Indonesia Deposit Insurance Corporation
Research Working Paper

SDI Application as a Means to Identify Bank Run

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Summary

A mismatch between financing period and source of funds (deposit funds) serves as a classic problem of almost all banking institutions in the world. Theoretically speaking, a bank is unable to survive if depositors withdraw large sums of their money simultaneously from their accounts (bank run). A depositors willingness to deposit funds in a bank is dependent on his/her trust toward the bank. Consequently, this loss of trust has been linked as the main cause of a bank run.

Banks need to take notice on the level of depositor trust as it is associated with contagion effect, which if a decrease in the level of trust is not effectively mitigated, the bank runs may trigger withdrawals at another bank. The aftermath of this phenomenon is the loss of depositor trust on a country's banking system which would in turn lead to an economic recession.

Recognizing the wide impact of bank runs, an Early Warning Indicator is required as a preventive measure to lessen the impact of a bank run. Hand in hand with the need to have an Early Warning Indicator concerning the risk of a bank run, we made notes on two issues, as follows:

1. To date, there has been plenty of literatures discussing the bank run phenomenon. The existing literature proposes various variables to indicate an increase in the probability of a bank run. These variablesoftentimes produce mixed signals that complicates efforts to analyse the potential of an occurence of bank runs
2. Laeven and Valencia offers an applicative method of analysingbank runs by examining monthly fluctuations in the level of deposits. However monthly movements in deposit amounts are very fluctuative in nature, hence it may not be able to serve as a useful early warning indicator in ordet ot take preventive measures.

The present study attempts to solve the aforementioned issues through designing an Early Warning Indicator using the monthly movement of deposit funds as the sole component to develop an indicator which in the end can provide a stable, clear, and easy to analyse signal.

I. Indonesia Deposit Insurance Corporation (IDIC) and *Bank Run*[1]

The 1997-1998 crisis has taught the banking industry on how crucial maintaining depositor trust is for banking system stability. The closure of 16 commercial banks in a time of crisis elevated tensions in the society and annihilated depositors trust toward the banking system which triggered depositors of other banks (outside the 16 banks initially closed) to withdraw significant amount of funds from these banks simultaneously, or also known as a Bank Run.

Several procedures were carried out by the Government of Indonesia and Bank Indonesia (the Central Bank of Indonesia) to reinstate depositors trust toward the Indonesian banking system. Among the measures taken are the implementing a blanket guarantee policy (Presidential Decree Number 26 and Number 193 Year 1998), banking restructurization and recapitalization program to improve the banks' performance and capital. Despite its ability to restore depositors' trust, the blanket guarantee policy has unintended side effects where it may increase the fiscal burden borne by the Government and has a tendency to induce moral hazard.

Upon fulfilling the objectives of a deposit insurance system to not only maintain depositors' trust toward the banking system but also to minimize the negative impact of a blanket guarantee scheme, the Government of Indonesia gradually reduced the deposit insurance coverage and only guarantees a limited amount of deposits (limited guarantee). This policy is stipulated in Article 37B Banking Law Number 10 Year 1998, which regulates the following: (1) Each Bank shall guarantee public funds deposited in the Bank concerned. (2) In order to protect Deposits of the public in Banks as referred to in paragraph (1), a Deposit Insurance Institution shall be established. (3) The Deposit Insurance Institution as referred to in paragraph (2) shall be in the form of an Indonesian legal entity. (4) The provisions concerning the protection of public funds and the Deposit Insurance Institution shall be further stipulated in a Government Regulation.

On 22 September 2004, Law Number 24 Year 2004 concerning Indonesian Deposit Insurance Corporation is enacted.

[1] http://lps.go.id/artikel/-/asset_publisher/0S8e/content/peran-lps-dalam-mendukung-stabilitas-sistem-perbankan

II. Concepts of Bank Run

II.1. Definition of Bank Run

Edoardo Rainone (2017) presents several definitions of Bank Run, as follows:

a. Silent run (Rocko, 2003), depositors simply write checks on a bank they consider weak and deposit them in another bank they consider stronger.

b. Noisy run (Rocko, 2003), depositors literally run down to the bank, stand in line with their scared fellow depositors, and withdraw cash, perhaps forcing the bank to close its doors.

c. Slow run (Gertler and Kiyotaki, 2015), at its outset, creditors made a steady stream of withdrawals and became increasingly reluctant to roll over short-term loans. As the market probability of a bank run increases, creditors withdraw some but not all of their funds.

d. Fast run (Gertler, Kiyotaki and Prestipino, 2016; Bernanke, 2010 and 2012), complete collapse of the banking system as depositors coordinate on a no rollover equilibrium. As a result, banks liquidate all their assets leading to a sharp drop in asset prices and rise in spreads.

As a Deposit Insurance Corporation, Bank Runs becomes one of the main issues to be monitored by the IDIC. Aside from its systemic impact to the banking system, the occurrence of bank run is a signal of financial crisis in a country (Kunt & Detragiache (1998), quoted in Muliaman D. Hadad, Wimboh Santoso, and Bambang Arianto (2003)[2]).

II.2. Various Arguments Regarding the Magnitude of Bank Run

An agreeable definition of Bank Run is "the sudden massive withdrawal of funds from the banking system which happens simultaneously". Yet, a question which comes into the surface is to what extent does the withdrawal of funds is categorized as "massive"?

In the words of Laeven and Valencia (2014)," Significant Bank Runs indicates whether the country's banking system experienced a depositor' run, defined as a one-month percentage drop in total outstanding deposits in excess of 5 percent during the period t through t + 1".

We are in favour of Laeven's and Valencia's usage of monthly movement of deposit funds as the indicator of bank run in a country. Nonetheless, the measure of a 5% decline in the

[2] Indikator awal Krisis Perbankan, December 2003

monthly movement of deposit funds as an indicator of a bank run is still too general. We believe that the determination of a massive decrease in deposit funds is country-specific and is heavily dependent on the characteristics of deposit funds' monthly movement in each country. Moreover, we argue that the decline in deposit funds based on MoM data can be associated with a Bank Run if the decrease is below the threshold of significant deviation from normal movement of deposit funds' MoM data[3].

In relation to the determination of the level of deviation as a threshold, no standardized benchmark is available to be generally applied. Eichengreen, Rose, and Wyplosz (1996) determined the crisis threshold at 1.5 standard deviations from its median, Kaminsky and Reinhart (1999) determined the crisis threshold at 3 standard deviations from its median, while Simorangkir (2012)[4], maintains that threshold is heavily dependent on sample.

II.3. Bank Run Threshold in Indonesia

In this study, we identify the Bank Run conditions in Indonesia through the Bank Run identification technique using the deposit funds monthly movement which was employed by Laeven and Valencia. Prior to the analysis process, the threshold was modified according to the opinions of Rose and Wyplosz (1996), Kaminsky and Reinhart (1999) and Simorangkir (2012), in which we employ the threshold according to the deviation from the monthly movement of deposit funds from its median with certain standard deviation values.

Since a Bank Run is highly associated with depositors' trust to the banking system, we hypothesized that a correlation exists between a Slow and a Fast Bank Run. While Slow Run indicate the start of a decline depositor trust toward the banking system, which leads to the withdrawal of some of their funds from the system, a Fast Run reflects an extreme condition due to the significant loss of depositors' trust, where depositors withdraw most of their funds from the banks. Therefore, we believe that Slow Run tend to occur prior to Fast Run. The latter will occur if the former is poorly mitigated.

