

ONLINE BANKING IMPLEMENTATION: RISK MAPPING USING ERM APPROACH

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ABSTRACT

The implementation of online banking in Indonesia is in line with the increasing of mobile device users who have become a part of people's lifestyle, hence online banking offers easiness to access on banking services. This study is to examine risk mapping on the implementation online banking using ERM approach, including risk mitigation strategies for identified risks. This research was conducted at XYZ Bank who has implemented online banking. The results of this study find 55 potential risks. Some of it identified risks related to bank system security such as vulnerability to viruses, malware, hacking, also access information by an unauthorized person. Risk mitigation strategies applied by XYZ Bank is mostly done by managing the risk because the implementation online banking is still on the development process, and the Bank remains optimistic with the future prospect of online banking by staying with government regulations.

Keywords: Risk, Banking, Online Banking, ERM
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I. INTRODUCTION

Referring to Law Number 10 of 1998 regarding the amendment of Law Number 7 of 1992 concerning banking, the Bank is a business entity that collects funds from the community and distributes it back to the community in other forms in order to improve the living standard of the community. One part of the activities, undertaken by the Bank, is to collect funds from the community and serve the financial transactions of customers. However, the business activities undertaken by the Bank cannot be separated from risks both calculated and unpredicted.

Based on the above phenomenon, it is necessary to manage risk in order to anticipate potential risks in fund management and customer transaction services. Referring to Bank Indonesia regulation Number 11/25/PBI/2010 amendment of PBI Number 5/8/PBI/2003 on May 19, 2003, concerning the Application of Risk Management for Commercial Banks, there are eight types of risks that must be managed or considered by banks which are the credit risk, market risk, operational risk, liquidity risk, compliance risk, legal risk, reputation risk, and strategic risk.

The phenomenon of the online banking application, in Indonesia, is in line with the increase in mobile device users that have become part of people's life. The online banking offers an easy access to banking services such as account opening, transfer, bill payment, or other financial planning. The emergence of new companies, based on financial technology (fin-tech) in the financial industry competition where they make technological innovations and products very quickly, demand the banking industry to make adjustments in the business processes and infrastructure that were originally processed manually or offline into the automation process or online with the aim of speeding up services to customers and surviving within the competition (Bank Indonesia, 2016). This change in bank services will create good value and customer experience to the eyes of the customers, and with the improvement of infrastructure can be utilized as a supporting tool in online banking risk management.

Compared to the conventional banking services, where the customers or potential customers must approach the Bank to conduct transactions, online banking services are perceived to be easier and more flexible. Changing the manual process to digital allows a more flexible process, where customers who initially have to go to the Bank office, which provides more comfort through the use of channels that work with the Bank (Eistert et al., 2013). The use of online banking technology has potential risks that must be managed and considered by the Bank. Bank Indonesia (BI) and the Financial Services Authority (OJK) acting as regulators in the financial industry apply some rules regarding online banking implementation. Some of these rules are as follows:

- 1) PBI 9/15/2007 On Implementation of Risk Management in the Use of Information Technology by Commercial Banks, the regulation in the account opening process is set forth in PBI 14/27 / PBI / 2012 concerning the Implementation of Anti Money Laundering and Counter-Terrorism Financing Program for Commercial Banks where Mandatory Commercial Banks must do Customer Due Diligent (CDD) and Enhancement Due Diligent (EDD) towards prospective customers in order to apply Know Your Customer (KYC) principles.

- 2) POJK Number 01/POJK.07/2013 on August 6, 2013, regarding Consumer Financial Services Protection and SE OJK Number 12/SEOJK.07/2014 on Information Submission in The Framework of Product and/or Financial Services Marketing aims at Bank to deliver related information on the financial services used by prospective customers in a transparent manner by explaining the risks attached to each Bank product to be used by the customer.

The scope of this study covers the risk mapping of online banking application with the Enterprise Risk Management (ERM) approach. Stages of the process were undertaken following the eight ERM frameworks which are internal environment, objective setting, event identification, risk assessment, risk response, control, information and communication, and monitoring. The reason for using ERM method in this research is to get a comprehensive picture of the integration process between the Bank's business objectives, the risks inherent in the business process, as well as the risk mitigation strategy chosen to keep the business process running. The expected output of this online banking risk mapping can be useful for the Bank in managing the risk of online banking services.

The second part of this paper presents a literature review related to online banking risks. The third section describes the data and methodology used. The fourth section presents the results of the discussion on online banking risk mapping, while the fifth section presents the conclusions of this study.

II. THEORY

2.1. The Linkage between Risks and Online Banking

The concept of online banking technology is not just a switch from an offline system to an online system, but also provision of both added value and convenience to the community as well as speed in terms of accessing banking services through technology. The online banking combines two parts, namely the external part associated with the customer experience and the internal part associated with operational processes that are effective and efficient (Eistert et al., 2013).

The use of technology in business processes is closely related to risk. The ease of accessing digital information and that of connections through mobile devices lead to growing risks in the use of technology. The balance between risk management and business processes is important where the use of technology should be an opportunity for business growth, while failure in risk management will harm the business (Baldwin & Shiu, 2010).

The broad concept of risk is an essential foundation for understanding risk management concepts and techniques. Studying the various definitions found in the literature is expected to improve the understanding of the concept of risk which becomes increasingly clear. Some of these differences in the definition of risk are due to the fact that the subject of risk is very complex with many different fields causing different understanding. The risk is divided into three senses: possibility, uncertainty, and the probability of an outcome that is different to the expected outcome (Diversitas, 2008). The systematic management of risks is covered in the concept of risk management. Risk management is a strategy that every industry must adapt to anticipate potential emerging losses that include risk identification activities, risk measurement, risk mapping, risk management, and risk control

(Djohanputro, 2008). Risk management also has other objectives such as obtaining greater effectiveness and efficiency by controlling risk in every company activity (Darmawi, 2006).

The risk categories that exist in online banking include transaction risk, compliance risk, reputation risk, and information security risk (Osunmuyiwa, 2013). While the adoption of e-banking will lead to potential operational and reputation risks (Ndlovu & Sigola, 2013). In addition, the authors argue that the potential for fraud and information security risk are some of the biggest challenges in addition to investment costs for e-banking infrastructure that requires a high cost.

One of the risks that arise from the implementation of online banking is the information security. A common problem affecting information security is the lack of a Bank in implementing controls that lead to a loss in terms of privacy, causing misuse of client confidential information that may affect clients trust in transactions using e-banking (Omariba, Masese, & Wanyembi, 2012). Customer knowledge of security in IT is a factor affecting security in internet banking access. The higher the customer knowledge about information security, the more diligent they will be in conducting activities through the internet (Zanoon & Gharaibeh, 2013).

2.2. Online banking risk mapping using the Enterprise Risk Management (ERM) method

Underlying the author's thinking is that (COSO-ERM, 2004) any organization is established to generate value for the stakeholders. All of the organizations face uncertainty and challenges and the function of management is to determine how much uncertainty is received as a compensation for increasing the value of the firm. The framework of the ERM presents four-goal categories and eight components related to corporate entities as the objects of ERM analysis. The four categories of corporate objectives include strategic, operational, reporting, and compliance. Meanwhile, the eight components related to the corporate entity include the internal environment, objective setting, event identification, risk assessment, risk response, control activities, information and communication, and monitoring - all of the ERM activities must be monitored and evaluated as the basis of subsequent development.

(Cormican, 2014) in his research on "Integrated Enterprise Risk Management: From Process to Best Practice" stated that the critical success factor of the ERM is the result of proper identification and risk grouping. This research used primary data obtained through interview and questionnaire filling. The result of this research is about the application of ERM, in theory, the practice of which has not been applied to Industry.

(Osunmuyiwa, 2013) in his research on "Online Banking and The Risk Involved" reviewed the implementation of online banking services that will provide the customers with the convenience and flexibility in accessing banking services via the Internet at home or elsewhere without having to come to the bank. In addition to these ease and flexibility factors, there are potential risks that arise in connection with this online banking application including strategic risk,

transaction risk, compliance risk, reputation risk, and information security risk.

(Sarma & Singh, 2010) in his journal about "Risk Analysis and Applicability of Biometric Technology for Authentication", one of the ways to mitigate risks is to apply security access using biometric authentication such as fingerprint detection, face, voice, body movement, and others. This study discusses how risk mitigation uses biometrics without using the ERM.

(Bahl, 2012) in his paper on "E-Banking: Challenges and Policy Implication" review the implementation of e-banking as a new opportunity for the banking industry. Although some countries have successfully implemented e-banking, to further refine the implementation of e-banking macroeconomic policy is required to determine the terms of cost and sustainability. Table 1 presents some of the previous research that has been done regarding the implementation of online banking and ERM.

Table 1.
Previous Research Related to Online Banking and ERM

Title	Authors	Methods	Results
Integration of Risk Management into Strategic Planning: A New Comprehensive Approach	Isabela Ribeiro Damaso Maia & George Montgomery Machado Chaves (2016)	SWOT and ERM	The research was conducted in public company where the obtained result was the biggest risk caused by strategic risk. The company failed to integrate risk management to company strategies.
Integrated Enterprise Risk Management: From Process to Best Practice	Kathryn Cormican (2014)	ERM	The critical success factors of the ERM are the results of risk identification and grouping.
Risk Mapping in the Tannery Industry with ERM Approach	Helen Wiryani, Noer Azam Achsani, Lukman M. Baga (2013)	ERM	The strategy that needs to be developed for effective risk mitigation for PT XYZ is to prioritize the handling of the highest risk first and then to lower risk.
Implementation of Enterprise Risk Management in order to Improve the Effectiveness of Operational Activities of CV <i>Anugerah Berkat Calindojaya</i>	Mellisa and Fidelis Arastyo Andono (2013)	ERM	The ERM implementation helps CV.ABC in finding risks at high, medium, and low levels. Risks that are classified as high risk are risks that must be considered by management and should be handled as soon as possible. The risk classified as medium risk has not a significant impact on the company. The risk that is classified as low risk is a risk that comes after the medium and high risks.
Report on The Current State of Enterprise Risk Oversight	Mark Beasley, Bruce Branson, Bonnie Hancock (2015)	ERM	There are still many companies that have not carefully taken care of risks, especially those related to strategies. The need to evaluate the process of risk management is based on the volume and complexity and the events experienced by the company

Table 1.
Previous Research Related to Online Banking and ERM - Continued

Title	Authors	Methods	Results
Online Banking and The Risk Involved	Lufolabi Osunmuyiwa (2013)	Literature review	The potential risks that arise in connection with the implementation of this online banking include risks such as strategic risk, transaction risk, compliance risk, reputation risk, and information security risk.
Internet Banking: Risk Analysis and Applicability of Biometric Technology for Authentication	Gunajit Sarma and Pranav Kumar Singh (2010)	Literature review	One way to mitigate security risks related to online banking system access is through the application of security access using biometric authentication such as fingerprint detection, face, voice, body movement, and others.
Internet Banking, Security Models, and Weakness	Bilal Ahmad Sheikh and Dr. P. Rajmohan (2015)	Literature review	Access security model of the internet banking that is currently widely used is based on user identification and authentication methods. However, if the Bank does not mitigate the risk of data loss and access security, it will result in fraud. The new solution to strengthen the access security is using biometric authentication
The Role and Importance of Risk Management In Internet Banking	Mojtaba Mali, Hossein Niavand, and Farzaneh Haghghat Nia (2014)	ERM	The most vulnerable risk is security risk related to transaction security, customer data security, and user access security. These risks need to be identified, classified, and risk assessments involving management in banks that have the competence to determine potential risks
E-Banking: Challenges and Policy Implication	Dr. Sarita Bahl (2012)		The implementation of e-banking as a new opportunity in the banking industry. Although some countries have successfully implemented e-banking, to further refine the implementation of e-banking, macroeconomic policy is required to determine the terms of cost and sustainability

III. METHODOLOGY

The types of data used in this study are primary and secondary data. The collected primary data were obtained from interviews and questionnaires, while secondary data were obtained through the publication of annual reports, financial reports, and other sources related to this research. The implementation of this research was conducted at Bank XYZ Head Office as an object that has implemented online banking.

Sampling for primary data was done with a specific purpose (purposive sampling) i.e. the sample taken with the purpose and certain considerations addressed to the respondents who will be interviewed in depth. The respondents, in this study, are internal Bank XYZ who have competency, capacity, and experience in the field of operational and risk management processes including risk management division, operational division, and business division. Each division provided as much as two respondents at the managerial level and two respondents at the head of unit level. Thus, a total of respondents 12 respondents was used. The respondents were selected to represent their respective divisions and directly involved in the creation of operational processes and online banking risk assessment process at Bank XYZ.

Research stages started from the data collection through the questionnaire filling which was done by conducting in-depth interviews to obtain information about the potential risks and risk mitigation that will be done. This research was conducted by using the descriptive approach in the form of the case study which was a detailed study (and in-depth related) of the object to be studied. Risk research carried out through the ERM (Enterprise Risk Management) method adapts to the ERM framework for obtaining risk mapping of the implementation of online banking.

IV. RESULTS AND ANALYSIS

The online banking risk mapping, at Bank XYZ, was conducted using the ERM framework. The stages of the implementation in this research were conducted by referring to the eight components of ERM, namely internal environment, objective setting, event identification, risk assessment, risk response, control, information, and communication, monitoring.

4.1. ERM 1: Internal Environment

The implementation of online banking services, at Bank XYZ, is done by focusing on serving the smartphone user segment. This is in line with the company's goal of improving service to customer oriented and utilizing digital technology. Bank XYZ's governance is implemented by applying Good Corporate Governance (GCG) which is to identify and control risk to improve the existing business process and apply the four eyes principles in which every process is done by dual control. Every business process, that is executed, must have standardized rules set forth in the form of policies or procedures and set its periodic evaluation plan.

4.2. ERM 2: Objective Setting

The objective setting of Bank XYZ can be seen from the four priority sides based on the ERM framework which includes Strategic Objective, Operating Objective, Reporting Objective, and Compliance Objective. In the strategic objective, XYZ Bank took the initiative to innovate in finance by developing online banking business that utilizes smartphone media to be able to provide financial and non-financial transactions to the community. In the operating objective, Bank

XYZ continuously improves the Bank's operational processes to enhance the effectiveness and efficiency of work processes and costs, in addition to conducting periodic evaluations of work processes that have been previously applied. In the reporting objective provides transparent and accurate reports for both internal and external parties. This is necessary so that the company can take appropriate steps for decision making and as accountability to stakeholders. The compliance objective complies with the regulations set by the government and regulator (BI and OJK) as well as the rules applicable regionally and internationally to be in line with the established Bank Business Plan.

4.3. ERM 3: Event Identification

The risk identification process of the online banking application at Bank XYZ is based on the deposition of risk categories based on BI and OJK rules covering credit risk, market risk, operational risk, liquidity risk, compliance risk, legal risk, reputation risk, and strategic risk. The risk identification process is conducted through in-depth interviews with those who have competencies in the areas of risk and operational processes. Based on the results of the identification, 55 potential risks from the implementation of online banking at Bank XYZ were observed. Table 2 presents potential risk obtained based on the identification results.

Table 2.
Risk Identification Results

Risk Categories	Risks No	Risks Identification
Liquidity risks	R1	Banks are bankrupt and customer funds are non-refundable
	R2	The customer keeps funds in small amount and short term, so the Bank does not get big fund in the long-term
Credit risks	R3	The Customer feeling the obligation to pay the loan to the Bank is reduced because it is not directly related to the Bank
	R4	The Customer does not make any loan payments to the Bank
	R5	Bank does not conduct customer analysis for customer who applies for loan
	R6	The Bank can not provide customer loan data or information for reporting
	R7	Lack of transparency on loan product information to customers leading to customer complaints
	R8	A change of policy from the government or regulator related to credit regulations
	R9	Changes in the value of the Rupiah (currency)
Market risks	R10	Changes in interest rates

Table 2.
Risk Identification Results - Continued

Risk Categories	Risks No	Risks Identification
Strategic risks	R11	Fail to achieve product sales target
	R12	Fail to develop products according to customers' needs
	R13	Fail to acquire new customers
	R14	Fail in prioritizing strategy
	R15	Competitors get a large market share
	R16	The Bank's fails to build an integrated network system with partners
	R17	Top management that has the capability to provide strategic direction, withdraw from the company
	R18	Partner work is not in line with agreement
Operational risks	R19	Customer can not transact due to forgotten PIN or User ID
	R20	The absence of clear procedures and business processes
	R21	The controlling process of the activity that has been executed does not exist yet
	R22	The password or PIN length is very complicated
	R23	Customer fails to make transactions via ATM
	R24	Less effective process
	R25	Error doing data input caused by lack of information on the input procedure
	R26	The political situation that leads to riots or demonstrations
	R27	Natural disasters on a national scale
	R28	Theft of Bank information by Customer/Internal Party/External Parties
	R29	The customer can not access the transaction through online banking due to the absence of the network or trouble with the system provider (down)
	R30	Bank systems are vulnerable to viruses or malware
	R31	SMS or Email delivery as transaction proof failed to be sent
	R32	Failure to store customer data and back it up
	R33	Theft of customer user ID by external parties
	R34	The fraud perpetrator acts on behalf of the client and unlawfully accesses the customer's account
	R35	Fraud actor that acts on behalf of the Bank and requests User ID or Password of the customer for fraud

Table 2.
Risk Identification Results - Continued

Risk Categories	Risks No	Risks Identification
	R36	Fraud perpetrators work with Bank employees to link ATMs with personal account numbers or other accounts
	R37	Fraud perpetrators use other domains to access the Bank system
	R38	The Customer denies transactions that have been made
	R39	The Customer has made an initial deposit for opening an account, but the account opening is rejected by the Bank
	R40	The Bank system is hijacked by external parties
	R41	Employees open fake accounts with customers to get incentives
	R42	The Customer can not provide identity cards and other mandatory documents
	R43	Customers do not receive ATM cards
	R44	The Bank does not have backup for Customer data
	R45	Fraud is detrimental to customers
	R46	Failed transaction
Reputation Risks	R47	Customer's location of the transaction does not receive signal
	R48	Customer complaints services are long
	R49	Employees of the Bank require remuneration to the Customer for the services provided
Compliance Risks	R50	The Bank does not fulfill the data fulfillment obligation for KYC Customer
	R51	Rule changes from the regulator
	R52	Rules of BI and/or OJK that cannot be fulfilled by the Bank
	R53	The Bank cannot resolve the dispute with the Customer
Legal risks	R54	Lack of clauses in the agreement made by the Bank with the Customer
	R55	Changes in laws and regulations that cause the Bank to change all or part of its agreement with the customer

Source: Processed Data of Bank XYZ (2016)

4.4. ERM 4: Risk Assessment

The next stage of risk identification is risk assessment based on probability and impact. The categorization of risks based on probability is divided into five scales i.e. very low, low, medium, high, and very high (Godfrey, 1996). The impact scale indicator refers to the criteria of risk probability indicators established by internal Bank XYZ. The indicators are obtained based on historical data of events within a period of one year (2016-2017) i.e. based on data of customer's complaints audit and internal complaints of bank related to system or IT. Table 3 represents risk indicators based on probability.

Table 3.
Risk Indicators based on Probability

No	Categories	Guidelines	Scale
1	Very low (improbable)	≤ 10 incidences per year	1
2	Low (remote)	11 – ≤ 20 incidences per year	2
3	Medium (occasional)	21 – ≤ 30 incidences per year	3
4	High (probable)	31 – ≤ 40 incidences per year	4
5	Very high (frequent)	> 41 incidences per year	5

Source: Processed Data of Bank XYZ (2016)

The classification of risk categories based on impact is divided into five scales: neglected, small, medium, large, and very large (Godfrey, 1996). The risk impact indicators used are sourced from the criteria indicated by Bank XYZ that are financial, regulatory, reputation, legal, and information security impacts. Each of these guidelines has its own risk impact weight in accordance with acceptable risk acceptance by Bank XYZ. Table 4 presents an impact-based risk indicator.

Table 4.
Risk Indicator based on Impacts

No	Categories	Guidelines					Scale
		Financial	Regulatory	Reputation	Legal	Information security	
1	Negligible	Profit is reduced < 10%	There is no reprimand from the regulator	<ul style="list-style-type: none"> No complaints in local/ national media Customer complaints increased by 10% 	<ul style="list-style-type: none"> There are no mistakes in the agreement clause There is no violation of the law There is no claim from the Customer 	<ul style="list-style-type: none"> Classification of internal data/ information Data leak/ information that does not provide benefits to internal parties 	1
2	Marginal	Profit is reduced 10% - ≤ 20%	There is a verbal reprimand from the regulator	<ul style="list-style-type: none"> Submission of complaints to at least one Local/ national media Customer complaints increased from 10.1% - 20% 	<ul style="list-style-type: none"> The existence of deficiencies in the agreement clause (minor) There is no violation of the law There is no claim from the Customer 	<ul style="list-style-type: none"> Classification Internal data/ information Data leak/ information that provides benefits to internal parties 	2

Table 4.
Risk Indicator based on Impacts - Continued

No	Categories	Guidelines					Scale
		Financial	Regulatory	Reputation	Legal	Information security	
3	Serious	Profit is reduced 20% - ≤ 30%	<ul style="list-style-type: none"> • There is a written reprimand from the regulator • No penalties 	<ul style="list-style-type: none"> • Submission of complaints to at least two local/national Media • Customer complaints increased from 20.1% - 30% 	<ul style="list-style-type: none"> • The existence of an error in the agreement clause (minor) • There is no violation of the law • There is no claim from the Customer 	<ul style="list-style-type: none"> • Classification of internal data/ information • Leakage of data/ information that does not provide benefits to external parties 	3
4	Critical	Profit is reduced 30% - ≤ 40%	<ul style="list-style-type: none"> • There is at least one written reprimand from the regulator • There are penalties 	<ul style="list-style-type: none"> • Submission of complaints to at least two Local/ national medias • Customer complaints increased from 30.1% to 40% 	<ul style="list-style-type: none"> • The existence of an error in the agreement clause (major) • There is no violation of the law • There is no claim from the Customer 	<ul style="list-style-type: none"> • Classification of internal data/ information • Data leak/ information that provides benefits to external parties 	4
5	Catastrophic	Profit is reduced > 40%	<ul style="list-style-type: none"> • There are written reprimands from the regulator >1 • There are penalties 	<ul style="list-style-type: none"> • Submission of complaints to at least 3 local / national medias • Customer complaints increased > 40% 	<ul style="list-style-type: none"> • The existence of a violation of the law • The existence of a claim from the Customer 	<ul style="list-style-type: none"> • Classification of confidential data/ information • Data leak/ information that provides benefits to internal and/or external parties 	5

Source : Bank XYZ processed Data (2016)

Having determined the risk indicators based on both the probability and impact, the next step is scoring which is carried out to determine the risk level of each identified potential risk. The level of risk is divided into five categories of risk level as follows: High (H), Medium to High (MH), Medium (M), Low to Medium (LM), and Low (L). Table 5 presents the result of risk scoring of each identified potential risk.

Table 5.
Risk Scoring Results

Risk Categories	No	Risk Identification	Score P	Score D	Total Score (P x D)	Risk Levels
Liquidity Risks	R1	Banks are bankrupt and customer funds are non-refundable	1	5	5	MH
	R2	The customer keeps funds in small amount and short term, so the Bank does not get big fund in the long-term	5	2	10	M
Credit Risks	R3	The Customer feeling the obligation to pay the loan to the Bank is reduced because it is not directly related to the Bank	3	2	6	M
	R4	The Customer does not make any loan payments to the Bank	5	5	25	H
	R5	Bank does not conduct customer analysis for customer who applies for loan	3	4	12	H
	R6	The Bank can not provide customer loan data or information for reporting	1	4	4	MH
	R7	Lack of transparency of loan product information to customers, leading to customer complaints	2	5	10	MH
	R8	Policy changes from government or regulators regarding credit regulations	1	4	4	MH
Market Risks	R9	Changes in the value of the Rupiah (currency)	3	1	3	LM
	R10	Changes in interest rates	1	2	2	LM
Strategic Risks	R11	Fail to achieve product sales target	2	4	8	MH
	R12	Fail to develop products according to customers' needs	1	4	4	MH
	R13	Fail to acquire new customers	5	4	20	H
	R14	Fail in prioritizing strategies	1	4	4	MH
	R15	Competitors get a large market share	3	4	12	H
	R16	The Bank fails to build an integrated network system with partners	1	2	2	LM
	R17	Top management, that has the capability to provide strategic direction, withdraw from the company	1	1	1	L

Table 5.
Risk Scoring Results - Continued

Risk Categories	No	Risk Identification	Score P	Score D	Total Score (P x D)	Risk Levels
	R18	Partner work is not in line with the agreement	1	5	5	MH
	R19	Customer can not transact due to forgotten PIN or User ID	5	2	10	M
	R20	The absence of clear procedures and business processes	1	3	3	M
	R21	The controlling process of the activities that have been executed does not exist yet	1	5	5	MH
	R22	The password or PIN length is very complicated	3	1	3	LM
	R23	Customer fails to make transactions via ATM	2	2	4	LM
	R24	Less effective process	1	5	5	MH
	R25	Errors during data input caused by lack of information procedure input	1	3	3	M
	R26	The political situation that leads to riots or demonstrations	1	1	1	L
	R27	Natural disasters on a national scale	1	4	4	MH
Operational Risks	R28	Theft of Bank information by Customer / Internal Party / External Parties	1	5	5	MH
	R29	The customer can not access the transactions through online banking due to the absence of the network or trouble with the system provider (down)	5	2	10	M
	R30	Bank systems are vulnerable to viruses or malware	1	4	4	MH
	R31	SMS or Email delivery as transaction proof failed to be sent	3	1	3	LM
	R32	Fail to store customer data and back it up	1	5	5	MH
	R33	Theft of customer user ID by external parties	1	5	5	MH
	R34	The fraud perpetrator acts on behalf of the client and unlawfully accesses the customer's account	1	5	5	MH

Table 5.
Risk Scoring Results - Continued

Risk Categories	No	Risk Identification	Score P	Score D	Total Score (P x D)	Risk Levels
	R35	Fraud perpetrator acts on behalf of the Bank and requests User ID or Password of the customer for fraud	2	5	10	MH
	R36	Fraud perpetrators work with Bank employees to link ATMs with personal account numbers or other accounts	2	5	10	MH
	R37	Fraud perpetrators use other domains to access the Bank system	1	5	5	MH
	R38	The Customer denies transactions that have been made	1	5	5	MH
	R39	The Customer has made an initial deposit for opening an account, but the account opening is rejected by the Bank	1	4	4	MH
	R40	The Bank system is hijacked by external parties	1	5	5	MH
	R41	Employees open fake accounts with customers to get incentives	1	5	5	MH
	R42	The Customer can not provide identity cards and other mandatory documents	5	1	5	M
	R43	Customers do not receive ATM cards	5	3	15	MH
	R44	The Bank does not have backup for Customer data	1	5	5	MH
	R45	Fraud is detrimental to customers	2	5	10	MH
	R46	Failed transaction	4	3	12	MH
	R47	Customer's location of the transaction does not receive signal	4	3	12	MH
	R48	Customer complaints services are long	3	5	15	H
	R49	Employees of the Bank require remuneration to the Customer for the services provided	2	3	6	M
Compliance Risks	R50	The Bank does not fulfill the data fulfillment obligation for KYC Customer	1	4	4	MH
	R51	Rule changes from the regulator	1	4	4	MH
	R52	Rules of BI and/or OJK that cannot be fulfilled by the Bank	1	4	4	MH

Table 5.
Risk Scoring Results - Continued

Risk Categories	No	Risk Identification	Score P	Score D	Total Score (P x D)	Risk Levels
Legal Risks	R53	The Bank cannot resolve the dispute with the Customer	1	5	5	MH
	R54	Lack of clauses in the agreement made by the Bank with the Customer	1	4	4	MH
	R55	Changes in the laws and regulations that cause the Bank to change all or part of its agreement with the customer	1	5	5	MH

Source: Bank XYZ processed Data (2016)

Once the risk score results are obtained, we can proceed to make the risk map according to the five risk levels. To make the differentiation easier, the five levels of risk were divided into several colors: High (H) red, Medium to High (MH) orange, Medium (M) yellow, Low to Medium (LM) dark green, and Low (L) green. Figure 1 represents the results of the risk mapping that has been done.

Figure 1. Results of Risk Mapping prior to Mitigation

	Negligible (1)	Marginal (2)	Serious (3)	Critical (4)	Catastrophic (5)
Frequent (5)	R42	R2, R19, R29	R43	R13	R4
Probable (4)			R46, R47		
Occasional (3)	R9, R22, R31	R3		R5, R15	R48
Remote (2)		R23	R49	R11	R7, R35, R36, R45
Improbable (1)	R17, R26	R10, R16	R20, R25	R6, R8, R12, R14, R27, R30, R39, R50, R51, R52, R54	R1, R18, R21, R24, R28, R32, R33, R34, R37, R38, R40, R41, R44, R53, R55

Source: Processed data of Bank XYZ (2016)

4.5. ERM 5: Risk Response

Based on the results of the risk mapping that has been done, the risk mitigation measure can be carried out. The identified potential risks are risk mitigation measures so that each risk can be monitored and not shifted towards a higher

level of risk. The main priority of the risk mitigation starts with the High-risk level, followed by level Medium to High, Medium, Low to Medium, and finally low-risk level. The risk response to the identified risks, at Bank XYZ, is shown in Table 6.

Table 6.
Risk Response to the Identified Risks

Risk Category	Identified Risks	Risk Responses
Liquidity Risks	Banks are bankrupt and customer funds are non-refundable	<ol style="list-style-type: none"> 1. Apply the rules set by BI and OJK, in particular, the implementation of risk management for liquidity risk. 2. Socialize with the customer on the fact that the Bank's fund is guaranteed by LPS with a maximum amount of 2 Billion Rupiah per customer.
	The customer keeps funds in small amount and short term, so the Bank does not get big fund in the long-term	<ol style="list-style-type: none"> 1. Reward the customers who make deposits in certain nominal and a certain period of time. 2. Provide interest rates above the average of the competitors.
Credit Risks	The Customer feeling the obligation to pay the loan to the Bank is reduced because it is not directly related to the Bank	<ol style="list-style-type: none"> 1. The Bank shall be required the verification of the customer upon the submission of the loan through a visit to the customer, by telephone, or other media in accordance with BI and/or OJK rules related to KYC (know your customer). 2. Mandatory credit agreement on approved loan. Credit agreements may be sent by mail or email.
	The Customer does not make loan payments to the Bank	<p>The Bank sets out the Client's criteria to be granted such as:</p> <ol style="list-style-type: none"> 1. Customer's balance for 6 consecutive months amounts to Rp. 500,000 and above. 2. Make transactions through online banking each month, at least 5 times. 3. Establish the criteria for customer's job that is eligible for a loan.
	Bank does not conduct customer analysis for customer who applies for loan	<ol style="list-style-type: none"> 1. Banks are required to establish rules or policies regarding credit processes that include credit required documents, credit application process, data verification, credit limit, credit approval until the control process must be performed.

Table 6.
Risk Response to the Identified Risks - Continued

Risk Category	Identified Risks	Risk Responses
		<ol style="list-style-type: none"> 2. Banks can collaborate with third parties to conduct credit score analysis process of the customers applying for loans.
	The Bank can not provide customer loan data/information for reporting	<ol style="list-style-type: none"> 1. Fulfill all customer information required under SID rules (debtor information system) in online banking system 2. Storage is required on server or cloud to store customer's data as the whole process is done online. 3. Set the retention period for customer data storage.
	Lack of transparency of loan product information to customers, leading to customer complaints	<ol style="list-style-type: none"> 1. The Bank provides a special menu on the online banking display that contains product information in the form of product specifications, costs, and the risks attached to the product. 2. The existence of disclaimer-specific pages prior to the submission of credit sent by the customer containing information that the customer has been given explanation and understand the product he selected. 3. Banks are required to submit credit agreements on loans approved by letter or email from customers.
	There is a change of policy from the government/regulator related to credit regulations.	<ol style="list-style-type: none"> 1. The compliance working unit monitors every published government, BI and/or OJK. regulations and reviews the rules 2. Coordinate with work units related to changes in rules such as business, operational, IT, and other units for action.
Market Risks	Changes in the value of Rupiah (currency)	<ol style="list-style-type: none"> 1. The risk of changes in the value of Rupiah can be ignored because the current online banking implementation uses the Rupiah as currency.
	Changes in interest rates	<ol style="list-style-type: none"> 1. Inform the Customer of interest rate changes through email, SMS, or other media.

