Interest Rate and Exchange Rate Risk Sensitivity of Bank Stock Return in Asean-5: A Panel Data Approach

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Abstract

This paper examines the roles of market, interest rate and exchange rate risks in the sensitivity of the bank stock returns in the ASEAN-5 countries, i.e. Indonesia, Malaysia, the Philippines, Singapore and Thailand, using the bank-level data. Empirical results from the panel data model show that the returns of a bank stock's portfolio are generally less risky than the market portfolio. Moreover, foreign exchange rate risk has the important roles in determining bank stock returns in portfolios classified by countries and bank's size. However, there is limited supporting evidence for the interest rate risk. The effects of interest rate risk on bank stock returns are significant only in the cases of Singapore and Thailand. In addition, the interest rate risks have a significant impact in the case of the large banks. However, the medium and small banks are not sensitive to changes in interest rates.

Keywords: Bank Stock Returns; Interest Rate Risk; Exchange Rate Risk; Panel data model
JEL Classifications: C33; G12; G21

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ความเสี่ยงของอัตราดอกเบี้ยและอัตราแลกเปลี่ยนที่ส่งผลกระทบต่ออัตราผลตอบแทนหุ้นธนาคารในกลุ่มภูมิภาคอาเซียน-5: ศึกษาแบบพาเนล

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บทคัดย่อ

การศึกษานี้มุ่งวิเคราะห์ปัจจัยเสี่ยงของการลงทุนในหุ้นสามัญกลุ่มธนาคารพาณิชย์ของประเทศในกลุ่มภูมิภาคอาเซียน 5 ประเทศ ประกอบด้วย อินโดนีเซีย มาเลเซีย ฟิลิปปินส์ สิงคโปร์ และไทย โดยครอบคลุมถึงปัจจัยความเสี่ยงของตลาด อัตราดอกเบี้ย และอัตราแลกเปลี่ยนเงินตราต่างประเทศ โดยใช้ข้อมูลในระดับธนาคารในการประมาณค่าแบบจำลองแบบพาเนลผลการศึกษาพบว่า นอกจากความเสี่ยงตลาดซึ่งมีความสัมพันธ์เชิงบวกอย่างมีนัยสำคัญต่ออัตราผลตอบแทนการลงทุนตามทฤษฎีการกำหนดราคาสินทรัพย์แล้วความเสี่ยงของอัตราแลกเปลี่ยนฯ ยังส่งผลอย่างมีนัยสำคัญต่อการลงทุนในกลุ่มธนาคารพาณิชย์เมื่อพิจารณาพอร์ตการลงทุนจำแนกตามขนาดธนาคารพาณิชย์และมีผลต่ออัตราผลตอบแทนเมื่อพิจารณาพอร์ตการลงทุนจำแนกตามรายประเทศ อย่างไรก็ตาม ความเสี่ยงทางด้านดอกเบี้ยมีความสัมพันธ์เชิงบวกอย่างมีนัยสำคัญเพียงบางกรณีเท่านั้น ได้แก่ พอร์ตการลงทุนจากธนาคารในประเทศสิงคโปร์และไทย และพอร์ตการลงทุนในธนาคารขนาดใหญ่โดยผลการศึกษานี้เป็นข้อมูลสำคัญในการพิจารณากระจายการลงทุนและการบริหารความเสี่ยงในพอร์ตพอลิโอของการลงทุนในกลุ่มธนาคารในกลุ่มประเทศอาเซียนซึ่งทวีความสำคัญมากขึ้นในการบริหารการลงทุนระหว่างประเทศ

คำสำคัญ: หลักทรัพย์กลุ่มธนาคาร, ความเสี่ยง, อัตราดอกเบี้ย, อัตราแลกเปลี่ยนเงินตราต่างประเทศ, แบบจำลองการวิเคราะห์ข้อมูลแบบพาเนล

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1. Introduction

Commercial banks are vital to financial systems. When focusing on the risk factors involved in investing in a commercial bank, the roles of interest and foreign exchange rates are usually identified as key risk factors. Interest rate variations can cause a shift in investment opportunity. Furthermore, bank assets and liabilities are sensitive to exchange rate fluctuations.