[3]Identifikasi penyimpangan sebagai identifikasi potensi sebuah krisis disinggung dalam Buku "IMF dan Stabilitas Keuangan Internasional, Suatu Tinjauan Kritis" terbitan Elex Media Komputindo

[4]Study on early warning indicators of bank runs in indonesia: markov-switching approach. presented Paper at the International Conference on Economic Modelling-Ecomod2012, Seville, Spain on July 4-6, 2012

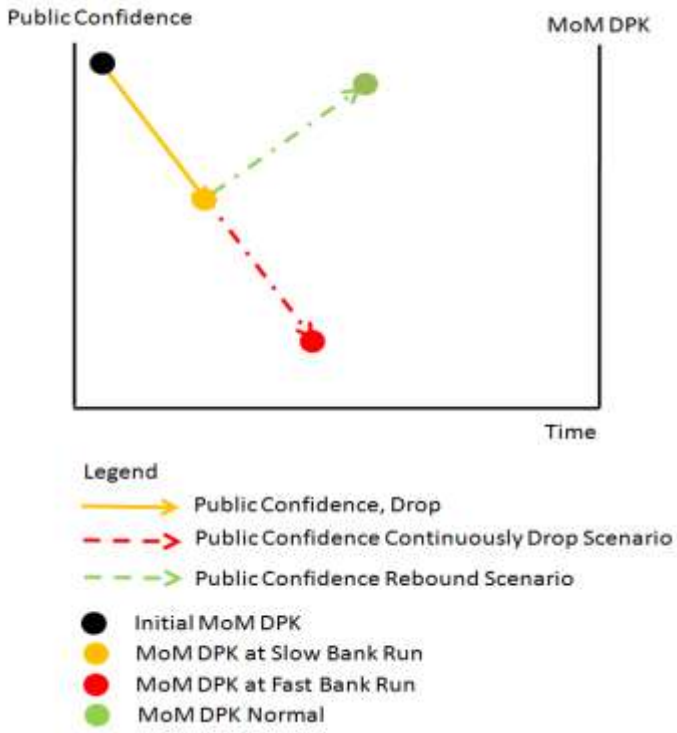

Figure 1. Slow Run, Fast Run and Public Confidence

Source: IDIC

To test the aforementioned assumptions, we require two thresholds to identify the Bank Run pressure condition in Indonesia, both for the Slow Run and Fast Run scenarios. Notwithstanding the importance of both types of Bank Runs, we are more inclined on exploring the potential of a Fast Bank Run after the occurrence of Slow Bank Run. As a result, we amended the "Slow Bank Run" term to "Potential Bank Run" and on the "Fast Bank Run" term to "Bank Run".

We define Potential Bank Run as "the withdrawal of some of the deposit funds and the increased probability of larger withdrawal of deposits". While Bank Run is defined as "the large, sudden, and simultaneous withdrawal of deposits which occurs due to the failure to mitigate the Potential Bank Run".

Considering the movement of deposit funds in Indonesia, we will test the threshold of 2 standard deviation from the median value as the identification of Potential Bank Run condition and 3 standard deviation from the median value as Bank Run condition.

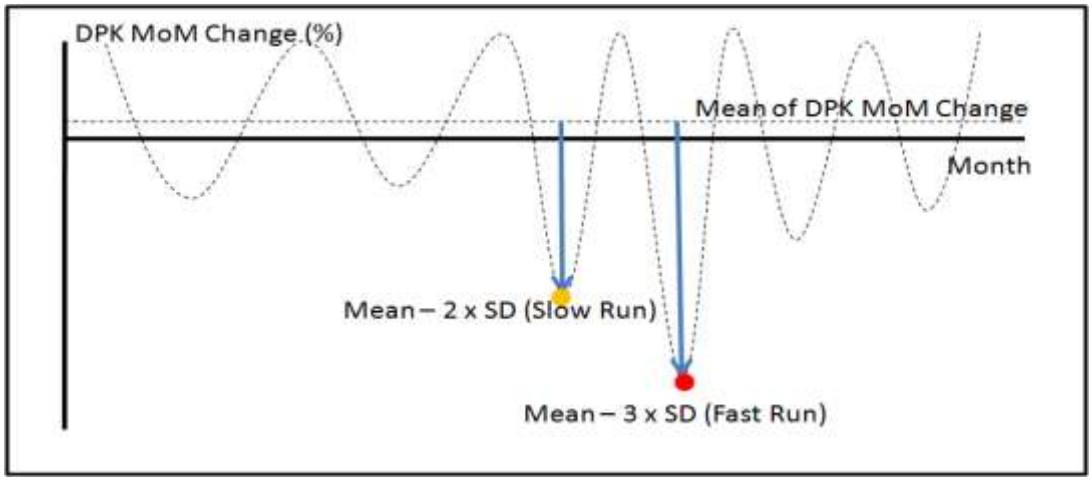

Figure 2. Threshold of Slow Run and Fast Run

Source: IDIC

II.4. Standard Deviation Index (SDI)

Our assumption of the Potential Bank Run which might lead to an even larger withdrawal of funds if it is not effectively mitigated has created several follow-up questions:

1. Is there an indicator which might act as a sign that a Potential Bank Run/Bank Run condition has ended? In other words, is there an indicator which signals the end of the Potential Bank Run/Bank Run pressure condition?
2. Taking note of the volatility of the monthly movement of deposit funds, is there a possibility that one can develop an indicator which can provide a clearer and more stable signal of the deposit funds movement?
3. Is there an indicator developed solely based on the movement of deposit funds and the deviation towards its median value with a certain multiplication of its standard deviation as the only component accounted for?

During the development of this paper, there exists several Early Warning Indicator models developed related to Bank Runs. For example, the regression model developed by Gonzalez-Hermosillo (1999), a model developed by Demirguc-Kunt and Detragiache (1999), a model developed by the Federal Deposit Insurance Coproration (FDIC) and other models developed by Hawkins and Klau (2000), which can be categorized into 3 types as follows[5] :

[5] IMF dan Stablitas Keuangan Internasional, Sebuah Tinjauan Kritis, Elex Media Komputindo, Editor Sjamsul Arifin Wibisono, Charles P.R. Joseph, Shinta Sudradjat.

a. Qualitative Model by comparing graphs of the economic fundamentals prior and post crisis and amid normal conditions or with other countries which are equivalent in terms of economy but do not experience crisis

b. Non-parametric Model by evaluating the use of various indicators in providing signals of the occurrence of a crisis and a delayed crisis where the threshold is determined for each indicator

c. Parametric Model using various types of regression

out of three different early warning methods above, one similarity we recognize is that all three approaches use more than one variable as as their main components. Deviating from that, in this study, we shall only employ one variable, namely the monthly movement of deposits and its standard deviation, which can be considered as a new approach in analysing the bank run phenomenon.

II.4.1. About SDI

One of the indices we created in this study is the Standard Deviation Index (SDI), which is formulated using the median and standard deviation. SDI is the instrument employed by the Department of Health and Human Services of America for Proficiency Test of the medical laboratories in America in accordance with the Clinical Laboratory Improvement Amendments (CLIA) and Medicare Laboratory Services. Principally, only those laboratories that pass the proficiency test are permitted to operate in conducting clinical trials.

