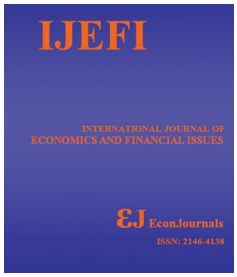

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Financial System Vulnerability Indicators in Indonesia

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ABSTRACT

The objective of this research is to analyze the indicators that cause vulnerability to financial system stability in Indonesia. The data used in this research is secondary data monthly with a range of 2006.1-2015.6. The method were used in this study Markov switching vector autoregressive. The indicators used in this analysis are development of financial indicators, the financial vulnerability indicators, and the world economic climate indicator. The results of this study showed that overall, the indicators used as an early detection of vulnerability to financial system stability in Indonesia is showing signs of permanent especially on some variables that are the growth of credit to total gross domestic product (GDP), interest rate spread, the fiscal deficit, current account, exchange rates and interest rate differentials. Credit to deposit ratio indicator does not allow instability in the financial system in Indonesia compared to the ratio of credit to GDP indicator. Inflation indicator showed chances of a crisis were small and not significant permanent. Indicators of capital transactions showed a smaller probability of the crisis compared to the current account.

Keywords: Early Warning Indicators, Financial Stability, Markov Switching
JEL Classifications: G17, G10, C34

1. INTRODUCTION

Global financial crisis in 2008 is an important lesson for macro economy management and became a caution to maintain financial system stability. The global crisis in 2008 is again a phase of world economic conjuncture decline after 1997 monetary crisis. At the end of third quarterly of 2008, the world economy experienced the decline of global economy stability indicated by widely spread financial crisis in many countries since August 2007. The decline started when one of biggest France Banks BNP Paribas announced several frozen security funds related to high risk subprime mortgage in the United States. As consequences, volatile financial market occurred and brought about domino effect to entire world. At the end of third quarterly of 2008, crisis became more intense as marked by the bankruptcy of the US biggest investment bank, Lehman Brothers and by financial difficulties faced by large scale financial institutions in the US, Europe, and Japan (Bank Indonesia, 2009).

Taylor (2009) asserted that the crisis was caused by the central bank's policy in maintaining a very low interest rates, as a result of long term low inflation level occurring before the crisis, without considering the risk for banking and financial sectors as a reaction of monetary policy. This is in line with studies by Turner (2010) revealing that the case of "leaning against the wind" through the use of interest level instrument to achieve price stabilization and the output implicates the risks toward the growth of credit and asset prices. Moreover, study by Rajan (2005) states that low interest rates will increase incentives for businessmen to find highly revenue generating and high risk assets. Furthermore, research by Gambacorta (2009) finds that good economy causes financial system more vulnerable due to excessive risk taking. Monetary stability stimulates economy actors' speculative behaviour to generate higher profit and to increase leverage when the interest rates are low and also to create market actors' moral hazard towards macro economy risks (Park, 2011). This is due to excessive expectation towards future economy causing the risks of excessive credit growth and assets price bubble.

Accordingly, Nier and Zicchino (2008) asserts that bank credit is influenced by the stance of monetary policy interacting with the pressure on bank balance sheet transmitted through bank loss.

Study by Bernanke and Blinder (1988), Bernanke and Gertler (1995) explains how monetary policy works by bank reserves influence bank credit deals in the economy. Meanwhile, Borio and Zhu (2008, 2012) mention the importance of risk taking channel in the transmission mechanism in monetary policy. The risk taking channel affects bank credit deals by changing bank behaviour when facing credit risk (Satria and Juhro, 2011). In risk taking channel, the change of interest rates will influence bank and company perception towards economy through their reserves in facing the risk. Tightening monetary policy will increase enterprise's risk perception of worsening the cash flow and financial balance that the bank tend to have risk averse. In contrast, when monetary easing with low interest rates occurs, the investors are encouraged to find high profitable assets (Agung, 2010).