Table 6.
Risk Response to the Identified Risks - Continued

Risk Category	Identified Risks	Risk Responses
Strategic Risks	Fail to achieve product sales target	<ol style="list-style-type: none"> 1. Determine realistic product sales target according to target market segment. 2. Create tools that contain information on the achievement of sales targets for each sale as material evaluation of target achievement.
	Fail to develop products according to customers' needs	<ol style="list-style-type: none"> 1. Analyze the market to determine which market segments to target by utilizing market analytic divisions or using consultant services.
	Fail to acquire new customers	<ol style="list-style-type: none"> 1. Conduct promotion through various media, especially social media. 2. Provide promotion by cooperating with store/merchant to offer discount on the purchase certain product.
	Fail in prioritizing strategies	<ol style="list-style-type: none"> 1. Set realistic target priorities to be achieved as directed by management. Target priority is submitted along with the timeline/ date of its realization.
	Competitors get a large market share	<ol style="list-style-type: none"> 1. Provide customer services such as free transaction fee for 50 transactions every month. 2. Offer interest rates above the average of the competitors.
	The Bank fails to build an integrated network system with partners	<ol style="list-style-type: none"> 1. Provides 2 network models namely online mode and offline mode. So if the online mode of the system is not running, it will be transferred automatically to offline mode.
	Top management that has the capability to provide strategic direction, withdraw from the company	<ol style="list-style-type: none"> 1. Divide the tasks and responsibilities to some senior management. In addition to providing training to employees who are considered to have good potential.
	Partner work is not in line with the agreement	<ol style="list-style-type: none"> 1. Make a cooperation agreement (MCC) that contains agreement on the responsibility of both parties, the completion of work, including the steps that must be taken in case of default.

Table 6.
Risk Response to the Identified Risks - Continued

Risk Category	Identified Risks	Risk Responses
Operational Risks	Customer can not transact due to forgotten PIN or User ID	1. Provide the User ID/Password forgot feature on the online banking application and connect it to the email/mobile phone number of the Customer.
	The absence of clear procedures and business processes	1. The working units, connected to the online banking process, work together to coordinate the formulation of policies or procedures to develop the operational processes and control those to be run.
	The controlling Process of the activities, that have been executed, does not yet exist	1. Standardize rules in the form of Policies or SOPs which contains operational processes that run along with the control process that must be carried out.
	Password length/PIN is very complicated	1. Provide PIN / Password reset feature in the online banking application connected with customer's email/phone number. 2. Use biometric authentication in the form of fingerprint scanning or face recognition.
	Customer fails to make transactions via ATM	1. Make transaction features, via smartphone, as a key feature in online banking services.
	Less effective process	1. Evaluate the process that has been implemented by involving various related units so that more objective input and suggestions can be obtained.
	Error in the input data caused by lack of information in the input procedure	1. Create an input procedure that is poured in the form of user manual document. 2. Specify mandatory fields in accordance with BI and/or OJK requirements to be adjusted in the online banking system.
	Political situation that leads to riot/demonstration	1. Make transaction features via smartphone as a key feature in online banking services.
	Natural disasters on a national scale	1. Make transaction features via smartphone as a key feature in online banking services.

Table 6.
Risk Response to the Identified Risks - Continued

Risk Category	Identified Risks	Risk Responses
		<ol style="list-style-type: none"> 2. The security of server/IT devices/ network systems supporting the online banking implementation must be carried out through the Business Continuity Plan (BCP) to keep business processes running.
	Theft of Bank information by Customer / Internal Party / External Parties	<ol style="list-style-type: none"> 1. Classify the data into 3 categories which are general, internal, and secret. 2. Restrictions on access to information according to classification based on positions and working units. 3. Standardization of the documents or files naming according to classification. 4. Encrypt if documents or files are sent via email.
	The customer can not access the transaction through online banking due to the absence of the network or trouble with the system provider (down)	<ol style="list-style-type: none"> 1. Working with providers with a wide internet network. 2. Provides information to the Customer through display on the Customer's smartphone in relation to the constraints that are being experienced, and directing the Customer to transact through other channels such as ATM.
	Bank systems are vulnerable to viruses or malware	<ol style="list-style-type: none"> 1. Periodically update antivirus and firewall. 2. Restrict access to certain web via internet. 3. Restrict access to USB usage on a computer or laptop device.
	SMS/Email delivery as transaction proof fails to send	<ol style="list-style-type: none"> 1. Provide proof of transaction notification in online banking feature in the form of transaction history information for the customer.
	Fail to store customer data and back it up	<ol style="list-style-type: none"> 1. The need for storage or special storage in the server or cloud to store Customer data in connection with all customer input data carried out online. 2. Set a retention period for customer data storage.

Table 6.
Risk Response to the Identified Risks - Continued

Risk Category	Identified Risks	Risk Responses
	Theft of customer user ID by external parties	<ol style="list-style-type: none"> 1. Include information related to the confidentiality of User ID and password at the end of the online banking display when opening an account. 2. Set a password change so that the Customer has to change the password every 3 months. 3. Perform a periodical reminder via SMS or email to the Customer on the need to maintain the confidentiality of the User ID and password.
	The fraud perpetrator acts on behalf of the client and unlawfully accesses the customer's account	<ol style="list-style-type: none"> 1. Submitting the authentication code to the Customer's mobile phone for any transactions done by the Customer as a means of verifying the validity of the transaction.
	The fraud perpetrator acts on behalf of the Bank and asks the User ID/Password of the customer for fraud	<ol style="list-style-type: none"> 1. Perform a periodical reminder via SMS or email to the Customer on the need to maintain the confidentiality of the User ID and password. 2. Provide harsh sanctions to employees who are proven of committing fraud.
	Fraud perpetrators work with Bank employees to link ATMs with personal account numbers or other accounts	<ol style="list-style-type: none"> 1. Apply dual control process (checker and maker) on the linking ATM number process with Customer's account. 2. Provide harsh sanctions to employees who are proven of committing fraud.
	Fraud perpetrators use other domains to access the Bank system	<ol style="list-style-type: none"> 1. Restricting system access using only the Bank's internal domains.
	The Customer denies transactions that have been made	<ol style="list-style-type: none"> 1. Send the authentication code to the Customer's mobile phone for any transactions done by the Customer as a means of verifying the validity of the transaction. 2. The delivery of transaction evidence by email or SMS.
	The Customer has made an initial deposit for opening an account, but the account opening is rejected by the Bank	<ol style="list-style-type: none"> 1. Information is provided that the account opening process, made by the Customer, is semi-active and the Customer will be able to use the account on a regular basis after obtaining approval from the Bank.

Table 6.
Risk Response to the Identified Risks - Continued

Risk Category	Identified Risks	Risk Responses
		<ol style="list-style-type: none"> 2. Require the inclusion of column of account number of destination account for refund in case of account opening decline. 3. Rules are made regarding refund of customer's funds and their returning SLA to the Customer.
	The Bank system is hijacked by external parties	<ol style="list-style-type: none"> 1. The IT Security working unit is required to monitor all system and network security used by the Bank such as performing the vulnerability assessment. Such monitoring shall be conducted periodically.
	Employees open fake accounts with customers to get incentives	<ol style="list-style-type: none"> 1. The Bank is required to verify to the Customer upon opening of the proposed account through a visit to the Customer, by telephone, or other media in accordance with BI and/or OJK rules related to KYC (know your customer). 2. Create a direct integration between the Bank system and the Dukcapil system (Population and Civil Registry) to verify the customer data.
	The Customer can not provide identity cards and other mandatory documents	<ol style="list-style-type: none"> 1. Create a mandatory document field for the customer so that account opening cannot be processed further if the document is not provided.
	Customers do not receive ATM cards	<ol style="list-style-type: none"> 1. Make a notification to the system that the customer has not received yet the ATM card for H + 2 since the opening of Customer's account was approved by Bank.
	The Bank does not have backup for Customer data	<ol style="list-style-type: none"> 1. A special storage for customer data back up is required in the server or cloud separated from the core storage.
Reputational Risks	Fraud that is detrimental to customers	<ol style="list-style-type: none"> 1. Provide harsh sanctions to employees who are proven of committing fraud. 2. Socialize all employees regarding the actions of fraud and sanctions.

Table 6.
Risk Response to the Identified Risks - Continued

Risk Category	Identified Risks	Risk Responses
	Failed transaction	<ol style="list-style-type: none"> 1. Work with providers that have a wide internet network. 2. Ensure that the infrastructure that supports online banking services runs well. 3. Compulsory rules must be made when receiving complaints from the Customer, such as the Customer is directed to transact through ATM.
	Customer's location of the transaction does not receive signal	<ol style="list-style-type: none"> 1. Work with providers that have a wide internet network. 2. ATM Provides information to the Customer through display on the Customer's smartphone in relation to the constraints that are being experienced, and direct the Customer to transact through other channels such as ATM.
	Customer complaints services are long	<ol style="list-style-type: none"> 1. Create a special unit that handles customer complaints. 2. Establish the SLA and inform the customer. 3. Inform the Customer that the complaint service can be reached through the contact center.
	Employees of the Bank require remuneration to the Customer for the services provided	<ol style="list-style-type: none"> 1. Provide an appeal to the Client not to provide any kind of compensation to Bank officers through email or SMS media. 2. Provide strict sanctions to Bank officers who are proven to require remuneration from the Customer.
Compliance Risks	The Bank does not accomplish the data fulfillment obligation for KYC Customer	<ol style="list-style-type: none"> 1. Ensure that the Bank's system meets all Customer's required information according to KYC (know your customer) rules at the time of account opening. 2. The KYC process is recommended to be performed by a third party with due regard to the rules of BI and/or OJK. 3. The Compliance Work Unit has reviewed the KYC scheme by third parties. 4. Socialization related to KYC process conducted by the third party.

Table 6.
Risk Response to the Identified Risks - Continued

Risk Category	Identified Risks	Risk Responses
	Rule changes from the regulator	<ol style="list-style-type: none"> 1. The Compliance Work Unit monitors every published government, BI and/or OJK regulations and reviews the rules. 2. Coordinate with work units related to changes in rules such as business, operational, IT, and other units for action.
	Rules of BI and/or OJK that cannot be fulfilled by the Bank	<ol style="list-style-type: none"> 1. The Compliance Work Unit reviews the rules of BI and/or OJK and coordinates with relevant work units regarding business process readiness, system readiness, rule readiness, and other infrastructure required to comply with these rules.
Legal Risks	The Bank cannot resolve the dispute with the Customer	<ol style="list-style-type: none"> 1. List all of the terms of the relationship between the Bank and the Client including the procedure of settlement in the event of a dispute. All of which are contained in clauses/agreements and approved by the Customer at the opening of online banking.
	Lack of clauses in the agreement made by the Bank with the Customer	<ol style="list-style-type: none"> 1. The Legal Work Unit is obliged to review the entire clause of the agreement and ensure all aspects of the agreement have been met.
	Changes in laws and regulations that cause the Bank to change all or part of its agreement with the customer	<ol style="list-style-type: none"> 1. The Legal Work Unit monitors every change in published legislation and reviews the rules. 2. Coordinate with work units in relation to changes in rules such as business, operational, IT, and other units for action.

Source: Bank XYZ processed Data (2016)

After the risk mitigation, the process continues with the risk mapping stage which is carried out to obtain an overview of the residual risk. This stage is done through the distribution of questionnaires and in-depth interviews with the parties with competencies in the field of risk and operational processes. The purpose of doing the risk mapping, after mitigation, is to obtain a picture of changes in the risks that occur when the mitigation actions are executed. The risk map, after the risk mitigation process at Bank XYZ, is shown in Figure 2.

Figure 2. Results of Risk Mapping Post Mitigation

	Negligible (1)	Marginal (2)	Serious (3)	Critical (4)	Catastrophic (5)
Frequent (5)	R2, R42	R19, R29, R43	R13, R4		
Probable (4)		R46, R47	R5, R15		
Occasional (3)	R3, R22, R31				
Remote (2)	R9, R23	R49	R11	R7, R35, R36, R45	R48
Improbable (1)	R17, R26, R10, R16	R20	R6, R8, R12, R14, R25, R27, R30, R32, R33, R34, R37	R1, R18, R21, R24, R28, R38, R39, R50, R51, R52, R54	R40, R41, R44, R53, R55

Sumber: Data Bank XYZ (2016) diolah

Based on the results of risk mapping, after mitigation, it can be seen that there are five potential risks, that previously included the High-risk level, have turned into Medium to High-risk level. However, there are also potential risks that have been mitigated but remain at the same level of risk as before, such as the risk of partner or third party work not in accordance with the agreement. Based on the results of the discussions with respondents, this is due to various factors such as the condition of the partner company experiencing the problem, or the person responsible in the process of withdrawing from the company who took the risk despite mitigation but the risk level has not changed. This level of risk is mandatory for periodic monitoring so that the risk level does not move into higher risk levels.

4.6. ERM 6: Control Activities

Control measures are taken to minimize losses incurred by risk and ensure the effectiveness of the responses to risk. Control can be done by Bank XYZ by giving a clear job description for each employee covering specific responsibilities and authorities in the work. The strict monitoring of the implementation of procedures or policies through periodic inspections by the Internal Audit working unit covering all processes should be undertaken along with periodic evaluations of all performance executed in order to address issues or problems arising from the process undertaken which become an important part of the control process.

4.7. ERM 7: Information and Communication

The results of the risk assessment that have been undertaken and the risk mitigation advice that has been given must be transmitted and socialized to each related work unit both internal or external to the company, and third-party that is related

to activities to be followed up so that the potential risk can be controlled. The transmission to the related parties can be in the form of a document procedure or policy or a Cooperation Agreement. In addition, the selection of the communication methods is also important to ensure that the information is delivered. Internal communication methods can be internal meetings using meeting minutes, special portals commonly accessed by employees email. The method of information transmission should also be easy to understand and adequately explained so that each employee understands the information submitted.

4.8. ERM 8: Monitoring

All identified risks must be periodically monitored to keep the risks under control. The supervision can be done through the monitoring of ongoing activities or processes or performing separate evaluations or a combination of both. In addition, there is a need to hold the regular internal meeting to discuss issues or problems arising from the process undertaken. In conducting the monitoring activities, each working unit associated with the process, Internal Audit, along with Risk Management, conducts assessments of various risks, monitors operational activities, and reports the evaluation results to the senior management.

V. CONCLUSIONS

The potential risks identified in the implementation of online banking services are reviewed through eight risk categories established by BI and OJK among as many as 55 potential risks. Strategies applied for effective risk mitigation are more often done for mitigating identified risks. This is done because the online banking business is in the process of development, so the Bank is optimistic about the prospect of online banking business which should still be guided by the rules that apply.

The results of this study are intended to guide in minimizing the emergence of risks through periodic risk control that involves working units related to the online banking process. Furthermore, monitoring, based on the results of customer complaints data and the internal audit of the process undertaken, can be used as the basis for improvement and evaluation in order to monitor other risks that may emerge in the process and were not previously identified.

Implications for the Bank, in connection with the implementation of online banking, in terms of strategic areas i.e. all the company's strategy to be achieved must be included in a written documents or presentations and socialized to all employees. The operational areas of continuous improvement must be performed through suggestions for innovative and creative process improvement in order to achieve company goals. The reporting field should provide back up data for reporting in relation to some previously unavailable data. Perform data storage or customer information and transaction documents in digital form according to regulatory provisions and retention period of storage. The areas of compliance make sourced policy or procedure in accordance with the applicable law and regulatory regulations. In addition, standardizing the control process for each policy or procedure undertaken with the objective of minimizing the risk posed.

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MARKET STRUCTURE AND COMPETITION OF ISLAMIC BANKING IN INDONESIA

Sunarmo¹

ABSTRACT

The aim of this study is to investigate the market structure and competition of Islamic Banking with H-statistics (Panzar and Roose) model using panel data over a period of July 2010 to September 2014. The result of H-statistics test for long-run equilibrium showed disequilibrium condition. It means that Islamic banking in developing stage. While the market structure and competition test confirmed that the value of the degree of H-statistics generally in monopolistic competition market with score 0.53 to 1.06.

Keywords: equilibrium, structure and competition, Islamic banking in Indonesia, H-statistics (Panzar and Roose model)

JEL Classification: C23, D40, D58, G21, L11

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I. INTRODUCTION

The implementation of the dual banking system, in 2008, stipulated that banks in Indonesia have now embraced two working systems that are based on conventional principles and Islamic. A large number of banks will certainly increase banking competition in the country, not to mention the competition in Islamic banking. As of October 2014, there are 13 Islamic banks consisting of four foreign exchange banks, six non-foreign exchange banks and three mixed commercial banks (www.ojk.go.id).

The size of competition and the market structure are seen from the market power, which is the ability of a company (seller) to raise its relative price compared to its competitors without losing all its sales. The market power is the difference between the price and the marginal cost expressed relative to the price, which is formulated as $L = (P - MC) / P$ where L is the Lerner index which is an indicator of market power, P is the price at which the firm sells its output, and MC is the company's marginal cost for the volume of the firm. When $P = MC$, the firm competes as in perfect competition where the product is sold homogeneously, then $L = 0$. If $P > MC$, then $L > 0$ means that monopolist profit is maximal (Pindyck and Rubinfeld, 2012).

This study uses the company's share approach on the grounds that this approach is more specific. The theory that can give a clear picture as revealed by Cruch and Ware in Teguh (2013) mentioning that there are two groups of oligopoly companies, namely oligopolies that control some sales or all sales. The first group represents the 8 largest companies that control 75% of the total output in the market. The second represents the 8 companies that control at least 33% of the total market output, if 8 companies control less than 33% of the market share, the industry can be said not concentrated. This statement is supported by Lubis (2012) which uses 8 sample banks in Indonesia.

Based on these two studies, the researcher used samples of 8 Islamic commercial banks using the percentage of finance share approach which is the result of the financing amount of each Islamic bank proxy to total financing of all Islamic banking.

Figure 1. The Rating of Islamic Banks Based on Financing in October 2014 (Processed)

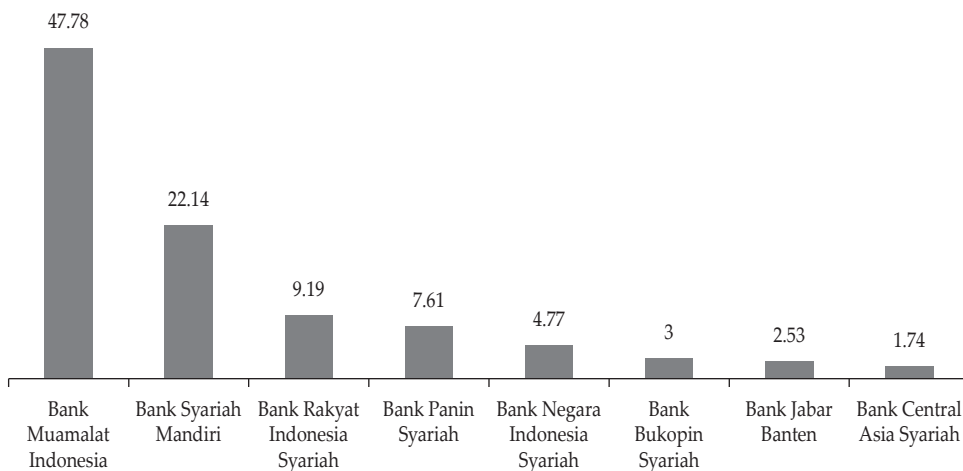


Figure 1 showed that the largest percentage of financing is owned by Bank Muamalat Indonesia (47.78%), followed by Bank Syariah Mandiri (22.14%), BRI Syariah (9.19%), Panin Syariah Bank (7.61%), BNI Syariah (4.77%), Bank Bukopin Syariah (3%), and BJB Syariah and BCA Syariah with 2.53% and 1.74%, respectively. The large difference in terms of financing between the top four banks and the four bottom banks indicates that the Islamic banking industry is sufficiently concentrated.

The banking concentration will bring competition to some banks, leading to monopoly. Uncompetitive competition is based on structural industry approach i.e. Structure-Conduct-Performance (SCP). The SCP approach assumes a one-way approach between the structure and performance (Martin, 1988). This is a disadvantage of the SCP approach. Thus, a new approach to measuring the competition parameters, based on the behavior, is the New Empirical Industrial Organization (NEIO). One form of this method is the Panzar and Rouse model or better-known as the model of H-statistics. Researcher uses this method as it has advantages over other models that are able to determine the broader market structures, estimates using linear regression, simple variables, and the use of individual data (cross section) which is more accurate in predicting market power (Panzar and Rouse, 1987). This paper aims to determine both the competition and market structure of Islamic banking based on Panzar and Rouse parameters.

The second part explores the theories and basic test models. The third section is a research methodology and the fourth section reviews the estimation results. The last part is a conclusion.

II. THEORY

2.1. The Development of Islamic Banking

The development of industrial economic calculation was very rapid after the approach of industrial economic model formulated by Bain (1956) through a combination of deductive and empirical approaches. This development has also had an impact on the banking industry. Banks, as strategic institutions in the intermediation of funds, play a significant role in the economic growth. Currently, the banking industry is not only based on the conventional principles, but also on sharia principles. The development of Islamic banking, internationally, was first initiated by Egypt at the Session of the Minister of Foreign Affairs of the Organization of Islamic Conference Organizations (ICO) in Karachi, Pakistan, in December 1970. In subsequent developments in the 1970s, efforts to establish Islamic banks began to spread to many countries. Some countries such as Iran, Pakistan, and Sudan have even transformed their entire financial system into no interest system.

The development of Islamic banking continues to the Southeast Asia countries, one of which is Indonesia. The establishment of an Indonesian Islamic bank began in 1980 through discussions on the theme of Islamic banks as pillars of Islamic economy. As a trial, the idea of Islamic banking was practiced on a relatively small scale such as in Bandung (Bait At-Tamwil Salman ITB) and Jakarta (Cooperative Ridho Gusti). Then, in 1990, the Indonesian Ulema Council initiated the

establishment of the first Islamic bank, Bank Muamalat Indonesia, which officially operated on May 1, 1992.

Today, the number of islamic banks is increasing due to at least two reasons. Firstly, the crisis of 1998 where Bank Muamalat, in that year, was stronger in facing the crisis. Secondly, Central Bank of Indonesia regulations that have officially implemented dual banking system supported by the enactment of Law Number. 21 of 2008 concerning Islamic Banking.

Both of these causes encouraged the conventional banks to open branches of islamic banks from the initial sharia units, only in the form of development into an independent islamic bank. The increasing number of islamic banks operating in Indonesia certainly pushed the level of competition between banks.

The relevant sizes of banking competition are used i.e. Panzar and Roose models (1987). The usual model, called H statistics, is based on the behavior of individuals or companies in the economy. The PR-H statistic test, in banking, was first performed by Shaffer (1982) with a sample of banks in New York, where the general results of banking in New York operate on monopolistic competition. This is similar to that of Molyneux and Forbes (1995) for banking in Europe, in countries such as France, Germany, Spain, and Britain in the period of 1986-1989, but the banking sector in Italy is indicated as a monopoly market. In addition, many economists such as Panzar and Roose (1987; 1982), Nathan and Neave (1989), Perrakis (1991), Bikker et al (2006) and Goddard and Wilson (2008) recommend the H-statistic PR models. Their study results assumed that companies are free to enter or exit the market without losing capital, and between firms, may lead to competition since it was first established (Gasaymeh, *et al*, 2014).

2.2. Non-structural approach

If in a structural approach with the SCP model prioritizing one-way approach where the performance of a banking can be seen from its structure, this is certainly not in accordance with the actual conditions in which the banking performance will be more visible from its competing behavior. Then, came the New Empirical Industrial Organization model. The Panzar Roose model, also known as H-Statistics, is an approach commonly used by researchers, especially in the banking industry.

This model was developed by Panzar and Rose in 1987 to measure the degree of competition in an industry, especially banking and competition derivatives in long-term equilibrium, monopoly, and monopolistic competition industries. There are two factors in the acceptance of banking which are the input price and control variable. Assuming that the n - input itself and output production function. The empirical model of H-statistics can be written as follows:

$$\log TR = \alpha + \sum_{i=1}^n \beta_i \log w_i + \sum_{j=1}^n \gamma_j \log CF_j + \varepsilon \quad (1)$$

where TR is the total revenue, w_i as an input factor consisting of wage labor, cost of funds and fixed capital costs. While the CF represents the controlled variable including total capital to total assets and total debt to total assets.

$$H - \text{Statistik} = \sum_{i=1}^n \beta_i \quad (2)$$

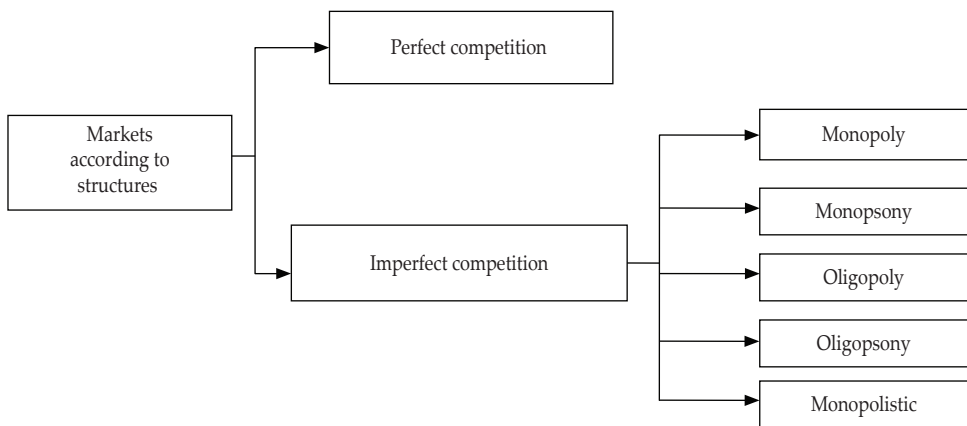
The H-statistical value reflects the competitive market structure and is the sum of the elasticity coefficients in the control variables. The representation of the H-statistic values is equal to 0 or negative, then it includes monopolistic competition or collusion oligopoly. It ranges between 0 and 1 for the case of monopolistic competition and if it is 1, then the form of competition is perfect.

The H-statistic model test has different results, it relates to the panel model used whether through Common-Constant, Fixed Effect method or Random Effect method (Naylah, 2010).

Some of the advantages of using H-statistic model are: (1) able to see the broader market structure, (2) can be estimated using linear regression model, (3) only need some variable for testing. Therefore, the Panzar and Roose (PR H-Statistics) model is very comprehensive if used to analyze competition, especially in the banking industry (Panzar and Roose, 1987).

The size of the competition is reflected in the form of market structure. In policy making, banks will consider the form of market structure so that the policy is taken on target. In addition, banks will gain profit or loss based on where they operate. Figure 2 presents the forms of market structure in the economy.

Figure 2. Forms of Markets in Economics



Source: Pindyck and Rubinfeld (2010), processed.

Based on figure 2 above, it can be explained that the perfect competition on the market is an industry where there are many sellers and buyers, and no seller and buyer can influence the price on the market (price taker). Monopoly is a market that has only one seller and many buyers (price maker). Instead, the monopsony market is a market with many sellers but only one buyer. The monopoly and monopsony are closely related. As a sole producer, the position of monopoly is unique. If the monopolist raises the price then he should not worry about competition. This is because the monopolist controls all the output to be sold (Pindyck and Rubinfeld, 2010).

The oligopoly market structure is a market structure where few firms compete with one another and the entry of other firms is inhibited, in contrast to the oligopsony which is the market structure with more sellers and more barriers to entry into the market. Basically, the monopolistic market lies between two types of markets namely perfectly competitive market and monopoly market with each company having unique products.

2.3. Empirical Review

Table 1.
Summary of Previous H-Statistical Research in The Banking Industry

No	Aspects	Description
1	Author	Muhamed Zulkehibri Abdul Majid and Fadzlan Sufian
	Title	Market Structure and Competition in Emerging Market: Evidence from Malaysian Islamic Banking Industry
	Period	2001 – 2005
	Results	H-Statistics ranged between 0.375 - 0.616 while in the equilibrium test the value ranged between 0824 - 0883 and rejected the Wald test, meaning that the market structure and competition of Islamic banking, in Malaysia, is in the market of monopolistic competition.
2	Author	Farhad khodadad Kashi and Jamal Zarein Beynabadi
	Title	The Degree of Competition in Iranian Banking Industry Panzar – Rosse Approach
	Period	2005 – 2010
	Results	H-Statistic of 0.7101, rejecting the Wald test for the monopoly market and perfect competition with a 1% significance, meaning that the Iranian banks compete in the monopolistic competition market.
3	Author	Rima Turk Ariss
	Title	Competitive Condition in Islamic and Conventional Banking: A Global Perspective
	Period	2000- 2006
	Results	H statistics showed that the banking in the Middle East operates on monopolistic market competition and the Lerner index value showed that Islamic banking is more competitive than the conventional.
4	Author	Maal Naylah
	Title	The Influence of Market Structure on the Indonesian Banking Performance
	Period	2004 – 2008
	Results	Testing of market structure (CR4): oligopolistic form of low moderate concentration (Type IV)
5	Author	Andi Fahmi Lubis
	Title	Indonesian Banking Market Power
	Period	1990 – 2004
	Results	Bresnahan-Lau model test showed that the level of competition on the credit market of Indonesian banking industry is still quite high based on the markup coefficient of 0.0223

Table 1.
Summary of Previous H-Statistical Research in The Banking Industry (Continued)

No	Aspects	Description
6	Author	Anwar Salameh Gasaymeh, Zulkefly A, Mariani Abdul, Mansor Jusoh
	Title	Competition and Market Structure of Banking Sector: A Panel Study of Jordan and GCC Countries
	Period	2003 – 2010
	Results	The only dynamic Oman model test operates on monopolistic competition, whereas the Jordan and other GCC countries are in monopolistic competition.
7	Author	Moh Athoillah
	Title	Market Structure of the Indonesian Banking Industry: Roose - Panzar Test
	Period	2002 – 2007
	Results	The condition of the banking market is in the long-term balance and monopolistic market structure with a value of 0.931
8	Author	Ratna Sri Widyastuti and Boedi Armanto
	Title	Competition of the Indonesian Banking Industry
	Period	2001 – 2006
	Results	The competition test showed that during the consolidation period, all commercial banks had monopolistic structure and post API, all banks were on collusive oligopoly market.
9	Author	Jean- Michel Sahut, Mehdi Mili, and Maroua Ben Krir
	Title	Factors of Competitiveness of Islamic Banks in the New Financial Order
	Period	2000 – 2007
	Results	Tests of PR-H statistics showed that the Islamic banks (0.0259055) are larger and significantly competitive than conventional banks (0.006566) and are in the monopolistic market. The Lerner Index test showed that the degree of market power of Islamic banks is (0.8063) greater than that of conventional banks (0.2621)

III. METHODOLOGY

3.1. Types and Sources of Data

The data used is panel data which is a combination of individual data (cross-section) and time series data with a sample 8 islamic commercial banks operating in Indonesia and classified based on financing in October 2014 with a time frame between June 2010 - September 2014.

Table 2.
Eight Islamic Commercial (C8) Banks

Ranking	Islamic Banks
1	Bank Muamalat
2	Bank Syariah Mandiri
3	BRI Syariah
4	Panin Syariah
5	BNI Syariah
6	Bukopin Syariah
7	BJB Syariah
8	BCA Syariah

Source: Financial Statements of Banking Publications, Bank Indonesia and the Financial Services Authority, processed.

3.2. Variable Restrictions

The variables consist of three independent variables, including labor inputs, cost of funds, fixed capital cost, and two controlled variables i.e. primary ratio, the asset to loan ratio, while the dependent variable uses the income ratio and return on asset (ROA).

Table 3.
PR-H Statistic Variables

Names of Data	Types of Variables	Time Frame	Units of Measurement	Sources of Data
Total Revenue (TR)	Bound	Monthly	Ratio	BI and FSA
Return on Asset (ROA)	Bound	Monthly	Ratio	BI and FSA
Wages of labor (W_L)	Free	Monthly	Ratio	BI and FSA
Cost of funds (W_F)	Free	Monthly	Ratio	BI and FSA
Fixed capital costs (W_K)	Free	Monthly	Ratio	BI and FSA
Primary ratio (Y_1)	Free	Monthly	Ratio	BI and FSA
Asset to loan ratio (Y_2)	Free	Monthly	Ratio	BI and FSA

Description of variable constraints:

1. Total revenue (TR) is total bank income derived from non-interest operational income for islamic banking which is proxy to total asset
2. Return on Assets (ROA) is the ability of a bank to make the profit through the use of its assets. The ROA is in proxy from the profit before tax to total assets
3. Wages of Labor (W_L) is the operational cost of the bank in terms of labor wages. The wage of labor is the burden the bank must pay to its workers. It uses the ratio of wages to total assets
4. The cost of funds (W_F) is the burden borne by banks for bonuses on third parties (customers)
5. The Fixed capital cost (W_K) is an administrative and promotional burden to be borne by a bank that is proxied using owned assets.
6. The Primary ratio (Y_1) is a ratio of capital health which measures the extent to which the decrease in total incoming assets can be covered by capital
7. The asset to loan ratio (Y_2) is the ratio to measure the amount of financing disbursed by the total assets owned by islamic banks.

3.3. Models and Methods of Analysis

Data analysis is the process of simplifying the data into a form that is easier to read and interpret. The econometric model for panel data was used in the present research. The form of the equation was as follows:

$$Y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_n X_{nit} + \varepsilon_{it} \quad (3)$$

The stages of panel data test consist of Pooled Least Square modeling, Fixed Effect, and Random Effect.

3.4. PR H-Statistic Method

The PR H-statistic method is one form of market power measurement in the banking industry with the un-structural approach. The un-structural approach is more of determining the company's behavioral aspects in influencing the market conditions (Widyastuti and Armanto, 2013). This method was first developed by Panzar and Roose in 1987 and used to measure the degree of market power in the banking industry. The measure of market power through the PR H-statistics is derived from the sum of the input of price elasticity coefficients i.e. labor costs (W_L), cost of funds (W_F) and fixed capital costs (W_K), which respond to the total revenue. The representation of the sum of input variables can be used to determine the market structure in which the firm operates.