To put it simply, proficiency test compares a laboratory test results to those of other laboratories in its peer group. An acceptance criterion can then be that a laboratory's result must be within the mean ± 2 SDI of the results from the laboratories using the same method (the peer group).

The SDI formulation is as follows[6] :

$$SDI = \frac{Laboratory\ Mean - Consensus\ Group\ Mean}{Consensus\ Group\ Standard\ Deviation} \qquad \ldots Formula\ 1$$

In which:

SDI = Standard Deviation Index

Laboratory Mean = The average value of laboratories' test results

[6] http://unityweb.qcnet.com/Documentation/Help/UnityWeb/399.htm

Consensus Group Mean	= The average value of laboratory in Peer Group's results
Consensus Group Standard Deviation	= The standard deviation of the test results of all laboratories in the Peer Group

In other formulas, Laboratory Mean is named Targed Value, Consensus Group Mean is equivalent to Average, while Consensus Group Standard Deviation is named Standard Deviation.

As previously elaborated, a laboratory successfully passes the Proficiency Test if the result is within the mean ± 2 SDI.

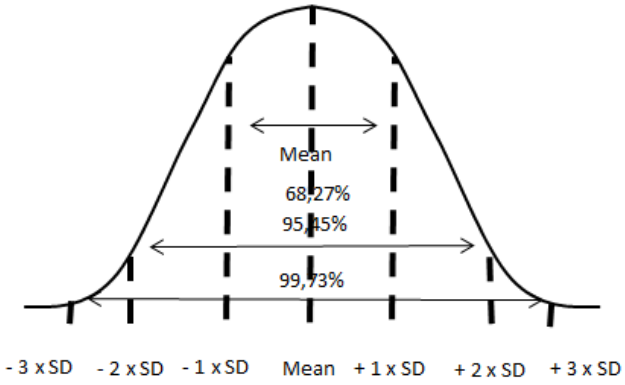

Figure 3. Normal Distribution and Standard Deviation

Source: IDIC

The magnitude of the SDI figures reveals that the tested laboratory results are in a 95.45%confidence interval from the total laboratories in the peer group[7].

II.4.2. SDI, Potential Bank Run and Bank Run Conditions

We hold the idea that the implementation of SDI to identify the probability of a Potential Bank Run occurrence as "promising". Our stance is based on the condition that if the SDI formulation reflects the proximity of a laboratory test result with the average of other laboratories' observation results, therefore if the target value and average value on the SDI formula is changed to:

$$\text{SDI} = \frac{\text{MoM DPK Potential Bank Run} - \text{Average MoM Deposit Funds}}{\text{Standard Deviation MoM Deposit Funds}} \qquad \textit{...Formula 2}$$

[7]Quoted from http://unityweb.qcnet.com/Documentation/Help/UnityWeb/399.htm

Formula 2 shall measure the proximity of the declining monthly deposit funds in the Potential Bank Run category and the average movement of the deposit funds in other periods.

Subsequently, due to the negative value of the deposit funds in a Potential Bank Run condition, we modified the SDI formula as follows:

$$\text{SDI} = \frac{\text{Average} - \text{Target Value}}{\text{Standard Deviation}} \qquad \textit{...Formula 3}$$

In which:

SDI	= Standard Deviation Index
Target Value	= Threshold Potential Bank Run
Average	= Average Value of Deposit Funds MoMduring observation period
Standard Deviation	= Standard Deviation of Deposit Funds MoM during observation period

By employing SDI in the Potential Bank Run and Bank Run identification, we will determine the threshold of the Potential Bank Run and Bank Run conditions on certain SDI value. In the situation where the SDI value is in the Potential Bank Run area, a high probability of Potential Bank Run exists. Similarly, when the SDI is in the Bank Run area, SDI will serve as the indicator of determining the Potential Bank Run / Bank Run pressures. We hypothesized that the exit of SDI from the Potential Bank Run / Bank Run areas signals the end of the pressure.

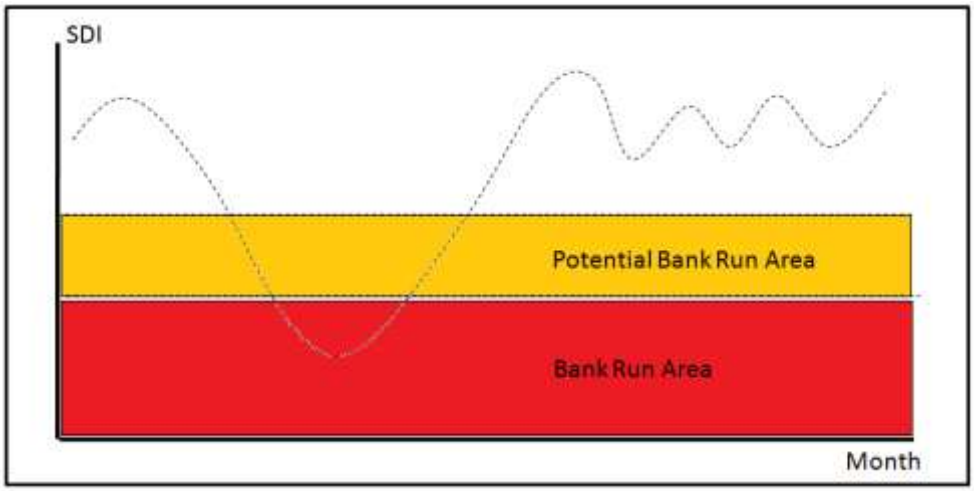

Figure 4. SDI, Potential Bank Run Area, Bank Run Area

Source: IDIC

To ensure that the indicator we develop is stable and sensitive enough to detect bank runs, it requires the appropriate period selection to calculate the average and standard deviation of the SDI.

Owing to the fact that the development of this index formed from monthly deposit fund data is to act as an more stable and clearer indicator for the occurence of a Potential Bank Run and Bank Run, therefore to come up with the SDI period we test severel SDI periods using Inverse Coefficient of Variance (ICV).

II.5. SDI and Logit

To anticipate the possibility of false signals from SDI in identifying the condition of Bank Runsin Indonesia, and to produce a more capable threshold, we add to our SDI analysis a Logit model which utilises the Event of a Potential Bank Run / Bank Run as adependant variable and SDI with a certain lag as an independent variable using the following equation:

$$Bank\ Run\ or\ Potential\ Bank\ Run\ Event_{\mathrm{t}} = f(SDI_t, SDI_{t-1}, SDI_{t-2}, SDI_{t-3}, C)$$

…Formula 4

Since our objective is to use SDI as the leading indicator of the deposit funds MoM movement, the SDI lag utilized in this study was determined using the Spearman Rank Correlation between SDI and deposit funds MoM.

III. Event Analysis

To ensure and investigate whether the Bank Run timing identification conducted satisfies the conditions, we performed Quantitative and Qualitative Event analysis methods on the signals obtained.

III. 1. Quantitative Event Analysis

As explained by Cesar E. Tamayo, at least 3 factors trigger a financial crisis, namely 1) Unanticipated decline in the value of the domestic currency exchange rate, 2) Increases in Interest Rates, 3) Government Fiscal Imbalances[8]. Considering the data availability and the simplicity of analysis, we chose to use the decline in the value of the domestic currency exchange rate as the quantitative event analysis.

