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# **TRI-CYCLES ANALYSIS ON BANK PERFORMANCE: PANEL VAR APPROACH**

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# Tri-Cycles Analysis on Bank Performance: Panel VAR Approach

Denny Irawan<sup>1</sup>, Febrio Kacaribu<sup>2\*</sup>

## Abstract

The financial crisis of 2007/8 has revealed the importance of risk, besides credit, in the dynamics of financial cycle and business cycle in the economy. This study examines relationship among those three cycles in the economy (Tri-Cycles), namely (i) business cycle risk, (ii) credit cycle and (iii) risk cycle, and their impacts toward individual bank performance. We examine the responses of individual bank credit cycle and risk cycle toward a shock in business cycle risk and its consequence to the bank performance. We use Indonesian data for period of 2002q1 to 2014q4. We use unbalanced panel data of individual banks' balance sheet with Panel Vector Autoregressive approach based on GMM style estimation by implementing PVAR package developed by [1]. The result shows dynamic relationship between business cycle risk and financial risk cycles. The study also observes prominent role of risk cycles in driving bank performance. We also show the existence of financial accelerator phenomenon in Indonesian banking system, in which financial cycles precede the business cycle risk.

**JEL Classification:** E320; G210; G310

## Keywords

Business Cycle Risk — Credit Cycle — Bank Lending — Financial Risk

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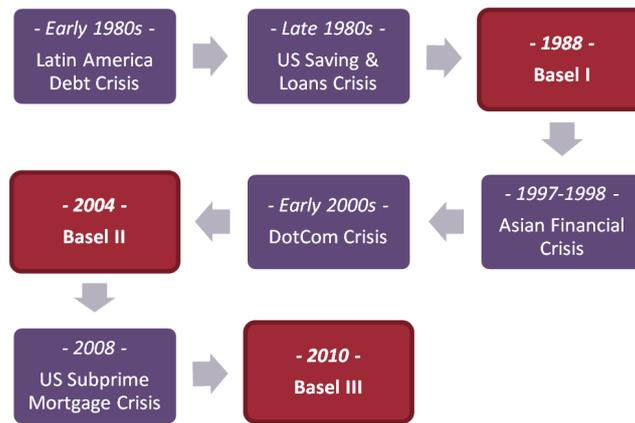
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## 1. INTRODUCTION

The period after the financial crisis is always followed by the introduction of new set of regulations that tighten the activity in the financial sector, particularly banks. In the international sphere this can be seen from the introduction and the implementation period of the Basel Rules by the Basel Committee on Banking Supervision (BCBS), which is a committee of central banks from various countries around the world. Basel I was officially introduced in 1988, triggered by Latin America debt crises in early 1980s ([2]) and US Saving and Loan (S&L) crisis in the late 1980s and early 1990s ([3]). In the 1997–98 many Asian countries were hit by financial crises. This was followed by the proposal for Basel II. After a long process, it was launched in 2004 and



**Figure 1.** Sequence of Financial Crisis and Basel Accord  
Source: Collaborated from many sources

was called the Revised Capital Framework. Likewise, the Basel III, which was introduced in 2010, was a reaction to 2008 financial crisis.

Each Basel regulation is not introduced to replace the previous one, but rather to revise or to complement with more detailed and tighter regulations on the banking system. Basel I, which is the first attempt to regulate bank's capital ratio took focus only on the application of minimum ratio of capital to risk weighted assets. This rule is then revised to be more detailed and stringent by Basel II which governs: (i) the application of more extensive minimum capital requirements, (ii) the strict process of monitoring and assessment of capital adequacy, and (iii) the implementation of obligations for banks to publish their financial statements to encourage market discipline and disclosure of information. Afterward, Basel III tightened the regulation even more by including: (i) the provision of a layer of additional capital reserves, (ii) the provision of counter-cyclical capital reserves, (iii) a tightening on the limit of leverage ratio, (iv) the application of the Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR) as new indicators of liquidity, and (v) the imposition of a special classification for Systemically Important Financial Institutions (SIFI) as explained by BIS ([2]).

The trend of tightening financial regulation is generally viewed as necessary to accommodate the rapid development in the financial market. As shown by Figure 2, trend of derivative market transactions grew exponentially since 1990. This growth is not only in terms of value and total transactions, but also the number of the derivative products in the market. The development of necessary regulations is needed to keep up with these developments in the market.

The regulations trend which are always coincidence crisis shape regulatory cycle which is in line with business cycle/economy. In general, business cycle is shown by fluctuation of Gross Domestic Product (GDP) of a country from its trend line. However, following a formal model developed by [4], this study employs Credit Default Swap (CDS) as proxy of business cycle. Then we prefer to address business cycle as business cycle macro risk, since CDS does not fully represent business cycle.

Furthermore, as in [5], the business cycle is always interconnected with financial cycle, which is usually represented by the credit cycle. This study then tries to relax the finan-

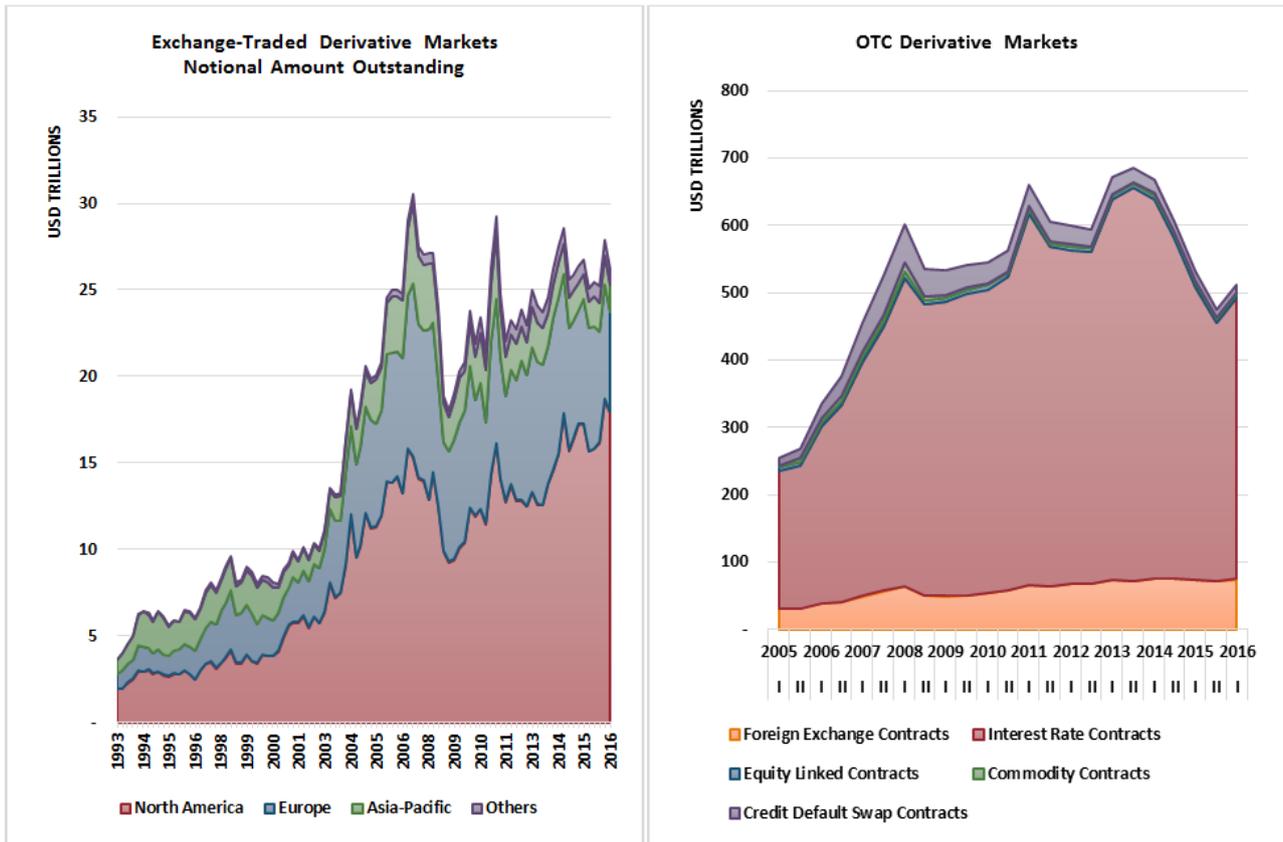
cial cycle by also examining the risk cycle besides of the credit cycle. The credit cycle is characterized by the flow of bank lending to the economy in order to perform the inter-mediation function. In line with the credit cycle, the risk cycle is characterized by risk level in each time period of the company both financial institutions and firms in general. In this study the focus is on the bank' balance-sheet as banking system is accounted for about 78% of asset of financial system in Indonesia ([6]).

The tendency of more tightened revision of regulation might squeeze the ability of financial institutions (banks) to innovate and to conduct risky activity. Although it will result in more resilient banking system, it will also impact bank's performance, since banks opportunity to make higher return from conducting riskier activity is becoming more limited. Moreover, banks also face direct opportunity costs as a result of tighter regulation. For examples, the implementation of (i) additional layer of reserve requirement; and higher (ii) Loan Loss Provision (LLP), may limit more third-party funds from being disbursed to the market, while it should keep paying the cost of the funds. However, without such policies, the market will be under threat of huge losses in the event of failure (default) of one bank or the entire banking system. So, there is a trade-off between system resiliency and bank performance (profitability) from regulating banking system.

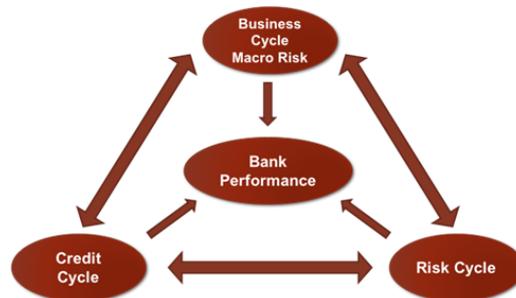
As in with business cycle, the credit cycle and the risk cycle also observe fluctuations by time. The relationship between these cycles are interesting and have been becoming focus of regulator, especially whether the regulator should take part to maintain these cycle to prevent excessive lending and risk-taking by the banks. If they should, which cycle they are better to focus on? Credit cycle or risk cycle?

Figure 3 describes the main focus of this study in stylized way. Each arrow represent hypothesis to be tested in this study. This study examines the cyclicity relationship between the business cycle toward the credit cycle and the risk cycle. By comparing the relationship of those Tri-Cycles, it can be determined which cycle should receive more attention from the regulators. So that the implementation of the counter-cyclical regulation could be better targeted.

Furthermore, this study examines the relationship of the credit cycle and the risk cycle toward the performance



**Figure 2.** Trend of Derivative Market Transactions  
 Source: Bank for International Settlements



**Figure 3.** Tri-Cycles and Bank Performance

of individual banks. This phase of analysis focus on the impact of the Tri-Cycles to the bank’s performance. Especially, to measure the cost borne by the banks resulted from controlled of credit cycle and risk cycle. The results of this study might provide insight for the regulator to estimate the impact of regulating lending and risk-taking to the performance of individual banks.

## 2. LITERATURE REVIEW

Since 1980s, the business cycle literatures has been largely driven by Standard Real Business Cycle (RBC) developed by [7] which assume no financial frictions in the economy. The theory was revised by Bernanke, Gertler, and Gilchrist/BGG ([5]) which revealed important role of Financial Accelerator – which is refer to credit market friction and financial cycle – in determining the business cycle dynamics. Then, 2007/8 financial crisis stimulated a new strand of literatures of business cycle which not only accommodate

financial cycle, but also risk dynamics or risk cycle.