Vulnerability characteristics of financial sectors in Indonesia occurred in 1997-1998. It is the period when economy sector instability was resulted from external imbalances and directed towards exchange rates crisis affecting banking stability. As consequence of sharp depreciation of Rupiah, in 1998-1999, Indonesia's banks severely suffered from the difference between lending interest rates and deposit (negative spread) and decline of bank's assets quality due to worst debtors' performance (Bank Indonesia, 1998/1999). Unlike crisis in the period of 1997-1998, when global crisis 2008 occurred, Indonesia financial system indicates stability. Learning from Asia's financial crisis in 1997-1998, the authorities and financial sector players improved their prudential banking principles. Bank Indonesia and the government passed regulation and policies promoting prudential principles yet remained giving dimension for banking intermediation and leasing through capital market and non-banking institutions. Despite Indonesia's resilience financial sector, the noticeable challenge is the tendency of asset bubble in line with market players' optimism towards the prospect of Indonesia's economy. Excessive optimism is potential to cause back pressure for the financial market. Another problem is shallow financial market that restricts market ability to reduce the risk and it tends to destabilizing finance (Bank Indonesia, 2009; Bank Indonesia, 2012).

Considering that financial system stability become the most important aspects in the economy, an in depth study on early warning indicator to mitigate instability or financial system crisis is required. Generally, the study about the early indicator uses signal extraction and econometric model such as logit model. This research uses Markov Switching Autoregressive Model (MSAR) to detect the possibility for financial system vulnerabilities against crisis. MSAR model are advantageous because first, the value limit for the crisis index (threshold) is endogen variable with the inclusion of crisis period into the estimation as latent variable. In this case, assumingly, the economy condition is within tranquil state or normal or in crisis. The second indicator can be observed directly by seeing attitude in both states. Crisis condition has higher value and fluctuates more than tranquil state. The movement from one state to another depends on transition probability. The incoming value of a state relies on that of present ones. Thus, this model enables the possibility that one state in crisis will stay in its crisis. Second, the application of Markov switching model allows the use of continuous dependent variables. Third, models can be used to grasp the dynamic information from the crisis. Furthermore, it is also able to interpret the tendency of the period of the crisis and the probability of transition period. Fourth, this model can be used for nonlinear behaviour (Simorangkir, 2012).

This research aims to detect and analyze the indicators that cause vulnerability to financial system stability in Indonesia. Some indicators were used in this study (1) development of financial indicators, the ratio of total credit and gross domestic product (GDP) and indicators of the difference between interest rates on credit and deposits, (2) the financial vulnerability indicators such as inflation, budget deficit ratio to GDP, current account, capital account, the exchange rate and the ratio of credit to deposit, (3) the world economic climate indicator such as the spread of domestic and foreign interest rate.

2. THEORETICAL BACKGROUND AND EMPIRICAL LITERATURE

2.1. Theoretical Background

Procyclicality of financial system and capital inflow affect the effectiveness of monetary policy implementation. The financial crisis experience provide lesson of the importance of financial system in the monetary policy. Thus, macroprudential policy becomes a complement or buffer for the effectiveness of monetary policy implementation. Tinbergen (1952) as cited in Schoenmaker et al. (2011) mentions that at least there aims one independent instrument for each policy's purpose. Whereas, Duisenberg (2003) in Schoenmaker et al. (2011) asserts that monetary policy cannot compensate structural rigidity that macroprudential policy is required. Study of Bailliu et al (2012) in Canada showed that interaction monetary and macroprudential policy is beneficial to react to financial imbalances where the benefits are larger in the presence of financial shocks that have broader effects on the macroeconomy

The use of the term macroprudential is increasing since the global financial crisis in 2008. According to Borio (2003), macroprudential is used to mitigate the risk in financial system that it can influence the output fluctuation. Meanwhile, Bank of England (2009) mentioned that the policy is aimed at maintaining banking intermediation towards the economy. Meanwhile according to WG G30 (2010), macroprudential policy is used to mitigate systemic risk caused by correlation amongst the financial institutions following the economy cycle or procyclicality. BIS (2011) further states that macroprudential policy is determined to limit the risk and the cost of systemic crisis as a result of domestic and external shocks. On the other hand, Clement (2010) argues that macroprudential policy is a prudent instrument aiming at entire financial economy stability. Since financial market is forward looking in nature, thus, similar to monetary policy, credibility and the expectation of economy agents is needed (Schoenmaker, 2011).

Macroprudential policy defines its goals to observe systemic risk in the entire financial system. Considering the risks, top down systemic risk surveillance consisting time varying risk and cross section risk is needed. Time varying risk is the risk related to

aggregate risk evolution in all time financial system. The risk in the financial and economy sector generates procyclicality of monetary cycle and business fluctuation which cause boom and bust condition. On the other hand, cross section risk is related to loan risk distribution and liquidity of the financial institution in particular circumstances and more related to market structure resilience. This is caused by the portfolio resemblance among the institutions in the system such as interbank lending.