There are two closely-associated opinions on the identification of pressure towards domestic currency exchange rate value; the opinions of A. Frankel & Andrew K. Rose (1996) and Luc

[8]Cesar E. Tamayo, BANK RUNS, FINANCIAL CRISES AND THE 2008 MELTDOWN, Money and Banking, Rutgers University, August 3rd, 2011, Lecture 11

Laeven and Fabián Valencia (2012). In their writings, Frankel and Rose state "We define a "currency crash" as the nominal depreciation of currency of at least 25% that is also at least a 10 percent increase in the rate of depreciation". Laeven & Valencia hold a similar statement to those of A. Frankel & Andrew K. Rose. The distinction lies on the depreciation which was modified from 25% to 30%.

By taking into account the more conservative depreciation conditions, we chose to employ the approach of Frankel on identifying the currency crash condition in Indonesia.

III. 2. Qualitative Event Analysis

Qualitative event analysis from the signal obtained was executed by looking for events / news adjacent to Bank Run identification dates with the keyword "Bank Run, Bail Out, Riots, Panic, Closed Bank, scandal, Demonstration, Change of President, Bank Closing, Crisis, Emergyncy Liquidity Assistance from Bank Indonesia, and others which are as relevant to the level of public confidence in the economy in general and banking in particular.

IV. Identification of Potential Bank Runs and Bank Runs in Indonesia

IV.1. Timing of Potential Bank Runs and Bank Runs in Indonesia

In analyzing the movement of deposit funds MoM of Indonesia, we employ the data from Indonesian Economic and Financial Statistics issued by the Central Bank of Indonesia and CEIC which was combined and customized with certain methods[9]. Figure 5 presents the data of deposit funds movement utilized in this analysis:

[9] For more details about data sources and treatment please contact the author.

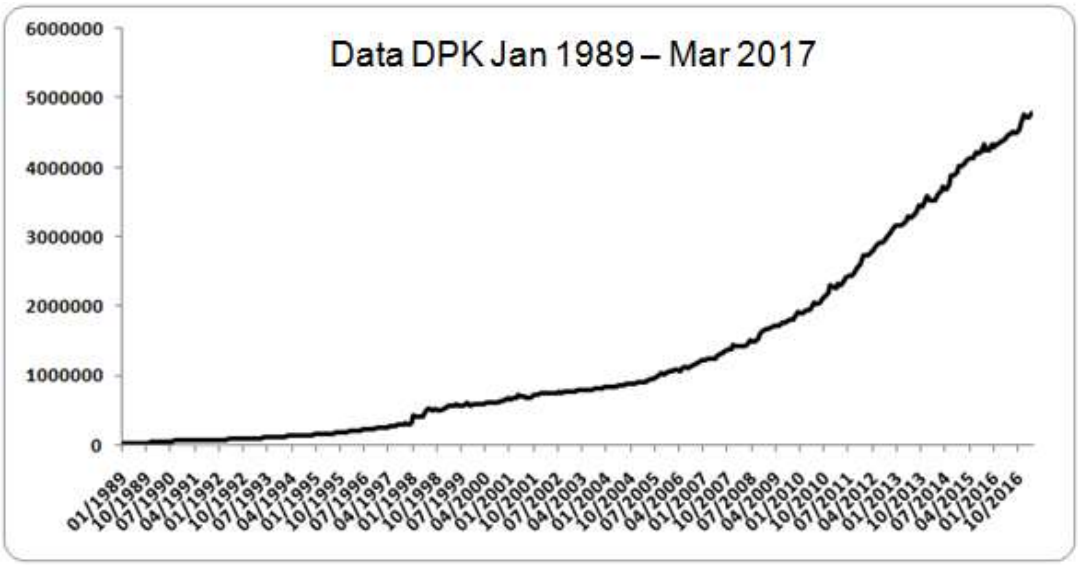

Figure 5. Movement of National Deposit Funds of Indonesia

Source: SEKI BI, CEIC, Adjusted

According to the movement of MoM data obtained, there was an extreme upward movement of monthly deposit amounts in January 1998 and June 1998 caused by the growth of foreign currency deposits which grew 88.64% (January 1998) and 40.76% (June 1998) respectively. The extreme growth of forex deposits is expected to result from the depreciation of the Rupiah (IDR) against USD occurring during those periods (92% MoM in January 1998 and 38% MoM in June 1998). In order to allow for a spike in the growth of deposit funds for those two periods without damaging the overall Deposit Funds MoM movement, we performed the following data filtering procedure.

Subsequently, by setting the threshold value:

MOM <= Mean – 2 x SD as the Potential Bank Run (Slow Run) *...Formula 5*

and

MOM <= Mean – 3 x SD as the Bank Run (Fast Run) *...Formula 6*

We obtain the threshold:

Deposit Funds MoM <= -2.5% as the Potential Bank Run threshold

and

Deposit Funds MoM <= -4.4% as the Bank Run threshold

Applying the threshold limit on the data of deposit funds MoM national movement, we obtain 9 (nine) Bank Run Events (Potential and Bank Run) between the period of 1992-2008 with the monthly details as follows:

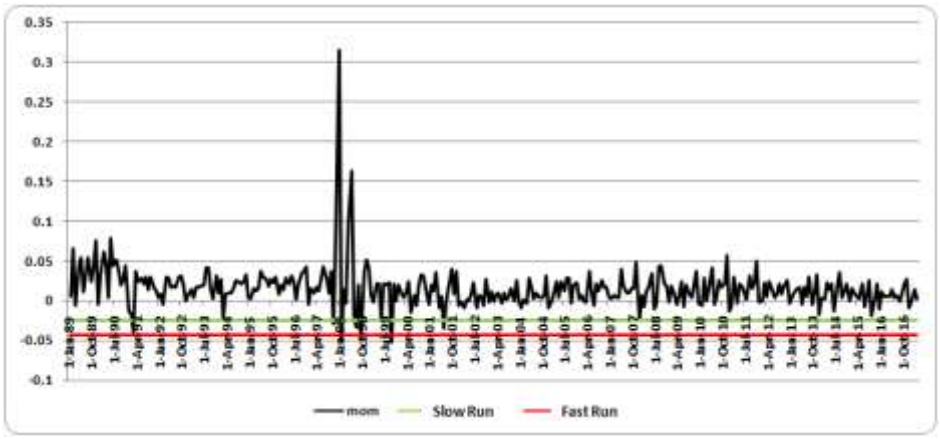

Figure 6. National Deposit Funds MoM of Indonesia and Threshold Slow & Fast Run

Source: IDIC

Dari data MoM, ditetapkan Batasan dan *reading* pada posisi :

Variable	Value	Status
Averge (Filtered)	1.38%	
Stdev (Filtered)	1.91%	
Averge - 2*stdev	-2.5%	Potential Bank Run
Averge - 3*stdev	-4.4%	Bank Run

Dari batasan dan reading yang ditetapkan, diperoleh signal sebagai berikut :

NOT Normal Condition

Date	MoM	Status
3/31/1991	-0.039992569	Potential Bank Run
11/30/1997	-0.029878209	Potential Bank Run
2/28/1998	-0.049118066	Bank Run
8/31/1998	-0.034060991	Potential Bank Run
10/31/1998	-0.048353405	Bank Run
6/30/1999	-0.025252865	Potential Bank Run
10/31/1999	-0.052285996	Bank Run
7/31/2001	-0.035293778	Potential Bank Run
1/31/2008	-0.024998257	Potential Bank Run

Figure 7. Identification of Potential Bank Run and Bank Run Threshold According to the National Deposit Funds MoM of Indonesia

Source: IDIC

As shown in Figure 7, the preliminary assumption that the Potential Bank Run always occurs before the Bank Run is proven, where the 3 Bank Runs identified in February 1998, October 1998, and October 1999 were always preceded by a Potential Bank Run. The Bank Run that occurred in February 1998 was preceded by a Potential Bank Run in November 1997. Subsequently, the Bank Run event in October 1998 was initiated by a Potential Bank Run in August 1998 and a Potential Bank Run in June 1999 eventually led to the occurrence of a Bank Run in October 1999.

