funds	The size of liquidity. The greater the LDR means the greater increase in credit than public funds collected by the bank so that liquidity that is available gets smaller and further increase the vulnerability to *bank runs* (coefficient sign -).
Monthly Credit Growth (GKREDIT)	Total credit growth of this month (t) compared to the previous month total credit growth ($t-1$)	Just like LDR, the higher credit growth, the less liquidity-owned banks thus it increases the vulnerability to *bank runs* (the sign of the coefficient is negative).
Non-Performing Loan (NPL)	Ratio between total non-current loans (not current, doubtful and loss) and total assets.	The size of Productive Asset Quality (KAP).). The worse KAP, the more third-party funds retained in non-current so that the liquid tool owned gets smaller and it further increases the vulnerability of banks to *bank runs* (negative coefficient sign).

Table 3.
Macroeconomic Condition Variables

Variables Name	Measurement Method	Basic Consideration Theory
INFLATION	The rate of annual inflation in the stated month	The higher inflation, then the economic uncertainty that tends to increase *bank runs* occur (negative coefficient sign).
LGDP	Economic growth is calculated from the logarithm of the monthly Gross Domestic Product. Monthly data is interpolated from quarterly data using the *quadratic* method.	The decline in economic growth can increase the credit default so it tends to increase *bank runs* (positive coefficient sign).
SBI	1 month SBI interest rate	The higher interest rates, the more diminish the ability of customers in the repay / pay off loans (performing loans increased) thus it tends to increase *bank runs* (negative coefficient sign).
LNT	Monthly percentage change in the exchange rate / USD which is calculated from the logarithm of the exchange rate of Rp / USD.	The higher exchange rate volatility, the higher the uncertainty that will leverage the occurrence of *bank runs* (negative coefficient sign)
GM2	Money supply money growth (M2)	The larger the money supply means that the loose of monetary policy so that the liquidity in the banking system gets greater so it will lower the vulnerability to *bank runs* (positive coefficient sign).
GNFA	*Net Foreign Asset* monthly growth (NFA)	The greater the NFA means that M2 growth so that it will increase liquidity in the money market / banking and the sequel it can reduce vulnerability to *bank runs* (positive coefficient sign).
IHSG	Percentage change in the Composite Stock Price Index	The lower the stock price index, the lower the price of the asset so that it can lead to vulnerability to *bank runs* (negative coefficient sign).
RSBUNGA	Real interest rates that are calculated by subtracting the nominal interest rate of 1-month SBI with annual inflation rate	The higher the interest rate, the higher cost of funding of debtor so it encourages an increase in bad credit loans and further increases the vulnerability to *bank runs* (negative coefficient sign).

Meanwhile, macroeconomic indicator (F_{hit}) includes inflation, economic growth, (LPDB), 1 month SBI interest rate, exchange rate (LNT), money supply growth (GM2), *net foreign asset* growth (GNFA), stock exchange price index (IHSG), real interest rate (RSBUNGA) as described below in Table 3. GDP quarterly data is interpolated to monthly.

V. RESULT AND ANALYSIS

5.1. Aggregately *Bank runs* Determinants (1990 – 2005)

To estimate *bank runs*, we use Equation 1 and add *dummy bank runs (dcrisis)* on the banking crisis occurred in 1997/1998.

$$\Delta Dep_{it} = \alpha + \beta_1 \Delta Dep_{it-1} + \sum_{k=1}^{K} \delta_k B_{kit} + \sum_{h=1}^{H} \gamma_h F_{hit} + \sigma dcrisis + \varepsilon_{it} \quad (2)$$

This dummy variable addition is necessary to capture the occurrence of structural break on the data, which may lead to the inefficient estimation result. As previously explained, following D'Amato, Grubisic and Powell (1995) and McCandless, Gabrielli and Rouillet (2003), the percentage change in a positive third-party funds means no *bank runs* occur, otherwise the percentage change in third party funds that the negative means *bank runs* occur, where the severity depends on the number of third-party withdrawals.