Instruments of macroprudential policy is used to prevent systemic risk against financial system instability caused by both from time varying risk and cross section risk. In the practices, the application of both micro and macro instrument to manage the crisis is difficult to reach more than one objectives. For example, the use of contingent capital, when applied to all banks before systemic phenomena occurs, microprudential is used, when applied systemically in the financial institution, microprudential is also used, and when responding to systemic phenomena, crisis management instrument is used.

Microprudential instrument related to time dimension aims at reducing the accumulation of systemic risks. Three instruments to mitigate procyclicality include countercyclical capital buffer as in Basel III, levy on non-core short term liabilities and countercyclical variation on the margin of collateral. In addition, the recalibrated category used to overcome procyclicality uses the instruments including loan to value (LTV), loan to income and debt to income. Meanwhile, according to IMF in Lim et al. (2011), macroprudential instruments are adapted to mitigate four systemic risks: First, the risks caused by high credit growth and the increase of set price; second, the risk caused by exceed leverage and deleveraging; third, liquidity systemic risk; fourth, the risks related to the amount and capital flow fluctuation including foreign currency loan. The policy instrument is adapted to the type or to the risks characteristics. This characteristics include the risk caused by the increase of asset price using LTV ratio, the risks caused by leverage or the amount of debts to add the exceeding assets with restriction instrument towards the profit distribution, liquidity systemic risk with limitation of maturity mismatch and the risks generated from the capital flow or from the exchange rates fluctuation using currency mismatch instrument.

2.2. Empirical Literature

Several studies using early warning indicator including exchange rates, balance payment until banking crisis towards the crisis have been done in several countries. Eichengreen et al. (1996) provides contagious currency crises that contagion appears to spread more easily to countries which are closely tied by international trade linkages than to countries in similar macroeconomic circumstances. Kaminsky et al. (1998), when an indicator exceeds a certain threshold value, it is interpreted as a warning signal that a currency crisis may take place within the following 24 months, the variables include exports, deviation of the real exchange rate, the ratio of broad money to gross international reserves, output and equity prices. Frankel (1996) examine composition of debt and variety of other macroeconomic, external and foreign factors related to crash incidence especially output growth, rate of change of domestic credit, and foreign interest rate. A low ratio of FDI to debt is consistenly associated with a high likelihood of a crash.

Kaminsky and Reinhardt (1999) identified early warning indicator twin crises which are banking and payment balance with the variable of credit and equity prices with capability of predicting crisis in 12-24 months ahead. Meanwhile, Borio dan Lowe (2002), Borio and Drehmann (2009) developed Kaminsky dan Reinhardt (1999) model by using threshold values through cumulative processes and considering the combination of indicator and multiple time horizons. Moreover, Gerdrup (2003) applied banking indicator such as the number of the banks, balance and asset prices as crisis determinants in the Norway. According to Turner and Goldstein (1996), there are two reasons why banking problems in the emerging economies merit particular attention, first, the serious consequences for the local economies and, secondly, the fallout on other countries as international financial markets have become more integrated.

Babecký et al. (2012) found the effect of domestic private credit as an early warning obtained by minimizing the function of central bank loss with type of Mistakes I (missed crises) and type of Mistake II (false alarms). During the quarter period of 12-20, the global variable is influencing significantly. Meanwhile, out of sample tested the financial crisis in France in 1990s and found out more accurate predictions when crisis occurs than that in the early period. Global credit growth and housing property prices become a crucial early warning indicator.

Antunes et al. (2014) tested out of sample using asset price index, the growth of debt to service, credit to GDP and housing price index. The result reveals that all indicators are specifically significant statistically. Debt to service is significant during the crisis, so as the credit ratio towards GDP which also indicates strong signals throughout the observation.

3. MODEL SPECIFICATION, DATA AND METHODOLOGY

3.1. Model Specification

Markov Switching Model in this study was using the latent variable that was following first derivation two-state Markov. $\{s_t\}_{t=1}^{T} s_t = 1$ crisis state and $s_t = 0$ tranquil state. Although in this model, s_t unobserved directly, the behaviour of dependent variable (y_t) was independent from s_t that can be formed:

$$y_t | s_t \infty N(\mu_{s_t}, \sigma^2_{s_t}) \quad (1)$$

Dependent variable that was used i.e., ratio of total credit and GDP, the spread of credit and deposit interest rate, inflation, ratio of budget deficit to GDP, current account, capital account, exchange rate and the ratio credit to deposits and spread of domestic and foreign interest rate.

