



Estimating Systemic Risk and Interconnectedness of Islamic Banks: Evidence from Indonesia

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Abstract: This research is designed to provide an analysis of the systemic risk of Islamic banks in Indonesia. As primary consideration in the systemic risk is the interconnectedness of financial institutions, this research proposes a novel method to measure the interconnectedness between the stability of Islamic banks by developing an econometric model for the indicator of individual banks' soundness. In order to measure of systemic risk, this research develops a Vector Auto Regression (VAR) econometric model for the z-scores of Islamic banks in order to analyse the interconnectedness between stability Islamic banks in the data sample and determine the systematically important bank in the Islamic banking industry afterwards. Based on the VAR model results, the stability of Bank Syariah Mandiri, as the biggest Islamic bank and the second Islamic bank in Indonesia, in the previous month consistently influences three other Islamic banks in addition to its own stability. Furthermore, considering the VAR model is a novel method in measure a systemic risk, this finding also prove that the VAR model is a robust method as its finding also confirmed by additional information such as total asset and the trajectory of the development of the Islamic banks in Indonesia.

Keywords: Financial Stability, Systemic Risk, Interconnectedness, Islamic Bank, Econometric, Vector Auto Regression.

JEL Classifications: C51, G21, G24

1. Introduction

The financial sector in Indonesia is dominated by the banking industry, which constitutes 80 percent of total assets of this sector. The banking industry in Indonesia applies a dual banking system, in which Islamic banks coexist with conventional banks. Bank Muamalat Indonesia, as the first Islamic bank, started to operate in 1992 to provide Islamic financial services as an alternative to conventional financial services. After Indonesian monetary crisis 1998, Bank Syariah Mandiri started to operate as the first government-owned Islamic bank in October 1999. The demand on Islamic banking services increased significantly subsequent to the Indonesian Muslim Scholar Council (MUI) issued a verdict on the prohibition of interest as riba transaction in 2003. As the response, Bank Mega Syariah was established by converting a conventional bank (Bank Umum Tugu) to the Islamic bank in July 2004. The significant growth of the Islamic bank in Indonesia found its moment after a dedicated Islamic Banking Act was issued in 2008. Following this supportive regulatory environment, eight Islamic banks started to operate from January 2009 to October 2010.

The development of Islamic banking in Indonesia has demonstrated a significant growth trend. The data from Indonesian Financial Services Authority (2015a) indicates that the total asset held by Islamic banks had increased over than 13 times from Rp20.8 trillion in 2005 to Rp272.5 trillion by the end of 2014 with 33.4 percent the average annual growth. As a comparison, the average annual growth



of total asset held by the banking industry in Indonesia recorded 16.1 percent for the same period (Indonesian Financial Services Authority, 2015b). In addition to this significant growth, Islamic banks in Indonesia tend to had better recovery compared to conventional banks after the Indonesian monetary crisis of 1997 – 1998, as indicated by the comparatively low of non-performing financing (NPF) ratio (Bank Indonesia, 2002). Reflecting the recent global financial crisis, Islamic banks in Indonesia seem to be more resilience as indicated by a relatively high growth performance and low level of NPF (Bank Indonesia, 2009).

Despite its severe impact, the latest global financial crisis has reinitiated the focus on the financial stability of Islamic banks, especially on their resilience during the global financial crisis (Hasan and Dridi, 2011). In a growing literature of Islamic banking, many empirical researches have been conducted to test the stability of Islamic banks in the time of the global financial crisis. The first empirical research that assessing the financial stability of Islamic banks was introduced by Čihák and Hesse (2010), which evaluates the financial stability of conventional banks and Islamic banks in 20 countries. This study becomes an important reference for other empirical researches, such as Abedifar (2013), Beck, et.al (2013), and Turk-Ariss (2010).