[8] in [9], one of the first among others, defined business cycle as:

” ... a type of fluctuations found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle ...”

the definition above embodies some notable features of business cycle, which becomes focus of many literature on this field. The first one is expansion, the period of surging business activity and gross domestic product expands until the period reach its peak. This period is also known as an economic recovery. The highest point of a cycle, the peak, is a key period in which the economic bubble get burst and

economy the economy turns into contraction period. This period is a phase in which economy as a whole is in decline. The lowest point of this phase, which signals the reversal or revival, is called recession.

## 2.1 Development of Business Cycle Theory

### 2.1.1 Econometric Business Cycle Research (EBCR)

Econometric Business Cycle Research (EBCR) is a term referring to strand of literatures combining theoretical and statistical approach in studying business cycle. Term EBCR has been popularized for the first time by [10]. The EBCR approach was developed in some way as a critic toward the then-previous approach that did not combine theoretical framework with data specification ([9]).

### 2.1.2 Real Business Cycle (RBC) Theory

Standard Real Business Cycle (RBC) model is based on seminal work of [7]. In the model, a competitive market creates resource allocation that maximizes the household utility with limited budget constraint of each resource ([11]). On the standard model, the most prominent determinant of the business cycle are shock by the government budget and technological development ([12]).

An ongoing debate is still going on about this theory ability to explain the heterogeneity of households and companies in the real world. This assumption is considered too strict. Even so, it encourages the further development/refinement of the RBC theory and not rather neglected its reliability.

In general, RBC theory explains how factors of production, namely labor, capital and other factors (such as technology and government budget) affect productivity (output) in the aggregate sense ([11]; [12]). In conditions where there is positive shock to productivity, the marginal product of labor will increase which will lead to a rise in real wage rates and labor supply quantity. The combined effect of rising wages and employment will drive the output to rise. However, because of the increase in productivity is only temporary, then the growth of output in the future will increase by lower pace than the present growth of output, and the growth of income and consumption will not rise as much as the output growth in the present ([11]). This condition will then encourage increase in investment and capital stock in the foreseeable future. This process then creates a new expansion phase. It applies in the opposite direction for the contraction phase.

One of the most criticized aspect of RBC model is its ignorance of the frictions in financial market. This stylized feature of the model departed from the strong assumption of efficient financial market. The hypothesis, which is very strict, assumes that in time of business fluctuation, every agent in the economy will instantly do recalculation of its economic behavior and decision to adapt with the change. Consequently, there is no such frictions in the financial market. Latter, in the late 1990s, [5] promoted a model to revised this view in examining business cycle.

### 2.1.3 Financial Accelerator

[5] are the first to develop a framework which they called as "Financial Accelerator". In their seminal work, they developed a dynamic general equilibrium model to reveal the frictions in the credit market which play prominent role

in determining business fluctuations. The term Financial Accelerator refers to endogenous developments in the credit markets which amplify and propagate shocks to the macro economy.

They materialized financial frictions in their model in three aspects. First, they internalized money and price stickiness to examine role of the friction in the transmission of monetary policy. Second, they relax the efficient financial market assumption by introducing lags in investment. Third, they relax the assumption of firms homogeneity in order to describe the condition in which every borrower has different access to capital markets. The main contribution of the model is how the financial accelerator give significant influence on business cycle dynamics.

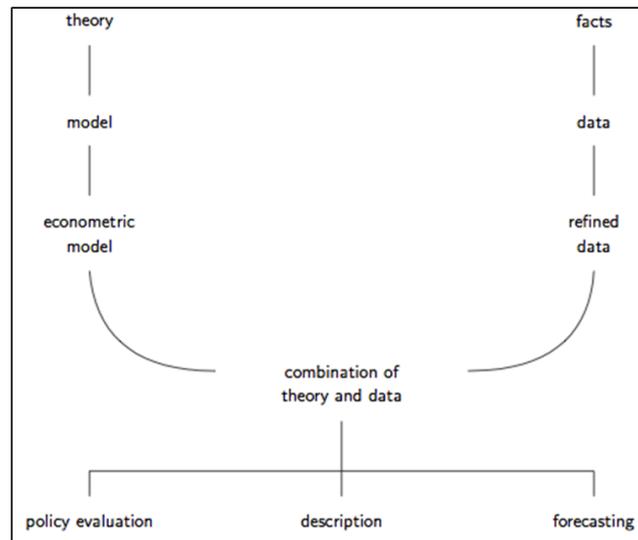
Departing from the standard RBC model, and influenced by Financial Accelerator model, [11] describes the effects of the business cycle toward the credit cycle. In general, relation between the two cycles are influenced by asset quality at every phase of the business cycle. In the period of expansion, there is substantial increase in the value of assets. The increase, including the value of the assets of the firm, make the firm has higher collateral to be utilized to get credit. Moreover, the business boom condition make firm's balance sheet substantially sound, which is a sign of growth. These conditions make the firm could obtain more credit to finance new investments and expand further. In line with this, the good economic conditions make the firm able to repay their credit and then it has good credit rating. The level of non-performing loan (NPL) in the banking system is then generally low.

The reverse condition happens when the economy is in contraction phase. Impairment of assets (the burst of the boom) and deterioration of economic conditions will generally make the firm experience a decrease in performance and asset values. As a result, loan repayments begin to deteriorate (NPL increase). On the other hand, the banks tend to have lower credit growth. This happens due to (1) deterioration of the financial condition of the firm/debtor; (2) the impairment of the value of assets/collateral; and (3) the bank's internal condition is getting worse by the rising of NPL rate.

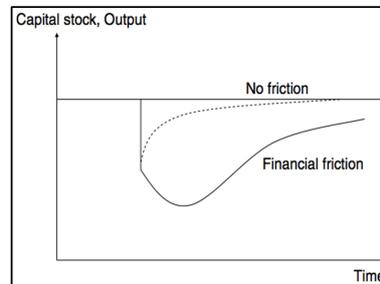
## 2.2 Empirical Studies

### 2.2.1 Relationship between Cycles

[13] in their study analyzed the cyclicity of individual bank lending toward business cycle. They segregated the sample based on the ownership, state-owned banks and private banks. The result shows the state-owned bank proved to be less cyclical than the private banks. The finding applies particularly in countries with higher governance index. In case for developed country, the result even shows counter-cyclical lending behavior by state-owned banks. The study came to the conclusion that state-owned banks can effectively play counter-cyclical role toward the country business cycle. State-owned banks could play a stabilizing role of the business cycle and financial cycle. However, [13] also found that loans allocation made by state-owned banks tend to be bad so that from business point of view, the behavior of the state-owned bank is not economically optimal because of its role to support government policy. The study therefore concluded that implementation of micro- and macro-prudential



**Figure 4.** The EBCR Framework  
Source: Jacobs (1998)



**Figure 5.** Response toward Shock in Asset Quality  
Source: Kiyotaki (2011)

banking regulations such as monetary policy and statutory reserves are better tools than altering behavior of the state-owned banks. Empirical model applied in the study are the first-difference GMM of [14] and the system GMM of [15] enhanced by [16]. The study was conducted with a sample of 1,633 banks from 111 countries in the 1999–2010 time period.

[17] conducted an analysis of influence between bank ownership and lending behavior of individual banks and its cyclicity over the business cycle. The sample of the study is banks in Europe in the period 1999–2011. Segregation of the sample conducted between profit-oriented bank (conventional bank) and not-for-profit bank (cooperative banks and saving banks). In his study [17] used first difference GMM by [14]. The result showed that there was no significant difference between the two groups of banks based on profit orientation. The main factors that can explain the behavior of bank lending is the monetary policy of the European Central Bank (ECB).

[18] conducted a study to compare the lending cyclicity between conventional banks and Islamic banks in Malaysia. The sample used in the study includes 21 conventional banks and 16 Islamic banks in Malaysia during the period 2001–2013. The data used is unbalanced panel data. The results showed that generally the behavior of bank lending is pro-cyclical to the business cycle. However, by segregating the samples it is observed different cyclicity behavior between conventional banks and Islamic

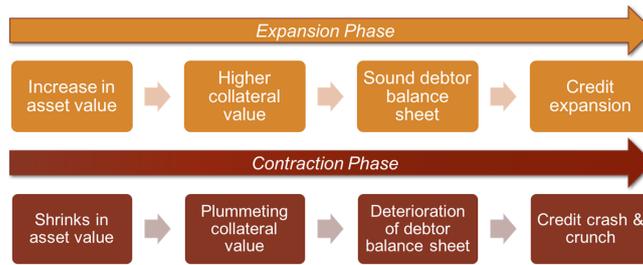
banks. Pro-cyclical behavior only observed at samples of conventional banks. While for Islamic banks, business cycle appears to have no effect on its lending behavior. In fact, the estimation results obtained show a negative value indicating a counter-cyclical lending behavior of Islamic banks. Similar with [13], the model estimation used in the study is the first-difference GMM and GMM system.

As for the case of Indonesia, [19] in their study examined the influence of Countercyclical Capital Buffer (CCB) policy on the growth of bank-lending in Indonesia. Estimation sample period is 2005Q1 to 2015Q2. Just like [13] and [18], the study used both the First Difference GMM and System GMM for estimation.

### 2.2.2 Individual Bank Performance

[20] conducted a study of the effects of business cycles on the performance of the credit portfolio of commercial banks in developing countries. The study period is 1996–2008. The results obtained indicate that economic growth is the main determinant of the performance of the loan portfolio. While the interest rate is the second strongest determinant. The estimation results also showed that the relationship between loan loss provision and economic growth is non-linear in conditions where the economy is in a state of stress.

[21] conducted a study of co-movement between the level of capital buffer and business cycle for the six largest banks in Canada. The results found positive relationship between the two variables. The data used are quarterly data



**Figure 6.** Expansion and Contraction Sequence in Business Cycle  
Source: Inferred from [11]

for the period of 1982–2010. The study results also showed that the implementation of the Basel regulatory framework does not affect cyclicity behavior of the banking industry in Canada. This suggests that banks in Canada are mostly well-capitalized.

[22] in his study analyze the effect of business cycles on the development of financial markets and the risk of individual banks. The samples used were 37 bank went public in seven countries in South America. The result shows that the business cycle is significantly affecting the banking risks. Besides, the development of financial markets also improve capital ratios and reduce the level of risk exposure of banks, indicating that financial market developments have lowered the banking risk.

[23] analyzing the impact of financial regulation and structural reforms and their effects on the efficiency of the banking industry. The sample used was a bank from 10 countries in Eastern and Central Europe in the period 2004–2009. Scores of cost efficiency is estimated using stochastic frontier analysis. The results obtained show that structural reforms in the labor market and businesses have a positive impact on the bank’s performance. It was also found that credit regulations raise the cost efficiency of the banks. As well, it appears that banks with stronger capital has a higher cost efficiency.

As for Indonesia case, [24] analyzed the effect of the bank’s income structure to market-based performance for listed-banks in Indonesia. The study was conducted using panel data for the period 2004–2012. The result obtained suggest that income diversification does not have a significant effect on the performance of the banks in Indonesia. Meanwhile, other variables such as total assets, asset-to-equity ratio, NPL and ROA have significant influence on the bank’s performance, while the variable cost-to-income and loan growth has no significant effect on the performance of the bank.

### 3. CONCEPTUAL FRAMEWORK

This conceptual framework refers to model developed by [4]. The overall economy in this model consists of several sectors, namely, the banking sector, savers, borrowers (both savers and borrowers are referred to as households, for simplicity), and the entrepreneurial sector (corporation).