The signs of financial system vulnerability towards the crisis are obtained by observing transition probability form normal state with no crisis to state with crisis. Probability value with more

than 0.5 shows the possibility of vulnerability of more than 50%. Meanwhile, the value of 1 means 100% possibility of crisis. In contrast, when the value of probability is 0, the possibility of crisis is also 0%.

3.2. Data

The data used in this research is monthly secondary data within the observation period of 2006.1-2015.6. Several indicators used include (1) financial development indicator: Ratio of total credit and GDP, spread of credit and deposit interest rate, (2) financial vulnerability indicator such as inflation, ratio of budget deficit to GDP, current account, capital account, exchange rate and ratio credit to deposits, (3) world economic climate indicators including in spread of domestic and foreign interest rate. Data sources are obtained from Indonesian Statistical of finance and economic from Bank Indonesia. (Bank Indonesia, 2014)

3.3. Methodology

MSAR model is developed by Hamilton (1990) with filtering operational procedure to evaluate likelihood function. Markov switching model uses latent variables following first order Markov process using two state markov that is crisis condition ($s_t = 1$) and quite condition of ($s_t = 0$) where s_t is not directly observed. The assumption in the first order markov is the probability from regime depending on the previous state.

$$P(s_t=j|s_{t-1}=i)=P_{ij}(t) \quad (2)$$

Where ij is a probability of transition from regime i in the period of t−1 ke regime j in the periode t.

And probability in transition matrix is in the form of

$$p(t)=\begin{bmatrix} p_{11}(t) & \dots & p_{1M}(t) \\ . & \dots & . \\ p_{M1}(t) & \dots & p_{MM}(t) \end{bmatrix} \quad (3)$$

Or it can be rewritten into:

$$\begin{bmatrix} P(s_t=0|s_{t-1}=0,x_{t-1}) & P(s_t=1|s_{st-1}=0,x_{t-1}) \\ =F(x_{t-1}^t\beta_0) & =1-F(x_{t-1}^t\beta_0) \\ P(s_t=0|s_{t-1}=1,x_{t-1}) & P(s_t=1|s_{t-1}=1,x_{t-1}) \\ =1-F(x_{t-1}^t\beta_1) & =F(x_{t-1}^t\beta_1) \end{bmatrix} \quad (4)$$

Where x_{t-1} is an early detecting indicator that can influence the opportunity of transition. F is a function in which the function of cumulative distribution normal cdf from the vector kxl. The assumption procedures used is maximizing likelihood function calculated by using iteration used by Hamilton (1990).

4. EMPIRICAL RESULTS

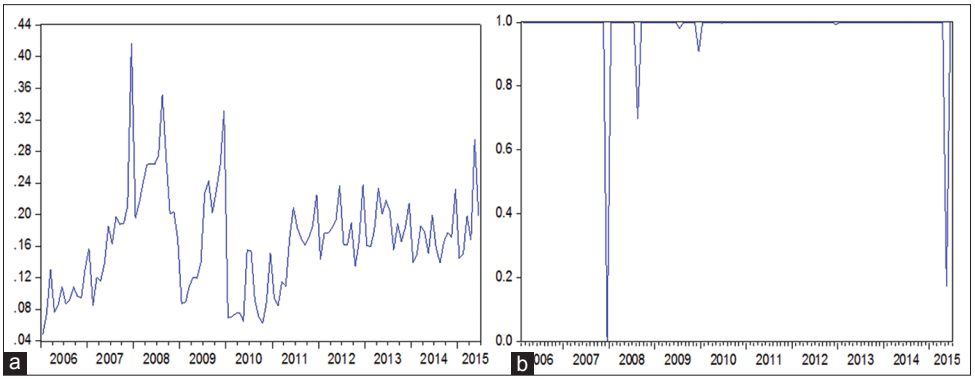
Early detection of financial system vulnerability in Indonesia can be seen from the indicators such as (1) the financial development indicators including ratio credit to GDP and spread of credit and deposit interest rate, (2) financial vulnerability such as inflation, budget deficit ratio to GDP, current account, capital account, exchange rate and ratio of credit to deposit (3) world economic climate indicator such as spread of domestic and foreign interest rates.