In the term of financial stability, the recent global financial crisis also has pointed out the importance to measure a systemic risk and the notion of a macro-prudential policy to deal with the financial system distress (Banulescu and Dumitrescu, 2015). A basic consideration of the systemic risk measures is the interconnectedness of financial institutions, which may increase the fragility of the entire system (Galati and Moessner, 2011). As the response of growing studies related to systemic risk measures, Bisias et.al (2012) conducted the survey and demonstrates 31 measures of systemic risk in the literature of economic and finance. They suggest there is no single systemic risk measure has been agreed as the systemic risk involves complex issues in the dynamic financial environment with the result the specific measurement of systemic risk depends on the preferences of regulators. Accordingly, Moreno and Pena (2013) argue that the simpler measure of a systemic risk is the better measure because it helps policymakers to take immediate action and might be applied as an element of an early warning system that will alert them when systematically important bank deals with the financial distress situation.

This research is designed to provide an analysis of the systemic risk of Islamic banks in Indonesia. As primary consideration in the systemic risk is the interconnectedness of financial institutions which may endanger the stability of the entire financial system, this research propose a novel method to measure the interconnectedness between the stability of Islamic banks by developing a Vector Auto Regression (VAR) econometric model for the z-score as the indicator of individual banks' soundness.

In order to reach the aim, some objectives of the research need to be set. The first objective is to calculate the z-score as the indicator of individual Islamic bank stability as the main variable in order to measure systemic risk in Islamic banking industry. The second objective is to measure systemic risk by developing VAR economic models to demonstrate the interconnectedness between stability Islamic banks and determine the systematically important bank in the Islamic banking industry. And the last objective is to test whether macroeconomic variables as controlling variables affect the VAR economic models in order to understand the economic linkage between Islamic banking industry and the macroeconomic environment.

This research contributes to the literature in three ways: (i) provides the first analysis of systemic risk of Islamic banks, especially at the country-level of Indonesia, (ii) provides a novel method to measure systemic risk by using VAR econometric model for the z-scores in order to understand the interconnectedness of the stability between Islamic banks, and (iii) assists the policymakers with the simple method of systemic risk analysis as an element of an early warning system in order to manage the financial distress situation.



2. Literature Review

2.1. Islamic Banking and Financial Stability

Islamic banking industry grows as one of the most rapid sectors in the financial industry, in the term of numbers and size, which has become systematically important in several countries and cannot be neglected in other countries (Hasan and Dridi, 2011). In some countries, the whole banking system is based on Islamic principles such as Pakistan and Iran. The other countries apply a dual banking system, in which Islamic banks coexist with conventional banks like in Indonesia and Malaysia. The rapid growth of the Islamic banking industry can be driven by several factors such as a growing demand for Islamic financial products, a strong demand from conventional investors for the diversification objectives, and an improvement of the supportive regulatory framework for the Islamic banking industry (Khediri et al, 2015).

The main distinct features of Islamic banking can be identified from its five basic principles, which derived from Islamic rules and laws as a legal framework for Islamic economic activities. (1) The prohibition for the Islamic bank to involve with interest based transactions (*riba*) as a premium that must be paid to the lender by the borrower in addition to the principal amount (Ayub, 2002). (2) The prohibition for the Islamic bank to conduct an excessive uncertainty transaction (*gharar*) and an excessive risk or gambling (*maysir*) such as speculative-related transactions (Thomas, 2006). (3) The prohibition on financing for illegitimate (non-halal) business activities that are not compliance with Islamic laws and rules such as prostitution or drugs (Kahf, 2003). (4) All transactions in Islamic banking should have real economic underlying transactions that involve the tangible asset (Iqbal and Mirakhor, 1987). (5) The profit and loss sharing (PLS) principle as one of the most essential features of Islamic banking, in which the entitlement to obtain profit is linked to the responsibility of loss (Obaidullah, 2005).

The product of an Islamic bank can be developed based on PLS principle such as equity participation (*musharaka*) and trustee finance (*mudharaba*) or based on mark-up principles such as cost-plus financing (*murabaha*), leasing (*ijara*), cash in advances for the agricultural product purchasing (*salam*) and commissioned manufacture (*istisnaa*). In an ideal Islamic banking model, PLS assets would reflect sound investment generating economic growth and sharing risks of assets by the liability side makes an Islamic bank tends to be more stable than a conventional bank because losses will be covered by profit sharing investment account (PSIA) and capital (Ahmed, 2011). Therefore, from the information given above, it can be seen that the Islamic banking model is an investment intermediary bank rather than just a commercial bank.