Some of the advantages of the PR H-statistic method are: (1) able to see the broader market structure, (2) can be estimated using econometric model with regression, (3) the variable used is quite simple, (4) using the individual data (cross-section) as a form of competition among banks.

The PR-H Statistics method is applied to companies with one type of product. Thus, banks are treated as producers with output in the form of loans. The assumptions of this method are long-run equilibrium and the maximization of profit earning (Panzar and Roose, 1987).

Before estimating the PR H-statistic, a long-run equilibrium test is intended, for, in case of balance, the research can proceed to market power, whereas if not, the research is stopped. However, Shaffer (1982) in Widyastuti and Armanto (2013), said that if the study shows a disequilibrium condition, it indicates that the banking industry is developing dynamically during research observation, thus, the research can proceed.

The equation of long-run equilibrium test of the PR-H statistic method is as follows:

$$\begin{aligned} \ln ROA_{it} = & \beta_0 + \beta_1 \ln(W_{L,it}) + \beta_2 \ln(W_{F,it}) + \beta_3 \ln(W_{K,it}) + \beta_4 \ln(Y_{1,it}) \\ & + \beta_5 \ln(Y_{2,it}) + \varepsilon_{it} \end{aligned} \quad (4)$$

The long-run equilibrium is interpreted as follows:

If PR - H statistic_{ROA} < 0 there is no equilibrium

If PR - H statistic_{ROA} = 0 there is equilibrium

PR - H statistic_{ROA} is the sum of the elasticities of β_1 , β_2 , and β_3 . Whereas, the equation to see the degree of market power is only by replacing the variable Return on Asset (ROA) with total bank income to total assets (TR).

So, the equation becomes:

$$\begin{aligned} \ln(TR_{it}) = & \beta_0 + \beta_1 \ln(W_{L,it}) + \beta_2 \ln(W_{F,it}) + \beta_3 \ln(W_{K,it}) + \beta_4 \ln(Y_{1,it}) \\ & + \beta_5 \ln(Y_{2,it}) + \varepsilon_{it} \end{aligned} \quad (5)$$

Description:

$\ln TR_{it}$ = Non-interest income/total assets

$\ln ROA_{it}$ = Profit before tax/total assets

$\ln W_{F,it}$ = Bonus expense (wadiah)/total assets

$\ln W_{L,it}$ = Labor load/ total assets

$\ln W_{K,it}$ = Operational load/total assets

$\ln Y_{1,it}$ = Total capital/total assets

$\ln Y_{2,it}$ = Total debt/total assets

The interpretation of the *market power* is as follows.

PR-H statistic_{TR} = 0 monopolistic competition

PR-H statistic_{TR} = 1 perfect competition

PR-H statistic_{TR} $0 < H_{TR} < 1$ = Monopolistic Competition

All of the variables in the PR H-statistic method use the addition of natural logarithm (ln) to show elasticity, since the market power values range between 0 and 1 so that the degree of the market indicator is immediately detected.

IV. RESULTS AND ANALYSIS

4.1. Panzar and Roose (PR H- Statistics) analysis

The panel data estimation is done on Eviews 7 with the timeframe of July 2010-September 2014, which is grouped every 3 months. Thus, there are 17 test result data of test phase, consisting of the best method selection (PLS, FEM, or REM), equilibrium test, and PR H-Statistic test. The results and discussion of each test are described as follows.

4.2. The Best Model of Islamic Bank Equilibrium Test

Table 4.
Selection of The Best Model of Islamic Bank Equilibrium Test

Periods	Test	Model Selection			
		Prob	Significance 0.05	Best Model	Conclusion
July – September 2010	Chow	0.0000	0.05	FEM	The best model is REM, because 0.0507 > 0.05
	Housman	0.0507	0.05	REM	
October – December 2010	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0000 < 0.05
	Housman	0.0000	0.05	FEM	
January – March 2011	Chow	0.0000	0.05	FEM	The best model is REM, because 0.3875 > 0.05
	Housman	0.3875	0.05	REM	
April – June 2011	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0320 < 0.05
	Housman	0.0320	0.05	FEM	
July – September 2011	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0479 < 0.05
	Housman	0.0479	0.05	FEM	
October – December 2011	Chow	0.0000	0.05	FEM	The best model is REM, because 0.9381 > 0.05
	Housman	0.9381	0.05	REM	
January – March 2012	Chow	0.0001	0.05	FEM	The best model is REM, because 0.9839 > 0.05
	Housman	0.9839	0.05	REM	

Table 4.
Selection of The Best Model of Islamic Bank Equilibrium Test (Continued)

Periods	Test	Model Selection			
		Prob	Significance 0.05	Best Model	Conclusion
April – June 2012	Chow	0.0000	0.05	FEM	The best model is REM because 0.82>0.05
	Housman	0.8299	0.05	REM	
July – September 2012	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0000 < 0.05
	Housman	0.0000	0.05	FEM	
October – December 2012	Chow	0.0000	0.05	FEM	The best model is REM, because 0.4376 > 0.05
	Housman	0.4376	0.05	REM	
January – March 2013	Chow	0.0000	0.05	FEM	The best model is REM, because 0.0000 < 0.05
	Housman	0.0000	0.05	FEM	
April – June 2013	Chow	0.0028	0.05	FEM	The best model is REM, because 0.8007 < 0.05
	Housman	0.8007	0.05	REM	
July – September 2013	Chow	0.0000	0.05	FEM	The best model is REM, because 0.5859 > 0.05
	Housman	0.5859	0.05	REM	
October – December 2013	Chow	0.0000	0.05	FEM	The best model is REM, because 0.2848 > 0.05
	Housman	0.2848	0.05	REM	
January – March 2014	Chow	0.0000	0.05	FEM	The best model is REM, because 0.6506 > 0.05
	Housman	0.6506	0.05	REM	
April – June 2014	Chow	0.0000	0.05	FEM	The best model is REM, because 0.7878 > 0.05
	Housman	0.7878	0.05	REM	
July – September 2014	Chow	0.0000	0.05	FEM	The best model is REM, because 0.8698 > 0.05
	Housman	0.8698	0.05	REM	

Source: Appendix 2.

The selection of the best model for islamic bank equilibrium test, as in Table 12, is Fixed effect model and Random Effect Model (REM). The FEM modeling took place in the period of October-December 2010, April-June 2011, July-September 2011, July-September 2012, and January-March 2013, while the other twelve periods used the REM test. However, this test often raises the problem of correlation between interference variables (autocorrelation), and to overcome it, the REM test method of Generalized Least Square (GLS) is used.

4.3. Best Model of PR H-Statistics Test in Islamic Banking

Table 5.
Selection of The Best Models of PR H-Statistics Test in Islamic Banking

Periods	Test	Pemilihan Model			
		Prob	Significance 0,05	Best model	Conclusion
July – September 2010	Chow	0.0000	0.05	FEM	The best model is REM, because 0.3360 > 0.05
	Housman	0.3360	0.05	REM	
October – December 2010	Chow	0.0000	0.05	FEM	The best model is REM, because 0.7003 > 0.05
	Housman	0.7003	0.05	REM	
January – March 2011	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0201 < 0.05
	Housman	0.0201	0.05	FEM	
April – June 2011	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0044 < 0.05
	Housman	0.0044	0.05	FEM	
July – September 2011	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0048 < 0.05
	Housman	0.0048	0.05	FEM	
October – December 2011	Chow	0.0005	0.05	FEM	The best model is REM, because 0.5280 > 0.05
	Housman	0.5280	0.05	REM	
January – March 2012	Housman	0.0001	0.05	REM	The best model is REM, because 0.1144 > 0.05
	Chow	0.0001	0.05	FEM	
April – June 2012	Housman	0.1144	0.05	REM	The best model is FEM, because 0.0000 < 0.05
	Chow	0.0001	0.05	FEM	
July – September 2012	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0000 < 0.05
	Housman	0.0000	0.05	FEM	
October – December 2012	Chow	0.0002	0.05	FEM	The best model is REM, because 0.6590 > 0.05
	Housman	0.6590	0.05	REM	
January – March 2013	Chow	0.0000	0.05	FEM	The best model is REM, because 0.0000 < 0.05
	Housman	0.0000	0.05	FEM	
April – June 2013	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0015 < 0.05
	Housman	0.0015	0.05	FEM	
July – September 2013	Chow	0.0000	0.05	FEM	The best model is REM, because 0.0000 < 0.05
	Housman	0.0000	0.05	FEM	
October – December 2013	Chow	0.4769	0.05	PLS	The best model is PLS, because 0.4769 > 0.05
January – March 2014	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0000 < 0.05
	Housman	0.0000	0.05	FEM	

Table 5.
Selection of Best Models of PR H-Statistics Test in Islamic Banking (Continued)

Periods	Test	Pemilihan Model			
		Prob	Significance 0,05	Best model	Conclusion
April – June 2014	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0000 < 0.05
	Housman	0.0000	0.05	FEM	
July – September 2014	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0000 < 0.05
	Housman	0.0000	0.05	FEM	

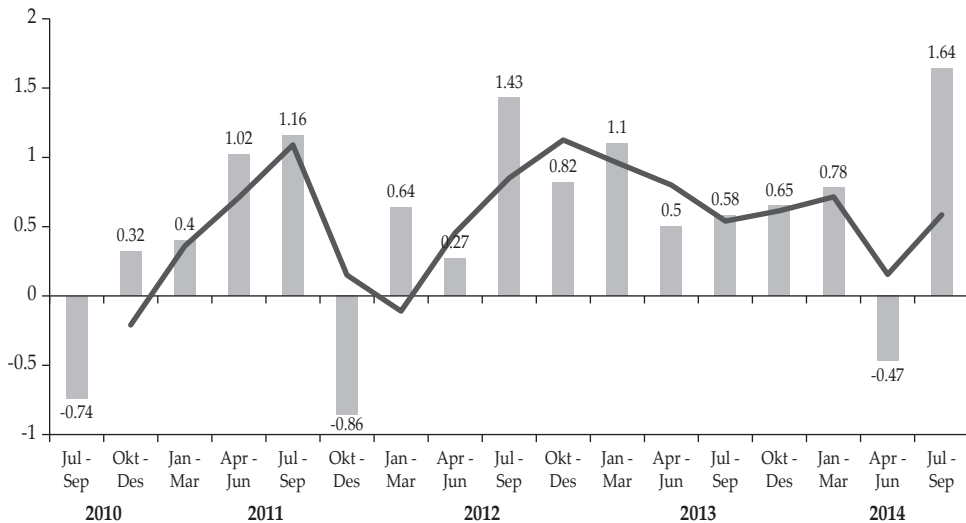
Source:

In general, in Table 14, the best model used in the estimation of the PR-H statistics islamic banking is the Fixed Effect Model (FEM) of 11 periods, while the Random effect is 5 periods i.e. July-September 2010, October-December 2010, October-December 2011, January-March 2012, and October-December 2012. Meanwhile, the Pooled Least Square model (PLS) is used in the period of October-December 2013. The PLS modeling, in that period, shows that the eight-islamic banking is assumed to have the same intercept and slope.

4.4. Long Run Equilibrium Test Results of Islamic Banking

This test is used to view the long-run equilibrium and is the sum of the input variable coefficients of the estimation using the Eviews 6.0 i.e. labor cost (InW_L), cost of funds (InW_F), and capital cost (InW_K) which are the main requirements of continuing to H - Statistics.

Figure 3. The Result of Long-Run Equilibrium Test of Islamic Banking, from July–September 2010 to July–September 2014



Islamic banking appears to have a tendency to approach the equilibrium level indicated by the value close to 0. However, the movement is quite extreme in the period of July-September with (1.16 points), July-September 2012 (1.43 points), and July-September 2014 (1.64 points).

Islamic banking is in disequilibrium condition and tends to approach 0. This is similar to the research conducted by Widyastuti and Armanto (2013) and Sahut, *et al.* (2012).

This condition indicates that islamic banking is in a developing condition which means that islamic banking is not yet dominating the economy. This is in line with the Financial Services Authority survey in 2013 on financial literacy, which showed that the community's understanding of banking was only 21.80%, which was lower compared to the Philippines (27%), Malaysia (66%), Thailand (73%) and Singapore with the highest level of understanding of the banking sector i.e. 98%.

The low level of banking literacy, in Indonesia, indicates that many people do not use banking as a financial intermediary institution. This has an impact on the low DPK owned by islamic banks and the hampering growth of the real sector.

The continuous development of islamic banking, in Indonesia, is caused by the visibility of its new market share of about 5% of the total banking assets in Indonesia. So, it takes hard work to add customers. One of the efforts made by the Financial Services Authority and Bank Indonesia is the promotion of Islamic finance, policy-making, and legislation. However, their efforts are certainly not enough to increase the market share of islamic banking. Therefore, there is a need for the role of the banking itself and the community. The efforts that need to be done by islamic banking is the increase in the number of branches and ATMs in the regions. In 2017, FSA recorded the number of operational headquarters (KPO) of islamic banks as follows: 152 offices, 136 sub-branches and 53 cash offices (still lacking).

Another effort that can be carried out is through the role of ulama in providing education on Islamic finance through Islamic study materials in mosques. With the collaboration of the government, banks, and community, it is expected that the future of islamic banking will be more advanced, growing and stable.

4.5. PR H-Statistics Test Results of Islamic Banking

Figure 4. PR H-Statistics Results Islamic Banking from July-September 2010 to July-September 2014

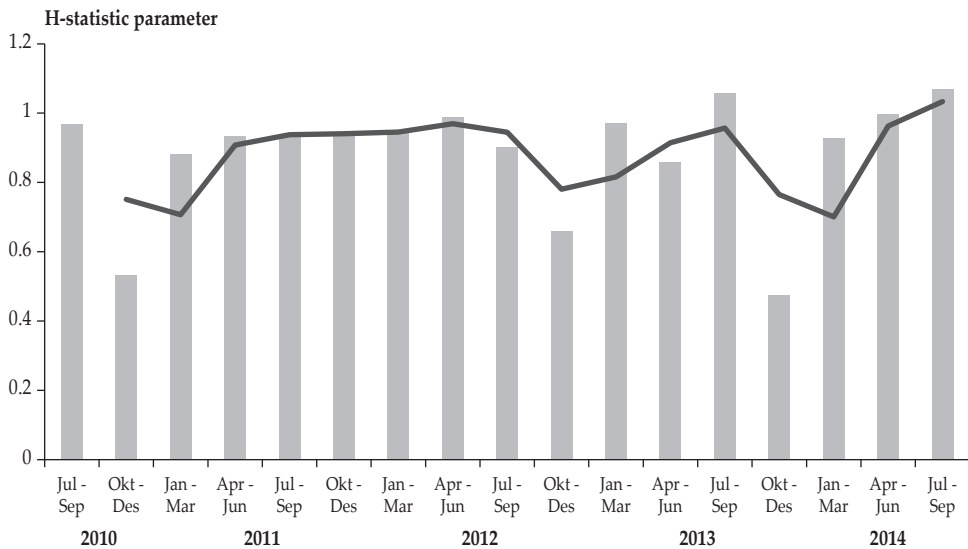


Figure 4 shows that the pattern of the strength of islamic banking always falls within a range of more than 0 to more than 1, indicating that it is in the perfect market and monopolistic competitions.

Perfect competition conditions occur twice i.e. in the period of July-September 2013 (1.05) and July-September 2014 (1.06). Meanwhile, the other periods operate in the monopolistic market. This means that the diversity of products and advertising in islamic banking during this period is quite dominant in order to increase the number of customers. The strong competition amongst islamic banks is caused by the dominance of conventional banking that opened the branch of sharia after the endurance of Bank Muamalat Indonesia during the economic crisis of 1998 (Faiz, 2010).

Another factor is the regulation of the Ministry of Religious Affairs of the Republic of Indonesia related to the pilgrimage funds that must be deposited into Islamic banking, which reflect the government's trust in Islamic banks in the management of pilgrim funds. In addition, islamic state securities products (retail Sukuk) issued by the government was recently quite enthused by the community. However, the products of Islamic banks themselves, in practice, are still dominated by the sale and purchase agreement (Murabaha) (Natadipurba, 2015).

Generally present in a monopolistic market and perfect competition means that although the product differentiation is quite good, there is still a perfect competition condition. This shows that islamic banking has not been consistent in making innovative financial products. Therefore, in the future, islamic banking needs to make superior financial products that will become his trademark. Thus, each islamic bank has its own market share and can compete from the non-price side.

V. CONCLUSIONS

5.1. Conclusions

Based on the description and discussion, it can be concluded that:

1. The equilibrium test results show the value close to 0, meaning that the condition of islamic banking, in the long run, does not show equilibrium. This means that islamic banking is in a developing condition. Therefore, the collaboration between the government, especially FSA and BI, banking and community is needed to increase the growth of islamic banking in the future.
2. The H-statistic test results show that islamic banking operates on the monopolistic market and perfect competition. This means that islamic banking has not been consistent in developing its products. So, it requires the development of excellent products with specific characteristics and market share.

5.2. Suggestions

The suggestions submitted by the author for further research improvements are as follows:

1. In order for the results to be more comprehensive, there is a need for additional variables and period of study.
2. The high level of competition in islamic banking demands the government, in this case, the Financial Services Authority and related parties, to improve the level of interbank competition.

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MARKET STRUCTURE AND COMPETITION OF ISLAMIC BANKING IN INDONESIA

Sunarmo¹

ABSTRACT

The aim of this study is to investigate the market structure and competition of Islamic Banking with H-statistics (Panzar and Roose) model using panel data over a period of July 2010 to September 2014. The result of H-statistics test for long-run equilibrium showed disequilibrium condition. It means that Islamic banking in developing stage. While the market structure and competition test confirmed that the value of the degree of H-statistics generally in monopolistic competition market with score 0.53 to 1.06.

Keywords: equilibrium, structure and competition, Islamic banking in Indonesia, H-statistics (Panzar and Roose model)

JEL Classification: C23, D40, D58, G21, L11

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I. INTRODUCTION

The implementation of the dual banking system, in 2008, stipulated that banks in Indonesia have now embraced two working systems that are based on conventional principles and islamic. A large number of banks will certainly increase banking competition in the country, not to mention the competition in Islamic banking. As of October 2014, there are 13 islamic banks consisting of four foreign exchange banks, six non-foreign exchange banks and three mixed commercial banks (www.ojk.go.id).

The size of competition and the market structure are seen from the market power, which is the ability of a company (seller) to raise its relative price compared to its competitors without losing all its sales. The market power is the difference between the price and the marginal cost expressed relative to the price, which is formulated as $L = (P-MC)/P$ where L is the Lerner index which is an indicator of market power, P is the price at which the firm sells its output, and MC is the company's marginal cost for the volume of the firm. When $P = MC$, the firm competes as in perfect competition where the product is sold homogeneously, then $L = 0$. If $P > MC$, then $L > 0$ means that monopolist profit is maximal (Pindyck and Rubinfeld, 2012).

This study uses the company's share approach on the grounds that this approach is more specific. The theory that can give a clear picture as revealed by Cruch and Ware in Teguh (2013) mentioning that there are two groups of oligopoly companies, namely oligopolies that control some sales or all sales. The first group represents the 8 largest companies that control 75% of the total output in the market. The second represents the 8 companies that control at least 33% of the total market output, if 8 companies control less than 33% of the market share, the industry can be said not concentrated. This statement is supported by Lubis (2012) which uses 8 sample banks in Indonesia.

Based on these two studies, the researcher used samples of 8 islamic commercial banks using the percentage of finance share approach which is the result of the financing amount of each islamic bank proxy to total financing of all islamic banking.

Figure 1. The Rating of Islamic Banks Based on Financing in October 2014 (Processed)

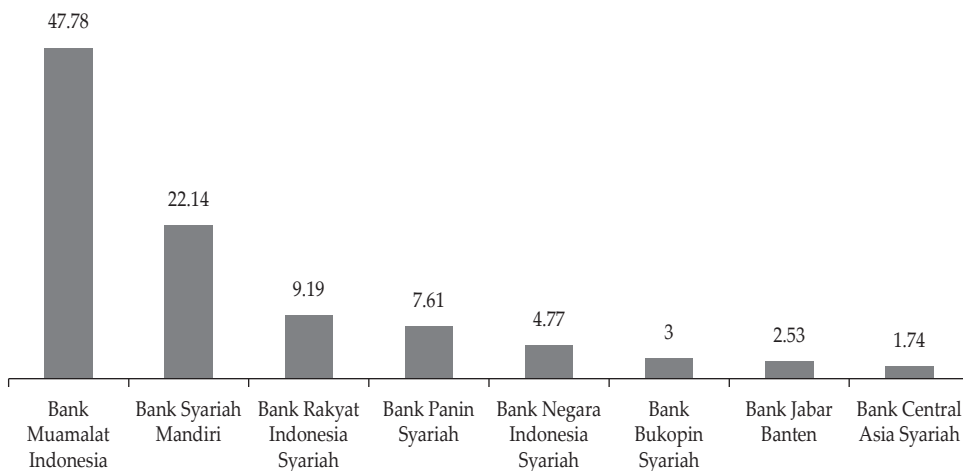


Figure 1 showed that the largest percentage of financing is owned by Bank Muamalat Indonesia (47.78%), followed by Bank Syariah Mandiri (22.14%), BRI Syariah (9.19%), Panin Syariah Bank (7.61%), BNI Syariah (4.77%), Bank Bukopin Syariah (3%), and BJB Syariah and BCA Syariah with 2.53% and 1.74%, respectively. The large difference in terms of financing between the top four banks and the four bottom banks indicates that the Islamic banking industry is sufficiently concentrated.

The banking concentration will bring competition to some banks, leading to monopoly. Uncompetitive competition is based on structural industry approach i.e. Structure-Conduct-Performance (SCP). The SCP approach assumes a one-way approach between the structure and performance (Martin, 1988). This is a disadvantage of the SCP approach. Thus, a new approach to measuring the competition parameters, based on the behavior, is the New Empirical Industrial Organization (NEIO). One form of this method is the Panzar and Rouse model or better-known as the model of H-statistics. Researcher uses this method as it has advantages over other models that are able to determine the broader market structures, estimates using linear regression, simple variables, and the use of individual data (cross section) which is more accurate in predicting market power (Panzar and Rouse, 1987). This paper aims to determine both the competition and market structure of Islamic banking based on Panzar and Rouse parameters.

The second part explores the theories and basic test models. The third section is a research methodology and the fourth section reviews the estimation results. The last part is a conclusion.

II. THEORY

2.1. The Development of Islamic Banking

The development of industrial economic calculation was very rapid after the approach of industrial economic model formulated by Bain (1956) through a combination of deductive and empirical approaches. This development has also had an impact on the banking industry. Banks, as strategic institutions in the intermediation of funds, play a significant role in the economic growth. Currently, the banking industry is not only based on the conventional principles, but also on sharia principles. The development of Islamic banking, internationally, was first initiated by Egypt at the Session of the Minister of Foreign Affairs of the Organization of Islamic Conference Organizations (ICO) in Karachi, Pakistan, in December 1970. In subsequent developments in the 1970s, efforts to establish Islamic banks began to spread to many countries. Some countries such as Iran, Pakistan, and Sudan have even transformed their entire financial system into no interest system.

The development of Islamic banking continues to the Southeast Asia countries, one of which is Indonesia. The establishment of an Indonesian Islamic bank began in 1980 through discussions on the theme of Islamic banks as pillars of Islamic economy. As a trial, the idea of Islamic banking was practiced on a relatively small scale such as in Bandung (Bait At-Tamwil Salman ITB) and Jakarta (Cooperative Ridho Gusti). Then, in 1990, the Indonesian Ulema Council initiated the

establishment of the first Islamic bank, Bank Muamalat Indonesia, which officially operated on May 1, 1992.

Today, the number of Islamic banks is increasing due to at least two reasons. Firstly, the crisis of 1998 where Bank Muamalat, in that year, was stronger in facing the crisis. Secondly, Central Bank of Indonesia regulations that have officially implemented dual banking system supported by the enactment of Law Number. 21 of 2008 concerning Islamic Banking.

Both of these causes encouraged the conventional banks to open branches of Islamic banks from the initial sharia units, only in the form of development into an independent Islamic bank. The increasing number of Islamic banks operating in Indonesia certainly pushed the level of competition between banks.

The relevant sizes of banking competition are used i.e. Panzar and Rose models (1987). The usual model, called H statistics, is based on the behavior of individuals or companies in the economy. The PR-H statistic test, in banking, was first performed by Shaffer (1982) with a sample of banks in New York, where the general results of banking in New York operate on monopolistic competition. This is similar to that of Molyneux and Forbes (1995) for banking in Europe, in countries such as France, Germany, Spain, and Britain in the period of 1986-1989, but the banking sector in Italy is indicated as a monopoly market. In addition, many economists such as Panzar and Rose (1987; 1982), Nathan and Neave (1989), Perrakis (1991), Bikker et al (2006) and Goddard and Wilson (2008) recommend the H-statistic PR models. Their study results assumed that companies are free to enter or exit the market without losing capital, and between firms, may lead to competition since it was first established (Gasaymeh, *et al*, 2014).

2.2. Non-structural approach

If in a structural approach with the SCP model prioritizing one-way approach where the performance of a banking can be seen from its structure, this is certainly not in accordance with the actual conditions in which the banking performance will be more visible from its competing behavior. Then, came the New Empirical Industrial Organization model. The Panzar Rose model, also known as H-Statistics, is an approach commonly used by researchers, especially in the banking industry.

This model was developed by Panzar and Rose in 1987 to measure the degree of competition in an industry, especially banking and competition derivatives in long-term equilibrium, monopoly, and monopolistic competition industries. There are two factors in the acceptance of banking which are the input price and control variable. Assuming that the n - input itself and output production function. The empirical model of H-statistics can be written as follows:

$$\log TR = \alpha + \sum_{i=1}^n \beta_i \log w_i + \sum_{j=1}^n \gamma_j \log CF_j + \varepsilon \quad (1)$$

where TR is the total revenue, w_i as an input factor consisting of wage labor, cost of funds and fixed capital costs. While the CF represents the controlled variable including total capital to total assets and total debt to total assets.

$$H - \text{Statistik} = \sum_{i=1}^n \beta_i \quad (2)$$

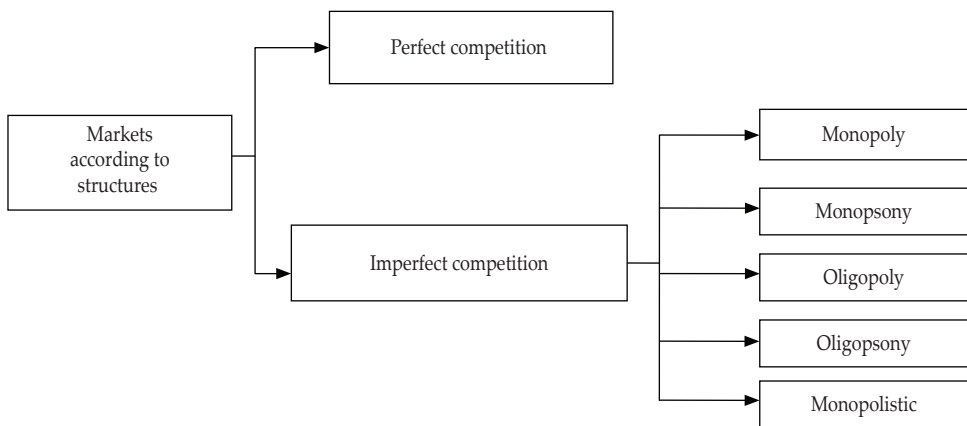
The H-statistical value reflects the competitive market structure and is the sum of the elasticity coefficients in the control variables. The representation of the H-statistic values is equal to 0 or negative, then it includes monopolistic competition or collusion oligopoly. It ranges between 0 and 1 for the case of monopolistic competition and if it is 1, then the form of competition is perfect.

The H-statistic model test has different results, it relates to the panel model used whether through Common-Constant, Fixed Effect method or Random Effect method (Naylah, 2010).

Some of the advantages of using H-statistic model are: (1) able to see the broader market structure, (2) can be estimated using linear regression model, (3) only need some variable for testing. Therefore, the Panzar and Roose (PR H-Statistics) model is very comprehensive if used to analyze competition, especially in the banking industry (Panzar and Roose, 1987).

The size of the competition is reflected in the form of market structure. In policy making, banks will consider the form of market structure so that the policy is taken on target. In addition, banks will gain profit or loss based on where they operate. Figure 2 presents the forms of market structure in the economy.

Figure 2. Forms of Markets in Economics



Source: Pindyck and Rubinfeld (2010), processed.

Based on figure 2 above, it can be explained that the perfect competition on the market is an industry where there are many sellers and buyers, and no seller and buyer can influence the price on the market (price taker). Monopoly is a market that has only one seller and many buyers (price maker). Instead, the monopsony market is a market with many sellers but only one buyer. The monopoly and monopsony are closely related. As a sole producer, the position of monopoly is unique. If the monopolist raises the price then he should not worry about competition. This is because the monopolist controls all the output to be sold (Pindyck and Rubinfeld, 2010).

The oligopoly market structure is a market structure where few firms compete with one another and the entry of other firms is inhibited, in contrast to the oligopsony which is the market structure with more sellers and more barriers to entry into the market. Basically, the monopolistic market lies between two types of markets namely perfectly competitive market and monopoly market with each company having unique products.

2.3. Empirical Review

Table 1.
Summary of Previous H-Statistical Research in The Banking Industry

No	Aspects	Description
1	Author	Muhamed Zulkehibri Abdul Majid and Fadzlan Sufian
	Title	Market Structure and Competition in Emerging Market: Evidence from Malaysian Islamic Banking Industry
	Period	2001 – 2005
	Results	H-Statistics ranged between 0.375 - 0.616 while in the equilibrium test the value ranged between 0824 - 0883 and rejected the Wald test, meaning that the market structure and competition of Islamic banking, in Malaysia, is in the market of monopolistic competition.
2	Author	Farhad khodadad Kashi and Jamal Zarein Beynabadi
	Title	The Degree of Competition in Iranian Banking Industry Panzar – Rosse Approach
	Period	2005 – 2010
	Results	H-Statistic of 0.7101, rejecting the Wald test for the monopoly market and perfect competition with a 1% significance, meaning that the Iranian banks compete in the monopolistic competition market.
3	Author	Rima Turk Ariss
	Title	Competitive Condition in Islamic and Conventional Banking: A Global Perspective
	Period	2000- 2006
	Results	H statistics showed that the banking in the Middle East operates on monopolistic market competition and the Lerner index value showed that Islamic banking is more competitive than the conventional.
4	Author	Maal Naylah
	Title	The Influence of Market Structure on the Indonesian Banking Performance
	Period	2004 – 2008
	Results	Testing of market structure (CR4): oligopolistic form of low moderate concentration (Type IV)
5	Author	Andi Fahmi Lubis
	Title	Indonesian Banking Market Power
	Period	1990 – 2004
	Results	Bresnahan-Lau model test showed that the level of competition on the credit market of Indonesian banking industry is still quite high based on the markup coefficient of 0.0223

Table 1.
Summary of Previous H-Statistical Research in The Banking Industry (Continued)

No	Aspects	Description
6	Author	Anwar Salameh Gasaymeh, Zulkefly A, Mariani Abdul, Mansor Jusoh
	Title	Competition and Market Structure of Banking Sector: A Panel Study of Jordan and GCC Countries
	Period	2003 – 2010
	Results	The only dynamic Oman model test operates on monopolistic competition, whereas the Jordan and other GCC countries are in monopolistic competition.
7	Author	Moh Athoillah
	Title	Market Structure of the Indonesian Banking Industry: Roose - Panzar Test
	Period	2002 – 2007
	Results	The condition of the banking market is in the long-term balance and monopolistic market structure with a value of 0.931
8	Author	Ratna Sri Widyastuti and Boedi Armanto
	Title	Competition of the Indonesian Banking Industry
	Period	2001 – 2006
	Results	The competition test showed that during the consolidation period, all commercial banks had monopolistic structure and post API, all banks were on collusive oligopoly market.
9	Author	Jean- Michel Sahut, Mehdi Mili, and Maroua Ben Krir
	Title	Factors of Competitiveness of Islamic Banks in the New Financial Order
	Period	2000 – 2007
	Results	Tests of PR-H statistics showed that the Islamic banks (0.0259055) are larger and significantly competitive than conventional banks (0.006566) and are in the monopolistic market. The Lerner Index test showed that the degree of market power of Islamic banks is (0.8063) greater than that of conventional banks (0.2621)

III. METHODOLOGY

3.1. Types and Sources of Data

The data used is panel data which is a combination of individual data (cross-section) and time series data with a sample 8 islamic commercial banks operating in Indonesia and classified based on financing in October 2014 with a time frame between June 2010 - September 2014.

Table 2.
Eight Islamic Commercial (C8) Banks

Ranking	Islamic Banks
1	Bank Muamalat
2	Bank Syariah Mandiri
3	BRI Syariah
4	Panin Syariah
5	BNI Syariah
6	Bukopin Syariah
7	BJB Syariah
8	BCA Syariah

Source: Financial Statements of Banking Publications, Bank Indonesia and the Financial Services Authority, processed.