4.1. The Indicators of Financial Development

Financial development indicators consist of ratio total credit and GDP and spread of deposit and credit interest rate. Ratio of total credit to GDP describes the ability of financial institution or banking as an intermediary institution. The probability value of transition from tranquil state to vulnerability state towards the crisis in Indonesia is permanent. Only several periods do illustrate the probability of transition from tranquil state to vulnerable state, which are from December 2007 to May 2015. The pattern is also indicated by probability value in State 2 with 0.974 with constant expected duration up to 38 months. Overall, the prediction of the effect of increasing credit growth opens possibility of vulnerability towards crisis in Indonesia financial system (Figure 1).

Meanwhile, spread of deposit and credit interest rate describe the level of competitiveness and banking sector efficiency. Larger spread of loan interest rate and the saving interest rate cause decrease the bank efficiency during the accumulation and distribution of fund to the third parties. Probability value of transition from tranquil state to vulnerable state to crisis in Indonesia is permanent showing several periods indicating the probability of transition to tranquil transition in July 2014 and May 2015. The pattern is illustrated by the value of probability in the State 2 with 0.98 with constant expected duration up to 77 months. The increase of total assets or bank capital becomes very important to minimize leverage and banking bankruptcy since it is affecting the spread of the interest rates (Figure 2).

Figure 1: (a) Ratio of credit and gross domestic product (GDP), (b) ergodic probability State 2 ratio of credit and GDP



4.2. Indicators of Financial Vulnerability

The indicator of financial vulnerability comprises inflation, ratio of budget deficit to GDP, current account, capital account, exchange rate and ratio of credit to deposit and property index prices. Inflation is an important indicator to provide description of macroeconomic fundamental stability. Price stability will provide momentum for economic growth. The value of probability of transition from tranquil state to vulnerable state to crisis in Indonesia is very low, only several periods showing the probability of transition to crisis in May-September 2006. The pattern shows probability value of State 2 with 0.86 lower than State 1 with 0.99 with constant expected duration up to 7.6 months. This demonstrates that price stability in Indonesia can be maintained that the inflation fluctuation does not affect the probability of transition state to crisis in the financial system and it requires fast stabilization adjustment (Figure 3).

Budget deficit becomes one of the vulnerability indicators because it displays government performance and investment trust. The probability value of transition from tranquil state to vulnerable state to crisis in Indonesia is considerable. Several periods showing probability of transition to crisis state is in 2006-2009. The pattern also shows probability value of State 2 with 0.99 with constant expected duration of 136 months. Higher fiscal deficit affects government ability to finance the development which finally implicate the entire economy stability (Figure 4).

Figure 2: (a) Spread of domestic interest rate, (b) ergodic probability spread domestic interest rate

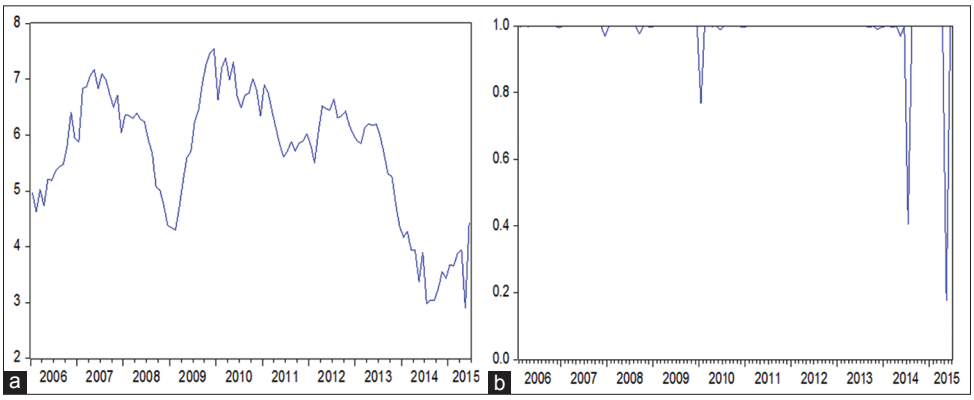


Figure 3: (a) Inflation indicator plot, (b) ergodic probability transition State 2 inflation indicator