An Islamic bank also has an additional feature that distinguishes from its conventional counterparts since it has a sharia supervisory board (SSB) as a sharia compliance supervisor in order to ensure that its products and business activities comply with Islamic laws and principles (Iqbal and Mirakhor, 2007). Despite the fact that the existence of the SSB within the organisation is not mandatory in some countries' jurisdiction, the majority of Islamic banks are required to have SSB within the organisation (Chapra and Ahmed, 2002). Some countries like Indonesia and Malaysia have a centralised SSB in the national level, which provides a supervisory of sharia-related issues of the product in particular and the Islamic banking sector in general (Ahmed, 2011). Accordingly, as the member of SSB in the national level does not involve in organisational operation, they can be expected to be able to promote the products that ensure the stability of the Islamic banking sector.

Finally, Islamic bank as a religious based institution, which has rooted in the developmental aims, expected not only providing services for the market but also promoting the development of societies (Asutay, 2012). Islamic bank also should emphasize on the optimal utilisation of resources, the equitable use and distribution to promote justice (Chapra, 1992). Consequently, "being a part of



the moral economy and following the sharia principles, Islamic bank has to conform not only to the national laws and statutes, but also to the Islamic law of contracts at the transactions level with the result that being ethical is required of an Islamic bank, not just expected.” (Ahmed 2012, p.1).

The global financial crisis has demonstrated that the interconnected and complex financial institutions may endanger the stability of the financial system, which point out the concept of too systemic to fail financial institutions (Bongini et.al, 2015). Accordingly, understanding Islamic banking from the financial stability perspective becomes more important for the reason that Islamic banks may become systematically important as it grows and interacts increasingly with systematically important conventional banks (Solé, 2007). The proponents of Islamic finance suggest that the application of Islamic principles associated to finance and economics may prevent the global financial crisis (Ahmed, 2009). In the Islamic finance system, debt cannot be traded for the reason it can lead to *riba* with the result product like collateralized debt obligations are prohibited. Moreover, the derivative product like credit default swaps are prohibited for the reason the existence of *gharar*. However, the practice of Islamic banking is deviating from its theoretical business model and replicating its conventional counterpart, in which its financial transactions are dominated by non-profit loss sharing transactions (Dar and Presley, 2000 and Chong and Liu, 2009). Consequently, by replicating conventional banking modes of transaction, Islamic banking can potentially end up with the similar situation faced by its conventional counterparts.

Many empirical researches in the growing literature of Islamic banking have been conducted from a wide-ranged perspective. An empirical research that directly examines the financial stability of Islamic banks is introduced by Čihák and Hesse (2010) by using the z-score to measure the level of individual bank stability, which indicates that Islamic banks have higher stability compared to conventional banks at the time of the global financial crisis in 18 countries. This research becomes an important reference for other cross-countries empirical studies, which examine the stability of Islamic banks such as Turk-Ariss (2010) in 13 countries, Beck et.al (2013) in 22 countries, and Abedifar (2013) in 24 countries. By using the z-score as the indicator of individual bank stability, these researches indicate consistent findings, in which Islamic banks are relatively more stable than conventional banks. This research attempts to contribute to the existing literature by examining the financial stability of the Islamic bank at the country level as comparison to the existing cross country literature. At the country level, by using the z-score indicator Gamaginta and Rohim (2011) compares the financial stability between conventional banks and Islamic banks in Indonesia. Different with Gamaginta and Rokhim (2011) which only includes 5 Islamic banks as the data sample, this research include 10 Islamic banks as the data sample with more recent time periods. In addition, this research also proposes a novel approach for measuring systemic risk for Islamic banking industry.