#### 3.1 Bank Lending: Base Case

The framework is based on three-date model of a bank, in which at  $t = 0$ , the bank receives deposits  $D$  from risk-neutral investors (savers of the economy) with reservation

utility  $\bar{u}$ . Depositors are compensated with  $r_D$ , the (gross) rate of return on deposits – deposit rate. In  $t = 1$ , the bank makes investments in projects (loans)  $L$ , while holding a fraction of a deposits as liquid reserves  $R$ . In  $t = 2$ , the bank-funded projects either success or fail, with the probability of success is given by  $\theta$ . The bank observes  $\theta$  after receiving deposits and sets  $r_L$ , the (gross) rate of return on loans – lending rate.

Bank reserves  $R$  are residual after the bank meets the loan demand:

$$R = D - L(r_L) \tag{1}$$

The bank could experience withdrawals at  $t = 1$ , which is represented by random variable given by  $\tilde{x}$ , where  $x \in [0, 1]$ . Thus, the total amount of withdrawals at  $t = 1$  is given by  $\tilde{x}D$ . If  $\tilde{x}D > R$ , then the bank faces a liquidity shortage, and it incurs penalty, given by  $r_p(\tilde{x}D - R)$ , which is proportional to the liquidity shortage, where  $r_p > r_L > 1$ . The bank owners’ problem is then summarized by:

$$r_{L,r_D,R}^{\max} \Pi \equiv \pi - r_L E[\max(\tilde{x}D - R, 0)] \tag{2}$$

subject to

$$E(\tilde{x}) + (1 - E(\tilde{x})) \left[ \theta r_D + (1 - \theta) \frac{E[\max(R - \tilde{x}D, 0)]}{(1 - E(x))D} \right] \geq \bar{u} \tag{3}$$

and

$$L(r_L) + R = D, \tag{4}$$

where  $E(\cdot)$  is the expectations operator over the distribution of  $\tilde{x}$  and profit,  $\pi$ , is given by:

$$\pi = \theta \{ r_L L(r_L) - r_D D (1 - E(\tilde{x})) + E[\max(R - \tilde{x}D, 0)] \} \tag{5}$$

Equation (5) states that the bank chooses deposit and lending rates as well as the level of bank reserves so as to maximize its expected profits,  $\Pi$ , net of any penalty incurred in case of liquidity shortage and subject to the participation constraint of the depositors given by expression (3) and the budget constraint given by Equation (4). The optimal gross lending rate is given by

$$r_L^* = \frac{1 + (r_p - 1)Pr(\tilde{x}D \geq R^*)}{\theta(1 - \frac{1}{\eta_L})}, \tag{6}$$

where  $\eta_L = -\frac{r_L L'(r_L)}{L} > 0$  is the elasticity of the demand for loans. The optimal gross deposit rate is given by

$$r_L^* = \frac{(\bar{u} - E(\tilde{x}))D - (1 - \theta)E[\max(R^* - \tilde{x}D, 0)]}{\theta(1 - E(\tilde{x}))D} \tag{7}$$

**Table 1.** Empirical Literature Review: Business Cycle and Credit Cycle

No	Author	Analysis	Variables	Sample	Result
1	Ibrahim (2016)	· Business cycle	· GDP	· Conventional Bank (Malaysia)	· Pro-cyclical
		· Bank lending	· Loan	· Sharia Bank (Malaysia)	· Counter-cyclical
2	Bertay et al. (2015)	· Type of Banks			
		· Business cycle	· GDP	· 111 countries	· Pro-cyclical
		· Bank lending	· Loan	· State-Owned Bank	· Counter-cyclical
		· Ownership		· Private Bank	
3	Ferri et al. (2014)	· Business cycle	· GDP	· Conventional Bank (Europe)	· Bank lending significantly correlated with monetary policy
		· Bank lending	· Loan	· Cooperative Bank (Europe)	
4	Pramono et al. (2015)	· Monetary policy	· Policy Rate		
		· Business cycle	· GDP	· Conventional Bank (Indonesia)	· Pro-cyclical
		· Bank lending	· Loan		
		· Counter-Cyclical Buffer	· Counter-Cyclical Buffer		

**Table 2.** Empirical Literature Review: Business Cycle and Bank Performance

No	Author	Analysis	Variables	Sample	Result
1	Glen & Mondragon-Velez (2011)	· Business cycle	· GDP	· Conventional Bank (Developing Countries)	· Non-linearity
2	Guidara et al. (2013)	· Credit Performance	· Loan Loss Provision		
		· Business Cycle	· GDP	· Six largest banks (Canada)	· Pro-cyclical
		· Capital Buffer	· Capital Buffer		· Basel Framework does not affect cyclicity
3	Vinthesonathi & Tongurai (2016)	· Basel Framework	· Basel Dummy		
		· Business Cycle	· GDP	· 37 listed banks (South America)	· Bank risk is pro-cyclical
4	Psillaki & Mamatzakis (2017)	· Financial Development	· Risk Exposure		
		· Bank Risk	· Capital Ratio	· 10 countries (Eastern & Central Europe)	· Regulation increase efficiency
		· Financial Regulation	· Credit regulation dummy		· Stronger capital raise efficiency
		· Banking industry Efficiency	· Cost efficiency		
5	Winata & Viverita (2013)	· Bank's income structure	· Capital ratio		
			· Income diversification ratio	· Listed banks (Indonesia)	· Income diversification does not affect performance
		· Market based performance	· Stock return		

And, the optimal level of reserves is given by:

$$R^* = D - L(r_L^*). \quad (8)$$

### 3.2 Internal Bank Dynamics and Excessive Lending

[4] build explicit model to explain the process behind excessive lending phenomenon. The model take focus on how managerial agency problems can have effect on bank lending policies. The bank manager has unobservable effort level,  $e$ , such that  $e \in \{e_L, e_H\}$ , with assumption that although the loans are affected by effort, they are not fully determined by it.

The manager earns income,  $b$ , which can be interpreted as bonuses, which increases as the manager sell more loans. But the manager also faces a penalty,  $\psi$ , if the principal conducts an audit and it is revealed that the manager had acted over-aggressively to increase loan volume by setting a loan rate lower than the one that maximizes the principal's expected profits.

The managerial penalty is some proportion,  $\gamma$ , of the penalty cost incurred by the bank due to liquidity shortfalls.

However, there is maximum penalty level received by the manager,  $\bar{\psi}$ , so that the managerial penalty is given by  $\psi = \min(\bar{\psi}, \gamma r_p S)$ , where  $S = \max(\bar{x}D - R, 0)$  represents the liquidity shortfall, if any, and  $\gamma \in [0, 1]$ . Thus, the net wage earned by the manager is given by  $w = b - \psi$ .

### 3.3 Bank Liquidity Flush

[4] assume an economy in which entrepreneurs have access to projects that yield a terminal cash flow  $C^c$  if it succeeds and zero otherwise. Macroeconomic risk is given by  $1 - \theta$ .

The probability of success depends partly on the realization of the state variable,  $\theta$ , and partly on the entrepreneurs' effort decision,  $\varepsilon$ , which identifies whether the entrepreneur is diligent ( $\varepsilon = 1$ ) or shirks ( $\varepsilon = 0$ ) in which case entrepreneurs extract a private benefit  $B$ .

If the entrepreneur is diligent, the probability of success as before is given by  $\theta$ , but in the presence of shirking the probability of success is  $\varphi\theta$ , where  $\varphi \in (0, 1)$ . Entrepreneurs promise to pay the risk-neutral investors who invest directly in their projects a face value of  $y$ . The entrepreneur's problem as maximizing the expected return is

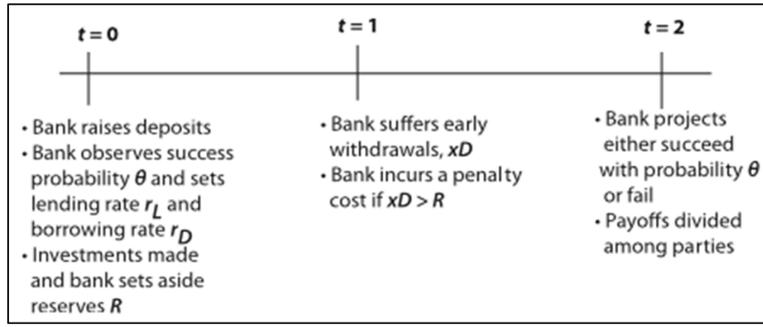


Figure 7. Three-date Model Framework

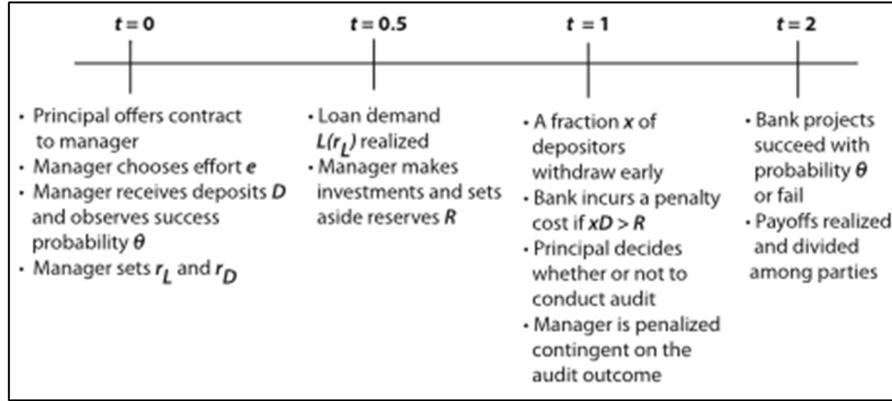


Figure 8. Extended Three-date Model Framework

then:

$$\max_y \theta(C^e - y) - m(y) \tag{9}$$

Subject to the constraint:

$$\theta y \geq \bar{u} \tag{10}$$

and

$$\theta(1 - \varphi)(C^e - y) \geq B \tag{11}$$

Constraint (10) is the investor’s rationality constraint that says that the expected return to the investor must at least equal the investor’s reservation utility. Meanwhile constraint (11) means the expected entrepreneurial return conditional on the entrepreneur being diligent exceeds his expected return from shirking.

Then, there is  $\theta^c$  such that, for  $\theta \leq \theta^c$ , the entrepreneur’s offer to the investors are not enough to satisfy the investors’ reservation utility. Intuitively, if macroeconomic risk is sufficiently high, the probability of success is low, and thus, the entrepreneur has little incentive to exert effort and is better off by shirking and consuming his private benefit.

However, if the entrepreneurial projects are financed by banks instead of dispersed investors, then such moral hazard can be alleviated via monitoring. Formally, in the presence of bank borrowing, entrepreneurs suffer a cost from shirking, say,  $\kappa$ . As long as  $\kappa \geq B$ , the entrepreneur has no incentive to shirk.

Because investors earn on average  $\bar{u}$  from depositing money in the bank, in the presence of entrepreneurial moral hazard, investors are better off by depositing their endowments in banks. However, if  $\theta \geq \theta^c$ , entrepreneurs can attract investors by offering them an expected return slightly above  $\bar{u}$ .

In summary, if investors observe  $\theta$  identically, then all investments are channeled directly into entrepreneurial projects if  $\theta \geq \theta^c$  and into banks if  $\theta \leq \theta^c$ .