Since the model used is the GMM, the model robustness is analyzed by looking at the *moment condition*. Arrelano and Bond (1991) suggested to use the serial correlation test of Arrelano and Bond and Sargan as described in session 4. Based on the results of Arrelano-Bond dynamic panel with one-step approach, there is a problem in a dynamic panel model (model 1), i.e. there are problems with the auto correlation and over-identification in the variables used. Considering this, the financial performance and macroeconomic indicators that exhibit multicollinearity will not be used to avoid problems of specification inaccuracies and serial correlation in the model. At the bank's financial performance indicators, the ROE is not used since we already have ROA. In addition, two variables have a close relationship so that it can cause problems of multicollinearity. Likewise the credit growth variable (gkredit) is removed because it is still associated with the *loan to deposit ratio* (LDR). For variable macroeconomic indicators, the monthly growth of *net foreign assets* (GNFA) is not used because GNFA is a factor affecting the growth of money supply (GM2). Besides, variable inflation, one-month nominal interest rates of SBI, and real interest rates (RSBUNGA) will be separated with a distinctive model. The separation is intended to avoid the relationship between interest rates with inflation

that are interrelated. Taking into account the problems of multicollinearity, the model 1 is not used to analyze the determinants of *bank runs*, but model 2 (model 1 with SBI minus ROE, GKREDIT, GNFA, Inflation and rsbunga), model 3 (model 1 with INFLATION minus ROE, GKREDIT, GNFA, SBI and rsbunga) and model 4 (model 1 with RSBUNGA minus ROE, GKREDIT, GNFA, SBI and inflation).

The results of one-step model of 2, 3 and 4 are not robust based on Arrelano-Bond serial correlation test, and Sargan tests indicated an *over-identifying restriction* problem. To overcome these problems, we performe two-step regression of the Arrelano-Bond dynamic panel model. This time, the two-step estimation results indicate that the model was *robust*. Furthermore the F statistic of the three models was statistically significant at α = 1%, which means the model can reject Ho: all *independent variable* coefficients are equal to zero. Thus, all *independent variables* together influence the *bank runs* significantly. The results is presented in Table 4.

Sign of coefficient of the *lag* third-party funds (GDPK (-1)) is positive as expected. This means decrease in third party funds in the previous period will lead to lower third-party funds in the current period. The coefficient parameters (GDPK (-1)) in model 2, 3 and 4 are all significant, as reflected by the *p-value* = 0.000. This significant coefficient indicates that the information about *bank runs* can encourage the customers to withdraw their funds and can further lead to the occurrence of *bank runs* on the other banks. The results are consistent D'Amato, Grubisic and Powell (1995) and McCandless, Gabrielli and Rouillet (2003) which shows that *self-fulfilling prophecy* factor is one of the causes of *bank runs* in Argentina in 1995 and 2001.

The results of the determinants of *bank runs* coming from the financial performance of banks in the form of ROA, LDR, liq, NPL, and CA can be described as follows. The coefficient of ROA has a positive sign so it accords to theoretical considerations as described in Table 2 and Table 3, i.e. the higher the profitability of the bank, the better the financial performance of banks so that it reduces vulnerability of the bank to *bank runs*. Concerning from its significance, the p-value of ROA coefficient by 0.000, which means at α = 1% ROA significantly affects the *bank runs* which is in this case it used a proxy variable used of *bank runs* is the change in bank third party fund (GDPK).

LDR financial performance indicators show positive signs so it is not aligned as expected. The LDR coefficient sign should have been negative because the higher the ratio the lower the LDR liquidity available in the bank so the bank would be vulnerable to a massive withdrawal of funds (*bank runs*). However, the LDR coefficient which is statistically significant affects the bank run by the p-value 0.0000. The coefficient of LIQ also has a negative sign so it does not fit with the expected sign, but it is statistically and significantly affects the *bank runs*. The explanation

of the opposite sign of the coefficient of two variables is mainly due to problems of limited information from the customers in terms of the performance of banks (*asymmetric information*). With limited information, the bank's customers pay more attention to rates of return than the publication of financial statements of banks in their fund withdrawals decision, as reflected by compatibility of ROA coefficient. While the LDR and LIQ variable are not sensitive to the withdrawal of third party funds.

Other financial performance indicators, the NPL showed a negative sign so that it fits with the expected sign. Considering from its significance, it is statistically significant affecting the *bank run* by the p-value of 0.000. Coefficient CA (capital adequacy ratio) has a negative sign so it does not fit with the expected sign, but is statistically significant. As explained in the LDR and LIQ, opposite sign of the coefficient is due to the limited information on the financial statements of bank customers through publication so that changes in third party funds are not sensitive to the capital adequacy ratio (CA). The significant variables of financial performance show the healthier a finance of a bank, the less of the tendency of *bunk runs*.