2.2. Measuring Systemic Risk

The current global financial crisis has revealed that the failure of interconnected financial institutions may undermine the stability of the entire financial system, which point out importance to manage and measure a systemic risk (Bongini et.al, 2015). Billio, et.al (2010) suggests the definition of a systemic risk as a circumstance that endangers the stability of the financial system. European Central Bank (2010) describes a systemic risk as a risk of instability of the financial institutions, which endangers the functioning of a financial system, in which welfare and economic growth materially suffer. Other systemic risk researches have focused on more specific issues, such as disruptions of information (Mishkin, 2007), information feedback behaviour (Kapadia et.al, 2009), imbalances (Caballero, 2009), asset bubbles (Rosengren, 2010), correlated exposures (Acharya et.al, 2010), and contagion (Moussa, 2011). Given literature discussion above, it is an encouraging sign that a basic consideration of systemic risk analysis is the interconnectedness between financial institutions and their collective exposure, which



could raise the fragility of the entire financial system (Galati and Moessner 2011).

In order to measure systemic risk, many studies have been conducted from a wide diversity point of view. Bisiyas et.al (2012) provides a survey of 31 measures of systemic risk in finance and economic literature. They suggest that the specific measurement of systemic risk depends on the preferences of regulators in order to overcome the financial system problem from divergent perspective. According to Moreno and Pena (2013), the simpler measure of a systemic risk is better for the reason it can assist the policymakers to take immediate action and might be applied as an element of an early warning system that will alert them when systematically important bank deals with the financial distress situation.

2.3. Vector Auto Regression (VAR)

This research proposes a novel method to measure a systemic risk by developing a Vector Auto Regression (VAR) econometric model for the z-score as the indicator of individual banks' financial stability. Vector Auto Regression (VAR) model is "a simple multivariate model, in which each variable is explained by its own past values and the past values of all the other variables in the system" (Holden 1995 p.159). The VAR model was introduced in econometrics literature by Sims (1980) as an alternative to large-scale simultaneous equations structural models in order to represent a causal chain. Sims (1980) argues that the VAR model can be seen as an unrestricted reduced form from a structural model because the restrictions that enforced on the economic models derived from economic theory are usually not valid with the result it is better to let the data define the model.

The advantage of the VAR model is the researcher is not required to specify which variables are exogenous or endogenous because all variables are endogenous (Brook 2014). The only assumptions required in this estimation are that the researcher has an appropriate list of the relevant variables and understand the form of data such as levels or differences, in which they are to appear (Holden 1995). The optimum lag length can be empirically defined by a simple lag criteria test after the estimation of the equation (Sims 1980). In addition, the estimation generated by the VAR model is often better than traditional structural models as indicated by McNees (1986), which indicates that the estimation for some variables such as the US real gross national product and unemployment rate produced is more accurate by using the VAR model compared to several different structural models. A possible limitation of the VAR model compared to other models are it uses little theoretical information about the relationship between the variables to guide the specification of the model (Brook, 2014).

By using VAR model analysis, this research tried to demonstrate the interconnectedness between z-score of each bank in order to measure the systemic risk and determine the systematically important bank afterwards. Compared to other measures, this approach is a simpler and more convenient method as it relies on the monthly financial statement of individual banks, which has been published and can be easily accessed. This simple measure is in line with the recommendation of Moreno and Pena (2013), which suggests that the simpler measure of a systemic risk is better for the reason it can assist the policymakers to take immediate action and might be applied as an element of an early warning system that will alert them when systematically important bank deals with the financial distress situation.

3. Data and Methodology

This research focuses on the Islamic banking industry in Indonesia by using monthly data observation for 10 Islamic banks from May 2010 – June 2015. One Islamic bank, namely Maybank Syariah, is excluded from the observation for the reason it operates less than five years. This research focuses on the country-level data of Islamic banking in Indonesia to get a more profound understanding of a systemic risk in a particular country since every country has its own developmental and regional contexts as the result of the different regulatory framework (Karwowski, 2009). As the controlling variables, this research also includes macroeconomic variables GDP growth as the indicator of national



economic growth, inflation as the indicator of price movement and purchasing power, money supply (M2) growth and Bank Indonesia rate as the indicator of monetary policy in addition to the main variable of individual bank stability, which measured by using the z-score indicator. The individual Islamic banks' financial data used in this research is retrieved from the Bank Indonesia database of banking monthly financial statement available on its official website. In addition, data of macroeconomic variables collected from the Indonesian bureau of statistics and Bank Indonesia database available on their official website.