### 3.4 Theoretical Framework: Modified

This study employs conceptual framework developed by [4] with some modification. The main framework implemented in this study is based on Equation (5), which is:

$$\pi = \theta \{ r_L L(r_L) - r_D D (1 - E(\tilde{x})) + E[\max(R - \tilde{x}D, 0)] \}$$

First modification, we distinguish the risk in the model,  $\theta$ , into two risk. First, macroeconomic risk,  $\theta_{MACRO}$ , which plays significant role in determining deposit flush received by the banks. Second, individual bank risk,  $\theta_{BANK}$ , which is represented as the share of the performing loan compared to total loan made by the bank. By doing so, the conceptual framework in this study becomes as follow:

$$\pi = \theta_{BANK} \{ r_L L(r_L) - r_D D (1 - E(\tilde{x}), \theta_{MACRO}) + E[\max(R - \tilde{x}D, 0)] \} \tag{12}$$

## 4. DATA AND METHODOLOGY

### 4.1 Characteristic of the Data and Some Related Issues

This study employs quarterly unbalanced panel data from balance sheet of all conventional banks in Indonesia in the period 2002q1–2014q4. The main goal of this study is to measure magnitude of dynamic cyclicity between business cycles macro risk, credit cycles and risk cycle toward the performance of individual bank. Therefore, it is necessary for the empirical model to be able describe the

dynamic relationship of the Tri-Cycles and its influence on the performance of the bank.

One of the benefits of the use of panel data is able to provide interpretation that can meet these objectives, in term of variation between individual and over-time ([25]). However, the utilization of unbalanced panel data, although not problematic, requires special attention. First, from the point of view of classical assumption, it makes the OLS estimators remain consistent and unbiased, but the standard error will be biased. Second, ANOVA methods cannot be perfectly applied for unbalanced data thus makes the property of unbiased in the optimal model of standard ANOVA are not met. Third, the asymptotic distribution of critical values of unbalanced panel data becomes unbalanced. Nonetheless, the use of unbalanced panel data remains possible and common statistical software such STATA has automatically accommodated this type of ([26]). This study uses STATA 13 MP to perform estimation and data processing.

One of the most popular models for cycle analysis is dynamic panel model as used by [17], [13], [19], and [18] in a study somewhat similar to this study. This model was chosen because of its ability to capture the dynamics between the two variables. So that it is very suitable for use in analyzing the relationship between two variables cycle.

The dynamic model in practical is implemented by entering the lag of the dependent variable as one of the independent variables ([25]). Dynamic panel model is characterized by the presence of more than one source of time persistence. Such conditions create dynamic panel model cannot be separated from the auto-correlation lag because of the presence of one of the dependent variables as independent variables. In addition, this model also cannot be separated from the heterogeneity among individuals who became observation.

Because of that, dynamic panel model is automatically not met the BLUE (Best Linear Unbiased Estimator) assumptions as owned OLS model standard and standard assumptions of GLS models ([25]). This happens because in dynamic panel model there is correlation between the independent variables with the error term. Because of that, the OLS estimators will be biased and inconsistent. Moreover, the standard GLS estimator cannot be used because there is a correlation between the variables predetermined by the error term. Furthermore, GLS models with instrument variable (IV) also cannot be used because of although it produces a consistent model, it did not provide an efficient parameter. This is due to the model GLS-IV does not use all the conditions of moment conditions.

Therefore, the use of dynamic panel model is not necessary to test classic assumptions on the data samples used. Dynamic panel model was essentially developed to be able to accept the conditions in which the classical assumptions are not met.

Specifically, dynamic panel model that will be used in this research is Panel Vector Autoregressive (PVAR) developed by [1] based on GMM style estimation from [14]. Specifically, the GMM model is used in combination with a robust estimator of [16] to avoid problems of over-identification and downward bias ([25]).

## 4.2 Overview of Panel Vector Autoregressive (PVAR) Model

In line with the aim of this study, cyclical relationship between the Tri-Cycles is the object to be observed. Thus, this study needs such method that can observe potential bi-directional relationship between each cycle. Because of that, this study employs Vector Autoregressive (VAR) approach. VAR methodology is categorized as an extension of autoregressive (AR) model in term of its multi-variate characteristic. Furthermore, it also resembles simultaneous-equation modeling (SEM) style estimation ([27]). The main difference is, each variable in the model is treated as endogenous variable and lag of every variable in the system is considered as independent variable.

This approach is then very suitable to fulfill the aim of this study. By placing every variable as dependent variable, it can observe bi-directional relationship of each cycle and also shows how each cycle affects bank performance. In the context of business cycle analysis, the approach might give insight of the dynamics between business cycle and financial cycle, which attracts big concern in the development of the literatures. The other advantage is it has rich of features. VAR estimation has features of Impulse Response Function (IRF), Forecast-Error Variance Decomposition (FEVD), and also Granger-Causality Test. These features make VAR estimation very popular for policy simulation. IRF describe response of each variable due to one standard deviation in other variable. Meanwhile FEVD decomposes degree of impact of each variable to the dependent variable. Granger-Causality test is useful in examining the potential bi-directional relationship between variables.

However, VAR approach has several disadvantages. First, it can be applied even as an a-theory approach. Researcher does not need basic theory and can simply put any variable into VAR system. This disadvantage then has been avoided in this study since the selection process of the variables in this study is all based on the theoretical framework as explained in Section 3. Second, the coefficient result from VAR estimation cannot be interpreted directly. The result is interpreted only in term of its direction (positive or negative) and significance.

Essentially, VAR estimation is developed for time-series process. However, as the availability of cross-individual data is increasing, VAR is getting popular to be implemented in panel estimation. However, standard built-in statistical package is not yet available to estimate Panel VAR. This study then employs PVAR user-based package developed by [1] which uses GMM estimation to estimate Panel VAR.

Theoretically, Panel VAR have the same structure as time-series VAR model. Each variable is treated as endogenous variable and also interdependent. The main difference is Panel VAR also observe cross-sectional dimension of the data. Panel VAR is also noticeable for several advantages, as revealed by [28] that Panel VAR: (i) captures both static and dynamic inter-dependencies; (ii) in unrestrictive style treats individual variation; (iii) incorporates coefficient variations and the variance of the shocks in term of time series; and (iv) examine cross-sectional dynamic heterogeneities.

As described by [28], think of  $Y_t$  is stacked version of variable  $y_{it}$ , while the  $G$  is vector of variables for unit of  $i = 1, \dots, N$ , i.e.,  $Y_t = (y'_{1t}, y'_{2t}, \dots, y'_{Nt})'$ . Individual is

represented by  $i$ . Meanwhile  $t$  represents time. Panel VAR empirical form is then:

$$y_{it} = A_{0i}(t) + A_i(\ell)Y_{t-1} + u_{it} \quad i = 1, \dots, N \quad t = 1, \dots, T$$

where  $u_{it}$  is random disturbances in the form of  $G \times 1$  vector and  $A_{0i}$  and  $A_i$  depend on the unit of observation, and  $\ell$  is the lag operator.

### 4.3 Empirical Model

Recalling Equation (12) in chapter 3, the bank profit is function is as follow:

$$\pi = \theta_{BANK} \{ r_L L(r_L) - r_D D(1 - E(\bar{x}), \theta_{MACRO}) + E[\max(R - \bar{x}D, 0)] \}$$

So that the bank profit is function of:

$$\pi = \pi(\theta_{BANK}, \theta_{MACRO}, r_L, r_D, L, D) \quad (13)$$

Due to data characteristic, rather than using Loan Rate ( $r_L$ ) and Deposit Rate ( $r_D$ ), this study use data of Net Interest Margin,  $r_\Delta$ , which is difference of the  $r_L$  and  $r_D$ . So Equation (13) becomes:

$$\pi = \pi(\theta_{BANK}, \theta_{MACRO}, r_\Delta, L, D) \quad (14)$$

Based on Equation (14), an empirical model might be constructed as follow:

$$\pi_{it} = \alpha_{0i}(t) + \beta_{1i}(\ell)\theta_{BANK_{t-j}} + \beta_{2i}(\ell)\theta_{MACRO_{t-j}} + \beta_{3i}(\ell)r_{\Delta_{t-j}} + \beta_{4i}(\ell)L_{t-j} + \beta_{5i}(\ell)D_{t-j} + u_{it} \quad (15)$$

where  $\alpha$  is intercept, and  $\beta$  is parameter. Meanwhile  $\varepsilon$  is the error-term. Both  $\ell$  and  $t - j$  are lag operator.

$\pi$  : Bank profit;

$\theta_{BANK}$  : Share of performing loans to total loans made by the bank;

$\theta_{MACRO}$  : Macroeconomic risk, Indonesia CDS 1Y – Spread;

$L$  : Total bank loans;

$D$  : Total bank deposits, represented by total Third Party Funds;

$r_\Delta$  : Net interest margin (NIM).

### 4.4 List of Variables

Table 3 gives complete list of variables employed in the empirical estimation. In total, the data set contain unbalanced panel data of 150 individual conventional bank balance sheet in Indonesia. Focus variables on this study are comprised of four variables. First, the business cycle macro risk, which is represented by CDS spread. In line with theoretical framework on this study which is based on [4], this study then uses CDS spread rather than GDP which is very common to represent business cycle. On their paper, [4] specifically recommend to use commercial paper spread as the measure of business cycle fluctuations. However, due to limitation and irregularity of commercial paper spread data in Indonesia, this study then employs credit default swap (CDS) spread data, which also represents macroeconomic risk.

The second focus variable of this study is bank lending, which represents credit cycle. The data come from individual bank balance sheet. All bank balance sheet data are

acquired from website of *Bank Indonesia* and *Otoritas Jasa Keuangan*, which are based on monthly and quarterly report of bank balance sheet. Bank lending data employed in this study uses outstanding credit data on the balance sheet. The data is then transformed into natural logarithm and then extracted to its cycle component using Hodrick-Presscott Filter. The third focus variable is performing loan ( $\theta_{BANK}$ ), which represents the risk cycle. The data acquired from Net Non-Performing Loan (NPL) data, specifically  $\theta_{BANK} = 100 - NPL$ . The data is then transformed into natural logarithm and the cycle component is extracted. Lastly, the fourth focus variable is bank performance, which is represented by the bank quarter profit. The data is also transformed into natural logarithm and then extracted to its cycle component.

Besides of the focus variables, there are also two other variables which are theoretically important, the deposit and net interest margin. The deposit data is sum of the total of third party fund, comprised of giro, savings and time-deposit. The data is transformed into natural log and its cycle component is extracted. Meanwhile the Net Interest Margin (NIM) data is employed as substitute of loan rate and deposit rate. The use of this substitute is due to bank do not report their loan rate and deposit rate in their balance sheet, but they report their net interest margin, which is the difference of both. The data is extracted into its cycle component by using HP filter.

## 5. RESULT AND DISCUSSION

### 5.1 Estimation Result

The suitability of the theoretical framework and rich feature of VAR estimation method has made it possible to answer all research questions in only one estimation process. VAR estimation is conducted with variables lag of 3 and instrument lag of 1/9. The complete result of tests and estimations are in the Appendix section.

Table 4 presented unit-root stationarity test based on Panel ADF-Fisher tests. All variables are stationary at level. Thus, there is no need to conduct co-integration. This condition means VAR model is eligible to be applied to analyze the data. This study applies VAR estimation based on GMM developed by [1]. If the variables are found to be non-stationary at level, then VEC Model need to be considered.

With selected lag specification, VAR stability check indicates stability of the model (Figure 9). It can be concluded as all eigenvalue lie inside the unit circle. It means that all eigenvalue has value equal to or less than 1. This stability condition is necessary for VAR estimation otherwise the estimation result become unreliable for analysis and the VAR system need to be re-calibrated.

Results presented on this section are arranged following 8 research questions of this study. Each sub-section (from 5.1.1. to 5.1.8.) address one research question. The results presented are VAR estimation result, Granger Causality Wald-exogeneity test result, and Cholesky IRF result. From those result each research question can be comprehensively addressed so that the aim of this study can be fulfilled.