Although several bank runs did occur after the potential bank runs, previous evidences have also pointed to the contrary. The potential bank run in March 1999, July 2001, and January 1998 are several examples where no bank run transpired after the potential bank run. However, this phenomenon is unable to be identified only by employing the data of deposit funds MoM movement as the sole indicator. Yet, the phenomenon can be explained by SDI.

IV.2. Event Analysis of Timing Potential Bank Run and Bank Run in Indonesia

IV.2.1. Quantitative Event Analysis

By adopting statements from Frankie and K. Rose, Indonesia from 1969 to September 2017, has experienced 9 Currency Crash which occured in the following sequences: 1) November 1978-October1979, 2) April 1983-March 1984, 3) September 1986-August 1987, 4) August 1997-5) November 1998, 6) June- July 2000, 7) October 2000-May 2001, 8) November 2008, February and March 2009 and 9) December 2013 - January 2014.

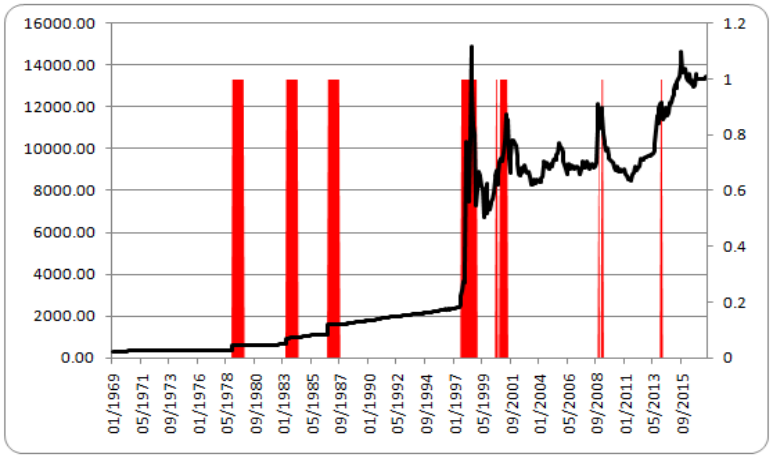

Figure 8. Identification of Currency Crash of Indonesia

Source: IDIC

The currency crash incidence identified confirm the Potential Bank Run and Bank Run in November 1997, February 1998, August 1998, and October 1998.

IV.2.2. Qualitative Event Analysis

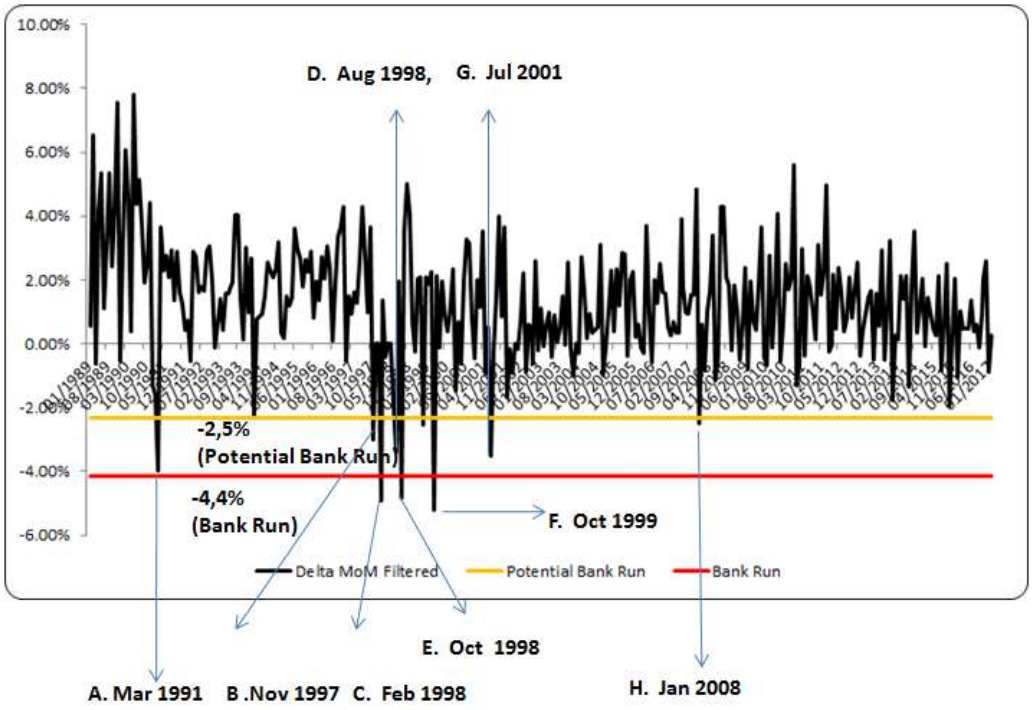

Figure 9. Time Identification of Potential Bank Run and Bank Run in Indonesia

Source: IDIC

A. March 1991, Potential Bank Run (Deposit Fund -3.99% MoM). The Potential Bank Run that materialized in March 1991 most possibly originated from the cases of Bank Duta (September 1990) and Bank Umum Majapahit (November 1990).

B. November 1997, Potential Bank Run (Deposit Funds -2.99% MoM). The closing of 16 banks based on what the IMF had recommended and evaluated raised very important question about the depositors' trust on the banking system. Profound decline on depositors' trust on the banking system led to the Potential Bank Run in November 1997 which was suspected to be triggered by the Currency Crash which happened from August 1997 to November 1998.

C. February 1998, Bank Run (Deposit Funds -4.91% MoM). On January 15th, 1998, the IMF signed a Letter of Interest (LoI) concerning the stabilization program which covers several agendas including the restructurization of the financial and real sector. The Indonesian Government responded tp the IMF's decision by establishing the Indonesian Bank Restructuring Agency (IBRA) in January 1998. Despite the agency's vision on resurrecting trust on the banking system, it failed to protect the country from Bank Run which later occurred in February 1998. The Bank Run which transpired in

February 1998 was inseparable from the Currency Crash prevailed between August 1997 and November 1998.

D. August 1998, Potential Bank Run (Deposit Funds -3.41% MoM). The pressure on August 1998 was first emerged in April 1998 when the Indonesian Government established 7 (seven) BBO banks and 7 (seven) BTO banks. The event transpired afterwards was the resignation of President Soeharto. The period also witnessed the suspension of 3 (three) BTO banks which befell in early August 1998. Likewise, the Currency Crash became a focal root cause of the Bank Run occurred in August 1998, which eventually resulted in the Potential Bank Run in the same month[10].