The primary variable in this research is the z-score as a measure of stability of the individual bank. The z-score has become a widely used measure for the individual bank soundness for the reason it is inversely related to the probability of default of the bank (Maechler et.al, 2005). In order to measure systemic risk, this research use Vector Auto Regression (VAR) model as "a simple multivariate model, in which each variable is explained by its own past values and the past values of all the other variables in the system" (Holden, 1995 p.159). The VAR model was introduced in econometrics literature by Sims (1980) as an alternative to large-scale simultaneous equations structural models in order to represent a causal chain. In order to set the scene, a simple VAR model to explain the z-score variables in this research is given by the following equation:

$$Y_{1t} = \beta_{10} + \beta_{11}Y_{1t-1} + \beta_{12}Y_{2t-1} + v_{1t}$$

Where Y_{1t} is a proxy of variable for z-score of the bank 1 at the time t and Y_{2t} is a proxy of variable for z-score of the bank 2 at the time t . Accordingly, the equation above indicates that the economic variables were observed, namely z-score influence each other. Furthermore, this research also includes macroeconomic variables as noted by the following equation:

$$Y_{1t} = \beta_{10} + \beta_{11}Y_{1t-1} + \beta_{12}Y_{2t-1} + \gamma_1 M_{t-1} + v_{1t}$$

Where M_{t-1} is a vector of macroeconomic variables which consists of GDP Growth variable as the growth rate of nominal growth national product (GDP), adjusted for inflation, Inflation variable as a year on year change of Consumer Price Index (CPI), M2 growth variable as a representation of money supply, which includes cash, saving deposits and demand deposits, and Bank Indonesia rates variable as the benchmark interest rate.

4. Analysis and Discussion

In order to measure a systemic risk in the Islamic banking industry, this research applies the VAR econometric model for the z-scores of overall Islamic banks in data observation. Based on the VAR estimation result for overall the z-scores of Islamic banks in the data sample, it can be seen the interconnectedness of each Islamic bank in the data sample. At 5% significance level, it is an encouraging sign that the z-scores of Bank Syariah Mandiri (BSM) influence three other Islamic banks, namely Bank Central Asia Syariah (BCAS), Bank Rakyat Indonesia Syariah (BRIS), Bank Syariah Bukopin (BSB) in addition to its own z-scores as shown in Table 1. The z-score of BCAS, BRIS and BSB influence the z-scores of the other Islamic bank at 5% significance level. On the other hand, it is also interesting to note that Bank Muamalat Indonesia (BMI), the first Islamic bank in the country second largest Islamic bank in Indonesia, not influence the z-score of other Islamic banks. The other three z-scores of Islamic banks namely Bank Negara Syariah (BNIS), Bank Panin Syariah (BPS), and Bank Victoria Syariah (BVS) also not influence the z-score of other Islamic banks. In addition, the z-scores of Bank Mega Syariah (BMS) influence two other z-scores of Islamic banks, however, its f-statistic values are below 5% significance level.

The z-score of BSM has positive correlation with the z-scores of Bank Syariah Bukopin (BSB) and Bank Central Asia Syariah (BCAS), which means that a higher stability of BSM will lead to a higher



stability of BSB and BCAS in the next month. By looking at their profile, BSM, BCA and BSB have similar financing schemes, which dominated by murabaha scheme with the average share during the observation period 90.82%, 89.64% and 85.84% respectively. On the other hand, the z-score of BSM has negative correlation with the z-score of BRIS, which means that the stability of BSM has inverse relationship with the stability of Bank Rakyat Indonesia Syariah (BRIS) in the next month. It is also important to note that BRIS has a unique characteristic compared to other Islamic banks in the data sample, in which it does not focus on the murabaha scheme only as indicated by its average share of the murabaha scheme that relatively low with 44.38% during the observation period.