**Table 3.** List of Variables

Variables	Symbol	Unit	Source	Treatment
Business Cycle Macro Risk				
Credit Default Swap (CDS) – Spread	$\theta_{MACRO}$	Percentage	Bloomberg	Cycle
Credit Cycle				
Bank Lending	$L$	Million Rp	OJK	Cycle of Natural Log
Risk Cycle				
Performing Loan	$\theta_{BANK}$	Percentage	OJK	Cycle
Bank Performance				
Profit	$\pi$	Million Rp	OJK	Cycle of Natural Log
Bank Specific – Theoretically Important				
Net Interest Margin (NIM)	$r_{\Delta}$	Percentage	OJK	Cycle
Deposit – Third Party Fund	$D$	Million Rp	OJK	Cycle of Natural Log

\*OJK stands for *Otoritas Jasa Keuangan* or Financial Service Authority

**Table 4.** ADF-Fisher Panel Unit-Root Test

Variable	ADF-Fisher Prob	Variable	ADF-Fisher Prob
business cycle macro risk	0.000	nim	0.000
credit cycle	0.000	deposit	0.000
risk cycle	0.000	profit	0.000

### 5.1.1 Tri-Cycles Dynamics

Estimation result from VAR and Granger Causality test reveal bi-directional cyclicity between business cycle macro risk and credit cycle. VAR estimation result indicate that shock in the credit cycle has lagged impact toward the business cycle macro risk (Table 5). On the other hand, shock in business cycle macro risk also has significant impact toward credit cycle. Granger Causality test results resembles the VAR estimation result. It reveals bi-direction relationship between business cycle macro risk and credit cycle. From the result can be inferred that the credit cycle granger-cause the business cycle macro risk. While on the opposite, the business cycle macro risk Granger-cause the credit cycle. Cholesky Impulse Response Function shows that shock in the credit cycle has lagged impact over the business cycle macro risk and the pattern is stable. Meanwhile business cycle macro risk has considerably unstable response toward shock in credit cycle (Figure 10).

Estimation result from VAR and Granger Causality test also reveal bi-directional cyclicity between business cycle and risk cycle. VAR estimation result indicate that shock in the risk cycle has lagged impact toward the business cycle macro risk (Table 5). On the other hand, shock in business cycle macro risk also has significant indirect impact toward risk cycle. Granger Causality test results resembles the VAR estimation result. It reveals bi-directional relationship between business cycle macro risk and risk cycle. From the result can be inferred that the risk cycle Granger-cause the business cycle macro risk. While on the opposite, the business cycle macro risk also Granger-cause the risk cycle. Based on IRF pattern, risk cycle exhibit unstable response toward shock in business cycle macro risk (Figure 10).

As for credit cycle and risk cycle, VAR estimation result indicate that shock in the credit cycle affect the risk cycle. On the opposite, shock in risk cycle also has significant impact toward credit cycle (Table 5). The result are also supported by Granger-Causality test, in which it reveals two-way relationship between credit cycle and risk cycle. From the result can be inferred that the credit cycle Granger-causes the risk cycle. While on the opposite, the risk cycle also Granger-causes the credit cycle. The IRF

pattern reveals considerably unstable response of risk cycle toward shock in credit cycle. Meanwhile at the opposite, credit cycle has stable and increasing response toward shock in risk cycle.

### 5.1.2 Tri-Cycles and Bank Performance

Estimation result from VAR and Granger Causality test reveal one-way cyclicity between business cycle macro risk and bank performance (profit). VAR estimation result indicate that shock in business cycle macro risk has impact toward bank performance (Table 6). On the other hand, as shown by the estimation result, shock in bank performance does not seem to have significant impact toward business cycle macro risk. Granger Causality test results confirm the VAR estimation result. It reveals one-way relationship between business cycle macro risk and bank performance. Business cycle macro risk granger-cause bank performance. While on the opposite, bank performance does not granger-cause business cycle macro risk. Figure 11 presents Cholesky Impulse Response Function of Tri-Cycles and bank performance. Shock in business cycle macro risk has lagged impact over bank performance. The IRF pattern show cyclical behavior of bank performance caused by the shock from business cycle macro risk.

Credit cycle has lagged impact toward bank performance as shown by estimation result (Table 6). On the other hand, shock in bank performance does not have impact toward credit cycle. Granger Causality also confirm VAR estimation result. Credit cycle granger-cause bank performance meanwhile on the opposite, bank performance does not granger-cause the credit cycle. The Cholesky IRF pattern result exhibit cyclical pattern of the response of bank performance caused by shock in credit cycle.

Shock in the the risk cycle has weak impact toward bank performance (Table 6). On the opposite, shock in bank performance does not has impact toward the risk cycle. Granger Causality test results resembles the VAR estimation result. It can be inferred that the risk cycle weakly granger-causes bank performance. While on the opposite, bank performance does not granger-causes the risk cycle. The Cholesky IRF of the risk cycle and bank performance

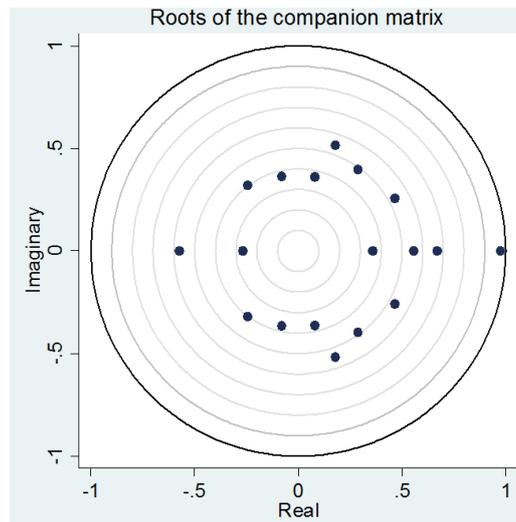


Figure 9. VAR Stability Check Result

Table 5. VAR Estimation and Granger Causality Result

Variable	VAR Estimation Result				Granger-Causality	
	Dependent	Independent	Coefficient	Prob >  z	Variable	Prob > chi2
Business Cycle Macro Risk ( $\theta_{MACRO}$ )	$\theta_{MACRO}$	$L_{-1}$	7.2628	0.002	$L \rightarrow \theta_{MACRO}$	0.000
		$L_{-2}$	-6.9603	0.015		
		$L_{-3}$	2.5197	0.035		
Credit Cycle ( $L$ )	$L$	$\theta_{MACRO-1}$	-0.0063	0.000	$\theta_{MACRO} \rightarrow L$	0.000
		$\theta_{MACRO-2}$	0.0044	0.002		
		$\theta_{MACRO-3}$	-0.0026	0.046		
Business Cycle Macro Risk ( $\theta_{MACRO}$ )	$\theta_{MACRO}$	$\theta_{BANK-1}$	-0.0054	0.665	$\theta_{BANK} \rightarrow \theta_{MACRO}$	0.024
		$\theta_{BANK-2}$	0.0044	0.766		
		$\theta_{BANK-3}$	-0.0485	0.004		
Risk Cycle ( $\theta_{BANK}$ )	$\theta_{BANK}$	$\theta_{MACRO-1}$	-0.1132	0.004	$\theta_{MACRO} \rightarrow \theta_{BANK}$	0.000
		$\theta_{MACRO-2}$	-0.0261	0.628		
		$\theta_{MACRO-3}$	-0.0030	0.953		
Credit Cycle ( $L$ )	$L$	$\theta_{BANK-1}$	0.0006	0.297	$\theta_{BANK} \rightarrow L$	0.000
		$\theta_{BANK-2}$	0.0009	0.102		
		$\theta_{BANK-3}$	0.0018	0.002		
Risk Cycle ( $\theta_{BANK}$ )	$\theta_{BANK}$	$L_{-1}$	5.6197	0.000	$L \rightarrow \theta_{BANK}$	0.000
		$L_{-2}$	1.5556	0.067		
		$L_{-3}$	1.4232	0.047		

reveals unstable response pattern of bank performance toward shock in risk cycle.

### 5.1.3 Business Cycle Macro Risk Dynamics: Credit Cycle and Risk Cycle

Figure 12 present Cholesky IRF of response of the credit cycle and risk cycle due to shock from the business cycle macro risk. The left side is the IRF of the credit cycle. Meanwhile the right side is the IRF of the risk cycle. By comparing the left picture and the right picture, it can be seen different response of the credit cycle and the risk cycle toward shock of business cycle macro risk. Credit cycle reveals stable response pattern toward shock in business cycle macro risk. Meanwhile risk cycle exhibit cyclical response toward shock in business cycle.

Comparison of these two IRF responses give comprehensive answer toward the first of two main research questions addressed by this study, especially to explain cyclical relationship of the Tri-Cycles. By the magnitude of response, the result is clear. Risk cycle tends to be more sensitive toward business cycle macro risk shock rather than credit cycle.

Meanwhile Figure 13 presents Cumulative Cholesky

IRF of the credit cycle and risk cycle in cumulative version. The IRF show negative relationship of shock in business cycle macro risk toward credit cycle. The IRF of risk cycle also show similar result. The overall impact of shock business cycle macro risk toward risk cycle is negative. Since business cycle macro risk is represented by Indonesia CDS 1Y spread, increase in the spread means contraction in business cycle macro risk. Negative relationship among business cycle macro risk and credit cycle thus has meaning of pro-cyclicality of lending behavior in Indonesia banking system. As the CDS spread increase, which is sign of increase in macroeconomic risk, means the economy is in bad condition. The condition then result in the slowing down of lending given by banks. Meanwhile for the risk cycle, which is represented by Performing Loan, increase in CDS spread will lower the performing loan level at individual bank. The result is then in line with the logic mentioned in Figure 6, where deterioration of economic condition will further give negative effect toward both bank and firm balance sheet.