3.2. Variable Restrictions

The variables consist of three independent variables, including labor inputs, cost of funds, fixed capital cost, and two controlled variables i.e. primary ratio, the asset to loan ratio, while the dependent variable uses the income ratio and return on asset (ROA).

Table 3.
PR-H Statistic Variables

Names of Data	Types of Variables	Time Frame	Units of Measurement	Sources of Data
Total Revenue (TR)	Bound	Monthly	Ratio	BI and FSA
Return on Asset (ROA)	Bound	Monthly	Ratio	BI and FSA
Wages of labor (W_L)	Free	Monthly	Ratio	BI and FSA
Cost of funds (W_F)	Free	Monthly	Ratio	BI and FSA
Fixed capital costs (W_K)	Free	Monthly	Ratio	BI and FSA
Primary ratio (Y_1)	Free	Monthly	Ratio	BI and FSA
Asset to loan ratio (Y_2)	Free	Monthly	Ratio	BI and FSA

Description of variable constraints:

1. Total revenue (TR) is total bank income derived from non-interest operational income for islamic banking which is proxy to total asset
2. Return on Assets (ROA) is the ability of a bank to make the profit through the use of its assets. The ROA is in proxy from the profit before tax to total assets
3. Wages of Labor (W_L) is the operational cost of the bank in terms of labor wages. The wage of labor is the burden the bank must pay to its workers. It uses the ratio of wages to total assets
4. The cost of funds (W_F) is the burden borne by banks for bonuses on third parties (customers)
5. The Fixed capital cost (W_K) is an administrative and promotional burden to be borne by a bank that is proxied using owned assets.
6. The Primary ratio (Y_1) is a ratio of capital health which measures the extent to which the decrease in total incoming assets can be covered by capital
7. The asset to loan ratio (Y_2) is the ratio to measure the amount of financing disbursed by the total assets owned by islamic banks.

3.3. Models and Methods of Analysis

Data analysis is the process of simplifying the data into a form that is easier to read and interpret. The econometric model for panel data was used in the present research. The form of the equation was as follows:

$$Y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_n X_{nit} + \varepsilon_{it} \quad (3)$$

The stages of panel data test consist of Pooled Least Square modeling, Fixed Effect, and Random Effect.

3.4. PR H-Statistic Method

The PR H-statistic method is one form of market power measurement in the banking industry with the un-structural approach. The un-structural approach is more of determining the company's behavioral aspects in influencing the market conditions (Widyastuti and Armanto, 2013). This method was first developed by Panzar and Roose in 1987 and used to measure the degree of market power in the banking industry. The measure of market power through the PR H-statistics is derived from the sum of the input of price elasticity coefficients i.e. labor costs (W_L), cost of funds (W_F) and fixed capital costs (W_K), which respond to the total revenue. The representation of the sum of input variables can be used to determine the market structure in which the firm operates.

Some of the advantages of the PR H-statistic method are: (1) able to see the broader market structure, (2) can be estimated using econometric model with regression, (3) the variable used is quite simple, (4) using the individual data (cross-section) as a form of competition among banks.

The PR-H Statistics method is applied to companies with one type of product. Thus, banks are treated as producers with output in the form of loans. The assumptions of this method are long-run equilibrium and the maximization of profit earning (Panzar and Roose, 1987).

Before estimating the PR H-statistic, a long-run equilibrium test is intended, for, in case of balance, the research can proceed to market power, whereas if not, the research is stopped. However, Shaffer (1982) in Widyastuti and Armanto (2013), said that if the study shows a disequilibrium condition, it indicates that the banking industry is developing dynamically during research observation, thus, the research can proceed.

The equation of long-run equilibrium test of the PR-H statistic method is as follows:

$$\begin{aligned} \ln ROA_{it} = & \beta_0 + \beta_1 \ln(W_{L,it}) + \beta_2 \ln(W_{F,it}) + \beta_3 \ln(W_{K,it}) + \beta_4 \ln(Y_{1,it}) \\ & + \beta_5 \ln(Y_{2,it}) + \varepsilon_{it} \end{aligned} \quad (4)$$

The long-run equilibrium is interpreted as follows:

If PR - H statistic_{ROA} < 0 there is no equilibrium

If PR - H statistic_{ROA} = 0 there is equilibrium

PR - H statistic_{ROA} is the sum of the elasticities of β_1 , β_2 , and β_3 . Whereas, the equation to see the degree of market power is only by replacing the variable Return on Asset (ROA) with total bank income to total assets (TR).

So, the equation becomes:

$$\begin{aligned} \ln(TR_{it}) = & \beta_0 + \beta_1 \ln(W_{L,it}) + \beta_2 \ln(W_{F,it}) + \beta_3 \ln(W_{K,it}) + \beta_4 \ln(Y_{1,it}) \\ & + \beta_5 \ln(Y_{2,it}) + \varepsilon_{it} \end{aligned} \quad (5)$$

Description:

$\ln TR_{it}$ = Non-interest income/total assets

$\ln ROA_{it}$ = Profit before tax/total assets

$\ln W_{F,it}$ = Bonus expense (wadiah)/total assets

$\ln W_{L,it}$ = Labor load/ total assets

$\ln W_{K,it}$ = Operational load/total assets

$\ln Y_{1,it}$ = Total capital/total assets

$\ln Y_{2,it}$ = Total debt/total assets

The interpretation of the *market power* is as follows.

PR-H statistic_{TR} = 0 monopolistic competition

PR-H statistic_{TR} = 1 perfect competition

PR-H statistic_{TR} $0 < H_{TR} < 1$ = Monopolistic Competition

All of the variables in the PR H-statistic method use the addition of natural logarithm (ln) to show elasticity, since the market power values range between 0 and 1 so that the degree of the market indicator is immediately detected.

IV. RESULTS AND ANALYSIS

4.1. Panzar and Roose (PR H- Statistics) analysis

The panel data estimation is done on Eviews 7 with the timeframe of July 2010-September 2014, which is grouped every 3 months. Thus, there are 17 test result data of test phase, consisting of the best method selection (PLS, FEM, or REM), equilibrium test, and PR H-Statistic test. The results and discussion of each test are described as follows.

4.2. The Best Model of Islamic Bank Equilibrium Test

Table 4.
Selection of The Best Model of Islamic Bank Equilibrium Test

Periods	Test	Model Selection			
		Prob	Significance 0.05	Best Model	Conclusion
July – September 2010	Chow	0.0000	0.05	FEM	The best model is REM, because 0.0507 > 0.05
	Housman	0.0507	0.05	REM	
October – December 2010	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0000 < 0.05
	Housman	0.0000	0.05	FEM	
January – March 2011	Chow	0.0000	0.05	FEM	The best model is REM, because 0.3875 > 0.05
	Housman	0.3875	0.05	REM	
April – June 2011	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0320 < 0.05
	Housman	0.0320	0.05	FEM	
July – September 2011	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0479 < 0.05
	Housman	0.0479	0.05	FEM	
October – December 2011	Chow	0.0000	0.05	FEM	The best model is REM, because 0.9381 > 0.05
	Housman	0.9381	0.05	REM	
January – March 2012	Chow	0.0001	0.05	FEM	The best model is REM, because 0.9839 > 0.05
	Housman	0.9839	0.05	REM	

Table 4.
Selection of The Best Model of Islamic Bank Equilibrium Test (Continued)

Periods	Test	Model Selection			
		Prob	Significance 0.05	Best Model	Conclusion
April – June 2012	Chow	0.0000	0.05	FEM	The best model is REM because 0.82>0.05
	Housman	0.8299	0.05	REM	
July – September 2012	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0000 < 0.05
	Housman	0.0000	0.05	FEM	
October – December 2012	Chow	0.0000	0.05	FEM	The best model is REM, because 0.4376 > 0.05
	Housman	0.4376	0.05	REM	
January – March 2013	Chow	0.0000	0.05	FEM	The best model is REM, because 0.0000 < 0.05
	Housman	0.0000	0.05	FEM	
April – June 2013	Chow	0.0028	0.05	FEM	The best model is REM, because 0.8007 < 0.05
	Housman	0.8007	0.05	REM	
July – September 2013	Chow	0.0000	0.05	FEM	The best model is REM, because 0.5859 > 0.05
	Housman	0.5859	0.05	REM	
October – December 2013	Chow	0.0000	0.05	FEM	The best model is REM, because 0.2848 > 0.05
	Housman	0.2848	0.05	REM	
January – March 2014	Chow	0.0000	0.05	FEM	The best model is REM, because 0.6506 > 0.05
	Housman	0.6506	0.05	REM	
April – June 2014	Chow	0.0000	0.05	FEM	The best model is REM, because 0.7878 > 0.05
	Housman	0.7878	0.05	REM	
July – September 2014	Chow	0.0000	0.05	FEM	The best model is REM, because 0.8698 > 0.05
	Housman	0.8698	0.05	REM	

Source: Appendix 2.

The selection of the best model for islamic bank equilibrium test, as in Table 12, is Fixed effect model and Random Effect Model (REM). The FEM modeling took place in the period of October-December 2010, April-June 2011, July-September 2011, July-September 2012, and January-March 2013, while the other twelve periods used the REM test. However, this test often raises the problem of correlation between interference variables (autocorrelation), and to overcome it, the REM test method of Generalized Least Square (GLS) is used.

4.3. Best Model of PR H-Statistics Test in Islamic Banking

Table 5.
Selection of The Best Models of PR H-Statistics Test in Islamic Banking

Periods	Test	Pemilihan Model			
		Prob	Significance 0,05	Best model	Conclusion
July – September 2010	Chow	0.0000	0.05	FEM	The best model is REM, because 0.3360 > 0.05
	Housman	0.3360	0.05	REM	
October – December 2010	Chow	0.0000	0.05	FEM	The best model is REM, because 0.7003 > 0.05
	Housman	0.7003	0.05	REM	
January – March 2011	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0201 < 0.05
	Housman	0.0201	0.05	FEM	
April – June 2011	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0044 < 0.05
	Housman	0.0044	0.05	FEM	
July – September 2011	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0048 < 0.05
	Housman	0.0048	0.05	FEM	
October – December 2011	Chow	0.0005	0.05	FEM	The best model is REM, because 0.5280 > 0.05
	Housman	0.5280	0.05	REM	
January – March 2012	Housman	0.0001	0.05	REM	The best model is REM, because 0.1144 > 0.05
	Chow	0.0001	0.05	FEM	
April – June 2012	Housman	0.1144	0.05	REM	The best model is FEM, because 0.0000 < 0.05
	Chow	0.0001	0.05	FEM	
July – September 2012	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0000 < 0.05
	Housman	0.0000	0.05	FEM	
October – December 2012	Chow	0.0002	0.05	FEM	The best model is REM, because 0.6590 > 0.05
	Housman	0.6590	0.05	REM	
January – March 2013	Chow	0.0000	0.05	FEM	The best model is REM, because 0.0000 < 0.05
	Housman	0.0000	0.05	FEM	
April – June 2013	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0015 < 0.05
	Housman	0.0015	0.05	FEM	
July – September 2013	Chow	0.0000	0.05	FEM	The best model is REM, because 0.0000 < 0.05
	Housman	0.0000	0.05	FEM	
October – December 2013	Chow	0.4769	0.05	PLS	The best model is PLS, because 0.4769 > 0.05
January – March 2014	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0000 < 0.05
	Housman	0.0000	0.05	FEM	

Table 5.
Selection of Best Models of PR H-Statistics Test in Islamic Banking (Continued)

Periods	Test	Pemilihan Model			
		Prob	Significance 0,05	Best model	Conclusion
April – June 2014	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0000 < 0.05
	Housman	0.0000	0.05	FEM	
July – September 2014	Chow	0.0000	0.05	FEM	The best model is FEM, because 0.0000 < 0.05
	Housman	0.0000	0.05	FEM	

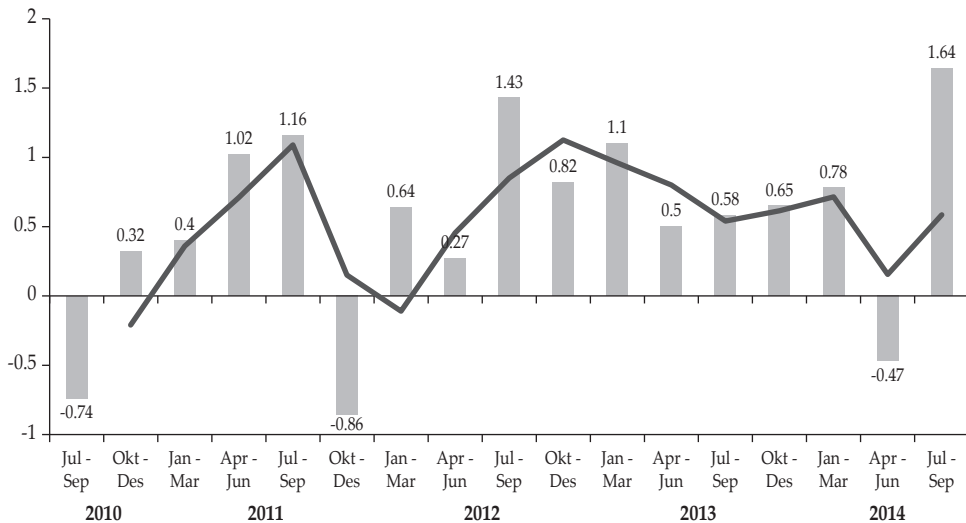
Source:

In general, in Table 14, the best model used in the estimation of the PR-H statistics islamic banking is the Fixed Effect Model (FEM) of 11 periods, while the Random effect is 5 periods i.e. July-September 2010, October-December 2010, October-December 2011, January-March 2012, and October-December 2012. Meanwhile, the Pooled Least Square model (PLS) is used in the period of October-December 2013. The PLS modeling, in that period, shows that the eight-islamic banking is assumed to have the same intercept and slope.

4.4. Long Run Equilibrium Test Results of Islamic Banking

This test is used to view the long-run equilibrium and is the sum of the input variable coefficients of the estimation using the Eviews 6.0 i.e. labor cost (InW_L), cost of funds (InW_F), and capital cost (InW_K) which are the main requirements of continuing to H - Statistics.

Figure 3. The Result of Long-Run Equilibrium Test of Islamic Banking, from July–September 2010 to July–September 2014



Islamic banking appears to have a tendency to approach the equilibrium level indicated by the value close to 0. However, the movement is quite extreme in the period of July-September with (1.16 points), July-September 2012 (1.43 points), and July-September 2014 (1.64 points).

Islamic banking is in disequilibrium condition and tends to approach 0. This is similar to the research conducted by Widyastuti and Armanto (2013) and Sahut, *et al.* (2012).

This condition indicates that islamic banking is in a developing condition which means that islamic banking is not yet dominating the economy. This is in line with the Financial Services Authority survey in 2013 on financial literacy, which showed that the community's understanding of banking was only 21.80%, which was lower compared to the Philippines (27%), Malaysia (66%), Thailand (73%) and Singapore with the highest level of understanding of the banking sector i.e. 98%.

The low level of banking literacy, in Indonesia, indicates that many people do not use banking as a financial intermediary institution. This has an impact on the low DPK owned by islamic banks and the hampering growth of the real sector.

The continuous development of islamic banking, in Indonesia, is caused by the visibility of its new market share of about 5% of the total banking assets in Indonesia. So, it takes hard work to add customers. One of the efforts made by the Financial Services Authority and Bank Indonesia is the promotion of Islamic finance, policy-making, and legislation. However, their efforts are certainly not enough to increase the market share of islamic banking. Therefore, there is a need for the role of the banking itself and the community. The efforts that need to be done by islamic banking is the increase in the number of branches and ATMs in the regions. In 2017, FSA recorded the number of operational headquarters (KPO) of islamic banks as follows: 152 offices, 136 sub-branches and 53 cash offices (still lacking).

Another effort that can be carried out is through the role of ulama in providing education on Islamic finance through Islamic study materials in mosques. With the collaboration of the government, banks, and community, it is expected that the future of islamic banking will be more advanced, growing and stable.

4.5. PR H-Statistics Test Results of Islamic Banking

Figure 4. PR H-Statistics Results Islamic Banking from July-September 2010 to July-September 2014

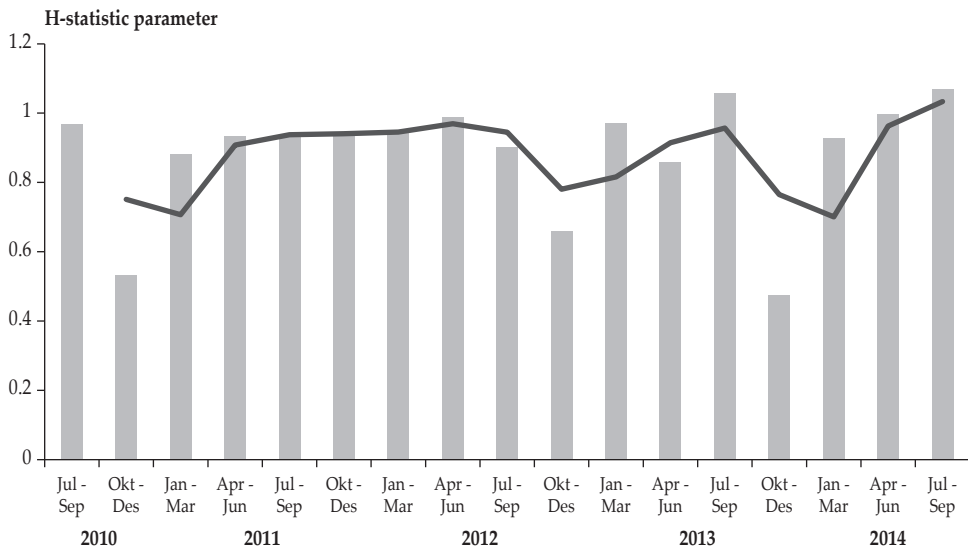


Figure 4 shows that the pattern of the strength of Islamic banking always falls within a range of more than 0 to more than 1, indicating that it is in the perfect market and monopolistic competitions.

Perfect competition conditions occur twice i.e. in the period of July-September 2013 (1.05) and July-September 2014 (1.06). Meanwhile, the other periods operate in the monopolistic market. This means that the diversity of products and advertising in Islamic banking during this period is quite dominant in order to increase the number of customers. The strong competition amongst Islamic banks is caused by the dominance of conventional banking that opened the branch of sharia after the endurance of Bank Muamalat Indonesia during the economic crisis of 1998 (Faiz, 2010).

Another factor is the regulation of the Ministry of Religious Affairs of the Republic of Indonesia related to the pilgrimage funds that must be deposited into Islamic banking, which reflect the government's trust in Islamic banks in the management of pilgrim funds. In addition, Islamic state securities products (retail Sukuk) issued by the government was recently quite enthused by the community. However, the products of Islamic banks themselves, in practice, are still dominated by the sale and purchase agreement (Murabaha) (Natadipurba, 2015).

Generally present in a monopolistic market and perfect competition means that although the product differentiation is quite good, there is still a perfect competition condition. This shows that Islamic banking has not been consistent in making innovative financial products. Therefore, in the future, Islamic banking needs to make superior financial products that will become his trademark. Thus, each Islamic bank has its own market share and can compete from the non-price side.

V. CONCLUSIONS

5.1. Conclusions

Based on the description and discussion, it can be concluded that:

1. The equilibrium test results show the value close to 0, meaning that the condition of islamic banking, in the long run, does not show equilibrium. This means that islamic banking is in a developing condition. Therefore, the collaboration between the government, especially FSA and BI, banking and community is needed to increase the growth of islamic banking in the future.
2. The H-statistic test results show that islamic banking operates on the monopolistic market and perfect competition. This means that islamic banking has not been consistent in developing its products. So, it requires the development of excellent products with specific characteristics and market share.

5.2. Suggestions

The suggestions submitted by the author for further research improvements are as follows:

1. In order for the results to be more comprehensive, there is a need for additional variables and period of study.
2. The high level of competition in islamic banking demands the government, in this case, the Financial Services Authority and related parties, to improve the level of interbank competition.

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ANNS-BASED EARLY WARNING SYSTEM FOR INDONESIAN ISLAMIC BANKS

Saiful Anwar¹, A.M. Hasan Ali²

ABSTRACT

This research proposes a development of Early Warning System (EWS) model towards the financial performance of Islamic bank using financial ratios and macroeconomic indicators. The result of this paper is ready-to-use algorithm for the issue that needs to be solved shortly using machine learning technique which is not widely applied in Islamic banking. The research was conducted in three stages using Artificial Neural Networks (ANNs) technique: the selection of variables that significantly affect financial performance, developing an algorithm as a predictor and testing the predictor algorithm using out of sample data. Finally, the research concludes that the proposed model results in 100% accuracy for predicting Islamic bank's financial conditions for the next two consecutive months.

Keywords: Early Warning System, Artificial Neural Networks, Islamic Banks, Financial Distress.

JEL Classification: C45, C53, G33, G21

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I. INTRODUCTION

The golden period experienced by Islamic banks has apparently been passed. The growth over 20% per year that occurred in 2009 until 2011 is continuously experiencing a decreasing trend. In 2012, Indonesian Central Bank reported that the growth of market shares of Islamic banks doubly decreased to 9.44% and further experienced a negative trend with a growth rate of 6.07% in 2013. Finally, for the first time in Indonesian Islamic Bank's development period, the market shares of Islamic banks experienced a negative growth of 4% in December 2014. The year actually became a difficult year for Islamic banking due to the increase of interest rate which caused the cost of bank funds to soar. In the first semester of 2013, the SBI interest rate stood still at 5.75% which was then kept increasing towards 7.75% in October 2014. This growth rate had a direct impact on the increase of deposit rates of conventional banks as the competitors of Islamic banks in collecting third-party funds. At the end of 2014, one of the Islamic banks offered a profit sharing rate for its deposit products which was equivalent to 10%-11% of interest rate in order to compete with conventional banks which offered averagely 8.07% in the same period for the one month of deposit. The significant pressure on the cost of funds affected the growth rate of market shares of Islamic banking decreasing. The profit of Islamic bank grew only 15.1% in 2014 compared with previous year which successfully reached 43.8% growth. The hard pressure towards Islamic bank's profit was triggered not only by the weakening of national economy marked by high inflation and the continuously weakening exchange rate but also due to the weakness of the Good Corporate Governance of Islamic banks.

The Non-Performing Financing (NPF) ratio of Islamic banks at the end of 2014 reached 4.33%, a very significant increase compared with the previous period which was only 2.62%. The more worrying conditions will be more clear when looking more detail at the absolute amount of NPF, whereas the default financing category increased to 2.24%, amounted to Rp4.465 trillion. This is almost equal to the total amount of NPF in 2013 which amounted to Rp4.828 trillion. This condition got worse with the widespread news of fraud occurred in the biggest Islamic bank in Indonesia which loosed hundreds of billions of rupiahs, causing the increase of reputational risk for Islamic banking industry.

The condition has created excessive distressing which comes from the social and economic views. The excessive distressing appears since the Islamic banking industry employs around 42 thousand employees which their lives and families' welfare depend on. Additionally, it would decline the derivative industries such as education whereas thousands of schools and universities already offered Islamic finance subject and already attracted tens of thousands of students throughout Indonesia. The social turbulence with significant economic loss will surely happen when a particular Islamic bank experiences difficulty. This local problem could be spread out which then created systemic risk.

Further, the systemic risk in Islamic bank could degrade the reputation of Islamic bank as a type of business institution which uses the symbol of religion. This could be a boomerang for Islamic economic development wherein intensive socialization has been conducted about the fact that the Islamic economy with its financing instruments is thought as an alternative financing system. The system is expected to become a catalyst for economic fluctuations due to maysir (gambling), ghoror (speculation), and riba (interest) transaction (Chapra, 2009).

Financial Services Authority (OJK) Act number 21 of 2011, the institution is mandated to organize a system of regulation and supervision which is integrated towards the entirety of activities in the financial services sector as to create a financial system condition which is organized, fair, transparent, and accountable, as well as to grow in a sustainable and stable way so that it is able to protect consumer and public interests. Accordingly, OJK has a responsibility to conduct preventive actions, one of which is to develop early warning system (EWS) for Islamic bank's failure detection. According to Indonesian, The EWS works to perform monitoring and supervision by providing signals indicating the probability of a declining in a bank's performance. According to that signals, the OJK can determine which banks are necessary to get strict supervision and give aid in a short time in the form of financing or managerial supervision to immediately pulled out the bank from bad conditions that probably lead towards bankruptcy.

Othman (2012) reveals that financial authority has two methods to develop EWS which are an on-site examination and off-site examination methods. The prior method is conducted by performing a direct assessment on the day to day banking operation. Pettway and Sinkey (1980) suggest EWS using accounting data and market information to determine the priority of the banks which need an on-site examination. Meanwhile, the off-site examination is a statistics or mathematics based method to determine the probability of a bank's bankruptcy (Othman, 2012). The effectivity of this method is measured according to its accuracy in classifying whether a particular bank is in a troubled or not compared to its actual condition.

Beaver (1966) is the first researcher who makes prediction using Univariate Discriminant Analysis method to make a prediction of bankruptcy. Two years after that, Altman (1968) introduced a model to predict a company's bankruptcy using Multiple-Discriminant Analysis (MDA) method which is now widely known as the Altman Z-score. In the 1980s, Takahashi (1984) and Friedmen et al. (1985) utilized the Recursive Partitioning Algorithm to predict bankruptcy. Bellovary et al. (2007) applied the statistical method and mathematical models to make a prediction. He observed many statistical and mathematical method starting from a simple statistical method until a complex data mining method such as neural networks.

Bellovary et al. (2007) reported that the use of the statistical method and data mining technique which introduced since year 1990s, resulted in a wide variety of accuracy. He observed 106 researchers who use statistical methods resulted in accuracy rate ranging from 24% to 94% in predicting a company's bankruptcy. Moreover, 40 researchers who use data mining techniques such as neural network resulted in accuracy rate ranging from 71% to 100%. Liao et al. (2012) reported that the usage of data mining technique received more attention since the number of the researcher who uses the technique is rapidly growing. The technique has many types such as artificial neural network, clustering, association rule, artificial intelligence, bioinformatics, fuzzy logic, support vector machine and so forth. Particularly, for the case of Indonesian Islamic bank research, Anwar and Ismal (2011) reported that the artificial neural network method empirically possesses a higher accuracy rate compared to support vector machine method in predicting the profit sharing rate of Islamic banks in Indonesia. The result depicted that the artificial neural network model has a better ability in understanding the context of the diversity and volatility of data patterns.

Accordingly, this research summarizes problems associated with Indonesian Islamic bank's performance that is necessary to solve, which are:

1. The decreasing of the financial performance of Islamic banks is considered to be main cause why many targets proclaimed by OJK are failed to be achieved such as the percentage of market share and profitability ratios.
2. The uniqueness of operational and business model of Islamic banks which lead to the special risks that are not found in conventional banks, such as displaced commercial risk and investment risk.
3. The very volatile economic conditions, such as the instability of exchange rates which causes the disturbance on achieving the growth rate targeted through the rise of credit risk and the liquidity problem in money market which creates difficulty to Islamic banks in obtaining a low cost of fund.

Therefore, it is necessary for Islamic banks to have EWS signaling the decreasing of financial performance. The EWS must be suitable with the characteristics and uniqueness of Islamic banks, ultimately in determining the best algorithms that understand those conditions properly. In order to answer the problems, the development of an EWS model is highly needed. For that purpose, this research will attempt to explore, to empirically test and to analyze as many as possible the reason for performance decrease in Islamic bank guided by research questions below:

1. What kind of variables could give negative impact to financial performance of Islamic banks?
2. How accurate are artificial neural networks (ANNs) as prediction algorithm in making a prediction (in term of accuracy)?

This research will use Bank Syariah Mandiri, the biggest Islamic bank in Indonesia, as a case study in measuring the accuracy and stability of ANNs as a prediction algorithm in EWS

II. THEORY

2.1. Financial Distress

The term of systemic risk is defined as the probability of severity that would affect other banks when a bank experiences problems. In another word, when a bank faces a financial decrease, it would possibly trigger financial decrease to other banks and at the end, the entire industry could be collapsed. This is why financial problems in a bank will frighten other parties and the economic system as a whole (Othman, 2012).

The financial problem was discussed by Altman (1993) who differentiated the conditions of a company's financial condition into four types: failure, insolvency, default, and bankruptcy. In detail, failure is a condition where the rate of return of money invested experiences a continuous decreasing which its value is less than return received in a similar industry. Meanwhile, insolvency is a condition where the company encounters difficulties in fulfilling its obligations at a certain time and temporary. If this insolvency continues for a long time, its conditions will lead to bankruptcy when the value of total obligation exceeds the value of total asset possessed by a company.

This research uses financial distress term because the researcher believes that a business' failure is not something that suddenly happens. Certainly, there is a series of continuous signals alarming bad condition of a company, if the signal is ignored without some effort to make improvement so that the current condition will lead towards a bankruptcy. This is in line with Cybinski's (2001) opinion that explains the definition of financial distress as: *"Failed and non-failed firms do not lie in separate boxes, but rather lie on a continuum of failed and non-failed"*.

In addition, Arena (2008) defines the character of a bank failure when the government performs recapitalization action in order to inject a sum of money or when that bank is identified as frozen which is disallowed conducting business.

Bankruptcy does not only happen to conventional banks, a few Islamic banks in the world also experience bankruptcy such as (Othman, 2012):

1. The International Islamic Bank of Denmark which was liquidized in 1986 due to channeling funding with an excessive exposure to a consumer.
2. The Islamic Investment Companies of Egypt which was closed in 1988 due to poor GCG, the lack of responsibility in the management, and the poor quality of the supervision which caused the bank to proceed transactions that do not comply with sharia law.
3. The closure of the Islamic Bank of South Africa in November 1997 due to its involvement in a debt amounting to R50-R70 million. This happened as the banking authority parties did not conduct enough supervision, consequently opening an opportunity for the management to commit fraud by channeling funding to related parties.
4. The Berhard Islamic Bank of Malaysia (BIMB) has experienced a significant loss at the end of June 2005. The loss suffered amounted to RM457 million due to a Non-Performing Financing amounted RM774 million.
5. The bankruptcy of the Ihlas Finance House (IFH) in Turkey in 2001. This happened due to poor GCG which the bank did transactions in the money market causing liquidity problem.
6. The failure to pay of sharia bonds issued by the Dubai World which requested restructuring of the debt payment amounted USD4 billion. This incident is known as the Dubai Debt Crisis due to its exorbitant amount.
7. The last case is the bankruptcy of the Arcapita Bank BSC. This bank was the first investment bank in America. The bankruptcy occurred when the bank failed to conduct an agreement with the creditor amounted USD1.1 billion for a syndication financing that the due date will be on March 28, 2012.

2.2. Model of Bankruptcy

The model of bankruptcy was first introduced by Meyer and Pifer in 1970. This research was continued by Martin (1977), Altman et. al (1981), Gunther (1983) and Espahbodi (1991). These four researchers have one similarity, which is the use of financial ratios as their independent variables to predict whether a bank will go bankrupt or not.

The initial researcher who predicts the bankruptcy of Islamic banks are Al-Osaimy and Bamakhramah in 2004. Applying the Discriminant Analysis method, Al-Osaimy and Bamakhramah (2004) predicted the profitability of Islamic banks

using financial ratios as independent variables. This model was followed by Hall, Mujawan, and Morena (2008) who conducted an analysis of the credit risks of Islamic banks by using the Artificial Neural Networks model.

2.3. Decision Support System and The Algorithm

Decision-making is the result of a highly complicated process aiming to anticipate the conditions that will occur in the future, be it the positive and beneficial ones or otherwise based on data, information, and modern knowledge and past experiences

This decision-making process begins with one's awareness who lives in a complex system and then continued by classifying external factors which are related to the problem. Afterward, the classification process will select the most significant factors that will be used as the basis for making a decision. The factors are then processed by using the additive factor employed as a prediction machine that will be used as a guide in the decision-making process. This prediction machine will ease someone in simplifying all the information which has already been classified beforehand and then providing options as predictions. Each option has been weighted which then to be chosen as the most suitable decision.

In the last few decades, humans have been assisted by the rapid development of information technology. This assistance is marked by the availability of state-of-the-art useful software in making a decision on both company and individual levels. Specifically, in the financial industry, Wen et al. (2008) propose a knowledge-based decision support system using ANNs as a prediction algorithm that measures and predicts the financial performance of a company. Beforehand, Tsang et al. (2004) propose a software supporting decision-making process by predicting the investment performance of a company, this system is named as Evolutionary Dynamic Data Investment Evaluator (EDDIE) employing genetic programming as prediction algorithm.

In the theoretical approach, Matheson and Howard (1968) explained that the decision support system (DSS) is a system that implements scientific procedures in a highly complex situation where some one necessitates to make decisions. This system uses a computation model that will quantitatively evaluate every option offered and then gives a comparison by calculating the weight of each available option. Subsequently, the system gives a suggestion to the user in making the decision. In detail, Wen et al. (2008) explained the parts of a sub-system comprising a DSS as follows: (1) Data management subsystem. (2) Knowledge management subsystem. (3). Model management subsystem. (4) Dialogue subsystem.