From the result obtain above, in which BSM consistently influence the other Islamic banks in both of the VAR models, it can be clearly be concluded that BSM is the systematically important bank among Islamic banks in the data sample. Accordingly, based on the Financial Stability Board (2009), a systematically important bank is defined as the institution “which disorderly failures, because of complexity and systemic interconnectedness, would causes significant disruption to the wider financial system”. By considering the development of Islamic banks in Indonesia that still recently developed with a limited number of players, the stability of BSM become very crucial in the Islamic banking industry. Therefore, from the VAR model estimation results, the definition from Financial Stability Board and considering the contextual of development of the Islamic banking industry, it can be clearly concluded that BSM is the systematically important bank in the Islamic banking industry.

Furthermore, as the consequence of being the systematically important bank, Bongini et.al (2015) suggests the financial institution should have a higher loss absorption capacity compared to others as it will get bailed out by the government in the systemic financial distress situation. Accordingly, BSM should have a high level loss absorption capacity, which make it ready to deal with the financial distress situation. Based on its latest financial statement in the June 2015 capital adequacy ratio of BSM is 14.76% (BSM Annual Report 2014). At the institutional level, BSM not only deal with Financial Service Authority as the micro-prudential regulator and supervisor, but also deal with Bank Indonesia as the institution with the macro-prudential responsibility.

In addition, it is interesting to note that BMI as the first Islamic bank with the second largest total asset apparently does not play a significant role in the interconnectedness of the stability of the Islamic banking industry. Based on the first VAR model which includes the overall Islamic bank in the data sample, BMI does not influence the stability of other Islamic banks and vice versa. It is also intriguing that BMI is the only Islamic bank that not a part of conventional bank groups in the data sample. The most obvious impact of this condition is BMI cannot easily involve in the banking payment system. The other Islamic banks can use the infrastructure of their parent company, which are conventional banks. For example, as part of Bank Mandiri (BM) group, the biggest bank in Indonesia, BSM can utilise the infrastructure of BM such as automatic teller machines (ATM) network, which one of the largest ATM network with 15.444 machines in 2014 (BM Annual Report, 2014).

By using macroeconomic variables as the controlling variables, this research indicates that interconnectedness between the stability of Islamic banks in the data sample demonstrates consistent findings with the previous VAR model estimation. In the 5% significance level, the z-score of BSM constantly influence all Islamic banks' z-score, except for the z-score of BJBS, in which it has positive correlation with the z-scores of BSB and BCAS, and has negative correlation with the z-score of BRIS. This consistent result can be understood by considering that this research is focusing on the country level data, in which the macroeconomic variables are same for all Islamic banks in the data sample. Therefore, it could be suggested that macroeconomic variables do not affect the interconnectedness between the stability of Islamic banks in the data sample. Given this result, it is clear that BSM can be considered as the systematically important bank in the Islamic banking industry.

**Table 1: VAR Estimation for Z-Scores of the Selected Islamic Bank**

Vector Autoregression Estimates

Date: 08/03/15 Time: 02:39

Sample (adjusted): 2011M07 2015M06

Included observations: 48 after adjustments

Standard errors in () & t-statistics in []