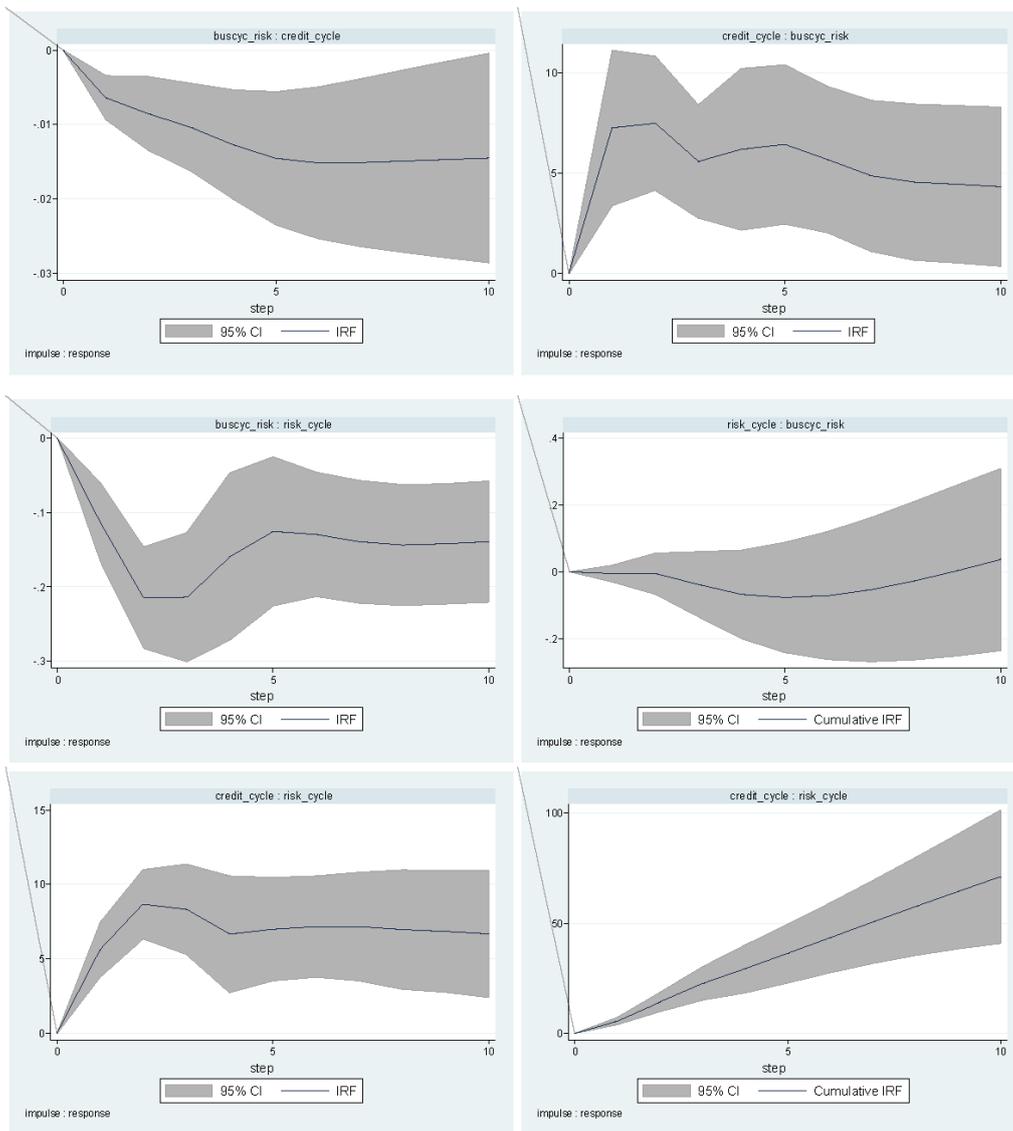


Figure 10. Tri-Cycles Dynamics

#### 5.1.4 Bank Performance Dynamics: Credit Cycle and Risk Cycle

Figure 14 presents Cholesky IRF of the response of bank performance caused by shock in credit cycle and risk cycle. The left side is the IRF describing impact in profit due to shock in the credit cycle. Meanwhile the right side is the IRF of shock in the risk cycle toward profit. By comparing the left picture and the right picture, it can be seen common response of bank performance, as represented by profit, caused by shock in the credit cycle and the risk cycle. Both credit cycle and risk cycle cause cyclical response toward bank performance. However, shock from risk cycle shows a bit more unstable response compared to shock from the credit cycle.

Comparison of these two IRF responses give answer toward the second question of two main research questions addressed by this study, especially to explain loss of profit opportunity borne by banks due to risk control and credit control regulation. By the magnitude of response, the result is clear. Bank performance tends to be more sensitive toward credit cycle shock rather than risk cycle. As presented by model of [4], bank lending is direct risk-taking action.

Bank takes more risk when it decide to give more lending. Meanwhile risk cycle can be interpreted as indirect form of risk-taking as its not only affected by credit, but also other factors. This result strengthens the notion of "high risk – high return" in banking business. So that credit-control and risk-control regulation imposed by regulator might impact the profitability of banks.

Figure 15 presents Cholesky IRF of bank performance as impacted by the credit cycle and risk cycle, in cumulative version. The IRF show negative relationship of shock in credit cycle toward bank performance. This result means that by expanding its lending, the bank takes more risk, which might lower the profitability. While the IRF of bank performance due to shock in risk cycle show positive relationship. Positive shock in risk cycle, which is represented by increase in performing loan level, will have positive impact toward bank profit. This result emphasize the importance of risk management at internal bank level both in the form of prudence credit assessment and supervision. Profit maximization at individual bank level is very sensitive toward dynamics of credit cycle and risk cycle.

**Table 6.** Estimation Result: Business Cycle and Bank Performance

Variable	VAR Estimation Result				Granger-Causality	
	Dependent	Independent	Coefficient	Prob >  z	Variable	Prob > chi2
Business Cycle Macro Risk ( $\theta_{MACRO}$ )	$\theta_{MACRO}$	$profit_{-1}$	-0.0117	0.312	$profit \rightarrow \theta_{MACRO}$	0.246
		$profit_{-2}$	0.0193	0.077		
		$profit_{-3}$	-0.0006	0.957		
Bank Performance ( $profit$ )	$profit$	$\theta_{MACRO-1}$	0.1404	0.227	$\theta_{MACRO} \rightarrow profit$	0.006
		$\theta_{MACRO-2}$	0.0275	0.827		
		$\theta_{MACRO-3}$	-0.2195	0.014		
Credit Cycle ( $L$ )	$L$	$profit_{-1}$	-0.0003	0.473	$profit \rightarrow L$	0.530
		$profit_{-2}$	0.0004	0.345		
		$profit_{-3}$	-0.0005	0.232		
Bank Performance ( $profit$ )	$profit$	$L_{-1}$	-13.8393	0.063	$L \rightarrow profit$	0.011
		$L_{-2}$	29.0063	0.003		
		$L_{-3}$	-13.4835	0.010		
Bank Performance ( $profit$ )	$\theta_{BANK}$	$profit_{-1}$	-0.0203	0.223	$profit \rightarrow \theta_{BANK}$	0.430
		$profit_{-2}$	-0.0074	0.666		
		$profit_{-3}$	0.0152	0.307		
Risk Cycle ( $\theta_{BANK}$ )	$profit$	$\theta_{BANK-1}$	0.0994	0.036	$\theta_{BANK} \rightarrow profit$	0.075
		$\theta_{BANK-2}$	-0.0363	0.524		
		$\theta_{BANK-3}$	0.0493	0.284		

## 5.2 Discussion

### 5.2.1 A Tale of Two Cycles: Business Cycle (Macro Risk) and Financial Cycle

Seminal work of BGG ([5]) has broadened the scope of business cycle literatures by promoting the important role of financial cycle in business cycle analysis. The term "Financial Accelerator" became popular and subject of many researches in macroeconomics. Financial accelerator phenomenon addresses the dynamics of financial cycle which propagates to output fluctuation. However, the formal model presented by them is not suitable enough for study at individual bank level. The framework is too macro for such study.

This study unexpectedly exhibits the financial accelerator phenomenon in Indonesia banking system in the period of 2002q1 to 2014q4. VAR estimation and Granger-Causality yield result that support the existence of financial accelerator phenomenon. However, this claim only applies in financial market context, because this study employs macroeconomic risk – rather than GDP – as representation of business cycle. VAR estimation result give a sign of significant relationship between credit cycle to business cycle macro risk and between risk cycle to business cycle macro risk.

As in [5], such phenomenon is caused by the existence of credit market frictions. In such ideal world, financial market is perfectly efficient so that every agent in economy can recalculate their decision instantly if any shock happens. Three features of credit market frictions in the BGG model are (i) money and price stickiness; (ii) lags in investment; and (iii) heterogeneity among firms. This study, even though is not specifically intended to examine BGG framework, accommodates those three features in some way. First, money and price stickiness are accounted in the estimation with net interest margin as representative of cost of fund. Second, lags in investment, which is represented by credit cycle, is accounted in the estimation which the result reveals lagged/indirect/non-contemporaneous effect between credit cycle and business cycle macro risk. Third, the heterogeneity of firms is presented by the span of the

data which cover the whole conventional bank population in Indonesia. In total, the observation covers up to 119 banks which differs significantly in term of size and market specialization. However, since BGG model is not the fundamental of this study, this study cannot infer any conclusion based on the model. There is a room for future study to examine this phenomenon with BGG model in Indonesia banking industry.

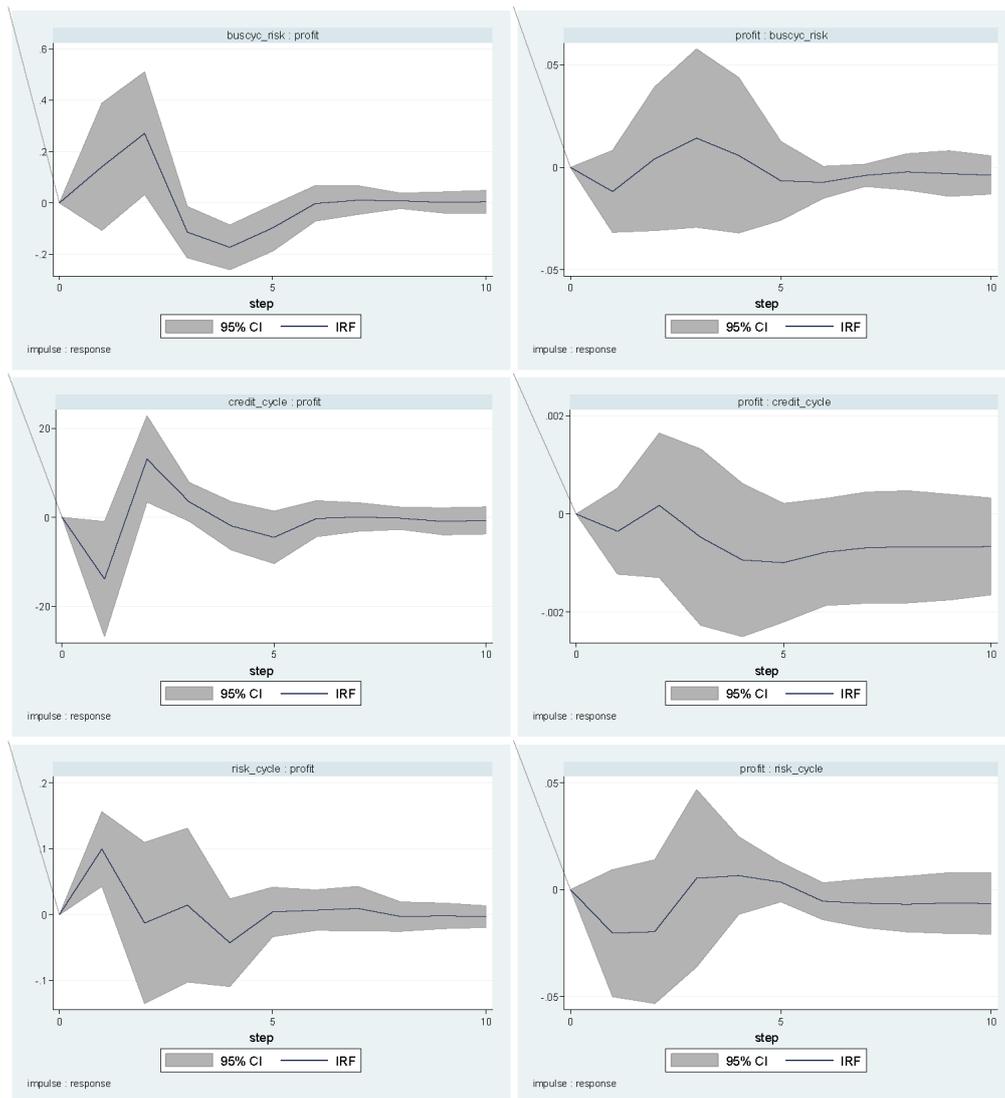
### 5.2.2 Inside the Financial Cycle: Credit Cycle and Risk Cycle

As [4] published their work about the "Seeds of Crisis", scope of the business cycle once again became more comprehensive. Financial cycle, which was solely represented by credit cycle, started to account the importance of risk dynamics. Their model talks about the process of building-up of a bubble in the economy, which then turns into crisis when it bursts.

This study only implements the beginning phase of the model presented by [4]. This study focuses on the propagation of shock in business cycle macro risk toward balance sheet of individual bank. The whole study is conducted in the business cycle context, in which all variables are extracted to its cycle component.

Estimation result exhibits pro-cyclicality behavior of the credit cycle toward business cycle macro risk. Deterioration of business condition, represented by increase in macroeconomic risk, will further decrease bank lending. When this context is about to happen, such counter-cyclical policy by the regulator is very important to prevent deeper deterioration of the economy.