As a system, each subsystem does not work alone, instead, the subsystem is being clustered and linked with each other to perform their duties in giving feedback and suggestions to the users. This DSS works initially by processing data in the data management subsystem. Afterwards, the DSS analyzes on each connection created to the whole successfully gathered data which are collected by the knowledge management subsystem. Next, the model management subsystem will model the data in which the results will be used to compare the available option as a basis for decisions according to the best-weighted factor. The best available option is then suggested to the users and displayed on the dialogue subsystem.

ANNs is one of the branches of machine learning method which simulates the workings of a nervous system. This model works in groups and has a structure consisting of cells called neurons forming a neural network that similar to the human brain. The elements which support a neuron's operation comprise input, weight functioning as a learning method, transformation function which will determine whether the incoming information is important enough to be forwarded to other neurons by comparing the weight of the information according to its threshold. Similar to the human brain, neurons in ANNs require a training process to perform a comprehension process such as recognizing patterns, generalizing a problem, and conducting a self-study to improve capabilities in doing analyses and drawing conclusions.

Technically, ANNs work as follows. Starting from a neuron called j possessing a few sources of input such as $(x_1, x_2, x_3, \dots, x_i)$ and an output (y_j) . Each input coming into the j neuron that has a weight in the form of $(w_{1j}, w_{2j}, w_{3j}, \dots, w_{ij})$ defined as the level of urgency from each input. Then, information that entering the j neuron is the sum of all the value of the incoming information multiplied by each of its weight so called the net value (u_j) . Next, the u_j will be compared with the threshold (t_j) of the j neuron and simultaneously determined whether the incoming information will be sent to the next neuron where each neuron has different t_j values. If u_j is larger than t_j , then the j neuron will process and then send it to other neurons in the form of an output (y_j) . To do this, the neuron needs a function called the activation function which is responsible for activating the u_j and transforming it into y_j . The most often used function as activation is the logistic and sigmoid functions.

The typology or architecture of ANNs that most often used in a research is multilayered (West et al., 1997). Therefore, this research will combine a few neurons in a multilayered form to be used in pattern recognition such as conducting a classification and a prediction. This multilayer is in the form of a feed-forward network consisting of the input layer, hidden layers, and output layer. Mathematically, the ANN model is written as follows:

$$y = f(x, \theta) + \epsilon$$

Wherein: x is a vector of the dependent or output variables which are the sources of information, θ is the weight of independent or input variables and ϵ is the random error component. Next, the equation is an equation derived from a function which will be used to run the task of estimation and prediction of a number of available data. This equation can be written as follows:

$$Y = f \left[v_0 + \sum_{j=1}^m h \left(\lambda_j + \sum_{i=1}^n x_i w_{ij} \right) v_j \right]$$

Where: Y =Output; f =The activation function of the layer output; v_0 =The output bias; m = The sum of hidden neuron units; h =The activation function of the hidden layer; λ_j =The bias of hidden units ($j = 1, \dots, m$); n =The sum of units serving as input; x_i = Input vector ($i = 1, \dots, n$); w_{ij} = The weight from input unit i to the hidden unit j ; v_j = The weight from the hidden unit j to the output($j = 1, \dots, m$).

III. METHODOLOGY

3.1. Data

The Indonesian Islamic bank as research population in this research consists of 12 full-fledged Islamic Banks and 22 Islamic windows. This research chooses Bank Syariah Mandiri as a sample since the bank is considered as the largest Islamic bank with asset amounting to Rp82 trillion with a profit reaching Rp180 billion. The data used in this research are primary data collected from Indonesian central bank, and Bank Syariah Mandiri.

Since the Risk Based Bank Rating (RBBR) begins to be implemented in an Indonesian Islamic bank as a basic platform for bank supervision, this research will use the primary parameters in RBBR as input variables which focuses on the three types of risks which are credit risk, liquidity risk, and operational risk.

Initially, the variable selection is conducted through desk study regarding EWS in conventional or Islamic banks. There are 14 variables selected as follow: Credit Risk Parameters consist of Total Financing to Total Asset (TPBY/TA), Financing Income to Total Asset (PPBY/TA), Debt-based Financing to Total Funding, (PUP/TPBY). Non Performing Financing to Total Financing (PBMSLH/TPBY). Impairment Loss (CKPN) for Murabahah Financing to Total Financing (CKPN/TPBY). Loan Loss Provision to Non-Murabaha Financing (PPAP/TPBY), Asset growth (ASET G); (2) Liquidity Risk Parameters consist of Total Liquid Asset to Total Asset (ALIQ/TA), Total Financing to Total Debt (TPBY/HTG), Total Non-Core Deposit to Total Deposit (NCD/TD); (3) Operational Risks Parameter consist of Wages Expense to Total Asset (BG/TA). Further, this research uses macro economic variables consisting of American dollar exchange rate to rupiah (KURS), Inflation total (INF), interest rate (BI RATE). Meanwhile, the output variables used in this research is the profit value (LABA) obtained from Bank Syariah Mandiri. Further, the collected time series data varying from January 2013 until February 2015 which period are classified into two levels: Validation Level and Testing Level.

3.2. Method or Estimation Technique

This research follows Anwar and Mikami (2011) and Anwar and Ismal (2011) who compared the accuracy rate of prediction between statistical method and ANNs. Accordingly, ANNs is found as the best algorithm for making a prediction for the case of Indonesian Islamic bank. Therefore, this research employs ANNs to find the best prediction model according to the accuracy level. The last step is applying the best prediction model to predict the financial performance of Bank Syariah Mandiri. In this step, the researcher will predict the financial performance through in-sample and out of sample data at a bank level. The positive growth of profit and negative growth of profit will be indicated by signs "Up (Naik)" and "Down (Turun)". All steps conducted in this research uses application which name is Alyuda Neuro Intelligence version 2.

IV. RESULTS AND FINDINGS

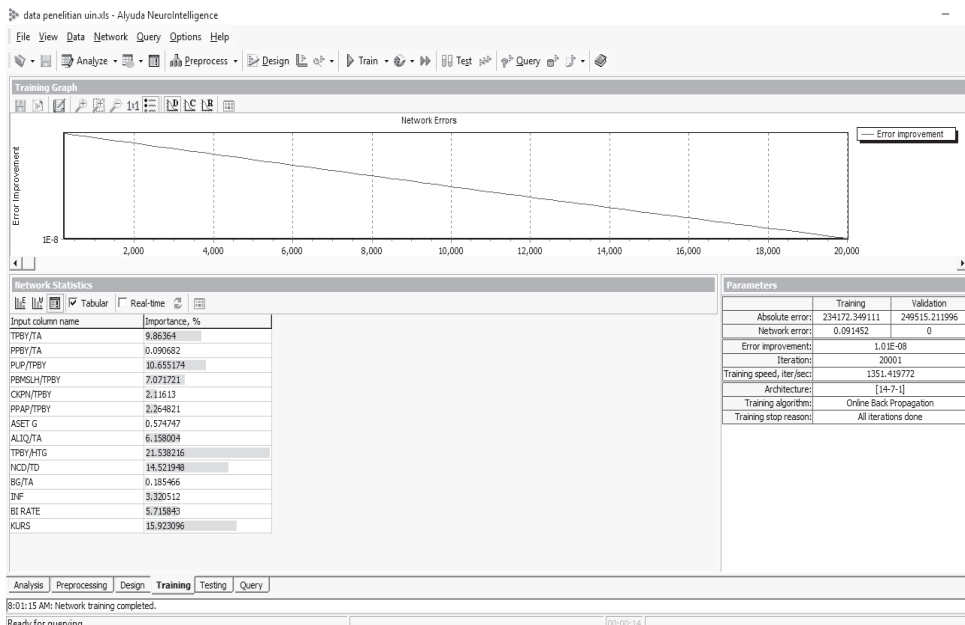
Data collected is consisted of 26-time series which are randomly partitioned to be used in the training process (69.23%), the validation process (15.38%) and testing

process totaling 15.38%. Afterward, this research conducts variable selection according to the level of significance, architecture selection, prediction model selection and accuracy level testing.

The variable selection process consists of three steps: (1) Designing the ANN's architecture. (2) Providing training to the ANN. (3) Evaluating the reliability of the ANNs. In designing the architecture of ANNs, this research uses the "exhaustive search method" to determine the best ANN architecture. This method consumes a significant amount of time due to fulfilling it is aimed to review all the type of available architecture of the ANNs that may be used. This process is then limited by using the r-squared amounting to 0.000001 as fitness criteria and the amount of iteration totaling 20,000 iterations. The ANNs training process is then conducted by initially setting three configurations. The first configuration employs the logistic function as the activation function on hidden layers. Further, the sum-of-squares errors method is chosen to minimize output errors. Lastly, the expected output is set between 0 and 1 because it uses the logistic function on hidden layers. After the three configurations are set, the ANNs subsequently are trained by using certain limits to avoid over-training conditions which cause non-optimal results. These limits are as follows:

1. The learning algorithm is determined by using the back propagation method.
2. The momentum rate is limited to 0.1.
3. The training process will be stopped when the mean squared error decreases to 0.000001 or when this process runs until the 20,000 iterations; whichever condition is met first.
4. The last process is conducted to ensure the ANNs is reliable enough in doing its job as selector.

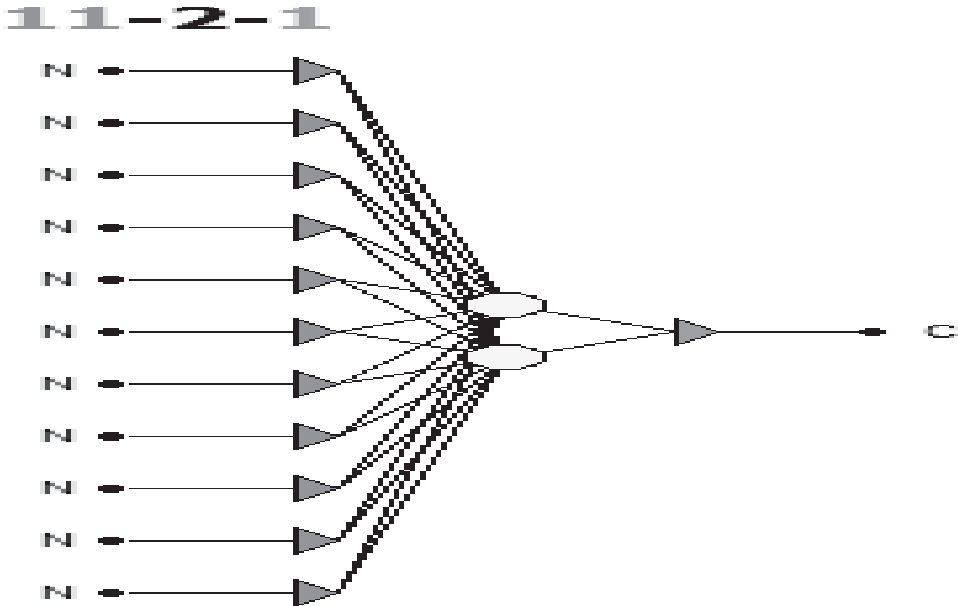
Figure 1. The Importance Level of Each Input Variable



The network reliability will be investigated by using the statistical approach according to correlation value (r), R2, the average absolute error value (AE) and the average relative absolute error value (ARE), as shown in the following picture. Accordingly, the ANNs architecture is selected ANN(14-7-1) which has 3 layers that each input has 14 nodes. Further, the hidden layer consists of 7 nodes and the output layer consists of 1 node (Figure 1).

Based on the selected architecture, ANNs results in 11 input variables which significantly affect the financial risk of Bank Syariah Mandiri which are: Total Financing to Total Debt ratio, Exchange Rate, Total Non Core Deposit to Total Deposit ratio, Debt-based Financing to Total Funding ratio, Total Financing to Total Asset ratio, Non Performing Financing to Total Financing ratio, Total Liquid Asset to Total Asset ratio, Interest Rate, Inflation, Loan Loss Provision to Non-Murabaha Financing ratio, and Impairment Loss for Murabahah Financing to Total Financing ratio. Subsequently, this research is able to proceed to develop a prediction model using the significant variable that selected by ANNs by initially transform the output variables into risk signals (SIGN) which show whether in the next period a bank will experience an increased risk or otherwise. In the prediction model development, this research is required to select the new architecture of ANNs since there is a reduction of 14 input variables into 11 variables. Using similar limitations, Alyuda chooses the ANN(11-2-1) as the best network architecture as depicted in Figure 2.

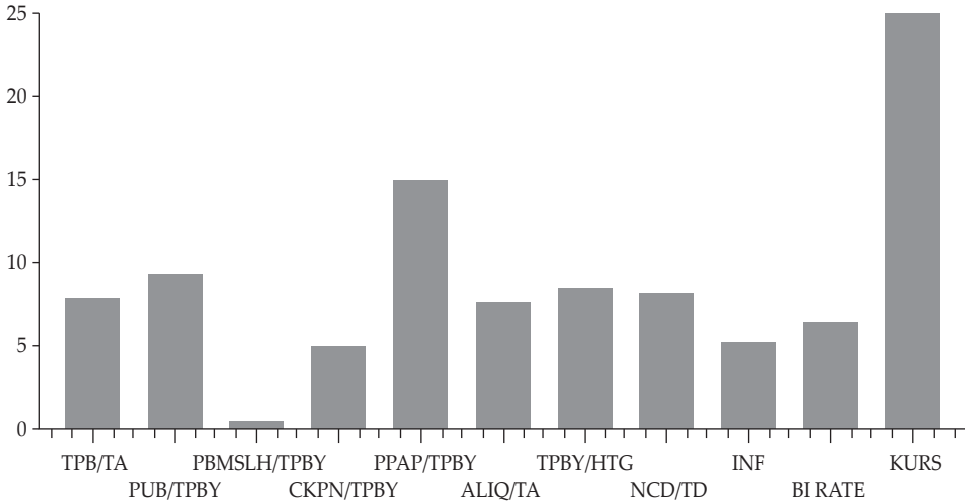
Figure 2. ANNs' Network Architecture



4.1 Network Training and Validation Step

In this step, the chosen network is trained to understand the data’s conditions so that it can be used to make a prediction. The training process is stopped automatically by Alyuda when the network reaches the lowest error point and does not experience any more improvement. In this learning phase, the network gives weight for each variable as shown in the Figure 3.

Figure 3. The Importance Level of Each Variable



The Figure 3. depicts that almost all variables are considered as having a significant weight in affecting the risk signal of Bank Syariah Mandiri. The exchange rate variable has the largest weight which means that the exchange rate produces a direct impact to the customers who affected by market risks since they buy raw materials from outside the country using USD and sell the product inside the country in Rupiah. Meanwhile, Non-Performing Financing to Total Financing variable has the smallest weight which means the variable is considered to indirectly expose the business risk of the bank.

The network that has been trained is then used to make a prediction. This process uses 17-time series data to run its learning process. The table below depicts the ANN’s ability in learning. This learning process produces good enough prediction ability since the network successfully understood the data’s behavior results in 58%, accuracy rate. In the next stage, the network conducts a validation process according to prior knowledge whereas the ANN network successfully understood the data characteristics perfectly (100%) as shown in the Table 1.

Table 1. The Results of the Prediction in Validation Process

Row	TPBY/TA	PUP/TPBY	PBMSLH/TPBY	CKPN/TPBY	PPAP/TPBY	ALIQ/TA	TPBY/HTG	NCD/TD	INF	BI RATE	KURS	Target	Output	Match?
VLD 18	0.166411	0.769912	0.017356	0.01926	0.020616	0.198556	0.821079	0.684776	0.0399	0.075	12189.06	Naik	Naik	OK
VLD 19	0.165142	0.76838	0.018326	0.018573	0.020843	0.223461	0.809647	0.634617	0.0456	0.075	12206.67	Naik	Naik	OK
VLD 20	0.170288	0.75875	0.01711	0.018346	0.019429	0.225136	0.816756	0.654784	0.0483	0.075	12390.77	Naik	Naik	OK
VLD 21	0.016389	0.762632	0.016273	0.017516	0.018429	0.233064	0.807076	0.63813	0.0623	0.075	12644.87	Naik	Naik	OK

Afterwards, the network finally required to be validated. During this phase, the network successfully achieved 75% accuracy rate which means the ANNs was able to answer 3 data conditions correctly. This accuracy level decreased slightly by 25% in the validation process since there are only 4-time series data available (Table 2). However, these results give enough confidence to the researcher that ANN(11-2-1) has produced satisfying results. Accordingly, the ANN(11-2-1) will be used as a prediction algorithm for the early warning system.

Table 2. The Results of the Prediction in Validation Process

ROW	TPBY/TA	PUP/TPBY	PBMSLH/TPBY	CKPN/TPBY	PPAP/TPBY	ALIQ/TA	TPBY/HTG	NCD/TD	INF	BI RATE	KURS	Target	Output	Match?	
TST	22	0.168205	0.753462	0.014302	0.019213	0.01657	0.233239	0.804875	0.632029	0.0836	0.075	12658.3	Naik	Naik	OK
TST	23	0.159687	0.763987	0.012159	0.023305	0.014517	0.250164	0.789801	0.65826	0.0696	0.075	12938.29	Naik	Naik	Wrong
TST	24	0.157009	0.763046	0.013027	0.024802	0.015353	0.25937	0.77536	0.632321	0.0629	0.0775	13079.1	Naik	Naik	OK
TST	25	0.160544	0.0758017	0.013687	0.023513	0.016099	0.262724	0.774115	0.625974	0.0638	0.0775	13249.84	Naik	Naik	OK

4.2. Model Testing

The last step for the early warning system development is to do testing to the chosen algorithms to predict the risks of Bank Syariah Mandiri by using out-of-sample input variable. Alyuda provides a query tool for inserting out-of-sample data into the network manually. Out-of-sample data means that the data is not yet used in the training, learning, and validation test phase. The data is then recalculated by using the chosen architecture and the weight resulted from the prior step to predict future information as the predicted output variable. The out-of sample data used are January and February 2015 are shown in Table 3.

Table 3. The Data Query for Out of Sample Testing

PERIODE	TPBY/TA	PUP/TPBY	PBMSLH/TPBY	SKPN/TPBY	PPAP/TPBY	ALIQ/TA	TPBY/HTG	NCD/TD	INF	BI RATE	KURS
Jan-15	0.16	0.76	0.01	0.02	0.02	0.26	0.78	0.63	0.06	0.08	13079.1
Feb-15	0.16	0.76	0.01	0.02	0.02	0.26	0.77	0.63	0.06	0.08	13249.84

The predicted output variable will then be compared with the actual condition. Accordingly, during January and February 2015, the EWS will generate a sign that profit will increase which means the risk is decreasing or otherwise. Accordingly, the researcher did an input for February 2015 by manually inputting each variable into the columns provided by Alyuda. Figure 4. depicts the prediction given by the system for January that the profit is predicted to increase where the bank booked profit amounted to Rp52.460 billion. It means the bank will experience a decreasing risk. Accordingly, the system made a prediction with the accuracy of 100% for January as it is consistent with the actual conditions.

Figure 4. The January Out of Sample Testing Results



Using the same method, the researchers did an input for February 2015 by manually inputting each variable into the column provided by Alyuda. It can be seen that the system also has the same ability in the February 2015. Figure 5. depicts the prediction given by the system for February 2015 that the profit is predicted to increase while the bank is actually got profit in February was Rp92.246 billion.

According to the prediction result, the proposed EWS system is able to reach 100% accuracy in predicting two consecutive months using out-of-sample input variables. The result is in line with Bellovary et al. (2007) reported that usage of data mining method such as neural network resulted in accuracy rate in making prediction ranging from 71% to 100% since ANNs has a better ability in understanding the context of data pattern variety and its volatility (Anwar and Ismal, 2012). Accordingly, Liao et al, (2012) reported that the usage of data mining method tends to increase. Specifically, Anwar and Ismal (2012) reported that the ANNs empirically provide higher accuracy rate compared to Support Vector Machine method in predicting the profit sharing rate of Islamic banks in Indonesia.

V. CONCLUSION

The decreasing financial condition of Islamic banking requires the best effort to resolve. The bankruptcy as the worst impact will not only result in financial and systemic risks but also will endanger the reputation of Islamic law itself. It is too expensive to pay since the Islamic economy is not mature yet and believed to be an alternative system against the capitalistic economy. Therefore, this research attempts to develop a system that can provide early warnings or deliver future information at an early time so that the risk of bankruptcy could be avoided.

The results from this research obtained the conclusion that from 14 variables collected as input variables, there are 11 variables considered to give significant impact in affecting Islamic bank's profitability. Accordingly, the research determines ANN(12-2-1) as the best algorithm that will be embedded in EWS. Finally, the testing results showed that the accuracy level generated by the algorithm using in-sample data is 75% accuracy rate. Afterwards, it was employed to predict the conditions in the incoming 2 consecutive months by using out-of-sample data which result in 100% accuracy rate. This indicates that the proposed EWS is suitable to predict bankruptcy risk of Indonesian Islamic bank.

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THE EFFECT OF FINANCIAL LIBERALIZATION AND CAPITAL FLOWS ON INCOME VOLATILITY IN ASIA-PACIFIC

Feriansyah¹ ², Noer Azam Achسانی², Tony Irawan³

ABSTRACT

This paper examines the effect of financial liberalization on income volatility focused on the direction of capital flows in the Asia-Pacific region. By using a dynamic panel model, this study investigates the effect of financial liberalization on income volatility in 19 Asia-Pacific countries over the period 1976-2015. The results show that the financial liberalization in the Asia-Pacific region associated with low income volatility is only perceived by developed countries, while not for developing countries. This paper also investigates the effect of capital flows on different types of directions. The results show that capital outflows will be associated with low income volatility, whereas capital inflows will be associated with high income volatility. The negative effect of financial liberalization on income volatility in developing countries is caused by the majority of those countries holding larger capital inflows, compared to capital outflows. Therefore, the excess capital inflows in developing countries increase the pressure and the vulnerability to the crisis.

Keywords: Asia-Pacific, Capital Flows, Financial Liberalization, Macroeconomic Volatility

JEL Classification: F41, F36

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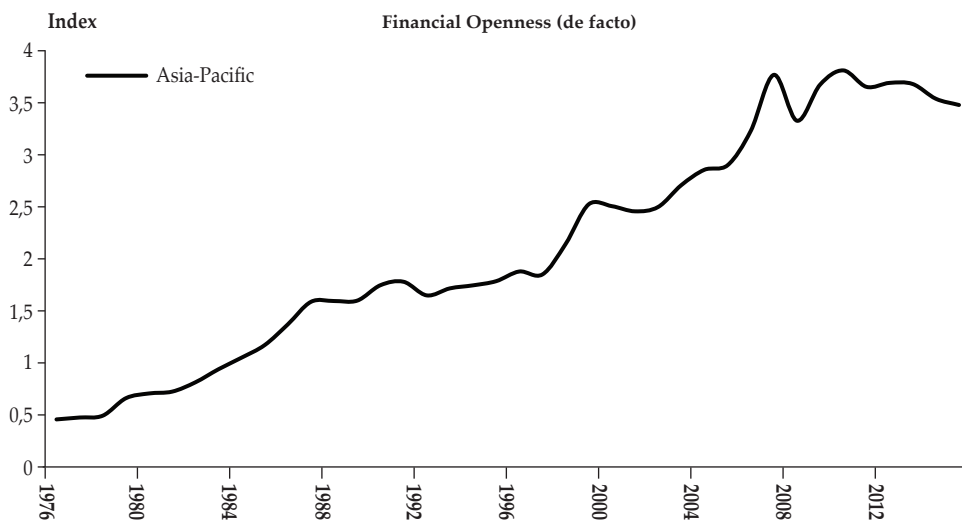
I. INTRODUCTION

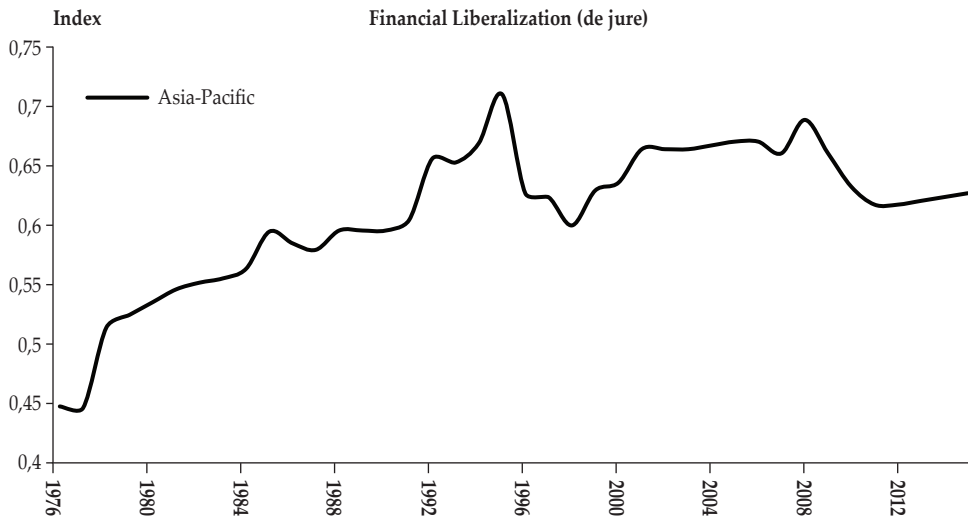
Since 1990, the economic globalization has created a world trade liberalization followed by integrated global financial markets (Rajan, 2001). Financial market transactions freedom is characterized by an increasingly free movement of capital in industrialized countries, especially countries in Europe and America. The increasing degree of financial sector liberalization in the industrialized countries subsequently has spread to various regions in the world, especially countries in the Asia-Pacific. Chinn and Ito (2008) revealed that since 1970, the financial openness of developing countries in the Asia-Pacific region has the greatest level relative to other regions. The high financial market activity in Asia-Pacific according to Borensztein and Loungani (2011) has shown that the integrated capital flows in the Asia-Pacific region and the mobility of capital has moved freely, thus making most of the liabilities of companies and banking countries in Asia-Pacific region began to be dominated by various foreign currency units.

Figure 1 shows de jure and de facto financial liberalization data movements in the Asia-Pacific. De jure level of financial liberalization shows the index of financial liberalization issued by Chinn and Ito (2008). This variable calculates the degree of capital account openness to foreign funding in a country. Meanwhile, the financial openness representing de facto financial liberalization is calculated using the measurement of financial openness of Lane and Milesi-Ferretti (2007). The method of calculating financial openness is by summing the total capital inflows and outflows divided by gross domestic product. The degree of financial openness in the Asia-Pacific has always increased over time. The data show that in 1976 the average degree of financial openness in the Asia-Pacific was only 0.45 index unit, then increased eightfold by the year 2015 to 3.4 index units. Similarly, the degree of

Figure 1.

Average Degree of Financial Liberalization and Openness in Asia-Pacific Countries





financial liberalization shows an increasing trend over time, except in 1997 which decreased due to the global financial crisis.

Economic globalization that makes the financial sector more integrated in the Asia-Pacific region becomes an interesting phenomenon to be observed. One of the reasons is, financial liberalization can affect the level of economic stability. According to Mirdala et al. (2015), the development of studies and empirical research on financial liberalization in the world began because of the effects of financial liberalization on the economy. These findings concluded that the liberalization process of capital flows led by industrialized countries which have been a stimulus in improving the efficiency of wealth allocation and sharing international financial risks. The allocation efficiency of wealth and the sharing of international risks will then affect the growth and maintain the economic stability. In addition to the benefit from allocation efficiency and risk sharing internationally, the flow of capital across countries will also determine economic outcomes and will further influence the volatility of macroeconomic variables. Ultimately, the risk of such macroeconomic volatility will affect the economic growth and will implicate the level of welfare in an economy indirectly.

Kose, Prasad, and Terrones (2006) have proved that the economic globalization marked by an increasing in the volume of international trade and financial flows has weakened the negative relationship between volatility and economic growth. Similarly, Ahmed and Suardi (2009), Pancaro (2010), Torki (2012) and Mirdala et al. (2015) have found that financial openness has contributed significantly to influencing income and consumption volatility. The integrated economy will contribute by lowering the volatility of output and consumption. The findings are reinforced by Ozcan, Sorensen, and Yosha (2013) who revealed that the integrated flow of cross-border capital will maintain fluctuations in macroeconomic variables.

Therefore the positive benefits of financial liberalization are still debated both in theory and empirical studies. Kose, Prasad, and Terrones (2003) revealed that the relationship between financial liberalization to income and consumption volatility

is still not conclusive and well explained. The lack of clarity on the relationship is due to the two forces in financial openness. These forces may increase or reduce the economic volatility. International financial openness can reduce volatility due to diversification in risk sharing. On the other hand, financial openness can lead to greater specialization and increase volatility levels. According to Mirdala et al. (2015), the advantages of financial liberalization in reducing economic instability are affected by economic conditions within a country. The existence of financial market openness empirically gives more positive effect for developed countries while not for developing countries.

The influence of financial liberalization on the uncertainty of the economic remains unclear. Therefore, an analysis of the impact of financial liberalization on income volatility in the Asia-Pacific region becomes important to be investigated. Since the Asia-Pacific region is still dominated by developing countries, this study will ultimately provide an important conclusion whether the presence of financial liberalization in the Asia-Pacific region will provide benefits or not. Moreover, the influence of the direction of capital flow becomes an important consideration in this study. The behavior of capital inflows and capital outflows in influencing income volatility is expected to explain the possible effect of different financial liberalization on income volatility, especially in developed and developing countries.

II. THEORY

Ramey and Ramey (1995) have proved that the volatility and growth output are negatively correlated. This indicates that countries with high volatility have low economic growth. The relationship concludes that the volatility of output that affects economic growth indirectly plays an important role because it will have implications for the level of welfare in an economy. The existence of these empirical relationships makes Kose et al. (2006) to examine the relationships between outputs volatility and growth in the context of globalization in light of the phenomenon of trade openness and financial integration in many countries by interacting the financial integration and trade openness to output volatility. The results showed that financial integration and trade openness have diluted the negative relationship between output volatility and growth.

In the relationship between financial integration and economic volatility, Kose et al. (2003) argued that international financial integration was having two major potential advantages. Firstly, financial integration may increase global allocation of capital and help countries to have better portfolio. Secondly, a country that has an integrated financial market usually will create a positive sentiment. Economic agents will assume that financial market integration will create stable output volatility. However, from the vast overview of existing literature, it is difficult to conclude that financial integration will actually reduce income volatility. In fact, there are several studies that find an opposite result, that international financial integration can increase income volatility.

Kose et al. (2003) examined the impact of financial integration on the volatility of income and consumption by using samples of industrialized countries in the period of 1960-1999. The results showed that high financial openness will be

associated with a relative increase in consumption and income volatility. Mirdala et al. (2015) studied the relationship between international financial integration and fluctuations in revenues. The results showed that the relationship between financial openness and economic development in developed countries was insignificant. As a result the effect of financial integration on the volatility of income and consumption disappears over time. Similarly, the financial integration impact on the volatility of income and consumption in developing countries decreases with the improvement of economic and institutional conditions. However the relationship between financial integration and volatility is positive which means that financial integration has resulted in greater volatility in income and consumption. Mujahid and Alam (2014) have investigated the relationship of financial transparency with macroeconomic volatility in Pakistan. Financial and trade openness significantly correlated positively to the volatility of output, consumption, and investment. Easterly, Islam, and Stiglitz (2001) probed the factors affecting volatility in 74 countries in the period of 1960-1997. The results found that an increasing financial system, resulting in financial openness could increase the risk of increased volatility in output growth.

This type of financial openness and the presence of other country-specific characteristics may also be meaningful. Kose et al. (2006) provided a conclusion that the existence of financial and trade openness has a positive effect on the economy by weakening the negative effects of volatility on economic growth. The existence of these important findings makes the study of financial and trade openness is growing. Ahmed and Suardi (2009) had developed a research from Kose et al. (2003) who studied the effect of trade and financial liberalization on macroeconomic volatility in Sub-Saharan Africa. By using representatives from 25 countries in the Sub-Saharan Africa region from 1971-2005. The results showed that an increase in financial openness in the Sub-Saharan Africa region leads to lower volatility in output and consumption. In contrast to conventional beliefs, trade openness in Sub-Saharan Africa will result in even greater instability in the economy. Bekaert, Harvey, and Lundblad (2006) examined the impact of market liberalization on equities and the openness of capital accounts to the consumption growth volatility. They found that financial liberalization was associated with low volatility of consumption growth.

The existence of differences in the empirical results of the study on the relationship of financial openness to the volatility of the economy is one of the issues in the academic literature. This suggests that the scope of the research in aggregation can mask important structural details that can potentially explain mixed results. Kose, Prasad, and Terrones (2009) have investigated the possibility that capital inflows and outflows can be important references to observing the potential for different effects on economic volatility. The capital flows used to focus on the level of external assets (capital outflows) and the level of external liabilities (capital inflows). This theory explains that capital outflows driven by the holders of domestic capital by buying offshore assets will create variations in dealing with risks from home countries. In addition, domestic investors may be able to increase profits from a given risk by increasing the number of capital outflows in purchasing external assets. Domestic financial assets kept outside will help domestic capital holders share their wealth risk in the face of a loss of output

shocks in the home country, where each asset holder will still earn income from abroad. It can be concluded that the existence of large external assets (capital outflows) is likely to be associated with low fluctuations in economic variables. Conversely, the external liabilities (capital inflows) are predicted to affect economic volatility in different directions. The recipient country experiences capital inflows, which in turn will increase the specific risks in their own country in the presence of additional risks from the donor country. Additional risk is possible due to capital flight and negative events due to world shocks. Large external obligations will then be associated with massive economic volatility.