E. October 1998, Bank Run (Deposit Funds -4.84% MoM). The decline in depositors trust toward the banking system which began in August 1998 as indicated by the Potential Bank Run continued to accelerate. In October 1998, a major student demonstration and the preparation of the People's Consultative Assembly's Special Session materialized. The politics which continued heating up engendered Bank Run occurred in October 1998. The period still witnessed the Currency Crash.

F. June 1999, Potential Bank Run (Deposit Funds -3.99% MoM). The first post-authoritarian election was held in June 1999 after President Soeharto stepped down from office.

G. October 1999, Bank Run (Deposit Funds -5.2% MoM). There were several incidents that might have triggered the Potential Bank Run in June 1999 which led to the Bank Run that occurred in October 1999. To name a few, a major student demonstration or so known as Semanggi Chapter 2 protests, the rejection of President Habibie' s accountability by the House of Representatives of the Republic of Indonesia, and the election of Gus Dur as the President of Indoneisa marked the end of the New Order Era.

H. July 2001, Potential Bank Run (Deposit Funds -3.5% MoM). We argue that several events may have provoked the Potential Bank Run in this period. The removal of Abdurrahman Wahid (Gus Dur) from the presidency by the People's Consultative Assembly was among the political events that happened in this period. President Gus Dur retaliated against the People's Consultative Assembly by issuing a decree on the

[10] SEJARAH BANK INDONESIA : PERBANKAN Periode 1997-1999, Unit Khusus Museum Bank Indonesia: Sejarah Bank Indonesia

dissolution of the parliament. The Potential Bank Run in July 2001 was preceded by the currency crash which commenced in the period of October 2000 until May 2001.

I. January 2008, The impact of the global financial crisis had already been felt in Indonesia since September 2007. On October 8-10, 2008, the Indonesia Stock Exchange was suspended. Furthermore, 23 (twenty-three) banks experienced a significant drop on their deposit funds, the Government placed 15 trillion of funds in BNI, BRI, and Mandiri (September 2008). In January 2008, the banks' deposit funds declined by 2.5% (MoM).

V. Employing SDI to identify the pressure of Potential Bank Run and Bank Run in Indonesia

Based on the results of timing potential bank run and bank run, it is evident that the decline of Deposit Funds by 2.5% (MoM) and 4.4% (MoM) accurately identify the Potential Bank Run and Bank Run conditons, which will later be used to create the SDI. Therefore, we will use -2.5% at Potential Bank Run as the target value on the SDI creation.

To create an ideal SDI line, we performed ICV testing from SDI for several periods. The findings indicate that Period 12 fulfills our requirements. Figure 10 presents the application of the using deposit funds MoM data from 12 periods selected based on the SDI calculation.

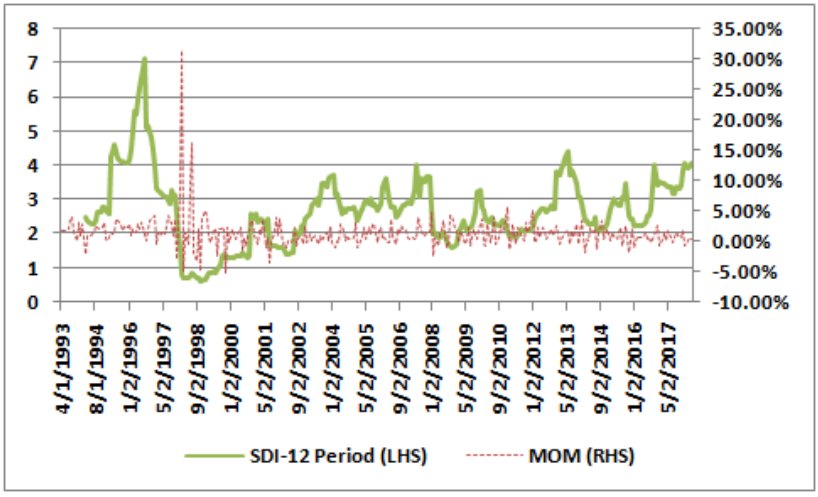

Figure 10. SDI Application on Period 12 of Deposit Funds MoM

Source: IDIC

VI. Logit, SDI, and Bank Run

As elaborated in the previous sections, to anticipate the probability of the emergence of false signals of SDI and to build an ideal threshold, we complement the SDI analysis with logit analysis using the Event Potential Bank Run as the dependent variable and SDI with certain lag as the independent variable.

Based on the results from the Spearman Rank correlation method, we selected the SDI with the Lag between 0-3 as the independent variable.

The analysis using the E-Views software resulted in the Logit equation as follows:

Dependent Variable: BR
Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)
Date: 06/18/18 Time: 01:24
Sample (adjusted): 1994M06 2017M03
Included observations: 274 after adjustments
Convergence achieved after 13 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
SDI	-17.70330	6.320495	-2.800935	0.0051
SDI(-1)	9.050769	3.810017	2.375519	0.0175
SDI(-2)	10.41730	4.361836	2.388282	0.0169
SDI(-3)	-8.219987	3.635807	-2.260843	0.0238
C	3.933011	1.963618	2.002942	0.0452

McFadden R-squared	0.604786	Mean dependent var	0.029197
S.D. dependent var	0.168667	S.E. of regression	0.127092
Akaike info criterion	0.140785	Sum squared resid	4.344998
Schwarz criterion	0.206718	Log likelihood	-14.28759
Hannan-Quinn criter.	0.167249	Deviance	28.57517
Restr. deviance	72.30310	Restr. log likelihood	-36.15155
LR statistic	43.72793	Avg. log likelihood	-0.052144
Prob(LR statistic)	0.000000		

Obs with Dep=0	266	Total obs	274
Obs with Dep=1	8		

Figure 11. Logit Application to Detect Bank Run

Source: IDIC

The analysis shows that the SDI with the lag between 0-3 demonstrates the coefficient with the significance level of over 95% and McFadden R-Square of 60.5%.

VII. SDI and Logit Threshold

To determine the threshold for the Logit signal, an adjustment of the probability numbers generated by the Logit equation using the existing Crisis event is performed. From the adjustment process, the critical point obtained is 14% (where we exclude the value of June 1999 since it only shows alogit probability of 4.4%).

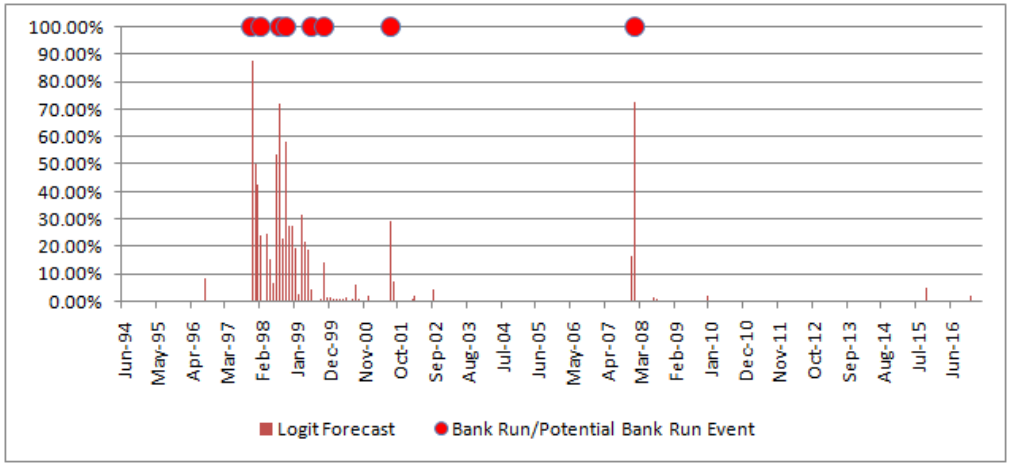

Figure 12. Forecast Logit Application of *Bank Run*

Source: IDIC

After obtaining the threshold for the probability by using a Logit equation and to provide a better leading impact on SDI, we decided to use 2 SDI thresholdsof 2.075 and 1.385 for for Potential Bank Run Area and Bank Run Area respectively. Applications from SDI and Logit, as well as the established threshold are demonstrated in Figure 13.