	D(BSM)	D(BRIS)	D(BSB)	D(BCAS)	D(BJBS)
D(BSM(-1))	0.825875 (0.22484) [3.67324]	-0.416768 (0.17849) [-2.33500]	3.038865 (1.55974) [1.94831]	2.538886 (1.33232) [1.90561]	0.070353 (0.24798) [0.28370]
D(BRIS(-1))	0.067777 (0.20435) [0.33167]	-0.128163 (0.16222) [-0.79003]	0.883064 (1.41762) [0.62292]	-0.681141 (1.21093) [-0.56249]	0.188777 (0.22538) [0.83758]
D(BSB(-1))	-0.144902 (0.03256) [-4.45098]	0.004490 (0.02584) [0.17374]	-0.728482 (0.22584) [-3.22562]	-0.117170 (0.19291) [-0.60737]	0.007755 (0.03591) [0.21599]
D(BCAS(-1))	0.001782 (0.02558) [0.06968]	0.009334 (0.02031) [0.45961]	0.149154 (0.17747) [0.84047]	-0.068679 (0.15159) [-0.45305]	0.000614 (0.02821) [0.02175]
D(BJBS(-1))	0.045849 (0.12999) [0.35273]	-0.060349 (0.10319) [-0.58484]	-0.282724 (0.90174) [-0.31353]	-0.408522 (0.77026) [-0.53037]	-0.362989 (0.14336) [-2.53192]
C	-0.633127 (1.64853) [-0.38406]	0.830937 (1.30870) [0.63493]	-2.935143 (11.4363) [-0.25665]	-5.212966 (9.76881) [-0.53363]	0.217535 (1.81821) [0.11964]
R-squared	0.327690	0.246384	0.225061	0.183637	0.157038
Adj. R-squared	0.247653	0.156668	0.132806	0.086451	0.056685
Sum sq. resids	5427.206	3420.281	261186.7	190575.2	6601.965
S.E. equation	11.36746	9.024148	78.85893	67.36100	12.53753
F-statistic	4.094240	2.746266	2.439556	1.889536	1.564857
Log likelihood	-181.5805	-170.4997	-274.5520	-266.9875	-186.2832
Akaike AIC	7.815856	7.354154	11.68967	11.37448	8.011799
Schwarz SC	8.049756	7.588054	11.92357	11.60838	8.245699
Mean dependent	-0.537574	0.848227	-2.487024	-6.210493	0.195129
S.D. dependent	13.10553	9.826684	84.68231	70.47621	12.90873
Determinant resid covariance (dof adj.)		1.29E+13			
Determinant resid covariance		6.62E+12			
Log likelihood		-1049.040			
Akaike information criterion		44.96001			
Schwarz criterion		46.12951			

Source: Author own estimation

Furthermore, it is also important to note that the trajectory of development Islamic banking industry apparently shapes a unique model of Islamic banking in Indonesia. As the biggest Muslim country in the world, Islamic finance arrived somewhat later in Indonesia than it did in other Muslim-majority countries for the reason that it was linked to radicalism and extremism under the regime of the second president, Soeharto (Venardos 2006). The first and the only Islamic bank under the Soeharto regime is Bank Muamalat Indonesia (BMI), which established in 1992 promoted by the Association of Indonesian Muslim Intellectuals (ICMI) as the manifestation of the struggle of the Indonesian Muslim



middle class (Hefner 1993). After monetary crisis 1998 and the national succession, BSM started to operate as the first government-owned Islamic bank in October 1999. Bank Mega Syariah (BMS) was established in 2004, following the verdict of the Muslim Scholar Council (MUI), which clearly stated interest as *riba* in the financial transaction. However, the most important moment in the Islamic banks' development is the issuance of the Islamic Banking Act in 2008, which followed by the establishment of eight Islamic banks during January 2009 to October 2010.

The unique trajectory development of Islamic banking in Indonesia apparently influences the high level of variance development of Islamic banking industry. BSM, as the second Islamic bank and the first government owned Islamic bank, grows as the biggest Islamic bank in Indonesia, with total asset Rp64.05 trillion and the 865 branch offices in 2014 (BSM Annual Report 2014). Following BSM, the total asset of BMI as the first Islamic is recorded Rp62.41 trillion in 2014 with the 914 branch offices in 2014 (BMI Annual Report 2014). The other Islamic banks which started to operate after Islamic Banking Act 2008 indicate relatively small total asset compared to BSM and BMI, in which their total asset average in 2014 is Rp8.82 trillion (Financial Services Authority 2015a). The smallest Islamic bank in the data sample is Bank Victoria Syariah (BVS) with Rp1.44 trillion in 2014 and the 19 branch offices, which operated only at 10 cities since February 2010 (BVS Annual Report 2014). Given this, it could be suggested that the high level of variance of the total asset of Islamic banks is affected by their starting period, in which the Islamic banks that started earlier tend to have a higher total asset than the later Islamic banks. The unique trajectory of development of Islamic banks highly influence the high level of variance of total asset, in which the time different between two biggest Islamic banks and the other Islamic banks can reach more than ten years.