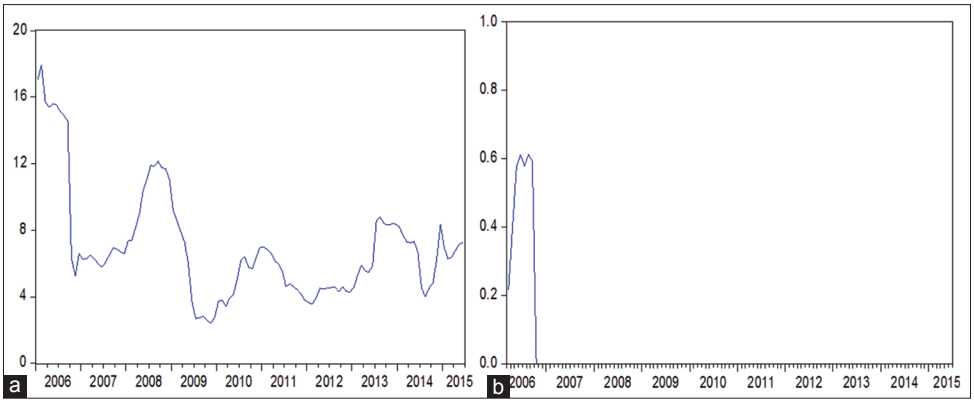
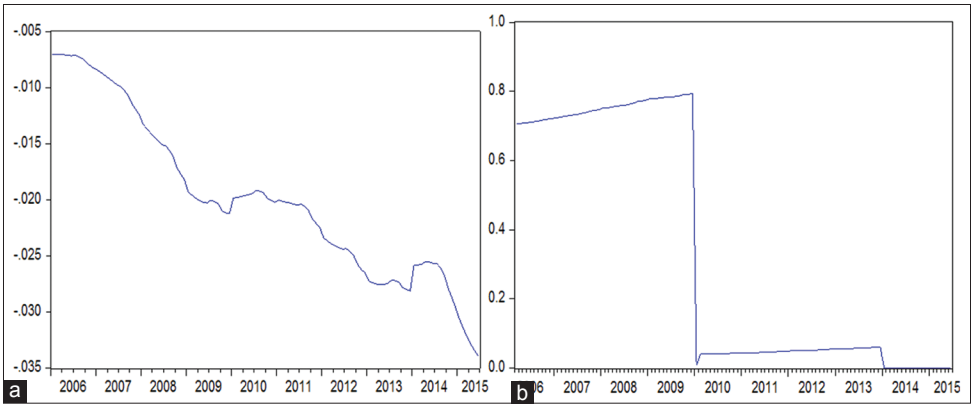


Figure 4: (a) Fiscal deficit indicator, (b) ergodic probability transition State 2 fiscal deficit indicator



The indicator of current account is very important to influence the performance of Indonesia trade balance. Current account deficit implicate the stability of price and exchange rates (Figure 5).

The probability value of transition indicator of current account from tranquil state to vulnerable state to crisis in Indonesia is quite high. Only several period shows the probability of transition from normal state in 2009 and in 2011. The pattern is indicated by probability value of State 2 with 0.96 with considerable constant expected duration of 25 months.

Capital account also illustrates the probability value of indicator transition from tranquil state to vulnerable state to crisis in Indonesia. The vulnerability is quite high but not as permanent as current account with period showing probability transition to crisis in 2010, 2012, 2014 and 2015. The pattern demonstrates probability value in State 2 with 0.94 with considerable constant expected duration of 17 months (Figure 6).

Exchange rate indicator showing the probability transition indicator from tranquil state to vulnerable state to crisis in Indonesia is high and permanent with several period showing probability of transition to tranquil state in October-November 2008 and in 2013 and early 2014. The pattern is also indicated by the probability value of State 2 with 0.97 with constant expected duration of 35 months. Exchange rate value still become indicators

Figure 5: (a) Current account indicator; (b) ergodic probability transition State 2 current account