The results of the determinant variables include macroeconomic conditions that include LGDP, LNT, GM2, JCI, SBI, INFLATION and RSBUNGA will be described hereinafter. In all models, economic growth (LGDP) has a positive sign so that it aligned as expected and is statistically significant influencing *bank runs* on $\alpha = 1\%$. The exchange rate did not significantly affect the bank run on all models. In model 2, the change in joint-stock index (IHSG) significantly affects the bank run at $\alpha = 5\%$, but is not significant in models 3 and 4. Furthermore, IHSG and LNT independent variable are separated by entering each variable in model 2, 3 and 4. Separation was performed to detect the occurrence of multicollinearity between IHSG and LNT. The results of dynamic panel with the separation of the two independent variables showed similar results, i.e. IHSG remained significant and influence *bank runs* on the model 2 and has a negative sign and did not significantly affect the *bank runs* in model 3 and 4. IHSG coefficient sign is negative so that it is contrary to that expected. IHSG negative sign indicates that the placement of customer funds in a bank is a substitution with the placement of funds in the stock market. Other macroeconomic indicators that significantly affect the growth of *bank runs* are the money supply M2 (GM2) with p-value of 0.000 in all three models.

SBI variables, INFLATION and RSBUNGA are estimated with separate models to avoid multicollinearity problems. SBI using model 2, INFLATION with model 3, and RSBUNGA model 4. SBI coefficient on the model 2 is negative so that it aligned as expected and significantly affects the bank run on $\alpha = 1\%$. Negative coefficient indicates the higher interest rates, the greater the cost of funding of debtor so it encourages an increase in bad credit loans and further increase the vulnerability to *bank runs*. INFLATION coefficient in model 3, did not

significantly affect the *bank runs*. Meanwhile, the coefficient of real interest rates (RSBUNGA) significantly affects the *bank runs* at $\alpha = 1\%$ and has a negative coefficient that has been in line with expectations. The significant coefficient indicates the greater the real interest rates, the greater the cost of debtor funds and further increase the bad credit loans and the vulnerability to *bank runs*. These results are consistent with research conducted by D'Amato, Grubisic and Powell (1995) and McCandless, Gabrielli and Rouillet (2003) who argued that the interest rates and high inflation is one of the causes of *bank runs* in Argentina in 1995 and 2001. These results are also consistent to the theory proposed by Mishkin (1994), the higher inflation and interest rates, the higher the uncertainty in the economy and will further increase the likelihood of *bank runs*.

Table 4.
Results of *Two-Steps* Dynamic Panel Arrelano-Bond in all Banks (1990-2005)

Dependent Variables	Model 1	Model 2	Model 3	Model 4	Expected Coefficient Sign*)
Gdpk(-1)	.0499097 (0.000)	.0558145 (0.000)	.0546436 (0.000)	.0568486 (0.000)	+
roa	.0003161 (0.000)	.0003511 (0.000)	.0003656 (0.000)	.0003308 (0.000)	+
roe	8.69e-07 (0.000)				+
ldr	1.51e-07 (0.000)	1.51e-07 (0.000)	1.51e-07 (0.000)	1.50e-07 (0.000)	-
liq	-.0045987 (0.010)	-.0039085 (0.000)	-.0037416 (0.029)	-.004143 (0.017)	+
gkredit	2.91e-07 (0.124)				-
npl	-.0000752 (0.000)	-.0000744 (0.000)	-.000075 (0.000)	-.0000741(0.000)	-
ca	-8.32e-09 (0.000)	-9.43e-09 (0.000)	1.07e-08 (0.000)	-9.85e-0 (0.000)	+
inflasi	.010806 (0.523)		-.01272767 (0.582)		-
lgdp	55.58811 (0.000)	57.0019 (0.000)	67.051549 (0.000)	59.29535 (0.000)	+
lnt	-1.721723 (0.794)	-2.942458 (0.525)	-5.001888 (0.447)	-8.2788 (0.092)	-
gm2	.6664031 (0.000)	.815951 (0.000)	.8681422 (0.000)	.9139102 (0.000)	+
gnfa	.0346286 (0.022)				+
sbi	-.1413058 (0.000)	-.1250546 (0.000)			-
rsbunga				-.0192167 (0.388)	-
ihsg	-.0146106 (0.000)	-.0090919 (0.041)	-.003091 (0.369)	-.0060853 (0.080)	+
dcrisis	9.268824 (0.607)	-27.51757 (0.367)	-22.13916 (0.341)	-10.05823 (0.642)	
_cons	-.2951076 (0.299)	-.4164169 (0.088)	-.4883353 (0.026)	-.3563791 (0.135)	
F-statistik	6105.26	27447.17	15344.52	11575.41	
Tes Serial Korelasi					
- Order 1	0.0183 (*p-value*)	0.2939 (*p-value*)	0.2919 (*p-value*)	0.2922 (*p-value*)	
- Order 2	0.3223 (*p-value*)	0.2415 (*p-value*)	0.2423 (*p-value*)	0.2421 (*p-value*)	
Tes Sargan	1.0000 (*p-value*)	1.0000 (*p-value*)	1.0000 (*p-value*)	1.0000 (*p-value*)	