Meanwhile risk cycle is shown to be unstable along the fluctuation in business cycle macro risk. The relationship is also pro-cyclical. Deterioration of business condition, represented by increase in macroeconomic risk, will further decrease the rate of performing loan. Therefore, such counter-cyclical policy which focuses on risk cycle need to be enhanced to prevent deeper contraction.



**Figure 11.** Impulse Response Function: Business Cycle Macro Risk and Bank Performance

### 5.2.3 Fund Allocation and Performance Risk

As the bank get liquidity flush resulted from business cycle swing, it has two option to increase risk; it can either simply lend more money to borrower with similar risk profile or conduct risk-shifting activity by giving credit to other borrower with worse risk profile. In other words, the bank can simply switch into riskier assets. Unfortunately the data and capability of the model applied in this study cannot observe this phenomenon closer. The only available channel to explain risk-taking activity in the model is represented by the bank distribute more credit.

This feature then make the model assume that risk in the model are solely caused from increasing amount of the credit. Meanwhile the risk profile of the projects to invested by the banks does not vary. This disadvantage gives the room for further improvement of the model. Separating low-risk project and high-risk project will make the model able to explain the risk-taking behaviour more resourceful. The dynamics of risk cycle is then no more solely depend on the growth of credit, but also structure of asset of the bank.

### 5.2.4 Liquidity and Risk-Taking

As the framework predict, we get a sign of pro-cyclicality between deposit and credit cycle. In the model, risk-taking activity is proxied by bank-lending. When the bank lend more money, that means the bank take more risk and this is the exact moment of the emergence of the seeds of a crisis. Flush of liquidity into the bank will induce risk-taking behavior, which is represented by the bank channeling more credit into the economy.

In the next episode of the model, this risk-appetite will stimulate excessive credit volume channeled into the market, which then result in asset price bubbles. However, that episode is beyond the scope of this study and is subject for further research. From bank's internal perspective, the model tells that this behavior is supposed to result in punishment if the manager of the bank get "caught" for practicing excessive lending. Another concern of the bank manager behavior in the moment of liquidity flush is that the manager might under-price of risk of projects or a credit. This will result on asset prices bubble in the long run.

Further the model also addresses a more detail aspect of excessive lending activity. The model tells that flush of liquidity into the bank will trigger excessive lending through

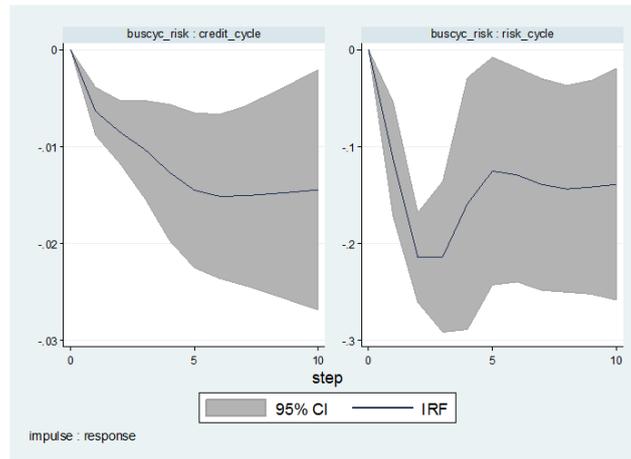


Figure 12. Response of Credit Cycle and Risk Cycle toward Shock in Business Cycle Macro Risk

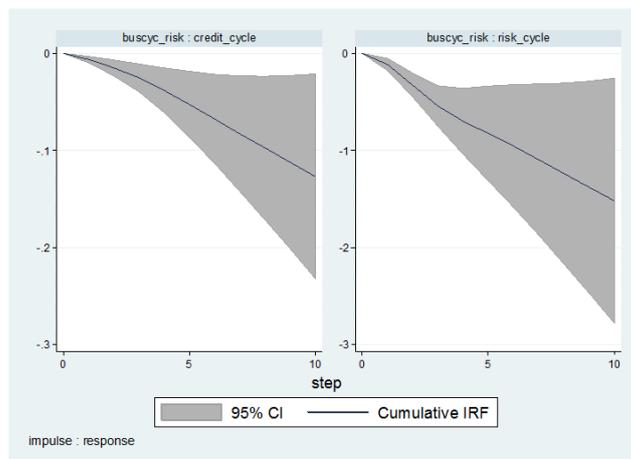


Figure 13. Cumulative Response of Credit Cycle and Risk Cycle toward Shock in Business Cycle

the bank manager will set lower rate of lending. This logic is strongly supported by the estimation result. Net Interest Margin (NIM), which represents rate of lending and deposit react negatively to shock in deposit. This counter-cyclical behavior indicate that banks tend to lower its lending rate, as shown by low NIM. The result also confirm counter-cyclical relationship of credit cycle to shock in NIM. Lower NIM will trigger over-lending and then will result on bigger compensation received by the bank manager.

At practical level, the story is more interesting. Many banks in Indonesia are outsourcing some of its activity to the third-party service provider. This behavior makes *Otoritas Jasa Keuangan* (OJK) or Indonesia Financial Service Authority impose a regulation, even though very loose, to remind banks to pay close attention about this outsourcing practice. One of the most popular practice is on marketing division, both at deposit side and credit side. The regulation states that the bank may outsource some only its low-risk activities to the third-party. Some activities on this classification for instance are call center services and telemarketing services, as clearly stated by the regulation ([6]). This regulation is a clear example that macro-prudential regulation has touched deeply into the bank daily activity. On the one hand, this regulation is a good example of comprehensive micro-prudential regulation in Indonesia. On the other hand, as much concerned by this study, every regulation has tendency to over-string bank activity, which may impact the

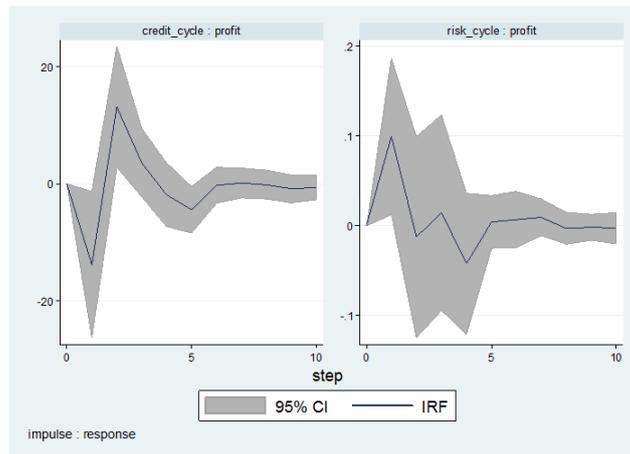
bank performance.

### 5.2.5 Performance Dynamics and Response of Banker and Regulator

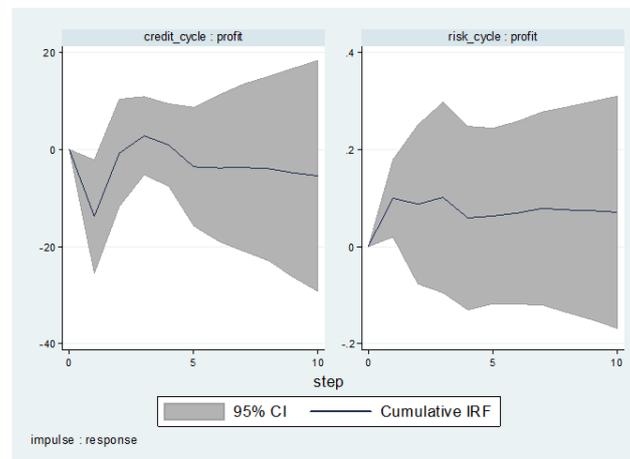
This study further contributes by accommodating bank performance dynamics in the discussion on context of the business cycle dynamics. For the bankers, profit is one of the most important barometer of their success. This notion applies since bank as a financial institution is basically similar with other business entity, in sense that their objective is to maximize profit.

The model presented by [4] is very suitable not only to discuss policy-making context, but also profit maximization behavior of the bank. The existence of relationship between Tri-Cycles and bank performance in the model make it possible to explain the sensitivity of bank performance along fluctuation of business cycle.

Business cycle, through credit cycle and risk cycle, is shown to play important role in determining bank performance (profitability). The result obtained in this study also shows that the notion "high risk - high return" applies in banking business. Therefore, regulator need to be aware of the trade-off faced in regulating the banking system. Shock in the business cycle macro risk clearly give more unstable effect toward risk cycle rather than credit cycle. The result also reveals considerably similar cyclical and unstable behavior of bank profit toward shock in credit cycle and risk



**Figure 14.** Response of Bank Performance toward shocks in Credit Cycle and Risk Cycle



**Figure 15.** Cumulative Response of Bank Performance toward shocks in Credit Cycle and Risk Cycle

cycle.

For the bank, this result means the bank needs to pay close attention to both credit cycle and risk cycle. Both variables are significant, sensitive and unstable in affecting the dynamics of profit. The role of internal audit to ensure compliance of the credit process needs to be strengthened. The separation of credit analyst authority and marketing division is one of a good example of internal control in the bank.

Meanwhile for the regulator, they clearly need to give focus on the risk cycle due to its higher sensitivity rather than the credit cycle toward a shock in business cycle macro risk. The regulation on bank lending might be made a bit more adjustable as long as the bank can maintain its NPL level.

Overall, the model presented by [4], which is applied in this study, seems to be very resourceful in addressing the dynamics of Tri-Cycles and bank performance. In the context of crisis, the model on its complete setting can be applied to examine the step-by-step of risk built-up and the burst of the bubble in the economy.

## 6. CONCLUSION

### 6.1 Tri-Cycles Dynamics and Bank Performance

The result of this study, as presented in Section 5, has successfully answered two main topics addressed. First, the dynamic cyclical relationship among the Tri-Cycles: (i) business cycle macro risk; (ii) credit cycle; and (iii) risk cycle.

Second, the dynamic relationship between the Tri-Cycles and bank performance, or exactly the profit.

Figure 16 wraps up the conclusion of this study. First, business cycle macro risk and credit cycle exhibit a two-way strong relationship, in which a shock in the credit cycle has a significant impact toward business cycle macro risk and vice versa. Second, business cycle macro risk and risk cycle show a bi-directional strong relationship. A shock in business cycle macro risk has a significant impact toward the risk cycle. However, a shock in the risk cycle only has a weak impact to business cycle macro risk. Third, credit cycle and risk cycle are both inter-dependent, which means a shock in each cycle has a significant impact toward its counterpart.

Fourth, business cycle macro risk and bank performance indicate a one-way relationship. A shock in business cycle macro risk has a weak impact to bank performance. Fifth, credit cycle and bank performance have a one-way relationship in which the credit cycle has a significant impact toward bank performance. Sixth, risk cycle and bank performance have a one-way relationship in which the risk cycle has a weak impact toward bank performance.