Sensitivity of bank stock returns to change in interest and exchange rates has been widely investigated in research at both theoretical and empirical levels. Merton (1973) explained that a change in the interest rate might exhibit a shift in investment opportunity. Hence, the sensitivity to risk of banks' excess stock returns to interest rate changes is widely recognised by bankers, regulators, academics and investors. Moreover, many empirical studies (Bae, 1990; Elyasiani & Mansur, 1998; Lynge & Zumwalt, 1980; Saunders & Yourougou, 1990; Song, 1994; Stone, 1974; Yourougou, 1990) also found supporting evidence for the interest rate risk sensitivity in bank stock returns.

In the case of exchange rate risk, increasing capital flow between international financial markets and the flexible foreign exchange rate regime are important components of global finance. The unexpected mobility of foreign exchange rates can affect the gains or losses of the banks from their foreign loan and portfolio investments. In addition, bank stock pricing includes a positive risk premium to compensate for fluctuations in exchange rates. Therefore, empirical studies on bank stock returns and risk include interest and foreign exchange rate risks as key variables for estimating the expected returns in asset pricing models (Choi, Elyasiani, & Kopecky, 1992; Fogler, John, & Tipton, 1981; Kasman, Vardar, & Tunç, 2011; Koch & Saporoschenko, 2001; Rahman, 2010; Ryan & Worthington, 2004; Sukcharoensin, 2013; Wetmore & Brick, 1994).

As a result, interest and exchange rate risks are applied to estimate the models of commercial bank stock returns; thus, they are key indicators in determining and managing risk exposure. However, empirical results still vary depending on the periods and countries in each study. For example, Choi et al. (1992) showed that interest rate and exchange rate sensitivity are important factors in modeling bank stock returns but the impacts vary between the pre- and post-1979 financial crisis; later, Wetmore and Brick (1994) show that coefficients of the three variables differ according to time period and bank size.

Meanwhile, most studies examine the sensitivity of stock returns on banking sectors in developed countries, i.e. the US and UK (Choi et al., 1992; Elyasiani & Mansur, 1998; Koutmos & Martin, 2003), Japan (Chamberlain, Howe, & Popper, 1997), and Australia (Ryan & Worthington, 2004). In the case of ASEAN countries, there is limited evidence as to the risk sensitivity of bank stock returns. However, the role of ASEAN stocks in financial markets is increasing with the implementation of the financial liberalisation under the ASEAN Economic Community (AEC) framework. The ASEAN Exchange and its

star portfolios have been developed to promote investment in financial markets. Currently, bank stocks are not only the key component of stock markets in each member country but also that of the ASEAN star portfolios.

By investigating the sensitivity of bank stock returns in ASEAN countries, this paper contributes to the existing literature on market, interest and foreign exchange rate risks, by providing an estimation of risk sensitivity on bank stock returns in all ASEAN-5 markets. The empirical results provide the useful information for the portfolio investors to manage their risks in investment of bank stocks. Moreover, the regulators also use them to monitor risk factors in bank stock returns. The remaining parts of this paper are organized as follow. Sector 2 provides literature review. Methodology and research hypotheses are outlined in section 3. Section 4 presents the empirical results from the panel data model. Lastly, conclusion and implications are discussed in section 5.

2. Literature Review

Sensitivity to interest rate risk generates significant attention in the application of bank stock returns under the intertemporal CAPM (ICAPM) and arbitrage pricing theory (APT). Variations in interest rate affect bank profits because the revenue and costs of financial institutions are directly dependent on interest rates. Early empirical studies showed evidence of the single factor model (Fama & Schwert, 1977; Lynge & Zumwalt, 1980; Sweeney & Warga, 1986), concluding that the interest rate factor significantly impacts on stock returns.

Additionally, empirical studies also apply both market and interest rate factors to the two-index model under the assumption of constant variance error terms (Bae, 1990; Booth & Officer, 1985; Flannery & James, 1984; Lynge & Zumwalt, 1980). As a result, interest rates have a direct negative effect on bank stock returns; for example, Flannery & James (1984) examine the cash flow of US bank stocks and conclude that market rate fluctuations in large banks had no effective impact on costs and profits. In contrast, Chance and Lane (1980) argue that interest rate volatility has a weak effect on the return generating process of financial institutions.