Note: Sign ( ) on coefficient is *p-value*

*) The basis of theoretical considerations the expected coefficient signs refer to Table 5.1 and Table 5.2

Meanwhile, the *dummy* banking crisis 1997-1998 (dcrisis) indicates the coefficients did not significantly affect the dependent variable (*bank runs*) on all models. These results indicate that there is no problem of *structural breaks* in the data of change percentage in third party funds so without using a dummy crisis, estimation of *bank runs* determinant model in this dissertation has been quite *robust*.

5.2. *Bank runs* Determinants in the period of Banking Crisis in 1997-1998

Bank runs determinants obtained from the result of data panel regression above by using monthly data from 1990 until 2005. However, as known in 1997 until the year 1998 there was *bank runs* in Indonesia that has sparked a national banking crisis. In this regard, this research would also like to see the determinants of *bank runs* from January 1997 until December 1998[11]. In addition, the analysis of *bank runs* determinants in the period 1997-1998 is a control variable to use the change of third party funds as a proxy of *bank runs*. As explained in section 4, the control variable is necessary given the changes of third party funds are not always followed by the occurrence of *bank runs*.

In relation to have multicollinearity between independent variables, then to analyze the *bank runs* determinants on the period of banking crisis in 1997-1998 used models 2, 3 and 4. The estimation of Arrelano-Bond dynamic data panel model with one-step approach shows bias result because the results of regression indicate the presence of serial correlation problem and over-identifying problem in restriction equation. In connection with the problems, looked for models that are not biased (robust), using two-step model of Arrelano-Bond dynamic panel, the results can be seen in Table 5. GMM regression results show that the relationship between the dependent variable with independent variable are statistically significant, as reflected by the F values statistically significant at α = 1%.

Based on the results of GMM regressions, the three models showed a lag DPK are used as a proxy of *self-fulfilling prophecy* has a positive sign and statistically significant with a *p*-value of 0.000 or α less than 1%. The significant coefficient shows that the news of a reduction in funds or bank run in another bank can cause to other customers in droves attracted funds in the bank (*bank runs*). The results of study are in line with *bank runs* research in Argentina conducted by D'Amato, Grubisic and Powell (1995) and McCandless, Gabrielli and Rouillet

11 Massive funds withdrawals has been experienced since Government change the policy from managed floating exchange rate to freely freely floating exchange rate on 14 August 1997 and the wave of *bank runs* was getting bigger since the closure of 16 banks on November 1997 until it gets recovered on August 1998

Table 5.
The Result of Arrelano-Bond *Two-Steps* Dynamic Panel in All Banks (1997-1998)

Dependent Variables	Model 2	Model 3	Model 4	Expected Coefficient Sign*)
Gdpk(-1)	.2974066 (0.000)	.3010486 (0.000)	.298317 (0.000)	+
roa	3.765414 (0.000)	3.520904 (0.000)	3.705551 (0.000)	+
ldr	-.0238338 (0.000)	-.0244307 (0.000)	-.239372 (0.000)	-
liq	-7.481348 (0.000)	-7.839653 (0.000)	-7.53001 (0.000)	+
npl	.1041378 (0.000)	.0986703 (0.000)	.107883 (0.000)	-
ca	-.0627725 (0.010)	.001975 (0.952)	-.0647577 (0.013)	+
inflasi		.5976495 (0.000)		-
lgdp	6.666501 (0.000)	3.044591 (0.000)	11.35838 (0.000)	+
lnt	-8.495236 (0.000)	-14.44655 (0.000)	-8.50948 (0.000)	-
gm2	.6948838 (0.000)	.7581463 (0.000)	.682149 (0.000)	+
rsbunga			-.1117645 (0.000)	-
sbi	-.1088567 (0.000)			-
ihsg	-.04066 (0.000)	-.032471 (0.000)	-.0430248 (0.000)	+
_cons	-.4034315 (0.000)	-.482142 (0.000)	-.4471285 (0.000)	
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	0.3547 (*p-value*)	0.3533 (*p-value*)	0.3350 (*p-value*)	
Tes Sargan	0.0538 (*p-value*)	0.0545 (*p-value*)	1.0000 (*p-value*)	