III. METHODOLOGY

3.1. Data

The data used in this study are secondary data collected from various sources. The data used are panel data with time series at the annual frequency of the period 1976-2015 and cross-section consisting of 19 countries in the Asia-Pacific region. Data used from World Development Indicators (WDI), Database of Economic Freedom in the World, Chinn-Ito Indicators and External Wealth of Nations. The data used in this study are GDP growth volatility, GNP growth volatility, financial openness (de facto size), financial liberalization (de jure size), total external liabilities, total external assets, trade openness, income per capita, inflation rate, inflation rate volatility, terms of trade volatility, discretionary fiscal policy, fiscal policy procyclicality, financial development, and institutional quality.

The financial liberalization variables in this study, denoted by FL_{it} , are based on de jure and de facto financial liberalization. The de facto financial liberalization data is represented by the financial openness collected from the External Wealth of Nations published by Lane and Milesi-Ferretti (2007). The de facto size of financial openness is the sum of the international financial gross assets and the international financial liabilities relative to GDP.

$$\text{Financial openness (de facto)} = \frac{\text{total asset}_{it} + \text{total liabilities}_{it}}{GDP_{it}} \quad (1)$$

Whereas for the size of financial liberalization de jure symbolized by financial liberalization and is illustrated by indicators Chinn and Ito (2008) to examine the potentially different impact of capital inflows and outflows on income volatility, this study divided international investment positions into two categories, total external assets and total external liabilities which measured relative to GDP. Where the total external asset is the proxy of capital inflows and the total external liabilities are the proxy of capital outflows.

Table 1.
Data Sharing Capital Outflows and Capital Inflows

	Capital Outflows	Capital Inflows
	external assets total: indicate the accumulated value of the stock of capital outflows	external liabilities total: indicate the accumulation of capital inflows stock value
Total Asset	$= \frac{\text{external asset total}_{it}}{GDP_{it}}$	$= \frac{\text{external liabilities total}_{it}}{GDP_{it}}$

The control variables are denoted by Z_{it} incorporating trade openness, income per capita, inflation rate, inflation rate volatility, terms of trade volatility, financial development, institutional quality, discretionary fiscal policy, and procyclicality fiscal policy. For discretionary fiscal policy was built using the method proposed by Fatas and Mihov (2003). This study uses annual data for 19 Asia-Pacific countries from the period 1976-2015 and estimates the following regression for each country:

$$\Delta G_t = \alpha_1 + \beta_1 \Delta Y_t + \gamma G_{t-1} + \delta t + \varepsilon_t \tag{2}$$

Where G is the logarithm of real government spending and Y is the logarithm of real GDP. Deterministic time trends are used to capture the observed trends in government spending at all times. The data from the size of the discretionary fiscal policy is ε_t . While for procyclicality fiscal policy data are built using Lane method (2003) which involves running a regression of each country with regression estimate as follows:

$$\Delta CG_t = \alpha_2 + \beta_2 \Delta CGDP_t + e_t \tag{3}$$

By using annual data where CG is the logarithm of the cyclical real government expenditure and CGDP is the logarithm of the real cyclical component of GDP. The logarithm of the cyclical component of a series is obtained by using the deviation log of the Hodrick-Prescott trend. β_2 measures the elasticity of government expenditure on output growth. A positive value indicates a procyclical fiscal state and the above unity value indicates a more comparable response than a fiscal policy to output fluctuations. The coefficient β_2 is a cyclicality that is estimated to measure the procyclicality fiscal policy.

Table 2.
Average of Dependent and Independent Variables per Decade

	1976-1985	1986-1995	1996-2005	2006-2015
Volatility growth of GDP	0.03	0.025	0.027	0.022
Volatility growth of GNP	0.09	0.081	0.091	0.088
Financial openness	0.89	1.66	2.49	3.62
Financial liberalization	0.46	0.53	0.56	0.57
Total external asset/GDP	0.41	0.85	1.38	2.02
Total external liabilities/GDP	0.55	0.65	0.74	0.77
Trade openness	0.77	0.84	1.02	1.02
Income per capita	5735.46	11900.51	18969.82	30699.47
Inflation	15.62	6.66	2.82	3.08
Inflation volatility	7.57	6.76	2.38	1.69
Terms of trade volatility	6.63	3.79	5.1	3.71
Discretionary fiscal policy volatility	0.0221	0.0127	0.0121	0.0128
Financial development	0.56	0.75	0.89	0.97
Institutional quality	5.88	6.18	6.41	6.37

* Procyclical fiscal policy is not reported by the construction. this variable does not vary over time.

To be able to provide more detailed information will be described table showing the average variables used per decade. The data to be explained include dependent and independent variables. In Table 2, the dependent variables used include the growth volatility of GDP and GNP. In every decade the average income volatility overall declined except in the 1996-2005 decade. The GNP variable has the highest volatility value when compared to the volatility of GDP. For independent variables financial openness (de facto) and financial liberalization (de jure) always increase in every decade. That is, for the Asia-Pacific region there has been an increase in the flow of capital increase per decade of time. In addition, the data flow of capital flow consisting of total external assets and total external liabilities on an average always increase per every decade. The increase in capital inflows and outflows is due to the increasing integration of financial markets of Asia Pacific countries to global financial markets.

Table 2 also shows the movement of control variables used in research per decade of time. The movement of trade openness data shows ever-increasing movements every decade. This indicates that the exchange of goods and services activities in Asia-Pacific countries has always increased over decades per decade of time. Similarly for per capita income on a regular basis in the Asia-Pacific region is always increasing every decade. Increased income per capita also showed a very significant increase where in the decade 1976-1985 only amounted to 5735.46 (US \$) increased significantly by 30699.47 (US \$) in the decade 2006-2015. Data inflation on average declined in the decade 1976-1985 to 1996-2005 and rose again in the decade 2006-2015. The increase in inflation at the end of the decade is due to some of the symptoms of the global financial crisis, such as the subprime

mortgage crisis and the European crisis. As for inflation volatility always decline every decade. The lower inflation volatility indicates that the price level stabilizes over time. Similarly with the data terms of trade volatility which in every decade always decrease. This is shown in the decade 1976-1985 terms of trade volatility is at the number 6.63 and at the end of the decade 2006-2015 dropped significantly about 3.71. Discretionary fiscal policy data declined in the first three decades and rose again in the last decade. Discretionary fiscal policy indicates the volatility of a government's expenditure shocks. The decade of 1976-1985 discretionary fiscal policy fell to the period 1996-2005 from 0.0221 to 0.0121, then climbed back in the last decade to 0.0128.

3.2. Empirical Model

This study will basically look at how financial liberalization affects the volatility of revenue growth in the Asia-Pacific region by considering the effect of different moving capital flow directions. The estimation model analysis method uses dynamic panel data. The dynamic models that are considered for the 15 Asia-Pacific countries from 1976-2015 are as follows:

$$Y_{it} = \alpha + \rho Y_{it-1} + \beta FL_{it} + \mu D_{it} + \omega (FL \times D)_{it} + \delta CF_{it} + \gamma Z_{it} + u_i + v_t + \varepsilon_{it} \quad (4)$$

$\forall i = 15; t = 1980, 1985, 1990, \dots, 2015$

Where i and t identify each state and time period, u_i denotes the influence of the state that cannot be observed, and v_t denotes the influence of time.

The model contains four sets of variables: (1) a collection of dependent variables (Y_{it}), (2) a collection of variables of financial liberalization proxy (FL_{it}) and capital flow direction (CF_{it}), (3) dummy variable (D_{it}): 1 for developed countries and 0 countries for developing countries, and (4) a set of control variables (Z_{it}). The dependent variables consist of two measures of income volatility, namely the volatility of GDP growth and the volatility of GNP growth. The volatility of the two income variables is calculated by the standard deviation of five years from GDP growth and GNP growth. The empirical results will be estimated separately for the two different volatility measures. There are two problems of endogenous forces in this model. First, dependent lag variables as control variables are correlated with unobserved country fixed effect (u_i). To solve this problem, this study used the GMM estimates proposed by Arellano Bond (1991). Second, for other independent variables (FL_{it} , CF_{it} , Z_{it}) may be correlated with error term (ε_{it}).

IV. RESULT AND ANALYSIS

4.1. Macroeconomic Volatility in Asia-Pacific

This section explores the dynamics of income growth volatility from 1976 to 2015. Figure 2 shows income growth volatility by dividing the Asia-Pacific into two groups of countries, namely: developed countries and developing countries. The income growth volatility data in this study is divided into two groups, namely the growth volatility of gross domestic product and the growth volatility of gross national product.

Figure 2. Income Volatility Developments in The Asia-Pacific based on Income Groups from 1976-2015

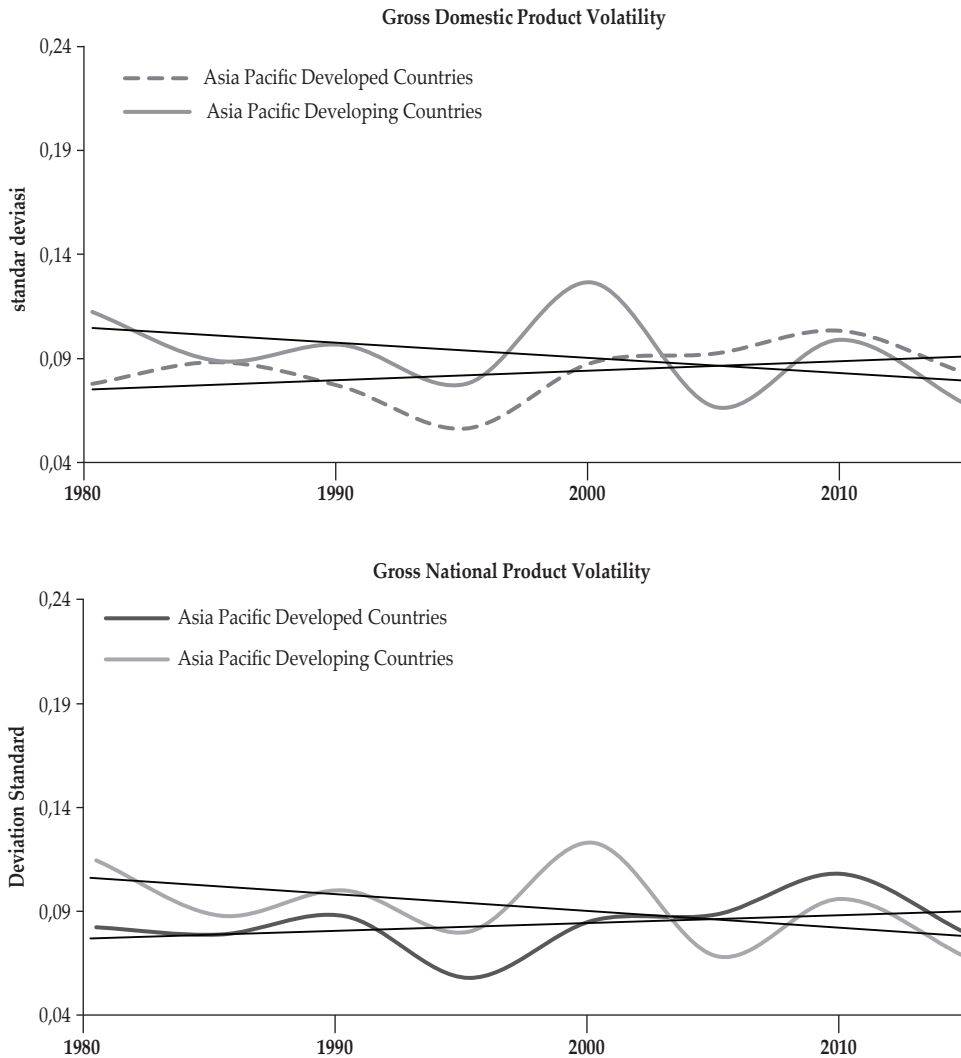


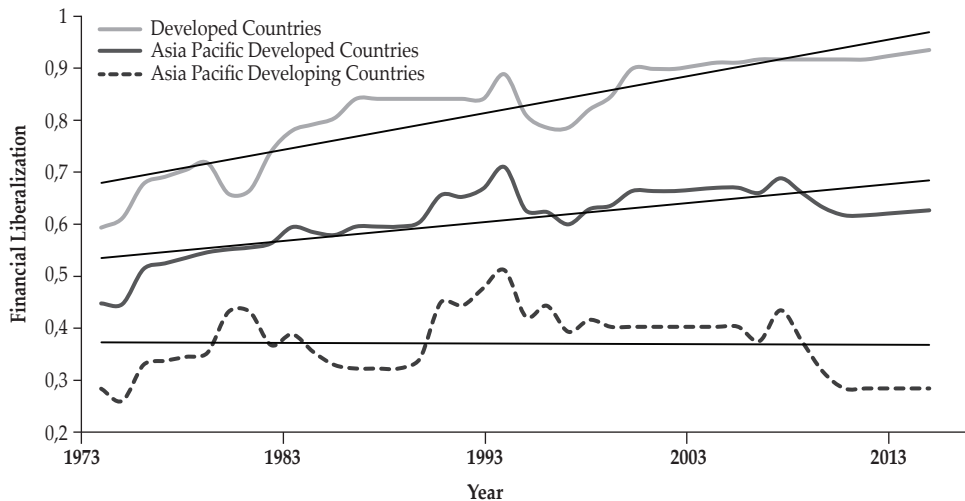
Figure 2 shows general pattern of volatility in both income groups fluctuates over time. The interesting point of Figure 2 is that the income growth volatility in developing countries is always higher than in developed countries from 1976 to 2003, but after 2003 the position of income volatility was in the opposite position. After 2003 developed countries have higher income volatility, compared to developing countries. These conditions occur both on the growth volatility of gross domestic product and gross national product. Another interesting point shown in Figure 2 is income volatility during the period 1998-2000. The increase in

income growth volatility during this period was due to the financial crisis that hit the world. The existence of financial crisis will eventually increase the instability of the economic conditions shown in each income variable.

4.2. Financial Liberalization and Openness in Asia-Pacific

This section explores the movement of financial liberalization and openness from 1976 to 2015. Figure 3 illustrates the development of de jure and de facto financial liberalization in Asia-Pacific over time. The graph showed the level of de jure’s financial liberalization, while the graph financial openness shows the level of de facto’s financial liberalization. Financial liberalization and openness data were shared by the Asia-Pacific Developed Countries and Asia-Pacific Developing Countries. Figure 3 shows an increasing pattern of financial liberalization, and openness data over time in the Asia-Pacific, Asia-Pacific developed countries and Asia-Pacific developing countries. It is seen that the level of financial liberalization for Asia-Pacific data averaged in 1975 is at the 0.44 level, an increase of 0.64 in the data end of 2015. There are only at some point that decreased due to the global financial crisis that hit the world. Figure 3 also shows that there is a difference in the level of financial liberalization data between Asia-Pacific developed countries and Asia-Pacific developing countries. The data on the level of financial liberalization in the developed countries show higher levels of financial liberalization, when compared to developing countries. This indicates that countries in the Asia-Pacific developed countries are more open and have a very low financial market constraint to global financial markets, when compared with Asia-Pacific developing countries.

Figure 3. The Development of Financial Liberalization and Openness in The Asia-Pacific from 1976-2015



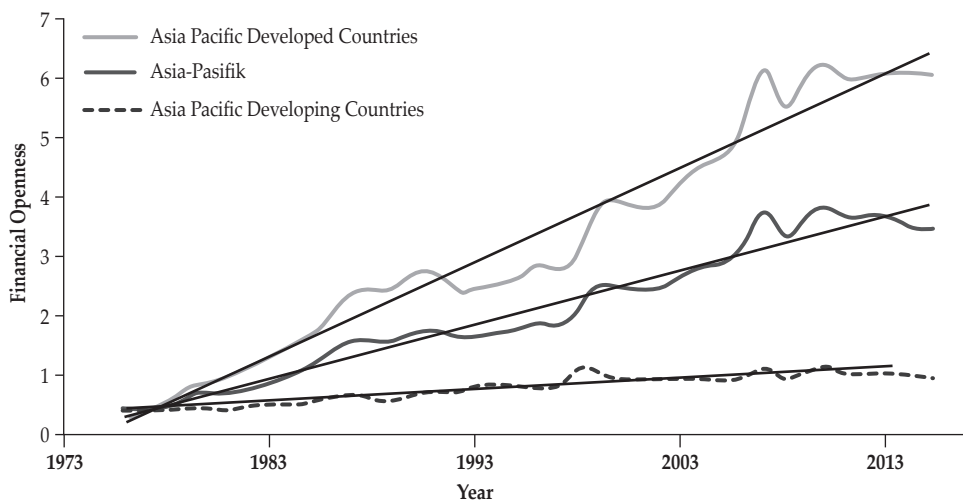
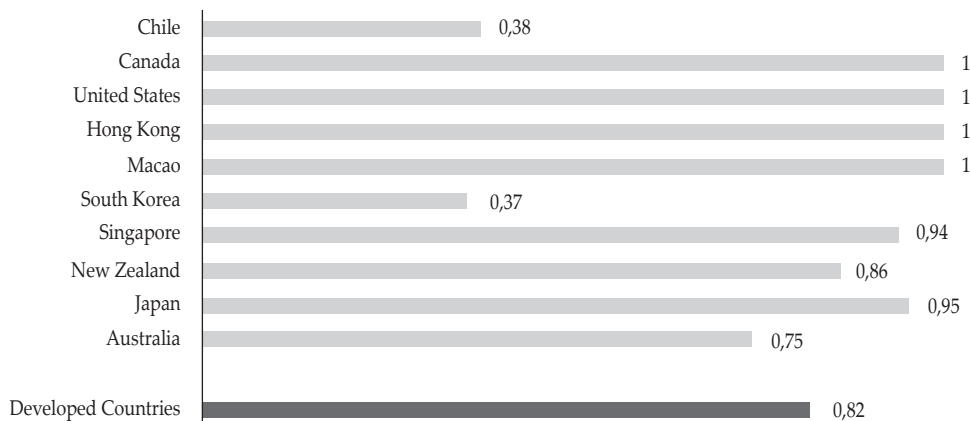
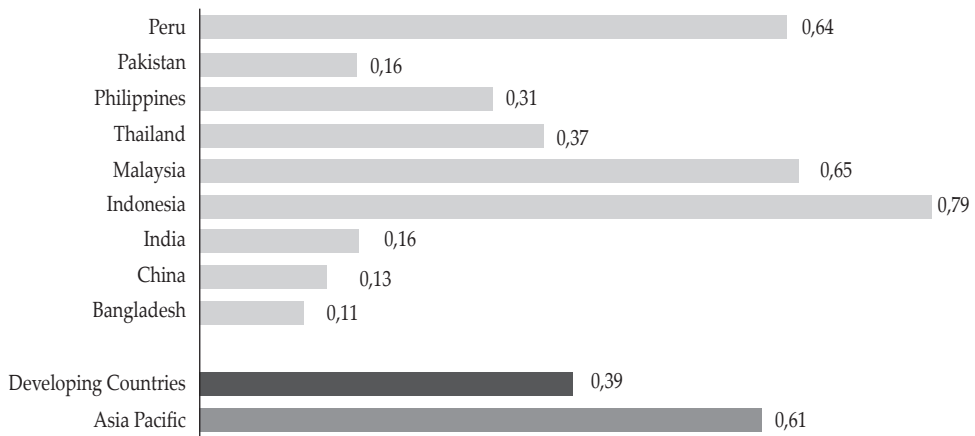


Figure 3 also shows that financial openness has increased overtime in the Asia-Pacific region. Financial openness indicates that financial activities occurring in the Asia-Pacific to global financial markets always increase over time. It also shows that the capital market activity in Asia-Pacific countries is getting more integrated with international capital markets. Financial openness in the Asia-Pacific developed countries is greater, when compared with the Asia-Pacific developing countries. In addition, financial openness activities in the developed countries experienced a very rapid growth when compared to developing countries that only showed the slow growth of financial activity.

Figure 4. The Average Rate of Financial Liberalization is based on Income Levels in The Asia-Pacific from 1976 to 2015

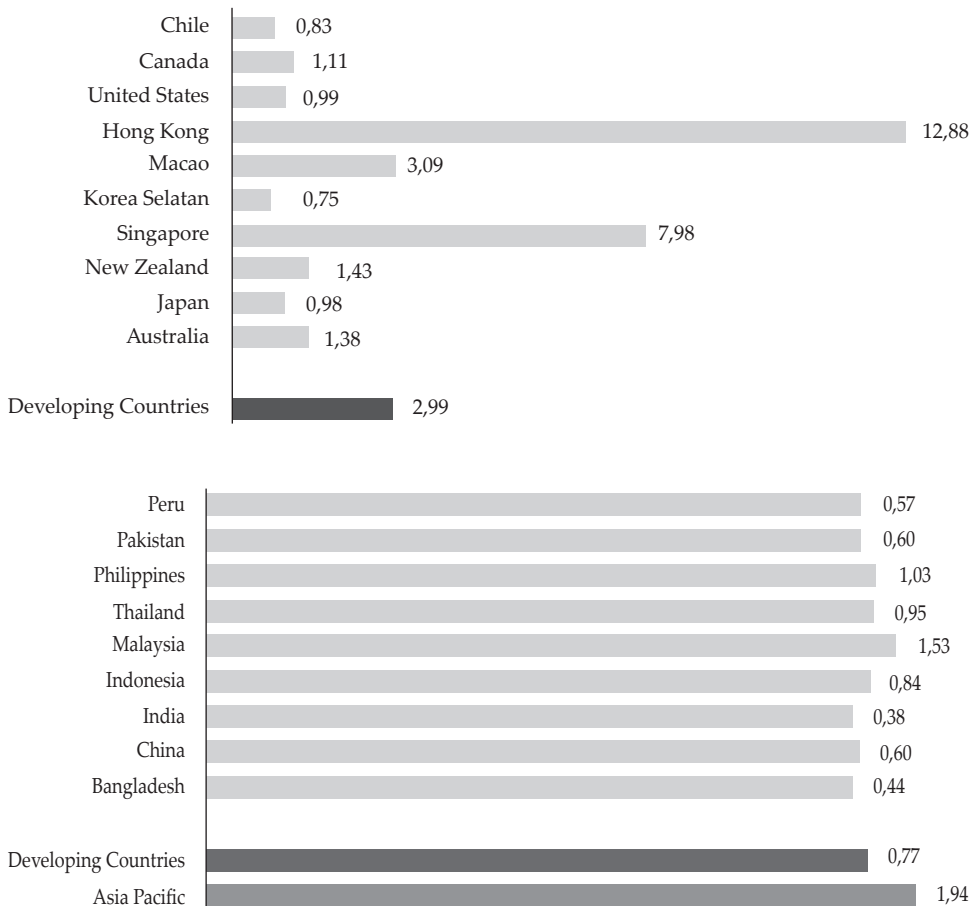




The next section is to show the level of financial liberalization in each country that becomes the object of research. Figure 4 shows the data on the level of financial liberalization divided into developed countries and developing countries. Overall, the average rate of financial liberalization in the Asia-Pacific shows the number of 0.61. Based on the income characteristics of countries belonging to the Asia-Pacific, the developed countries showed a high rate of financial liberalization of 0.82, while in the Asia-Pacific developing countries showed a low rate as much as 0.39. This is consistent with the explanation of Figure 3 which shows that on average the rate of financial liberalization in the developing countries is greater than in the developed countries.

Figure 5 shows the data on the degree of financial openness are data calculated using the measurement of financial openness Lane and Milesi-Ferreti (2006). Overall, the average rate of financial openness in the Asia-Pacific was 1.94. Based on income group that divided of Asia-Pacific developing countries and developed countries. The level of financial openness shows a much different figure. The Asia-Pacific developed countries has an average financial openness level of 2.99, while for the developing countries shows an average rate of financial openness of 0.77. There is a considerable difference in the level of financial liberalization in both groups, with the difference in the degree of financial openness of 2.22. This is also due to the capital flow constraint factor in Figure 4, where Asia-Pacific developing countries tend to have high levels of constraints on financial markets. This is what causes the capital flow activities of the developing countries to global financial market is very low when compared with the group of developed countries.

Figure 5. The Average Rate of Financial Openness is based on Income Levels in The Asia-Pacific from 1976 to 2015



An interesting analysis of Figure 5 is an indicator of financial liberalization that has not yet determined the level of country's financial openness. This is seen in the condition of financial liberalization and openness in Indonesia. Indonesia has a high level of financial liberalization in Figure 4, but the level of openness and financial activity in Indonesia on global financial markets is still low compared to Malaysia, Philippines, and Thailand. The existence of this important distinction is one of the reasons why this study uses two measures the level of domestic financial liberalization on global financial markets. The use of these two indicators is based on the reasons for complementary weakness of each size (Quinn, Schindler, and Toyoda, 2011).

4.3. Development of Capital Outflows and Inflows in The Asia Pacific

Figure 6 shows total accumulated capital flows of total assets and liabilities averaged from 1976 to 2015. Total external assets and liabilities data show the US dollar billion. On average, for countries in the Asia-Pacific, total external assets show 675.8, while total external liabilities on average 656.6. This shows that on average, the total capital outflows is still dominant in the Asia-Pacific when compared to the total capital inflows. Figure 6 also shows the average total capital flows based on income groups. The activity of both capital inflows and outflows on average is still dominated by developed countries. On average, total activity of capital inflows and outflows (total external assets + total external liabilities) are 2.250, while developing countries if averaged only 314.79. The dominance of substantial financial activity in developed countries is associated with high liberalization and financial openness in these countries. The developed countries have a high degree of financial openness due to the structure of the industrial economy, so to expand its domestic production pattern requires a high capital flow.

Figure 6. Average Total Capital Inflows and Outflows (Total Assets and External Liabilities) of Asia-Pacific Countries Period 1976-2015

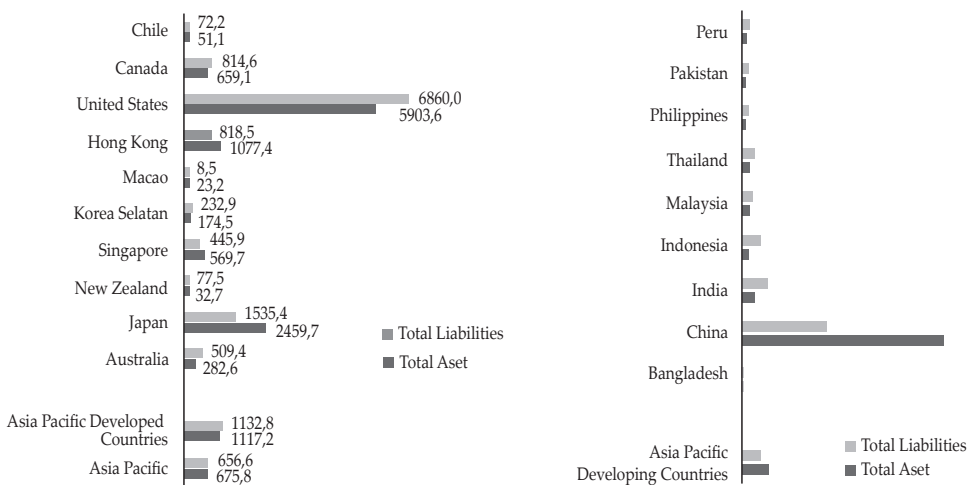


Figure 6 shows that for developed countries, the United States still dominates activity in global financial markets. Then followed by Japan and Hong Kong. The total external liabilities in each country are 6860, 1535.4, and 818.5. Meanwhile, the total external assets of each country are 5903.6, 2459.7, and 1077.4. The interesting points are shown in the figure relate to the state of the state capital flow direction in the United States, where the total external liabilities are on average larger than the total external assets. Similar conditions were also shown by Chile, Canada, South Korea, New Zealand, and Australia. While for Japan and Hong Kong are in the opposite condition, where the total external liability average is smaller than the total external assets. State conditions similar to Japan and Hong Kong are Singapore and Macao. The country with the lowest total inbound and outbound

capital inflows in the developed countries is Macao of 31.7. Figure 6 further reassembles the Asia-Pacific countries by developing countries. In the developing countries, the highest and most significant capital flow activity is China with an average total external liability of 585.69. While the total average external assets in China amounted to 1371.02. High capital inflows and outflows after China are India and Indonesia. An interesting point is shown in conditions in China, where the total external asset is on average much larger than the total external obligation. This is in contrast to other developing countries, where in contrast the total external obligation is much greater than the total external asset. The country with the lowest total capital inflows and outflows in the developing countries is Pakistan at 41.83.

4.4. The Effect of Financial Liberalization and Capital Flows on Income Volatility in the Asia-Pacific

This section examines the effect of financial liberalization on income growth volatility in terms of GDP and GNP. Theoretically, the effect of financial liberalization on income volatility is still debatable because it has two forces. Financial liberalization not only reduces income volatility but also increases volatility. Table 4 provides estimates of the effects of financial liberalization and other factors on income volatility in the Asia-Pacific region using the GMM method. Financial liberalization factors are divided into two, namely financial liberalization factor which shows de jure financial liberalization (Chinn and Ito, 2008) and financial openness factor which shows de facto financial liberalization (Lane and Milesi-Ferretti, 2007). The estimation results also include the dummy variable of Asia-Pacific developed countries (where the value of 1 is for developed countries, while the value of 0 is for developing countries). In addition, dummy Asia-Pacific developed countries interacted with financial openness. This is intended to see the chance of different effect from financial openness among country income groups such as findings from Kose et al. (2003) and Mirdala et al. (2015). Other factors are also included in this estimate: trade openness, income per capita, inflation, inflation volatility, term of trade volatility, discretionary fiscal policy volatility, fiscal policy procyclicality, financial development, and institutional quality.

Estimation results began by showing the impact of financial openness on the volatility of income growth variable in the Asia-Pacific region. Estimation results show that financial openness has a significant negative relationship to income growth volatility. It means that financial openness in the Asia-Pacific region will have a positive effect by reducing income growth volatility. The estimation results show a significant effect on the volatility variable of GDP and GNP growth with coefficient of -0.0062 and -0.0053. This is similar to the findings of Ahmed and Suardi (2009) who have studied in Sub-Saharan Africa and Kose et al. (2003;2006) who have researched using aggregate samples. However a question show based on research facts from Mirdala et al. (2015) which indicates that financial market openness is more profitable for developed countries while it is disadvantageous to developing countries. This study corrects the estimation results of the effect of financial openness in the Asia-Pacific Region as a whole by including dummy variables (developed countries = 1, developing countries = 0) and dummy which

is interacted by financial openness. The results show that developed country has higher intercept value when compared to developing countries for the volatility of GDP and GNP. The average difference in the value of volatility between developed and developing countries if all independent variables equal 0 for the volatility of GDP and GNP growth is 0.0726 and 0.0746.

Another interesting result is the value of slope financial openness developing countries shows a significant positive relationship for all equations of GDP and GNP growth volatility with coefficient value: 0.0525 and 0.0560. This explains that the financial openness in the Asia-Pacific region to the global financial market has not had a positive effect on the group of developing country countries. That is, an increase in financial openness in developing countries will increase income growth volatility. While the results of dummy interaction with financial openness in developed countries showed significant negative relationship for GDP and GNP volatility. Where the estimation results for the slope dummy interaction (FI × Asia developed countries) in GDP and GNP volatility are as follows (slope dummy interaction - slope financial openness): -0.0036 and -0.0025. However, these results are consistent with research from Mirdala et al. (2015), Evans and Hnatkovska (2007), Neaime (2005) and Kose et al. (2003) which explains the existence of financial openness in developing countries has increased the degree of income volatility. On the other hand, the existence of financial openness is only advantageous for developed countries.