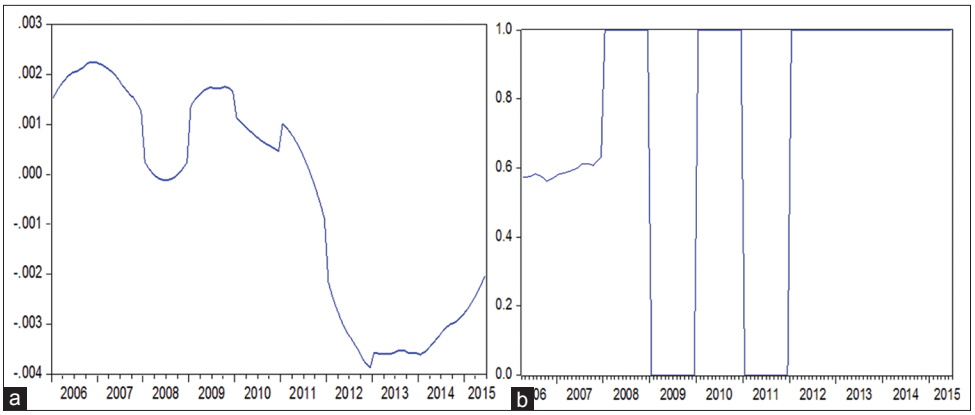


Figure 6: (a) Plot of capital account; (b) ergodic probability transition State 2 capital account

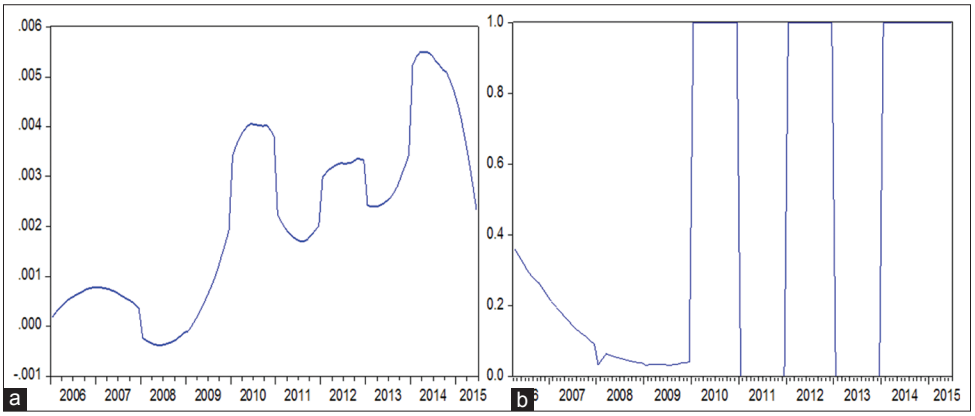


Figure 7: (a) Exchange rate indicator plot, (b) plot *ergodic probability* transition State 2 exchange rate

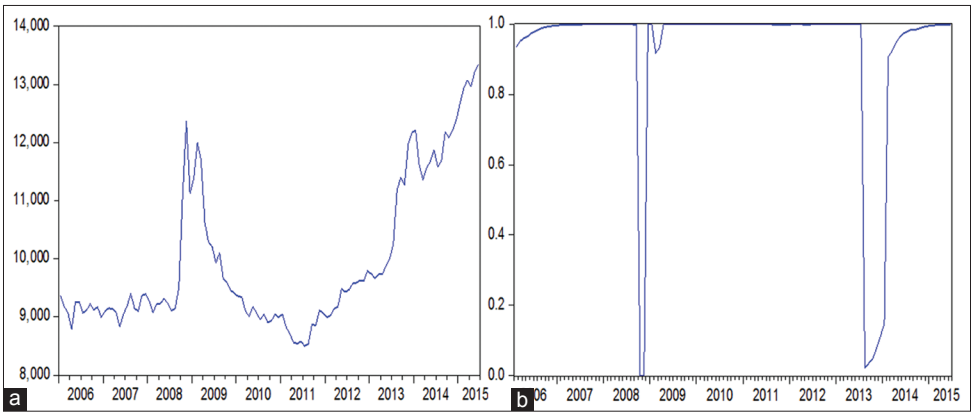


Figure 8: (a) Ratio of credit to deposit, (b) ergodic probability State 2 ratio of credit to deposit