Seventh, when comparing the impact of a shock of business cycle macro risk toward the credit cycle and risk cycle, it can be inferred that the risk cycle is more sensitive. The Cholesky IRF reveals the response of the risk cycle toward a shock in business cycle macro risk. Last, eighth, bank performance seems to be sensitive toward both shocks of the risk cycle and

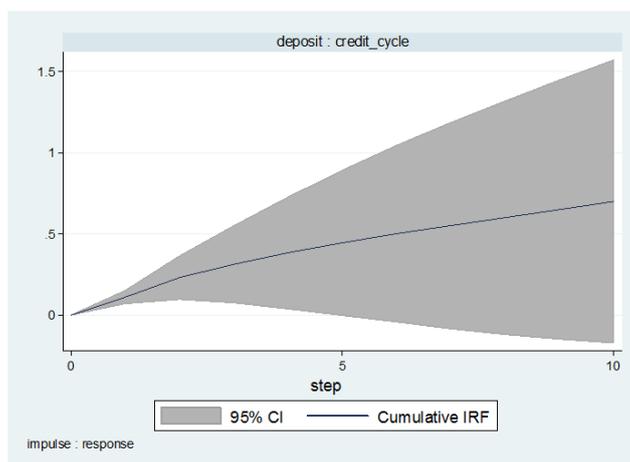


Figure 16. IRF of Credit Cycle and Deposit

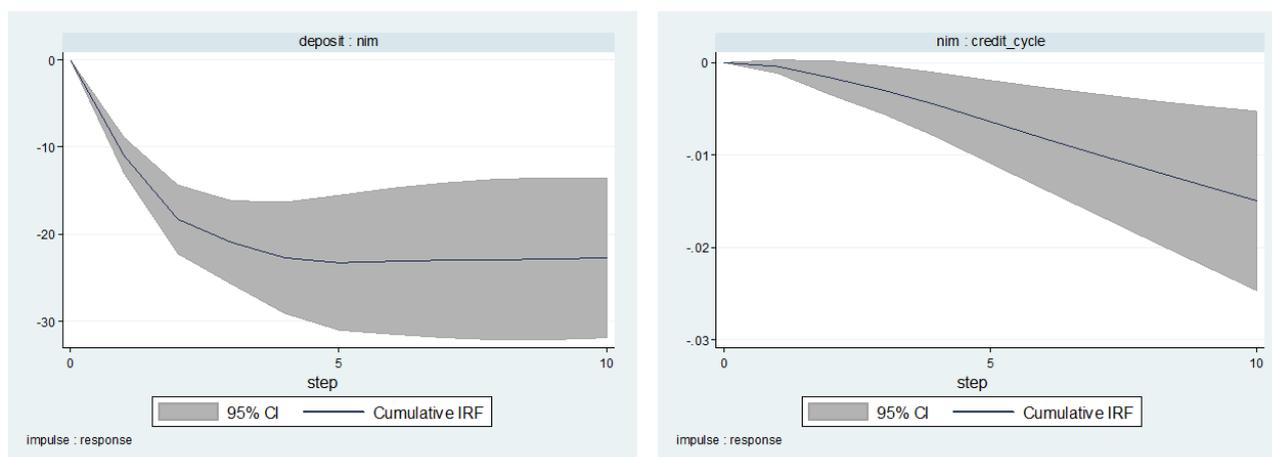


Figure 17. NIM, Deposit, and Credit Cycle

credit cycle.

## 6.2 Notable Contributions

This study exhibits the initial finding of the existence of financial accelerator phenomenon in Indonesia. The result show dynamics of financial cycle – in the form of credit cycle and risk cycle – preceded the business cycle macro risk. This study then has contributed to the business cycle literature by revealing this phenomenon especially in emerging country. This finding is very important in order to deeply understand the financial cycle characteristic in Indonesia. Further research need to extend the analysis by examining real output fluctuation, which was not addressed in this study.

This study is also one of the first to employ CDS spread as alternative representative of the business cycle fluctuation in Indonesia. Especially since previous studies mostly employed GDP as representative of business cycle fluctuation. In fact, Indonesia did not experience GDP contraction in 2007/8 financial crisis. So GDP can explain almost nothing when examining business cycle fluctuation in the episode of 2007/8 financial crisis in Indonesia.

Furthermore, most studies addressed financial cycle issue by only focusing on credit cycle. This study is then one of the first to examine financial cycle in the form of credit cycle and risk cycle at individual bank level in Indonesia. Risk cycle – besides of credit cycle – has attracted many at-

tentions after 2007/8 crisis. Credit cycle can no more solely explain the dynamics of financial cycle and its relationship with business cycle.

In term of econometrical method, this study attempted to employ a newly developed statistical package – Panel VAR/PVAR – from [1]. VAR approach which had long historical implementation in time series context is now possible to be implemented in panel context because of this package.

## 6.3 Recommendations

From the stance of the policy maker, specifically banking regulator, the result obtained in this study reveal the cyclical and unstable response of the financial cycle (credit and risk) due to shock in business cycle macro risk. The result then gives important insight for the regulator in the implementation of counter-cyclical policy to maintain the bank balance sheet stability.

For market participants, especially the bankers, this study has revealed unstable response of profit due to the shock in business cycle through the risk and credit channel. This result somewhat strengthens the existence of the notion of "high risk – high return" in the banking business. The bankers then need to give special attention in the internal bank risk cycle, along with the internal bank credit cycle. As modeled by theoretical framework used in this study, the bankers are assumed to get more bonuses by selling more credit. The bankers might need to find the alternative

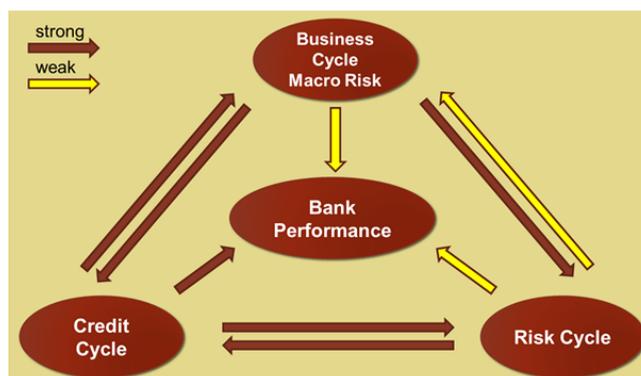


Figure 18. Result of the Study: Tri-Cycles and Bank Performance

scheme of incentive in lending system. Separation of the marketing department with the credit approval analyst is one of good example. The bankers might also consider the effectiveness of flat incentive system in credit selling. However, this study does not intend to examine these alternatives. Further research is needed to provide comprehensive discussion toward this topic.

#### 6.4 Disadvantages and Suggestion for Further Research

From the point of view of econometrical approach, Panel VAR approach employed in this study gives satisfying solution. If it seems possible, further study might explore a more complex statistical setting such as Panel VECM approach to conduct more comprehensive examination.

For further research, it might be very fruitful if the design of this research can be uplifted to cover cross-country experience, such as ASEAN countries. By doing so, the study will reveal cross-country variation of the Tri-Cycles dynamics. Such setting is very important regarding the fact that Indonesia as single country did not experience contraction in GDP cycle in financial crisis 2007/8. While other countries in ASEAN such as Singapore and Malaysia did.

Finally, recalling the complete formal model presented by [4], the design employed in this study has not yet captured the whole feature of the model. Their model essentially was designed to explain the full story of the birth of crisis, which they called as "The Seeds of Crisis". So, the story presented by this study is only the beginning phase of the complete tale covered by the model. Further research certainly need to address the model in complete setting.

## References

- [1] Michael RM Abrigo and Inessa Love. Estimation of panel vector autoregression in stata: A package of programs. *University of Hawai'i Working Paper*, 16-2. Retrieved from [http://www.economics.hawaii.edu/research/workingpapers/WP\\_16-02.pdf](http://www.economics.hawaii.edu/research/workingpapers/WP_16-02.pdf) (accessed 2017) 2015.
- [2] Bank for International Settlement. *Basel Committee for Banking Supervision*. Retrieved from <http://www.bis.org/bcbs/history.htm> (accessed 2017) 2017, January 3.
- [3] FDIC. *Federal Deposit Insurance Company*. Retrieved from <https://www.fdic.gov/bank/historical/sandl/> (accessed 2017). 2017, January 3.
- [4] Viral Acharya and Hassan Naqvi. The seeds of a crisis: A theory of bank liquidity and risk taking over the business cycle. *Journal of Financial Economics*, 106(2):349–366, 2012.
- [5] Ben S Bernanke, Mark Gertler, and Simon Gilchrist. The financial accelerator in a quantitative business cycle framework. *Handbook of macroeconomics*, 1:1341–1393, 1999.
- [6] Otoritas Jasa Keuangan. *Surat Edaran OJK Nomor 11/SEOJK.03/2017 tentang prinsip kehati-hatian bagi bank umum yang melakukan penyerahan sebagian pelaksanaan pekerjaan kepada pihak lain*. 2017.
- [7] Finn E. Kydland and Edward C. Prescott. Time to build and aggregate fluctuations. *Econometrica: Journal of the Econometric Society*, 1345–1370, 1982.
- [8] Arthur F Burns and Wesley C Mitchell. *Measuring business cycles*. 1947.
- [9] Jan Jacobs. *Econometric business cycle research: an assessment of method. Ph. D. dissertation at the University of Groningen, presented at the CCSO seminar, Groningen*, 1998.
- [10] J. Tinbergen. Econometric business cycle research. *The Review of Economic Studies*, 7(2):73–90, 1940.
- [11] Nobuhiro Kiyotaki. A perspective on modern business cycle theory. *FRB Richmond Economic Quarterly*, 97(3, Third Quarter):195–208, 2011.
- [12] David Romer. *Advanced macroeconomics, 4th Edition*. McGraw-Hill, 2012.
- [13] Ata Can Bertay, Asli Demirgüç-Kunt, and Harry Huizinga. Bank ownership and credit over the business cycle: Is lending by state banks less procyclical? *Journal of Banking & Finance*, 50:326–339, 2015.
- [14] Manuel Arellano and Stephen Bond. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58(2):277–297, 1991.
- [15] Richard Blundell and Stephen Bond. Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1):115–143, 1998.

- [16] Frank Windmeijer. A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics*, 126(1):25–51, 2005.
- [17] Giovanni Ferri, Panu Kalmi, and Eeva Kerola. Does bank ownership affect lending behavior? Evidence from the Euro area. *Journal of Banking & Finance*, 48:194–209, 2014.
- [18] Mansor H. Ibrahim. Business cycle and bank lending procyclicality in a dual banking system. *Economic Modelling*, 55:127–134, 2016.
- [19] Bambang Pramono, Januar Hafidz, Justina Adamanti, Maulana Harris Muhajir, and Muhammad Sahirul Alim. Dampak kebijakan countercyclical capital buffer terhadap pertumbuhan kredit di Indonesia. *Working Paper Bank Indonesia, WP/4/2015*, 2015, Desember.
- [20] Jack Glen and Camilo Mondragón-Vélez. Business cycle effects on commercial bank loan portfolio performance in developing economies. *Review of Development Finance*, 1(2):150–165, 2011.
- [21] Alaa Guidara, Issouf Soumaré, Fulbert Tchana Tchana, et al. Banks' capital buffer, risk and performance in the Canadian banking system: Impact of business cycles and regulatory changes. *Journal of Banking & Finance*, 37(9):3373–3387, 2013.
- [22] Chaiporn Vithessonthi and Jittima Tongurai. Financial markets development, business cycles, and bank risk in South America. *Research in International Business and Finance*, 36:472–484, 2016.
- [23] Maria Psillaki and Emmanuel Mamatzakis. What drives bank performance in transitions economies? The impact of reforms and regulations. *Research in International Business and Finance*, 39:578–594, 2017.
- [24] Alvian Chandra Winata and Viverita. *Analisis pengaruh struktur pendapatan bank terhadap market-based performance: Studi empiris bank yang terdaftar pada Bursa Efek Indonesia periode 2004–2012*. Universitas Indonesia, 2013.
- [25] Badi Baltagi. *Econometric analysis of panel data, 3rd Edition*. John Wiley & Sons, 2005.
- [26] Adrian Colin Cameron and Pravin K Trivedi. *Microeconometrics using stata*, volume 5. Stata press College Station, TX, 2009.
- [27] Damoder N. Gujarati. *Basic econometrics, 5th Edition*. McGraw-Hill, 2009.
- [28] Fabio Canova and Matteo Ciccarelli. Panel vector autoregressive models: A survey. *European Central Bank Working Paper Series*, 507, 2013, January.

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