Consequently, by considering the development of Islamic banks in Indonesia that still recently developed with a few players, in which BSM grows as the biggest Islamic bank, the stability of BSM become very crucial in the Islamic banking industry. Therefore, from the VAR model estimation results and considering the contextual of development of the Islamic banking industry, it can be clearly concluded that BSM is the systematically important bank in the Islamic banking industry. Based on the VAR model analysis which includes the macroeconomic variables namely economic growth, inflation, money supply and BI rate, it is an encouraging sign that the interconnectedness of the stability of Islamic banks in the data sample is not affected by macroeconomic variables. Given this, it could be suggested that the Islamic banking industry is not fully integrated into the economic system since it is recently developed with a limited number of players and small share in the overall banking industry in Indonesia.

By referencing to the classic economic literature, Islamic bank should promote economic well-being with the maximum rate of economic growth, justice distribution of wealth, and full employment, in which its activities are embedded in the real economy (Ahmad 1978; Siddiqi 1981; Naqvi 1981; Chapra 1992). However, from the result given above, it is an encouraging sign that Islamic banks tend to deviate from their ideal business model. Islamic banks in the data sample seem more focus on consumer financing, which entails less risk and less multiple effect on the real economy rather than productive financing as indicated by their high level of the share of the *murabaha* scheme. Among others, only BRIS which focuses on the productive financing as indicated by the higher level of share non-*murabaha* financing. This result also in line with the existing literature, which indicates that Islamic banks are replicating the conventional banking business model (Aggarwal and Yousef, 2000; Dar and Presley, 2000; and Chong and Liu, 2009).



4. Conclusions and Policy Implication

Based on the VAR model results of the z-score of Islamic banks in the data sample, it can be clearly demonstrated the interconnectedness of each Islamic bank, in which the stability of BSM in the previous month consistently influences three other Islamic banks in addition to its own stability. Accordingly, from the VAR model estimation results, and the contextual development of the Islamic banking industry, it can be clearly concluded that BSM is the systematically important bank in the Islamic banking system. Furthermore, considering the VAR model is a novel method in measuring a systemic risk, this finding also prove that the VAR model is a robust method as its finding also confirmed by additional information such as total asset and the trajectory of the development of the Islamic bank in Indonesia.

As the policy implication, BSM should have a higher loss absorption capacity compared to others Islamic banks as it will get bailed out by the government in systemic financial distress. At the institutional level, BSM should comply with the macro-prudential policy under Bank Indonesia as the central bank, in addition to Financial Service Authority's micro-prudential regulations.

Furthermore, it could be suggested that the Islamic banking industry in Indonesia is not fully integrated into the economic system since it is recently developed with a limited number of players and small share in the overall banking industry. In addition, Islamic banks in the data sample seem more focus on consumer financing, which less risk and less multiple effect on the real economy than productive financing. This result also substantiate the existing literature, which indicates that Islamic banks are replicating the conventional banking business model, such as Aggarwal and Yousef (2000), Dar and Presley (2000) and Chong and Liu (2009).

Based on the previous discussion, it is a matter of concern that Islamic banks which are part of conventional banks, tend to have a similar pattern with their parent company. BSM, as a government owned Islamic bank, grows as the biggest Islamic bank and follows its parent company as the biggest conventional bank in Indonesia. BCAS as the most stable Islamic bank in the data sample follows its parent company by adopting more prudent strategy compared to other Islamic banks. Furthermore, BRIS continuing the role of BRI as the cooperative bank that provides Islamic financial services in the rural area. This similar pattern can be explained as Islamic banks which are part of the group of conventional banks have similar shareholders, similar human resources and usually use a similar system. Given this, it is important to analyse a systemic risk in the Islamic banking system by including conventional banks as well in further research to fill the gap on limitation of this study.

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