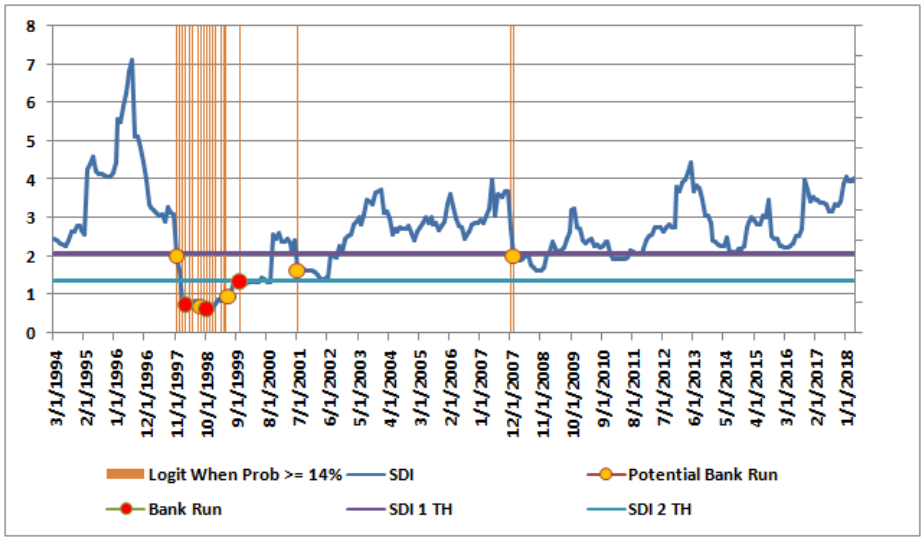

Figure 13. The Integration of SDI and Logit as a Means to Predict Bank Run

Source: IDIC

The conclusions derived from Figure 13 are as follows:

1. By combinging the signals delivered by the SDI and Logit equation, we obtain a clearer signal which by logic could eliminate the false signals, especially if the SDI line is still within the potential bank run area. The confirmation acquired from the Logit equation in determining the pressure level when the SDI is still within the potential bank run area can be seen from the potential bank run that occurred on July 2001 and January 2008. As an Early Warning Indicator, the SDI and Logit equation can provide an early indication (despite its relatively low probability) of a bank run, regardless of whether the SDI is still within the potential bank run area. For instance, the potential bank run case on July 2001 was preceded by the entry of SDI into the potential bank run area on May 2001. While for the case of January 2008, although the SDI was still above the potential bank run area (the entry of SDI in January 2008 happened congruently with the potential bank run based on deposit funds MoM movement), the Logit equation captured an early signal of a potential bank run /bank run with the probability that reached 16.58% on December 2007.
2. When the SDI is inside the bank run area, no confirmation from logit signal is needed to predict the probability of bank run/potential bank run.
3. SDI can confirm whether a potential bank run/bank run pressures are still ongoing when these instances occur:
    a. Potential bank run has occurred (-4.4% < MoM Deposit Funds <= -2.5%) and the SDI line is still inside the potential bank run/bank run area, the probability of bank run occurrence increases
    b. A bank run has occurred (-4.4% < MoM Deposit Funds <= -2.5%) and the SDI line is still inside the potential bank run/bank run area, the probability of a follow-up bank run/potential bank run increases
    c. The exit of SDI from the potential bank run area marks the end of the potential bank run/bank run pressures

VIII. Notes on "False Signals"

Eventhough the SDI is deemed as a reliable leading indicator in detecting the occurence of a potential bank run and/or bank run. Nevertheless, it has on occasion exhibited signals that contradicts with what actually transpired, for example the information on bank run pressure

which was not followed by a decrease in Deposit Funds MoM. This event happened in January 2011 until June 2011 and again in September 2014.

We will not rush to conclusions by stating that the bank run pressure status in 2011 and 2014 was indeed a false signal. However, we will briefly elaborate the false signal phenomenon.

VIII.1. Period of January – June 2011

Date	MOM	SDI	Prob	SDI 1 TH	SDI 2 TH	Prob TH
12/1/2010	5.58%	2.085023	0.39%	2.075	1.385	14%
1/1/2011	-1.33%	1.948834	0.15%	2.075	1.385	14%
2/1/2011	-0.64%	1.950132	0.00%	2.075	1.385	14%
3/1/2011	2.96%	1.946936	0.01%	2.075	1.385	14%
4/1/2011	-0.39%	1.917835	0.03%	2.075	1.385	14%
5/1/2011	2.13%	1.935965	0.02%	2.075	1.385	14%
6/1/2011	1.74%	1.987057	0.01%	2.075	1.385	14%
7/1/2011	1.03%	2.156063	0.00%	2.075	1.385	14%

Tabel 1. False Signals in January– July 2011

Source: IDIC

Based on an observation from the monthly data of national deposit funds MoM acquired from SEKI (Indonesia Economic and Financial Statistics, Bank Indonesia), the deposit funds in January 2011 only experienced a drop of 1.33%. However, the data for daily deposit funds of commercial banks sourced from the Daily Report of Commercial Banks (LHBU) published by Bank Indonesia did not display a similar figure. In the period of 20 days[11], on January 28th, 2018 the deposit funds were found to have decreased by 2.6%, which falls into an extreme decline category since it exceeds the standard limit of decline in deposit funds MoM according to SEKI data (the threshold is a decline of 2.5% in deposit funds MoM). Therefore, the sharp decline in deposit funds in January 2011 is considered as potential bank run. We also performed an analysis of deposit funds MoM movement using daily data from LHBU. Similarly, we presume that the significant drop of deposit funds (-2.6%) is quite extreme since it deviates more than 3 standard deviation from the mean (data from August 30th 2005 - November 28th 2017). Significant decline in deposit funds were only found in 2 periods, which is January 30th 2008 (occurred simultaneously with the Potential Bank Run event

[11]Commercial banks report their deposit fund position to Bank Indonesia by submitting the Daily Report of Commercial Banks (LHBU) at the end of every working day, where on average there are 20 work days within a given month.

identified by the SDI, logit, and National Deposit Funds MoM indicators). Hence, it is safe to assume that on January 28th 2011, there was a high potential of the occurrence of Potential Bank Run. However, we do not perceive the deposit funds data by LHBU as a reliable tool to detect potential bank run/bank run due to several reasons as follows:

- The data source is different to that of SEKI (SEKI is developed from monthly commercial bank reports otherwise known as LBU, daily data from LHBU)
- Different definitions of deposit funds in SEKI and LHBU, where the deposit funds data in SEKI excludes the Government position and non residents, but includes the Rural Banks, vice versa.
- Excessively high data frequency is difficult to manage properly (validation is done on +/- 387,400 data points)

VIII.2. Period of September 2014

Date	MOM	SDI	Prob	SDI 1 TH	SDI 2 TH	Prob TH
8/1/2014	1.74%	2.134173	0.04%	2.075	1.385	14%
9/1/2014	3.51%	2.074012	0.00%	2.075	1.385	14%
10/1/2014	0.36%	2.184409	0.00%	2.075	1.385	14%

Tabel 2. False Signals in September 2014

Source: IDIC

For 2014, another Crisis Management Protocol (CMP) indicator used by the IDIC called the Banking Stability Index (BSI) showed signs of alert status on February 2014 (101 <BSI <= 102) triggered from the Market Pressure Sub Index[12].