Table 3. Estimated Results of The Influence of Financial Liberalization and The Direction of Capital Flows on Macroeconomic Volatility in The Asia Pacific Region

	V _{GDP}			V _{GNP}		
Financial openness	-0.0062*** (0.005)	0.0525** -0.029		-0.0053*** (0.010)	0.0560** -0.016	
Asia-Pasifik developed countries (dummy)		0.0726** -0.018			0.0746*** -0.008	
Financial openness		-0.0561**			-0.0585*** (0.009)	
Asia-Pasifik developed countries		-0.015				
Financial liberalization	-0.0033 (0.840)			-0.0014 (0.934)		
Total Asset / Gross Domestic Product			-0.049*** -0.001			-0.040*** -0.001
Total Liabilities / Gross Domestic Product			0.043** -0.01			0.039*** -0.007
Trade openness	0.0188* (0.068)	0.0075 -0.327	0.025** -0.012	0.0161 (0.100)	0.0041 -0.58	0.225** -0.016
Income per capita	0.0103*** (0.000)	0.0082*** 0	0.012*** 0	0.0097*** (0.000)	0.0076*** 0	0.012*** 0
Inflation	-0.0277 -0.706	-0.0204 -0.755	-0.036 -0.564	-0.0058 -0.933	0.0016 -0.979	-0.014 -0.813

Table 3. Estimated Results of The Influence of Financial Liberalization and The Direction of Capital Flows on Macroeconomic Volatility in The Asia Pacific Region Continued

	V _{GDP}			V _{GNP}		
Inflation volatility	0.4419*	0.4509**	0.479**	0.3692*	0.3757*	0.405
	-0.061	-0.039	-0.016	-0.095	-0.063	-0.028
Terms of trade volatility	0.4679***	0.5313***	0.4759***	0.4310***	0.4969***	0.438***
	-0.003	-0.001	-0.003	-0.006	-0.002	-0.006
Discretionary fiscal policy	0.117	-0.0225	0.002	0.124	0.0241	0.013
	-0.512	-0.919	-0.986	-0.443	-0.907	-0.925
Fiscal policy procyclicality	0.0338*	0.0354**	0.023	0.0263	0.0278*	0.017
	(0.095)	-0.04	-0.126	-0.116	-0.072	-0.25
Financial development	0.0082	-0.0037	0.002	0.0048	-0.0088	0.0002
	-0.605	-0.815	-0.862	-0.723	-0.517	-0.985
Institutional quality	0.0005	-0.0025	-0.002	-0.0004	-0.0031	-0.002
	-0.91	-0.585	-0.575	-0.922	-0.497	-0.472
Observation	133	133	133	133	133	133
Sargan (p-value)	0.304	0.544	0.372	0.275	0.428	0.238
AR (1)	-2.45	-2.76	-2.47	-2.47	-2.79	-2.41
	[0.014]	[0.006]	[0.013]	[0.013]	[0.005]	[0.016]
AR (2)	0.94	0.95	0.12	1.41	1.41	0.97
	[0.345]	[0.345]	[0.903]	[0.160]	[0.159]	[0.331]

Information : value in () is *p-value*

***, **, * significant on 1%, 5%, 10%

Furthermore Table 3 describes the effect of capital inflows and outflows on income growth volatility. In theory, the effect of international financial openness has two forces. Where the two forces may reduce or even increase the risk of economic volatility. On the one hand, financial openness can reduce volatility due to international risk sharing which will then maintain the stability of the economy. However on the other hand, financial openness can lead to greater specialization which will be increasing income growth volatility (Kose et al., 2003). In this section, various empirical results of financial openness different effects are examined. Research is aimed by examining the issue through the different effects possibility of capital flows different movements towards income growth volatility. Total assets or GDP show the accumulated stock value of capital outflows. Total liabilities or GDP show the accumulated stock value of capital inflows. Table 4 shows that a higher level of total external assets is associated with significantly lower income growth volatility. That is an increase in capital outflow will maintain the stability of domestic income. This is seen in the growth volatility equation of GDP and GNP with coefficients of -0.049 and -0.040. Meanwhile, Table 4 also shows that a higher level of total external liabilities is associated with the high volatility of income growth. It can be seen in the growth volatility equation of GDP and GNP with coefficients of 0.043 and 0.039. This finding implies that the diversification of international risk sharing which is a key advantage of financial liberalization is determined by the accumulation of external assets (capital outflows). Meanwhile,

the external level of liabilities (capital inflows) has the opposite effect on income growth volatility.

The difference effect of capital inflows and outflows in this section can be a basic for explaining detail why financial openness gives negative effect to the income growth volatility in developing countries, while not for developed countries. The negative effect of financial liberalization on Asia-Pacific developing countries due to the free flow of capital in these countries is still dominated by capital inflows, while very low capital outflow activity. According to Elekdag, Kose, and Cardarelli (2009) capital inflows often create important challenges for policymakers because of their potential to generate excessive pressure, loss of competitiveness due to appreciated exchange rates, and increased vulnerability to crises. Stiglitz (2002) argues that the negative side of capital liberalization may bring about excessive instability in financial markets rather than an increase in the effect of growth inductions, if an economy is still not very mature. Rodrik and Subramanian (2009) also argue that the accumulation of capital from developing countries is not enough not because they are less saving but because they have no chance to invest. The low chances of investing, followed with an increase in incoming capital, will add pressure to developing countries and no profit can be made with increased investment. Thus, the financial liberalization that has been dominated by capital inflows in developing countries has increased the risk of domestic income volatility. So the benefits of financial liberalization are only obtained by the developed countries.

Table 3 also explains other factors affecting income volatility in the Asia-Pacific region. The trade openness of the estimates shows a positive and significant impact on GDP and GNP growth volatility in the Asia-Pacific region. This is consistent with the results of research Kose et al. (2003), Dupasquier and Osakwe (2006), Ahmed and Suardi (2009), and Neaime (2005) that trade openness has a positive effect on the income growth volatility. The existence of trade liberalization has increased the fluctuation level of domestic import and export prices which will then create uncertainty of domestic consumption and production, which in turn will increase income growth volatility. Other results show a significant positive effect in terms of trade volatility on income growth volatility. An increase in trade fluctuations will increase the uncertainty of trade positions on Asia-Pacific countries that ultimately increases economic fluctuations. This result is similar to that of Kose et al. (2003), Ahmed and Suardi (2009), and Neaime (2005), Fiscal policy procyclicality also exerts an influence on GDP and GNP growth volatility. This shows that fiscal indiscipline can also cause fluctuation in income through building inflationary pressure which damage government credibility. This result is similar to that of Ahmed and Suardi (2009).

Furthermore, the estimation results show the effect of income per capita on income growth volatility that has a positive and significant impact. This is consistent with research from Easterly et al. (2001) which showed positive results on economic volatility. This means that the higher of income per capita will increase economic volatility. Variable inflation volatility showed a significant positive effect on volatility of GDP and GNP. This consistent with the research of Ahmed and Suardi (2009) and Neaime (2005), that the existence of these negative effects according to Friedman (1977) due to the adverse effects of inflation uncertainty on

economic growth. Increased inflation uncertainty will distort the effectiveness of price mechanisms in allocating resources efficiently, thereby causing a negative effect on income volatility. Meanwhile, financial development and institutional quality showed that they did not significantly affect the growth volatility of GDP and GNP.

V. CONCLUSION

The impact of financial openness as a measure of de facto's financial liberalization shows a negative relationship and significant to income growth volatility in overall Asia-Pacific. This shows that the existence of financial openness has a positive effect by weakening the instability of economic conditions. Furthermore, the results of this study separate countries in the Asia-Pacific region based on income groups using dummy variables. The results show that the negative relationship between financial openness and income growth volatility in the Asia-Pacific region, is only occurring in high-income countries, whereas not for developing countries. Financial openness related to income growth volatility. This shows that financial openness has a negative effect by increasing GDP and GNP volatility in developing countries. The effect of financial liberalization as a measure of de jure's financial liberalization shows insignificant results on all income growth volatility.

The accumulation of total external assets as a proxy of capital outflows shows a negative relationship to income growth volatility. This indicates that more capital outflows will keep income variables stable. On the other hand, the accumulation of total external liabilities as a proxy of capital inflows indicates a positive relationship to all income growth volatility. This indicates that more capital inflows actually increase the instability of income variable. The positive effect of capital outflows to GDP and GNP volatility is due to international risk sharing, while the negative effect of capital inflows on GDP and GNP volatility is due to the specialization that leads to a risk shift. There is a negative effect of financial liberalization on Asia-Pacific developing countries as the flow of free capital in these countries is still dominated by capital inflows, while very low capital outflows. So that the benefits of financial liberalization with international risk sharing occur only in developed countries, while not for developing countries.

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VOLATILITY TRANSMISSION OF THE MAIN GLOBAL STOCK RETURN TOWARDS INDONESIA

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Abstract

Volatility of stock returns is a very interesting phenomenon as it impacts the existence of global financial markets. Indeed, the impact of shocks in a country can be transmitted to markets in other countries through the mechanism of transmission, leading to financial instability in related markets (Liu et al., 1998). The present paper aims to determine the best model in describing the volatility of stock returns, to identify the asymmetric effect, and also to explore the transmission of seven foreign stock return volatilities in Indonesia over the period of 1990-2016 (on daily basis). The stock return volatility modeling process uses symmetric GARCH and various asymmetric GARCH models. Whereas, the stock return volatility transmission analysis uses the Vector Autoregressive system. The result of fitting the right model for all of seven stock markets showed that the asymmetric model of GARCH had a better estimation in portraying the stock return volatility. Moreover, the model can also reveal the existence of asymmetric effects on the seven stock markets. The other findings demonstrated that Hong Kong and Singapore play a dominant role in influencing the volatility return of Indonesia. In addition, the degree of interdependence between Indonesia's stock market and foreign's stock market has increased substantially after the 2007 crisis. In the period after the crisis of 2007, the effects of return volatility of both the US and UK stock markets experienced a drastic increase in affecting return volatilities of the Indonesia stock market.

Keywords: GARCH asymmetric, modeling, the stock market, volatility return, volatility transmission.

JEL Classification: C01, C51, C58, G15

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I. INTRODUCTION

The Indonesian economic growth has strengthened over the last decade, after the Asian crisis (OECD, 2015). The Gross Domestic Product (GDP) of Indonesia is expected to grow by 5.3% in 2017, up from a forecast of 5.0% in 2016 (IDX, 2016). This brighter outlook has attracted considerable foreign investment in both real and financial assets through its investment portfolio on a stock exchange. It looks at the performance of the Indonesia Stock Exchange which became one of the largest stock exchanges in Asia, holding the 9th rank in the Asian stock exchanges through market capitalization size indicator (Pratiwi, 2015). The improved performance of the Indonesian capital market becomes a factor of interest and optimism for both foreign and domestic investors in choosing Indonesia as an investment destination not only in the present but also in the future.

Along with increased globalization, international finance become increasingly integrated, more opened, and market shares in several different countries are interconnected (King and Wadhvani, 1990). Associated with the fact that the international financial markets become increasingly integrated, the mobility of capital from one country to another country also grew. Most industrialized countries, nowadays, are not restricted in the control of foreign assets (Dornbusch et al., 2011). This condition occurs in the Indonesia Stock Exchange as the impact of globalization, which is about 65% of the public shares owned by foreign investors (Volatility Study Team and World Economy, 2010).

Another fact that must be faced, regarding the impact of increased globalization, is the world's financial markets without borders that leads to possibilities of increment in risks through shocks that happened on a certain market which become harder to isolate from the other markets. The impact of a shock in a country can be spilled over into another country through the mechanism of transmission which will result in financial instability on the related markets (Ajireswara, 2014). It makes the diversification gains from investing internationally might have to reduce significantly (Liu et al., 1998). In turn, the transmission process can weaken the stability of financial markets and invite the risk of investment that might significantly rise.

Financial globalization also contributed to the financial crisis. Indeed, almost all of the world financial markets, especially emerging markets, were traumatized since the onset of the global financial crisis that peaked in 2008. This crisis was triggered by the explosion of subprime mortgages in the United States. The development of the financial crisis has impacted the investment, commercial banking, insurance industry, which have been transmitted through the countries in Europe, Japan, and eventually spread to almost all developing countries. Tumbling world stock prices reached a very low level. The deteriorating condition of the US financial markets, as the pole of world's economy, brought significant impact on the weakening of other countries economies in the world, including Indonesia. Thus, poor conditions or a market failure in a country can be transmitted to other markets, which will result in the increase of volatility (King and Wadhvani, 1990).

In relation to the above description, the market risk is one thing that must be considered by traders, companies, and investors, while making investment decisions. The stock price index moves in seconds and minutes, then returns stock are also moving up and down within a relatively short period of time. This movement is known as the volatility of stock return, which will lead to risks and uncertainties faced by investors that could be increasingly large with the unstable interest of investors. The existence of volatility is closely related to the risk on the stock market. High volatility reflects uncommon characteristics of supply and demand. Thus, the volatility on the financial market, especially on the stock market, is an interesting phenomenon that attracts the interests of both researchers and the general public who care about the risks.

Market participants can control and reduce the market risk of the assets, that are traded such as shares, by estimating the volatility through the modeling process. The modeling volatility can be done with the initial generation of GARCH models such as ARCH of Engle (1982) and GARCH of Bollerslev (1986), which can reveal the presence of volatility clustering, for big shocks are followed by big shocks (Awartani and Corradi, 2005). However, the initial generation of GARCH models cannot capture the asymmetric effect, which refers to the fact that bad news significantly increases the volatility compared to good news. An explanation related to that fact was first emphasized by Black (1976) who stated that the fall in the value of stock return (negative return) usually display a tendency of negative correlation with the changes in volatility return, making the stocks riskier and thus, increasing its volatility. This phenomenon is called "leverage effect"; also known as the asymmetric effect. It is important to know that each state has differences in the performance, size, and characteristics in capturing the effects of leverage. Therefore, various types of specifications of asymmetric GARCH models need to be chosen to have accurately fix volatility model (Yalama and Sevil, 2008). A more precise model that is used to describe the volatility of stock return will make the appropriate decisions for companies and investors in forecasting the risk of an investment that would be close to the actual value. In turn, the information will be used by investors in taking proper precaution in investing such as whether investors should keep or remove their investments in a particular state.

Based on the background described, this research is divided into two sections. The first section is focused on choosing the appropriate model to illustrate the volatility of stock return and to identify the existence of asymmetric effect which refers to the difference in the response of a good news and a bad news on certain markets. The second section is analyzing the speed of response and the variance decomposition of stock return volatility in Indonesia towards the stock return volatility on foreign markets i.e. Singapore (Lestano and Sucito, 2010), Hong Kong (Chuang et al., 2007), Japan (Miyakoshi, 2003), United States; US (Dimpfl and Jung, 2011), United Kingdom (Veiga and McAleer, 2004), and Australia, which were deliberately chosen to observe the effects. These countries display some differences in terms of economic growth, capital size, and trade size (terms of trade). Another aspect that needs to be examined with regard to the impact of the crisis is the international transmission on the stock market that may

change after the turbulence on world stock markets (King and Wadhvani, 1990). Thus, this study also attempts to identify the change in dynamic interaction structure of the Indonesian stock market after the crisis in 2007 (or the crisis of subprime mortgage).

The objective of this study are:

1. Determine the best model to describe the volatility return of a stock market.
2. Identify the asymmetric effects on volatility stock return of the world stock markets.
3. Examine the transmission of volatility return of another stock market towards that of the Indonesian markets in the period pre and post-crisis in 2007.

II. THEORY

2.1. Modeling of the Stock Market Volatility

The volatility on financial markets illustrates the fluctuations in the value of an instrument within a certain period. In statistical term, the volatility is defined as the changes in the value of the average fluctuation of a financial time series, which will lead to greater risks and uncertainties faced by the market players, so that the interest of market participants to invest become unstable. Moreover, the existence of volatility also impacted on the existence of global financial markets as it relates to the notion of risk.

Stock price volatility is very important to observe for investors, as it is the basis for calculating the volatility of stock return. The volatility of stock return describes a fluctuation of differences in daily price observations within a specified observation period. Financial time series has given rise to time-varying volatility or "heteroscedasticity" of the data. The Linear Model trend, exponential smoother, or ARIMA models have failed to observe the phenomenon of their high volatilities (increased variance), because the models assume a constant residual variance (Montgomery et al., 2007). Over the past three decades, many studies were conducted to model volatility, especially on the financial markets.

Bollerslev (1986) proposed a model generalized autoregressive conditional heteroscedasticity (GARCH) with order k and l ; $GARCH(l,k)$. GARCH represents the current conditional variance which is also dependent on the previous conditional variances and residual squared lag. The GARCH models indicate that the volatility of returns asset depicts clustering volatility views from the lagged variances. The classical ARCH and GARCH models work within the assumption that all of the effects of shocks on volatility have a symmetric distribution. But in fact, returns asset does not always have a symmetrical distribution, but asymmetrical distribution as well, represented in the asymmetric GARCH models.

The characteristics that often appear in the observation volatility data in the financial sector is the existence of asymmetric volatility. The classical model of GARCH ignores the phenomena of asymmetric volatility that better suits the volatility modeling of stock return,

because it captures the leverage effect; the negative correlation between volatility and return at the last period. The asymmetrical conditions generally arise where the stock market is in a crash condition i.e. when a drop in stock price bring further effects and significantly increase the volatility of the stock (Wu, 2001). Thus, causing negative events with greater effects than the positive ones towards the volatility of the asset. Engle and Ng (1993) also explain that the positive and negative information has a different impact on volatility; where bad news is likely to have a higher impact on volatility than the good news.

It is important to know that one country towards other countries has different performance in capturing the leverage effect so that the various specifications of asymmetric GARCH models should be chosen to make the models more accurate (Yalama and Sevil, 2008). Specifications for asymmetric GARCH models among others are *Exponential-GARCH* (EGARCH) proposed by Nelson (1991), *Threshold-GARCH* (TGARCH) proposed by Zakoian (1994), GJR proposed by Glosten et al. (1993), *Integrated-GARCH* (IGARCH) by Engle and Bollerslev (1986), *Component-GARCH* by Engle and Lee (1993), *Asymmetric power ARCH* (APARCH) by Ding et al. (1993).

The study of the data, that contain the effects of asymmetric volatility, has a lot to do with the studies of researcher such as Engle and Ng (1993), Nelson (1991), Zakoian (1994), Glosten et al. (1993), Engle and Bollerslev (1986), Ding et al. (1993), Engle and Lee (1993), and several other related research. Whereas the volatility in the stock market, both at the corporate level, local or global, has a lot to do with the studies of researcher such as Gokbulut and Pekkaya (2014), Wu (2001), Awartani and Corradi (2005), Yalama and Sevil (2008), Mishra et al. (2007), Booth et al. (1997), Lestano and Sucito (2010), and Miran and Tudor (2010).

Gokbulut and Pekkaya (2014) examined the ability of symmetric and asymmetric GARCH to estimate and forecast the volatility of the stock market, the exchange rate, and the interest rate on the Turkish financial market. The main results obtained from these study indicated that there are asymmetric effects on each market. The asymmetric GARCH models used in the current estimation and forecasting time series data of the financial markets showed a better performance in describing the volatility compared to the classical model.

Research conducted by Awartani and Corradi (2005) used stock index S&P-500 to test the predictive ability of GARCH samples of 10 different models. They found that the asymmetric GARCH plays a crucial role in predicting volatility. GARCH model is weak when compared to the asymmetric GARCH model in describing volatility. In addition, the stock return combines the leverage effect, so that the asymmetric behavior of volatility can provide more accurate predictions. Yalama and Sevil (2008) also studied the 7 different GARCH to perform forecasting on daily data of 10 different countries. Based on the research results, the GARCH models have different performances from one country to another country and the performance of EGARCH, PARCH, TARCH, IGARCH, GARCH, and GARCH-M is better in estimating the volatility.

Engle and Ng (1993) define the news impact curve which measures how new information is incorporated into the estimation of volatility. The specifications of the models are used in

modeling unpredictable returns (residual) such as GARCH, EGARCH, *Asymmetric-GARCH*, VGARCH, *Nonlinear-Asymmetric-GARCH*, GJR-GARCH, and *Partial nonparametric (PNP) ARCH*. The selection model is made to find a model that fits in the daily modeling of stock return of the Japanese stock market from 1980 to 1988. The results of the model tests indicated that there were types of asymmetric effects of news on volatility. All of the models were tested to find results proving that negative shocks are more volatile than the positive ones.

2.2. Stock Market Volatility Transmission

The increasingly sophisticated technology and the increase of information processing throughout the world make international transactions, especially in the field of finance, easier and cheaper than ever before. Meanwhile, the liberalization of capital movements and securities on the stock market has increased very sharply, so that the national stock market can react quickly to new information from the international market. The movement in the stock market allows for a transmission between markets in terms of volatility. King and Wadhvani (1990) investigated on what happened in October 1987, nearly all of the stock markets fell simultaneously and widespread, despite being in different economic circumstances that varied. The investigation was constructing a model of the "contagion" across the market as a result of the efforts of rational agents towards price changes in other markets. This leads to a signal that the "mistake" on a market can be transmitted to other markets through a process called "contagion effect". Some of the reasons that support the transmission of shocks on a market that can affect the other stock markets include:

- a) Dominant economic power: in the period after the World War, the United States became the most influential economy, as the US currency (US dollars) has been dominant in international trade. Achsani and Strohe (2005) also found that the US stock market has a very strong influence on all stock markets, including Europe and Asia stock markets.
- b) Common investor groups: countries that are geographically adjacent have normally a similar group of investors on their markets. Therefore, these markets will affect each other.
- c) Multiple stock listings: when a stock is traded on multiple markets, the shock on one market can be transmitted to the other market.

Liu et al. (1998), examined the structure of the international transmission on six national stock markets through their daily return, including the United States, Japan, Hong Kong, Singapore, Taiwan, and Thailand. The analysis of the structure of the interactions among the 6 stock markets was based on the vector-autoregressive analysis (VAR) introduced by Sims (1980). The VAR is used to test the dynamic structure of the international transmission on the stock market for the six countries. The results showed that there are facts that the US market plays a dominant role in influencing the markets in the Pacific-Basin, Japan, and Singapore, with a significant persistent influence on the Asian market.

Veiga and McAleer (2004) examined the effect of volatility between mature markets in the world and the relation between the stock market in the United States, UK, and Japan. They found that these markets are related as they influence the volatility of each other, although the three countries have different economic performances. The US stock market is a stock market that has the greatest influence in the transmission of the volatility among the three markets. The relevance to this study is justified through the selection of US, UK, and Japan as samples of international stock markets that affect other markets. In addition, Japan, Hong Kong, and Singapore, that were the subjects of the study of Liu et al. (1998), revealed that the three countries and the US have mutual influence, as well as significant impact on the Asian market. Based on previous research, the stock markets have an influence on both global and regional markets. Thus, the present study used seven sample stock markets, including the United States, UK, Japan, Hong Kong, Singapore, Australia, and Indonesia.

The spillover of the return asset volatility on the Asian stock markets is a major concern in the economic literature since the Asian financial crisis of 1997-1998. In et al. (2001) investigated the transmission of volatility return on the three stock markets of Asia, namely Hong Kong, South Korea, and Thailand by using multivariate models of GARCH and VAR. The results revealed that Hong Kong plays an important role in the transmission of volatility with the reciprocal effects on other Asian stock markets, while the volatility transmission from Thailand to South Korea is a one-way direction.

III. METHODOLOGY

3.1. Data

The data used in this study are daily closing stock market indices for Indonesia, US, Australia, UK, Japan, Hong Kong, and Singapore. The data were retrieved from Financial Services Authority (OJK). Table 1 shows the stock market index and the period of data used on each market.

Country	Index Stock Market	Data Period
Indonesia	Jakarta Stock Exchange Composite Index (JKSE)	03/01/1990 - 06/15/2016
United States	Standard and Poors 500 Index (S&P 500)	02/01/1990 - 06/15/2016
Australia	Australian Stock Exchange All Ordinaries Index (AS30)	02/01/1990 - 15/06/2016
United Kingdom	Financial Times-Stock Exchange 100 Index (FTSE)	02/01/1990 - 15/06/2016
Japan	Nikkei 225 Index (Nikkei 225)	04/01/1990 - 15/06/2016
Hong Kong	Hang Seng Index (HSI)	02/01/1990 - 06/15/2016
Singapore	Strait Times Index (STI)	08/31/1999 - 15/06/2016

3.2. Procedure for Data Analysis

3.2.1. Return of Stock Price Measurement

This study does not use the stock price index of input variables that make up the econometric model but replace it with a value of the stock price return. Awartani and Corradi (2005) define stock prices return as follows:

$$r_t = \ln \left(\frac{S_t}{S_{t-1}} \right) \quad (1)$$

where, r_t is the return of stock price on day t ; continuously compounded return, S_t is the opening stock price on day t , and S_{t-1} is the closing stock price on day $t-1$.

3.2.2. Identification of econometric models

Identification of econometric models was carried out to determine the best model that could describe the volatility return of a stock market. The best models, which was selected in this process, were the best symmetric and asymmetric models. The estimation of the best asymmetric model could be used to identify the presence of an asymmetric effect on the volatility of stock return. Thus, the best model can provide information on the existence and symmetric shapes of the stock return volatility.

We compare the relative predictive ability of the following model, such as GARCH, EGARCH, GJR-GARCH, TGARCH, IGARCH, APARCH, and CGARCH. GARCH (l, k) proposed by Bollerslev (1986), process is as follows (Montgomery et al., 2007),

$$\sigma_t^2 = \beta_0 + \sum_{i=1}^k \beta_i \sigma_{t-i}^2 + \sum_{j=1}^l \alpha_j e_{t-j}^2 \quad (2)$$

where σ_t^2 is the conditional variance, e_{t-j}^2 is a lag squared residual, and σ_{t-j}^2 is lag conditional variance that represents the difference between GARCH and ARCH. Then, α_j and e_{t-j}^2 are known as ARCH component, β_i and σ_{t-i}^2 are known as GARCH component and β_0, β_i , and α_j are positive.

Nelson (1991) introduced one of several models of asymmetric GARCH as EGARCH by arranging Exponential ARCH. The EGARCH model can be expressed in Equation (3) as follows (Awartani and Corradi, 2005):

$$\log \sigma_t^2 = \omega + \sum_{i=1}^k \beta_i \log \sigma_{t-i}^2 + \sum_{j=1}^l \left\{ \alpha_j \frac{e_{t-j}}{\sigma_{t-j}} + \gamma_j \left(\left| \frac{e_{t-j}}{\sigma_{t-j}} \right| - E \left| \frac{e_{t-j}}{\sigma_{t-j}} \right| \right) \right\} \quad (3)$$

The presence of leverage effect can be seen from the value γ_j . If $\gamma_j \neq 0$ then there is an asymmetric influence if $\gamma_j = 0$ then there is no asymmetric effect.

GJR-GARCH models proposed by Glosten et al. (1993) as cited by (Lee, 2009) in Equation (4) below:

$$\sigma_t^2 = \omega + \sum_{i=1}^k \beta_i \sigma_{t-i}^2 + \sum_{j=1}^l [\alpha_j + \gamma_j I_{e_{t-j} < 0}] e_{t-j}^2 \tag{4}$$

$$I_{e_{t-j}} = \begin{cases} 1; & e_{t-j} \leq 0 \\ 0; & e_{t-j} > 0 \end{cases}$$

When e_{t-j} is positive, the total effect on conditional variance is given by $\alpha_j e_{t-j}^2$, when e_{t-j} is negative, the total effect on conditional variance is given by $[\alpha_j + \gamma_j] e_{t-j}^2$.

TGARCH is similar to the GJR model in using dummy variables but the TGARCH model proposed by Zakoian (1994) used standard deviation, expressed in Equation (5) as follows (Gokbulut and Pekkaya, 2014):

$$\sigma_t = \omega + \sum_{i=1}^k \beta_i \sigma_{t-i} + \sum_{j=1}^l [\alpha_j |e_{t-j}| + \gamma_j I_{e_{t-j} < 0} e_{t-j}] \tag{5}$$

The IGARCH model was proposed by Engle and Bollerslev (1986). This model is similar to GARCH model in Equation (1), the difference is that there is a restriction in the IGARCH model of the total estimated value parameter which is equal to one. The IGARCH model is expressed in Equation (6) below (Awartani and Corradi, 2005):

$$\sigma_t^2 = \omega + \sum_{i=1}^k \beta_i \sigma_{t-i}^2 + \sum_{j=1}^l \alpha_j e_{t-j}^2; \quad 1 - \sum_{i>1}^k \beta_i - \sum_{i=1}^l \alpha_i = 0 \tag{6}$$

APARCH modeled by Ding et al. (1993), the model is expressed in Equation (7) as follows:

$$(\sigma_t)^\delta = \omega + \sum_{i=1}^k \beta_i (\sigma_{t-i})^\delta + \sum_{j=1}^l \alpha_j (|e_{t-j}| - \gamma_j e_{t-j})^\delta \tag{7}$$

The APARCH model is a key model and can be adopted by some ARCH models, such as ARCH (when $\delta=2$, $\beta_i=0$, and $\gamma_j=0$), GARCH (when $\delta=2$ and $\gamma_j=0$), GJR (when $\delta=2$), TARCH (when $\delta=1$), Taylor Schwert's (when $\delta=1$ and $\gamma_j=0$), and so on (Peters, 2001).

The CGARCH is modeled by Engle and Lee (1993) to decompose the components of variance into a temporary or permanent component. CGARCH models were written in Equation (8) as follows:

$$\sigma_t^2 = q_t + \sum_{i=1}^k \beta_i (\sigma_{t-i}^2 - q_{t-j}) + \sum_{j=1}^l \alpha_j (e_{t-j}^2 - q_{t-j}) \quad (8)$$

$$q_t = \omega + \rho q_{t-1} + \phi (e_{t-1}^2 - v_{t-1})$$

where q_t is a permanent component of conditional variance.

The software used to identify the econometric models in this study is R 3.1.2. The steps that must be taken in the identification of econometric model are as follows:

1. Stationary test

The stationary condition of series are conditions where the data series do not have any particular movement patterns, in other words, the series does not contain pattern like trends. The series are stationary when they have a constant mean, constant variance and constant covariance for each lag. The Augmented Dickey-Fuller (ADF) unit root test has been applied to check whether the series is stationary or not. The stationary condition of series has been tested by using the ADF (Gujarati, 2003).

2. GARCH model (Equation (2))

Stock return modeling in this study was carried out simultaneously, meaning that the overall GARCH process was running and the best model selected with certain criteria. Unlike the case of Gokbulut and Pekkaya (2014), the modeling of stock return was carried out by optimizing the ARIMA process in order to obtain the best ARIMA model and proceed with the GARCH model with the mean model, obtained in the previous ARIMA optimization process. The ARIMA model identification, conducted in this study, is a combination of order $p = 0, 1, 2,$ and 3 and $q = 0, 1, 2,$ and 3 , and the identification of models of ARCH / GARCH is a combination of the order $k = 0, 1, 2,$ and 3 for GARCH and $l = 0, 1, 2,$ and 3 to ARCH. The ARIMA model was used as a mean model to compose the GARCH model. The fitting model of any ARIMA model was followed by GARCH process with a combination of its order. So that, in each of the ARIMA model with a specific order, the fifteen selection of models ARCH / GARCH will be obtained. Thus, this modeling process will result in 225 model options.

3. Asymmetric GARCH Model

The specifications for the asymmetric GARCH models are EGARCH as shown in Equation (3), GJR-GARCH is shown in Equation (4), TGARCH shown in Equation (5), IGARCH shown in Equation (6), APARCH shown in Equation (7), and CGARCH shown in Equation (8). The best asymmetrical model criteria are all the independent variables that are significant, both mean model coefficient and ARCH-GARCH coefficient, then proceed with the selection of the smallest AIC value.

3.2.3. Vector Autoregressive (VAR) system

The VAR analysis permits us to assess the volatility transmission of stock return of Indonesia towards shocks emanating from some of the world's stock markets, both prior and post the crisis of 2007. The software used in the identification of the VAR model is *EViews6*. The steps taken when estimating the data with VAR included:

1. Stationary test

Stationary test needed to determine the shape of the VAR model that will be used in this study. The existence of variables that are not stationary in the VAR system is important to observe, for it can be a cointegration relationship. For example, if the variables used in the VAR system was stationary at a level, then the form of the VAR model to be used is unrestricted VAR.

2. Determination of optimal lag

Optimal lag is required in order to capture the effect of each variable towards another variable in the VAR system.

3. Volatility dynamic relationship of the return Stock

The model used in this study to modify the model written by Veiga and McAleer (2004). The specifications of the model are as follows (Equation 9):

$$\mathbf{V}_t = \mathbf{A}_0 + \mathbf{A}_1\mathbf{V}_{t-1} + \mathbf{A}_2\mathbf{V}_{t-2} + \mathbf{A}_3\mathbf{V}_{t-3} + \dots + \mathbf{A}_p\mathbf{V}_{t-p} + \mathbf{e}_t \quad (9)$$

where,

\mathbf{V}_t = 7×1 column vector that contains seven variables, namely volatility of stock returning the country j ; $j= 1, 2, 3, \dots, 7$

p = length of the lag (order) VAR

\mathbf{A}_0 = 7×1 column vector of interception

\mathbf{A}_i = 7×7 matrix coefficients or parameters measurement for every $i= 1, 2, \dots, p$

\mathbf{e}_t = measurement error 7×1 vector

4. Analysis of Impulse Response to shocks

The speed of response to the volatility of Indonesian stock return market towards shock of the volatility return of other stock markets can be observed by using the analysis of impulse response function (IRF). This analysis permits to observe the fast or slow response to the volatility of the Indonesian stock return market towards the volatility shocks of other stock markets.

5. Analysis of Forecast Error Variance Decomposition (FEVD)

The analysis of how the volatility returns of foreign stock markets influences the Indonesian stock market volatility will be determined by predicting the decomposition variance; which is called FEVD analysis. In addition, the volatility returns of foreign stock that mostly influence the volatility of the Indonesian stock return market can be also determined.