Noted: () sign on the coefficient is the p-value
*) Basic theoretical considerations the expected coefficient signs refer to Table 5.1 and Table 5.2

(2003) which shows a factor of *self-fulfilling prophecy* is one of the causes of *bank runs* in Argentina.

ROA financial performance variables have positive signs as expected and significant influence on *bank runs* at α = 1%, with a p-value of 0.003. LDR has a negative sign as expectations and significantly affect the bank run at α = 1%. Instead LIQ, NPL and CA have opposite sign with expectations, with LIQ is marked by negative signs, NPL is positive and the capital adequacy ratio is negative. The different sign of the coefficients are likely due to limited customer information on the financial statements so that these three variables are not sensitive to the withdrawal of funds from customers. The significant variables of the bank's financial performance show that better bank's financial condition, and then less likely the *bank runs* occur.

The variable of macroeconomic indicator, in the form of economic growth (LGDP), the exchange rate (LNT) and the money supply growth (M2) in all three models have signs as expected and significantly affect the bank run at α = 1%. The significant coefficient of LGDP shows that better economic growth, the less likely *bank runs*. While LNT significant coefficient shows the higher the depreciation of exchange rate, then higher bank foreign liabilities denominated in rupiahs and will further increase the likely *bank runs*. GM2 significant coefficient shows increasing the money supply, then greater the liquidity available at banking and will further reduce the possibility of *bank runs*. The results are consistent with the results of research conducted by Demirguc-Kunt and Detragiache (1998), Hardy and Pazarbasiouglu (1999) and Ho (2004) which showed economic growth and exchange rates affect *bank runs* and banking crisis.

Other significant macroeconomic variables affect the *bank runs* at α = 1% and has a sign in accordance with the theory of *bank runs* is a 1-month SBI in model 2, Inflation in models 3 and real interest rates (RSBUNGA) in model 4. The significant of inflation coefficient, SBI interest rates and real interest are consistent with the theories argued by Mishkin (1994) and D'Amato research, Grubisic and Powell (1995) and McCandless, Gabrielli and Rouillet (2003) who argued that the interest rates and high inflation is one of the causes of *bank runs*.

Meanwhile, the IHSG variable on all three significant models affect *bank runs* at α = 1%, but the coefficient is negative that is inconsistent with the theory as described in Table 2 and Table 3. The negative of IHSG coefficient shows that the third party funds in banking is a substitute for the stock product.

VI. CONCLUSION

This paper provide the empirical test of bank runs determinants in Indonesia. Focusing on the self-fulfilling prophecy, the dynamic panel result shows that the *self-fulfilling prophecy* variable significantly influences the *bank runs* in Indonesia. The implication policy from this result shows that the information of *bank runs* occurrence or the third party significant withdrawal in a bank can influence the customer's expectation to greatly withdraw money in other bank. Regarding to the discovery, in the bank risk based supervision frame, supervisor authority needs to map the sensitive banks toward *self-fulfilling prophecy* factor. The bank sensitivity mapping, is inserted to the cycle of bank supervision in risk valuation frame toward bank individual so that can be early prevented the contagious *bank runs* impact from one bank to another bank. Besides, reliable communication management needs to be built to restore the worsen society's expectation toward a bank. Building customer trust toward bank needs also to be supported

by government as the source of emergency funding in terms of *bank runs* occurrence that has systemic risk. Support can be done by increasing the coordination on bank supervision, between Bank Indonesia with government via existing financial system stability forum.

Caveat

This research is using lag of independent variable (third party fund change percentage) as *bank runs* proxy. The use of this robust variable to get the *self-fulfilling prophecy* factor, however, it is still possible to find better proxy.

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