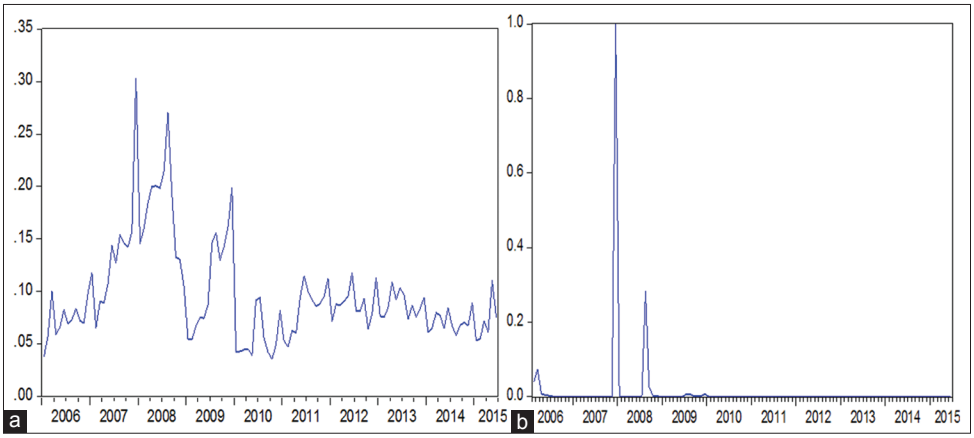
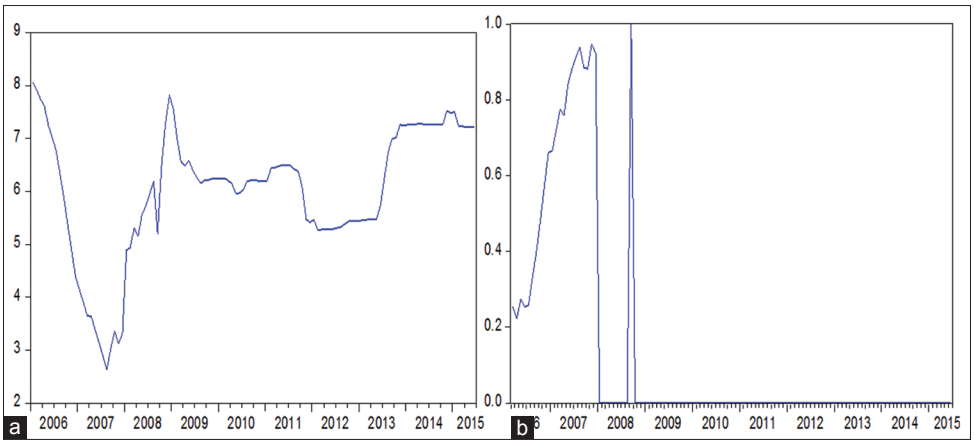


Figure 9: (a) Spread of domestic and foreign interest rate, (b) ergodic probability State 2 spread of domestic and foreign interest rate



signalling strongly to financial crisis vulnerability in Indonesia (Figure 7).

Differing from ratio credit to GDP, the ratio of credit to deposit does not show probability of transition from tranquil state to vulnerable state to crisis in Indonesia. The pattern also indicates the probability value of State 2 with 0.67 with shorter constant expected duration of 3 months. This displays the adequacy of credit ratio with deposit which improve banking performance to maintain capital and leverage (Figure 8).

The difference interest rate of domestic and foreign indicator illustrating the probability of transition from tranquil state to vulnerable state to crisis in Indonesia does not shows permanent condition where the crisis state occurs in November 2006 and in the end of 2007. The pattern is also indicated by the probability value of State 2 with 0.94 lower than State 1 with 0.98 with large constant expected duration of 19 months (Figure 9).

5. CONCLUSION

Based on the analysis it can be concluded that:

1. Overall, the indicators used as early detector of financial system vulnerability in Indonesia shows permanent signal particularly several variables including credit growth to GDP, spread of domestic interest rates, fiscal deficit, current account, exchange rate and the difference of domestic and foreign interest rate.
2. Ratio of credit to deposit does not provide chances for instability in the financial system in Indonesia compared to ratio of credit to GDP.
3. Inflation indicators indicates the chance of small and non-permanent crisis meaning that the price stability is still maintained to support macroeconomic stability.
4. Capital account indicator shows less probability towards crisis compared to current account.

5.1. Policy Recommendation

1. Generally, the fundamental macroeconomic in Indonesia is considerably good in maintaining the financial system stability mainly in responding external shocks. As consequences, it is important to strengthen integrated policy comprehensively in terms of monetary, macroprudential and fiscal policy to strengthen the macroeconomic.
2. Policy coordination in monetary, macroprudential, microprudential and fiscal is important to determine the direction of macroeconomic policy.

It is important to analyze further the early warning system indicators to anticipate or mitigate the financial crisis through the use of comprehensive policy as stated in the target and objective of each policy.

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