IV. RESULT AND ANALYSIS

4.1. Descriptive Analysis of Return Stock

The volatility on the capital markets is generally observed by looking for variations in the return of certain capital markets. The return stocks are those given by a share on the relevant market. In the daily observations, the stock return is defined as the difference between the opening price and the closing price. Therefore, the input variable, that will be used in the process of

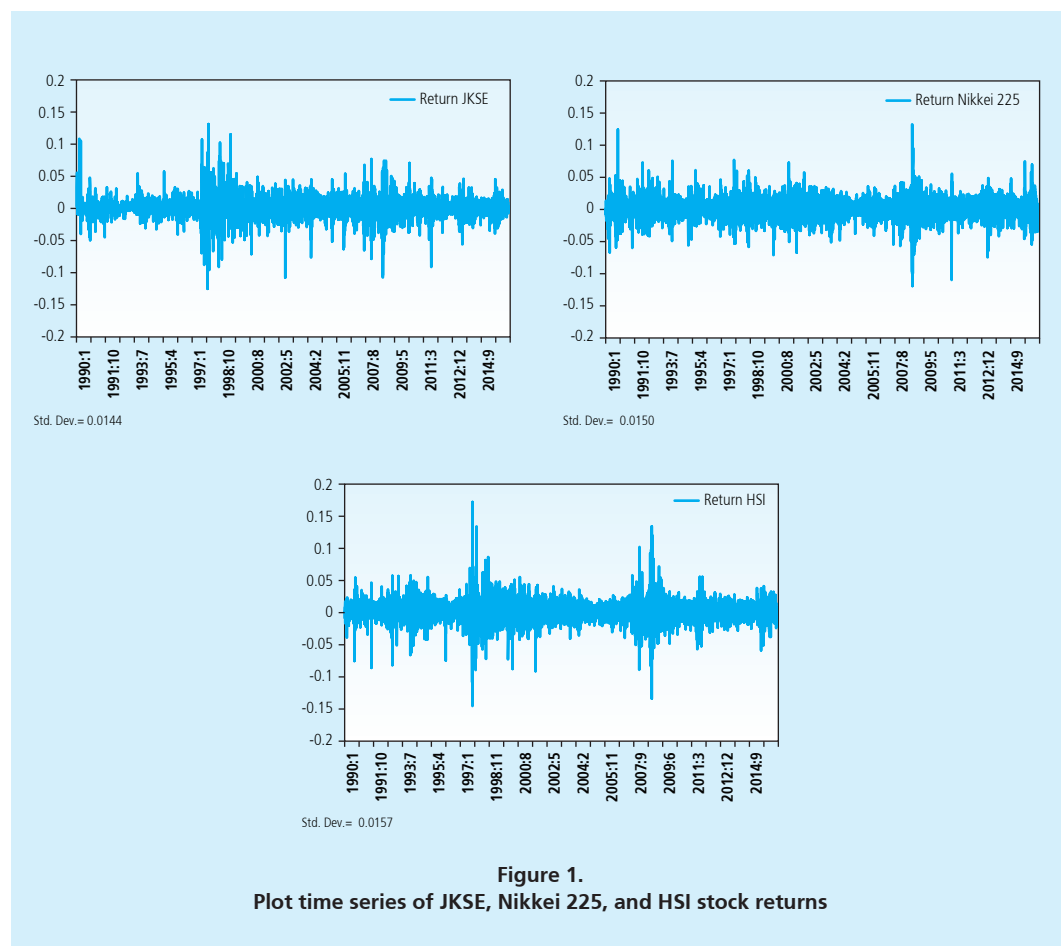
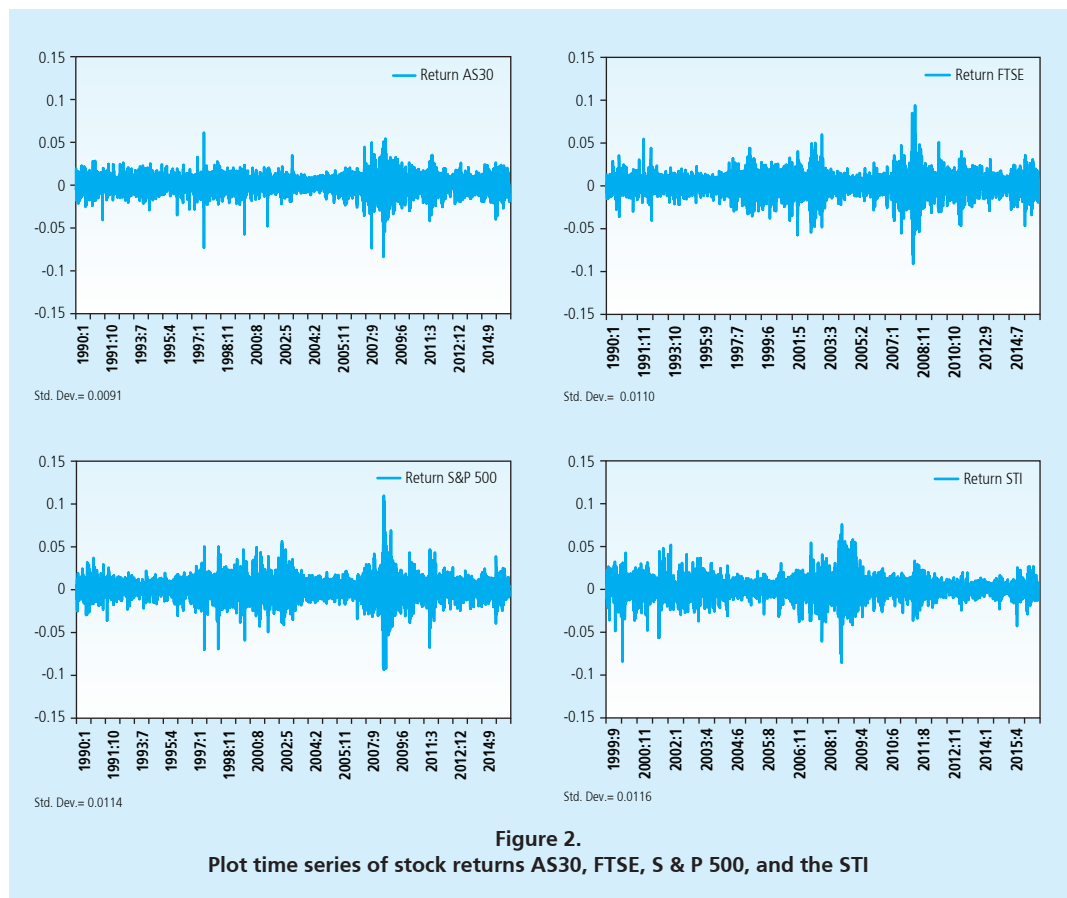


Figure 1.
Plot time series of JKSE, Nikkei 225, and HSI stock returns

modeling the volatility of a stock in this study, is no longer a closing stock price, but the return stock. Thus, prior to the modeling process, there is a need to transform the closing price of stock in the form of using continuous return (Awartani and Corradi, 2005).

Figure 1 and 2 present a chart pattern of returns for stock market indices. The stock markets have been grouped into two i.e. the market group with a relatively high deviation and the market group with a relatively low deviation. The group division was based on the standard deviation of return of a stock, if the value of the standard deviation is more than the average value of the standard deviation of the market (0.0126), then the market is categorized as a market with a relatively high fluctuation. Meanwhile, if the returns of a stock with a deviation of less than the average value of the standard deviation of the market, then the market is categorized as a market with a relatively low fluctuation.

Figure 1 shows the movement of stock return of three countries, namely Indonesia (JKSE), Japan (Nikkei 225), and Hong Kong (HSI). The three markets have relatively high fluctuations of return compared to other country samples. The value of the standard deviation of the return



is observed during the period of 26 years, showing that the Indonesian stock market (0.0144) has the lowest fluctuation of return stock, followed by the Japanese stock market (0.0150), and Hong Kong's stock market (0.0157) which has the highest fluctuation of stock return the group.

Australia (AS30), UK (FTSE), United States (S&P 500), and Singapore (STI) are categorized as a group market with relatively low fluctuations (Figure 2). The values of the standard deviations for the UK and the US were observed during the period of 26 years, while that of Singapore was observed for over 16 years. The comparisons were made on three stock markets i.e. Australian, UK, and the US, and since the three stock markets were observed in the same period, the results showed that the Australian stock market (0.0091) had the lowest fluctuation of return stock, followed by the UK stock market (0.0110), and the US stock market (0.0111) which had the highest fluctuation of stock return the group.

Figures 1 and 2 revealed that the movement of return varies with time changes. Both of these figures demonstrated positive serial correlation or volatility clustering which may imply that large changes tend to be followed by large changes and small changes are also likely to be followed by small changes, which means that the volatility clustering observed on data return stock.

4.2. Best GARCH Model

After the returns of all of the used stock markets have been ascertained at a stationary level, the next step is selecting the best model by using the variable stock return as a variable input. Fitting the best model is needed to describe the volatility of the seventh stock return indices observed. The fitting model of the return series is not suitable if using the ARIMA process because the return series have volatility; with a variance of residual which is not constant, leading to heteroscedasticity. Thus, the volatility of stock return is modeled using the GARCH process.

This stage focuses on the selection of the best model to describe the volatility of each stock market using the symmetric GARCH models. The best model criteria are the model with all significant estimated coefficients (real impact on response), both coefficients in the mean model and ARCH-GARCH model. Afterwards, the selection process of the smallest AIC values could be carried out. The process of selecting the best symmetric GARCH model in this study is through the optimization process (simultaneously). The simultaneous optimization is done as a whole, which means every ARIMA model is used as a mean model in the GARCH process without going through the optimization process of the ARIMA. The process of selecting the best model is carried out at the end of the simulations with a combination of orders that have been determined, both the order for ARIMA models and orders for symmetric GARCH models. The candidates of the model will choose the best symmetric model with the given criteria. The simultaneous optimization is done with the intention to obtain a global optimization level.

Table 2.
AIC Value of The Best Symmetric and Asymmetric GARCH Model

No	Return	Type of Model	AIC of Best Model	Selected Asymmetric Model
1	JKSE	Symmetric	-6.0510	APARCH (1,2)
		Asymmetric	-6.0550	
2	S&P 500	Symmetric	-6.5658	TGARCH (2,2)
		Asymmetric	-6.6011	
3	FTSE	Symmetric	-6.5196	TGARCH (1,1)
		Asymmetric	-6.5460	
4	Nikkei 225	Symmetric	-5.7767	TGARCH (2,1)
		Asymmetric	-5.8088	
5	HSI	Symmetric	-5.8201	APARCH (1,1)
		Asymmetric	-5.8413	
6	STI	Symmetric	-6.4345	TGARCH (2,2)
		Asymmetric	-6.4440	
7	AS30	Symmetric	-6.8057	TGARCH (1,1)
		Asymmetric	-6.8332	

Bold text indicates the smallest AIC value in the group

The GARCH symmetric model assumes that the volatility is symmetric, meaning that there is no difference in the effect of the volatility when a negative or positive shock occurred. There are indications that the volatility of stock return has asymmetric behavior. So, to detect the presence of an asymmetric effect on the behavior of the volatility of return stock, this study will specify several asymmetric GARCH models by orders of the best models that have been obtained in a symmetric model. These models are EGARCH, GJR-GARCH, TGARCH, IGARCH, and APARCH. Table 2 shows the results of model estimation that were obtained for each country (with differences), which is in accordance with research conducted by Yalama and Sevil (2008), stating that the performance and the size of one state against another state is different, so the model obtained in describing the volatility stock return also vary.

Based on the obtained results, the overall model of asymmetric GARCH presents a better model than that of the symmetric GARCH model. It can be seen in the best asymmetric GARCH models which have smaller AIC values compared to those of the symmetric model for each stock market, as shown in Table 2. Thus, it indicates that the result estimated in asymmetric GARCH models for each market stock is better than that of the volatility stock return of symmetric GARCH model. These results are consistent with the results of research conducted by Awartani and Corradi (2005) which states that the asymmetric GARCH models play an important role in predicting volatility. Symmetric GARCH process weakens when compared to the asymmetric GARCH models in describing the volatility return of a stock market.

Table 3.
Coefficient Parameters for Best Model of Asymmetric GARCH for Each Stock Return

	JKSE	S&P 500	FTSE	Nikkei 225	HSI	STI	AS30
Model	APARCH	TGARCH	TGARCH	TGARCH	APARCH	TGARCH	TGARCH
ARMA	(3,2)	(2,3)	(3,3)	(3,3)	(2,3)	(3,2)	(3,2)
GARCH	(1,2)	(2,2)	(1,1)	(2,1)	(1,1)	(2,2)	(1,1)
ω	0.0000* (0.0000)	0.0002* (0.0000)	0.0002* (0.0000)	0.0005* (0.0000)	0.0001* (0.0310)	0.0002* (0.0000)	0.0002* (0.0000)
α_1	0.1577* (0.0000)	0.0641* (0.0000)	0.0632* (0.0000)	0.0574* (0.0000)	0.0761* (0.0000)	0.0545* (0.0000)	0.0668* (0.0000)
α_2		0.0229* (0.0006)		0.0709* (0.0000)		0.0718* (0.0000)	
β_1	0.4144* (0.0000)	0.8336* (0.0000)	0.9350* (0.0000)	0.8862* (0.0000)	0.9210* (0.0000)	0.7500* (0.0000)	0.9258* (0.0000)
β_2	0.4369* (0.0000)	0.0757* (0.0000)				0.1482* (0.0000)	
γ_1	0.1106* (0.0000)	1.0000* (0.0000)	0.8130* (0.0000)	1.0000* (0.0000)	0.4367* (0.0000)	0.7987* (0.0197)	0.8455* (0.0000)
γ_2		-0.1149 (0.7615)		-0.6093* (0.0000)		-0.5427* (0.0000)	
δ	1.7212* (0.0000)				1.2139* (0.0000)		
AIC	-6.0550	-6.6011	-6.5460	-5.8088	-5.8413	-6.4440	-6.8332

*Significant at the 5% significance level

Table 3 shows the results of model estimation in describing the best asymmetric volatility stock return of seven stock markets, namely: Indonesia (JKSE), US (S&P 500), UK (FTSE), Japan (Nikkei 225), Hong Kong (HSI), Singapore (STI), and Australia (AS30). The result of estimation parameters of ARCH (α) and GARCH (β) on the seventh stock markets is positive and statistically significant at the 5% (significance level). The positive value of ARCH and statistical significance can be interpreted as the mean effects of any shocks at this point (e_t), depending on the size of the shocks in the past. Thus, the great shocks in the current period (t) will increase the effect of the shock in the next period ($t+1$, $t+2$, and so on). Meanwhile, the positive value of GARCH and statistical significance can be interpreted as the mean volatility at this time depends on the volatility of some of the previous period. Based on these results, it can be stated that the volatility return of a stock market is not only affected by shock and volatility at this time, but also by shocks and volatilities in the previous period. Thus, investors need to observe fluctuations (volatilities) of stock return and shock that occurred in early periods, before taking steps for investment. This is necessary so as the investors are able to control and reduce the market risk of the asset being traded.

The coefficient $\gamma_{i,j=1,2}$ indicates the presence of an asymmetric effect on the seven stock markets. If the estimated value of $\gamma_{i,j=1,2} \neq 0$, then there is an asymmetric effect on a stock market, meaning that there is a difference between the effects of bad news or good news on the volatility return of a stock market (current). Table 3 showed that the coefficient $\gamma_1 \neq 0$ is positive

and significant at the 5%. This means the volatility return of the Indonesian stock market, US stock market, UK stock market, Japanese stock market, Hong Kong stock market, Singapore stock market, and Australian stock market has the asymmetrical effect, which means that bad news that occurred in a previous period ($t-1$) will further increase the volatility of returns in the current period (t) than when there is good news in the previous period ($t-1$). Meanwhile, the coefficient of γ_2 is negative and significant at the 5%, that means the effect of bad news at this point (t) of the volatility return will be corrected two days later ($t+2$). In other words, volatility will begin to decline at $t + 2$. The decline in volatility occurs as a result of the correction of overreaction or mispriced on the bad news in the previous period. Overreaction occurs because of pessimistic response towards bad news in the previous period. This attitude accelerates the increment of volatility, so there is an element of mispriced, the result would counter the current to correct these mispriced.

The results of the best models of each of the stock market as a whole showed that the effects of bad news on the volatility of return are greater than the good news because of the leverage effect. These phenomena do indeed occur on the financial markets. Bad news will result in a huge drop in stock prices. This decrease, in turn, will increase the debt to equity ratio; the ratio which measures the extent to which the company is financed by debt. Improved debt to equity ratio causes an increased risk of asset ownership, thus leading to the increase in the volatility of the asset. Therefore, the existence of asymmetric effect appears when the condition of the stock market is experiencing a crash (Wu, 2001). Thus, the bad news at this time will further increase the volatility of return on the following day ($t+1$) compared to good news. Seven stock market used in this study indicated that there are asymmetric effects and statistical significance at the 5%. This proves that the presence of asymmetric effects on the stock market is indeed true.

In connection with the fact that the volatility of the return on a stock market showed a different response when there is bad news and good news, the volatility modeling of stock returns using symmetric GARCH model becomes less relevant in describing the actual state of the stock market. The usage symmetric GARCH models in describing the volatility of returns stock will lead to a result in forecasting the risk of a lack of proper investment. This, In turn, will lead to market participants, in this case, the company and any investor making a wrong decision in response to market conditions.

4.3. Analysis Vector Autoregressive (VAR) System

The period of sample data used in analyzing the VAR system ranged from September 1st, 1999 to June 15th, 2016. The reason for choosing this period of sampling is because the sets of intersection data period were used in the study. It is intended that all of the criteria in the process of selecting optimal lag can be compared to various lag so that the number of observations used in the VAR model system should be the same (Juanda and Junaidi, 2012). In addition,

the period of sample data is divided into two sub-periods, namely the period before the crisis in 2007 (September 1st, 1999 and December 29th, 2006) and the period after the crisis of 2007 (January 1st, 2007 until June 15th, 2016). The input variables used in the VAR system analysis was the volatility return of the stock market of Indonesia, US, UK, Japan, Hong Kong, Singapore, and Australia. The volatility of stock return of each stock market gained from the best model estimation that has been done in the previous stage.

The objective of VAR systems analysis is to explore whether the transmission structure changed after the 2007 crisis (subprime mortgage crisis), because the international transmission on volatility return may change after a turbulence on the world market (King and Wadhvani in 1990). The results of VAR analysis are an analysis of impulse response (IRF) and analysis of forecast error variance decomposition (FEVD). It is important to remember that, before conducting a VAR analysis, the necessary stages are a stationary test, selection of the optimal lag, and the stability test of the VAR.

4.4. Analysis of the Impulse Response Function (IRF)

The aim of the IRF analysis is to test the response of volatility return on the Indonesian stock market toward shocks on volatility return on other stock markets i.e. US, UK, Japan, Hong Kong, Singapore, and Australia stock markets. The dynamics of the volatility response on the Indonesian stock market and the dynamics of the international markets are divided into two periods, which are the period before and after the crisis of 2007.

Figure 3 shows the behavior of impulse response on volatility return of Indonesian stock market toward shocks emanating from volatility on US, UK, Singapore, Hong Kong, Australia, and Japan stock markets, both in the period before and after the crisis of 2007. If observed in the first 15 days (equivalent to three weeks) at the commencement of a volatility shock of a stock market was observed an Indonesian stock market volatility, suggesting that volatility shocks emanating from the Hong Kong market is relatively providing the most impact on the Indonesian market volatility for both in the period before and after the crisis of 2007. The volatility shock derived from the Singaporean stock market also provides a relatively large influence on the Indonesian market volatility at the beginning of the observation period, although not as much as the transmission of volatility due to shocks on the Hong Kong stock market.

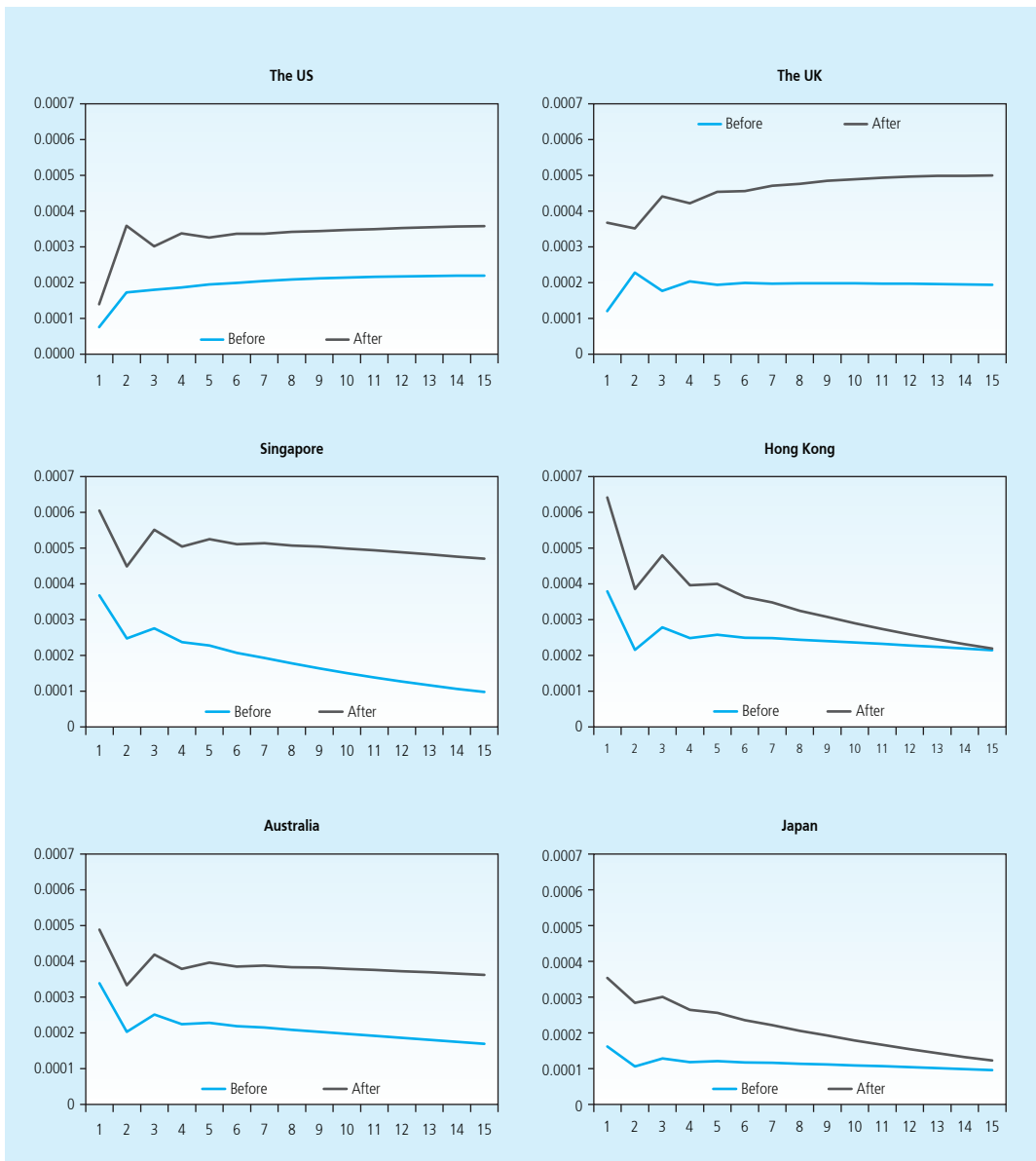


Figure 3. Impulse Response of the Indonesian Stock Market Volatility Return towards shock on Volatility of Foreign Stock Market; prior and post Crisis (2007)

Different thing with the effect of volatility shock is coming from the US and UK markets, both provide a relatively large influence on the second day after the shocks and the next, not on the first day of shocks, such as the effect of volatility shocks originating from Hong Kong, Singapore, Australia, and Japan (Figure 3). This can be understood as the impact of differences

in transaction time. The US and UK markets have a relatively large time difference (in hours) to Indonesia, thus giving rise to differences in the operating hours of the exchange. Thus, shocks originating from Hong Kong, Singapore, Australia, and Japan will be faster in responding by the Indonesian stock market because it has a relatively small time difference compared to the US and UK markets. This also caused volatility shocks coming from the US and UK markets to last longer.

Figure 3 also showed that the period after the crisis indicates that interactions of the foreign stock market that were observed with the Indonesian stock market substantially increased. This increase is characterized by an increased in values of impulse response on the Indonesian stock market to volatility shocks emanating from foreign stock markets. These results are consistent with research conducted by Liu et al. (1998), stating that the degree of interdependence of national stock markets rises substantially after the crisis. This leads to an increase in transmission to the stock market, which in turn may increase the effect of volatility return on a market against the volatility return of other markets, or in the context of this study, the Indonesian market (Trihadmini, 2011).

Volatility transmission can be triggered by the liberalization of international capital movements, portfolio diversification across countries, as well as an increased transaction as a result of developments in the electronic telecommunications system (Lau and Ivaschenko, 2003). The liberalization of international financial markets, especially related to the flow of foreign investment to emerging markets will make the market more volatile in response to changes in economic conditions (Santis and Imrohorglu, 1997). The consequences of volatile investment flow will have an impact on the high volatility in stock prices, particularly in emerging markets. Figure 3 shows that the Indonesian market is more exposed to the impact of volatility transmission compared to other stock markets in the period after the crisis. This indicates that the Indonesian stock market has increased interdependency relationship due to the influence of globalization of financial markets. As stated by Santis and Imrohorglu (1997), an increase in market interdependency relationship on the Indonesian stock market which in fact belong to the emerging markets will lead to the Indonesian market more volatile than before, in response to the change of the state of the economy. Thus, in turn, will increase the impact of foreign stock market volatility transmission to the Indonesian stock market volatility, as shown in Figure 3.

4.5. Analysis Forecast Error Variance Decomposition (FEVD)

The FEVD analysis is used to analyze the contribution of the foreign stock market volatility observed in a study of the diversity of volatility *return* in Indonesia. Based on the decomposition of diversity shown in Table 4, the influence of the volatility of stock market can be identified and observed. In this study, the Indonesian stock market volatility was observed both before and after the crisis. Table 4 shows that an important source of variance on volatility return of Indonesia stock market is volatility of the stock market of Indonesia itself. However, when

Table 4.
Decomposition of Variance (%) Volatility Return of the Indonesian Stock Market

Periode	Volatility of Return						
	JKSE	FTSE	S&P 500	STI	HSI	AS30	Nikkei 225
Before Crisis							
1	91.8431	0.3494	0.2026	1.0562	4.6212	1.7925	0.1351
2	90.3885	1.1114	0.9754	1.1696	4.3596	1.8411	0.1545
5	89.2492	1.2946	2.0044	0.9674	4.4467	1.8947	0.1429
10	87.6422	1.5851	3.2640	0.6629	4.7876	1.9414	0.1169
15	86.0744	1.8131	4.3734	0.5795	5.1109	1.9485	0.1001
After Crisis							
1	84.5767	4.3349	0.6716	8.4980	0.0000	1.9188	0.0000
2	80.7807	4.0527	3.8920	9.3377	0.0168	1.8795	0.0407
5	75.8722	5.7491	5.9981	10.2490	0.2625	1.8297	0.0393
10	69.1925	8.2096	8.4197	10.9915	1.0706	1.8674	0.2487
15	63.2820	10.3072	10.4221	11.3302	2.0744	1.9162	0.6679

compared to the period before the crisis and after the crisis, the contribution of the Indonesian stock market in the period after the crisis is relatively small compared to the period before the crisis in the 15 days of observation. This indicates that there is a strong interaction between the stock market in the period after the crisis.

It can be seen, in more detail, that in the period before the crisis, the volatility return of Indonesian stock market observed in the 15-days observation period was influenced by the volatility of returns stock itself with an average value of 88.40%. The rest is the effect of volatility return of foreign stock markets, the volatility of *return* the market of Hong Kong (HSI; 4.69%), US (S&P 500; 2.66%), Australia (AS30; 1.91%), the UK (FTSE; 1.41%), Singapore (STI; 0.81%), and Japan (Nikkei 225; 0.31%). Based on the estimates of the variance of decomposition, the volatility of return of the stock market of Hong Kong turned out to be the most contributing country towards the volatility return of Indonesian stock market compared to other stock market volatility. These results are supported by research conducted by Chuang et al. (2007) which states that the Hong Kong stock market is a stock market that has a considerable influence on the regional stock markets of Asia, particularly Indonesia stock market.

In the period after the crisis, the percentage decomposition of the variance of the volatility return of Indonesian stock market over a period of 15 days of observation is affected by the volatility of stock return itself with an average value of 72.30%. The rest is the effect of volatility return of foreign stock markets, the volatility return of Singapore (10.50%), UK (7.19%), US (7.08%), Australia (1.87%), Hong Kong (0.83%), and Japan (12:22%). The volatility return of Singapore stock market has a dominant influence on the period after the crisis. Ajireswara (2014) also found that the Singapore stock market has a dominant influence on the decomposition of the Indonesian stock market volatility compared to the effect of the decomposition of the stock market of Hong Kong, Japan, the US, and the UK.

As noted earlier, the average percentage contribution of volatility returns of the foreign stock market to the volatility return of the Indonesian stock market has increased in the period after the crisis of 2007. The average contribution of the Indonesian stock market volatility also decreased after the crisis period of 2007. In addition, the influence of mature markets such as the US and the UK also experienced a significant increase in the period after the crisis of 2007 and resulted in the average effect within 15 days of observation time. So, a strong influence shows that there is a greater interaction in the period after the crisis of 2007. The results of this FEVD supports the results of the analysis of IRF noted previously (Figure 3).

In general, the role of a mature market is proxied by the volatility return of the US and UK stock markets, which increased dramatically the influence on the volatility return of the Indonesian stock market in the period after the crisis. This suggests a volatility transmission due to the role of dominant economic power, such as US and UK markets. The US and UK are countries with great influence in the economy because the currencies of both countries have been widely used in international trade. Meanwhile, the growing influence of the volatility return of Singaporean stock market towards the volatility returns of the Indonesian stock market in the period after the crisis indicated that the volatility return transmission is a reason for the common investor groups. This refers to the fact that the countries are geographically adjacent groups with the same investment objectives (Achsani and Strohe, 2005). Kartika et al. (2012) also state that countries which have close economic and geographical basis would indicate a strong relationship. So that, in turn, these markets will affect each other. Thus, the interaction between Indonesia, the mature market and the stock market which is geographically closer to Indonesia should be observed as a reference of vigilance of the financial stability.

V. CONCLUSION

The objective of this study was to determine the best model to describe the volatility return of stock and identify their asymmetric effects on returns stock on several stock markets including the Indonesian stock market. In addition, this study also aimed to analyze the structure of volatility transmission return of the Indonesian stock within periods before and after the crisis of 2007. Based on the results of the analysis conducted in this study, the following points could be summarized:

1. The asymmetric GARCH models better present the estimates of volatility return compared to GARCH symmetric model for the entire stock market used in this study. The volatility return of the Indonesian and Hong Kong stock markets was described by the APARCH model. In addition, the volatility of the stock return markets of United States, UK, Japan, Singapore, and Australia was described by the TGARCH model TGARCH. Every country has different volatility characteristics so that the results of the established model were different.
2. The entire observed market indicated the presence of an asymmetric effect on stock return with a statistical significance. This means that there is a difference between the effects of

bad news or good news on the current volatility return. Thus, modeling the volatility of the stock return using symmetric GARCH models become less relevant in describing the actual state of the financial markets.

3. The results of the analysis of the impulse response of volatility return of the Indonesian stock market shocking other volatility return on the stock market showed that the biggest volatility transmission both in the period before and after the crisis of 2007, mainly came from Hong Kong stock market, followed by the Singaporean stock market. When compared to the results of impulse response volatility return the Indonesian stock market before and after the crisis, it suggests that the Indonesian stock market is more exposed to shocks within the period after the crisis. This indicates that the Indonesian stock market has increased the interdependency relationship of financial markets as a result of globalization.
4. The results of the variance decomposition of volatility return of the Indonesian stock market showed that in the period before and after the crisis of 2007, the volatility return of the Indonesian stock was predominantly influenced by itself. As for the external influences, the Hong Kong stock market has the biggest influence in the period before the crisis. Within the period after the crisis, the Singaporean stock market has the most impact. The analysis of variance decomposition also showed that the influence of the mature market was proxied by stock market of the US and UK which have increased drastically, affecting the volatility on the Indonesian stock return market in the period after the crisis of 2007.

Based on the results of the analysis conducted in this study, some recommendations that can be put forward for the policy perpetration authorities and investment actors on the stock market are as follows:

1. For the investment actors, especially for those in need to observe the fluctuations of stock returns and shocks that occurred in early periods, before taking steps for current investment. This is necessary so that the investors are able to control and reduce the market risk of the asset being traded. As such, the investors may be cautious in determining the decisions of investment, such as whether an investor has to release or hold his assets.
2. For the policy perpetration authority, once it is known that the perpetrator of investment is very easily influenced by negative sentiment on the market, the implications of policy perpetration authority is needed to maintain the condition of the market in case of negative sentiments, for example: macroeconomic factors and their negative issues that develop on the market. This is necessary because the negative sentiment can cause fluctuations in returns, an excessive stock which in turn will affect a factor of interest for investors.
3. For the policy perpetration authority, having in mind the increase in volatility transmission of foreign stock return towards the Indonesian market in the period after the crisis of 2007, the implications for the policy perpetration authority is the need of vigilance in addressing foreign stock market volatility, so that the reversal impact of capital outflow could be drastically anticipated.

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