[12] BSI Working Paper

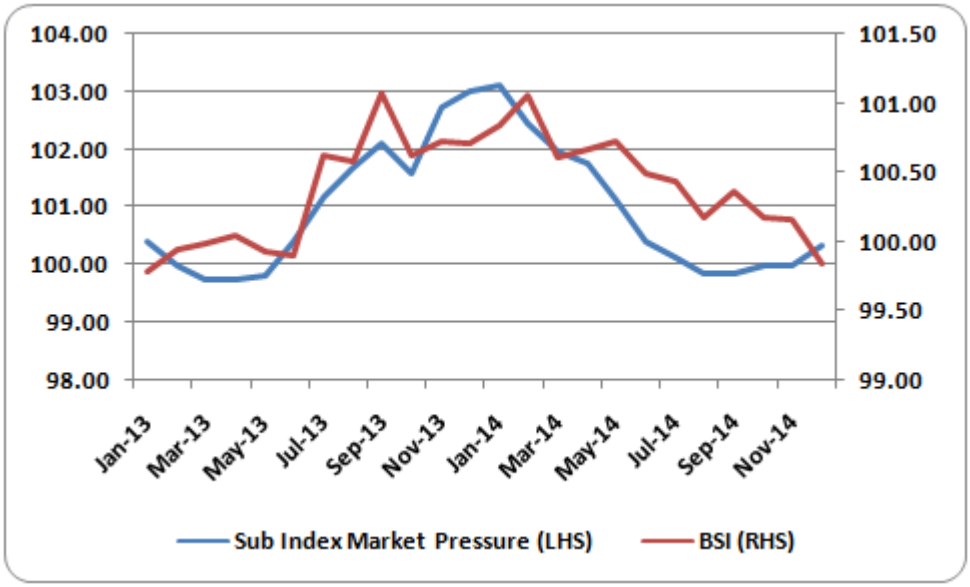

Figure 14. Banking Stability Index and Market Pressure Sub-Component

Source: IDIC

From observations of the BSI components we find that the increase in BSI's status in February 2014 was due to intensifying pressure on the Market Pressure Sub Index component starting from July 2013 which culminated in January 2014. The increase in pressure mainly stemmed from the depreciation of the Rupiah against the US Dollar.

As explained by Cesar E. Tamayo, at least 3 factors trigger the financial crisis, namely 1) Unanticipated decline in the value of the domestic currency exchange rate, 2) Increases in Interest Rates, 3) Government Fiscal Imbalances[13]. If the two main factors trigerring a financial crisis are analysed, then we can infer the following:

From the Exchange Rate Point of View

As elaborated in Section III.3.1 Quantitative Event Analysis, referring to Frankel's definition of a "currency crash", the year 2014 witnessed the occurrence of currency crash which happened since December 2013 until January 2014. The currency crash pressure in the period, coupled with the appreciation of USD against IDR, triggered the increased probability of a potential bank run that was detected by SDI in September 2014.

From the Interest Rates Point of View

[13]Cesar E. Tamayo, BANK RUNS, FINANCIAL CRISES AND THE 2008 MELTDOWN, Money and Banking, Rutgers University, August 3rd, 2011, Lecture 11

Based on the indicator of bank interest rate movement by IDIC, it is evident that there was an upward trend in bank deposit interest rates which started in June 2013 and ended in October 2014[14]. The period also witnessed an increase in deposit interest rate by an average of 199 bps. As an additional note, the period marks the longest spike in industry wide interest rates (June 2013 - September 2014, 16 months) since 2005. According to the industry wide interest rate identification tool used by IDIC, the industry wide interest rate increase in 2008 only lasted for 8 months (May 2008 - December 2008).

From the above analysis, it can be concluded that despite its failure to produce a drop of 2.5% in deposit funds' MoM in September 2014, it clearly conveys an indication of the pressure that occurred at the time.

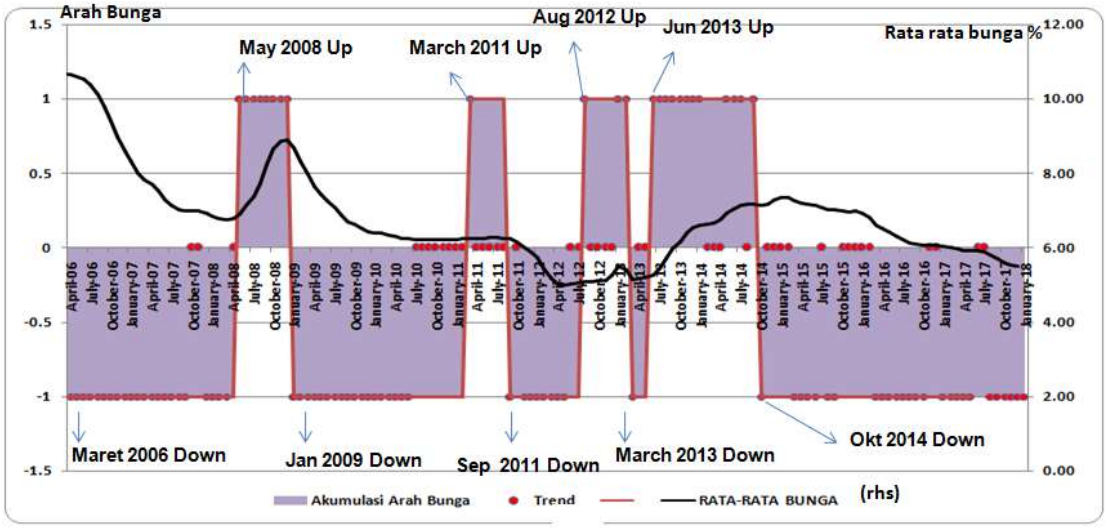

Figure 15. Surveillance of the Direction of Interest Movement Indicator

Source: IDIC

IX. Conclusion

1. Potential Bank Run might trigger the occurrence of a Bank Run
2. The integration of SDI and Prob indicators might become the leading indicator on detecting most of the potential bank run and bank run cases in Indonesia
3. SDI is reliable for identifying bank run in other countries
4. The usage of period in SDI is country-specific and heavily dependent on the characteristics of deposit funds' monthly movement in each country.

[14]Indikator Arah Pergerakan Bunga Industri dilakukan dengan menggunakan metode Wilcoxon Mathed Pairs Test.

5. Although the entry of SDI in the potential bank run area in January-June 2011 and September 2014 was not followed by the decrease in Deposit Funds, our analysis suggest that the signals created hold crucial information
6. The selection of the SDI period and the determination of threshold to identify the occurrence of Bank Run by using Deposit Funds MoM data is country-specific and is therefore greatly depend on the nature of the data movement.

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