Due to the market power of many large banks, they are able to operate net interest margins to their advantage in the face of interest rate changes. These empirical results are mentioned by Vaz, Ariff, & Brooks (2008), who explained that Australian banks from 1990 to 2005 were able to advantageously manage net interest margins to produce higher returns.

In the case of exchange rate risk, foreign exchange rate fluctuations influence bank margins, especially in the international management environment. Currently, few empirical studies focus on foreign exchange rate sensitivity on bank stock returns, despite exchange rates directly affecting the pricing component of bank stocks. Hamao (1988) and Jorion (1991) found that the exchange rate does

not affect stock market prices in either the US or Japan. On the other hand, (Prasad & Rajan, 1995) argued that exchange rate is an important factor in the US, UK and Japanese stock markets.

Choi et al. (1992) found that interest rate risk plays a vital role in explaining the US bank stock returns than exchange rate volatility. Furthermore, Wetmore & Brick (1994) also employed the model of Choi et al. (1992) using US bank stocks from 1986 to 1991. The results show that the estimated coefficients of the three factors are time dependent. Therefore, the assumptions limited by the unconditional multi-factor asset pricing model represented by these studies may yield bias results. In the case of Asian countries, there are limited empirical studies on interest and exchange rate risk in banking stock returns. Hahm (2004) investigated the two-index factor for banking sectors in Korea during the pre-crisis period. The empirical results showed that exchange rate risk dramatically decreased but interest rate risk increased at the end of the crisis.

Though many studies have investigated risk factors in bank stock returns, most previous papers focused on commercial banks in developed countries. Currently, there are limited papers examining bank stock returns in ASEAN countries. In addition, papers investigating risk sensitivity usually focus on individual banks or financial markets. There is still a lack of empirical studies focusing on investment in bank stock returns in ASEAN countries as a group of banks in a portfolio. In this paper, data from individual bank stock returns is used. However, the panel data model is applied to combine the data from individual banks to form a portfolio classified by country and bank size. Therefore, the empirical results should provide important information for those investing in emerging markets.

3. Methodology and Research Hypothesis

3.1 The Data

We collect the monthly data of closing prices to calculated bank stock returns from the DataStream database starting from January 1997 to December 2015. The individual bank stocks data are from the five ASEAN countries, i.e. Indonesia (IND), Malaysia (MYS), the Philippines (PHL), Singapore (SGP) and Thailand (THA).

Next, we investigate the sensitivity of risk in bank stock return by the panel data models. The components of banks in each model are classified based on two criteria. First, we set up the panel of the bank stock data for five countries (IND, MYS, PHL, SGP and THA). Second, we consider the panel of the bank data categorized by banks' size, i.e. large, medium and small banks[1].

[1] The criteria for classification of bank based on total assets suggested by (Neuberger, 1991).

The three risk factors applied in this study consist of market risk, interest rate risk and exchange rate risk. The market index data "MKT" was collected from Morgan Stanley Capital International (MSCI) South East Asia index applied as the proxy of the market portfolio for all countries. In this study, we consider the returns in bank stocks and market portfolios in ASEAN-5 countries. Therefore, the total return index will have limitation to obtain for market indices and individual bank stocks for every country in our dataset. The uses of individual bank stock prices and market indices will provide the consistent return data in estimation[2].

The one-year government bond yield represented the interest rate factor, namely "INT". We use one-year government bond yield because to represent the general benchmark interest rate for the ASEAN countries. "FX" represents last factor, foreign exchange risk, and is proxy by the return of the exchange rate of local currency against the US dollar. Therefore, an increase in exchange rate represents the deprecation. Since this paper uses a panel of countries with different domestic currencies, all variables measured by US dollars to represent the non-hedged portfolio returns for the international portfolio investments.

[2] The similar types of bank stock indices and market indices are also used in previous studies e.g. Cai, X.J. et al. (2016)

Table 1 Summary descriptive statistics for country

Variable	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera Test	
					JB Statistics	Probability
INDONESIA						
Return	0.00218	0.15109	-0.21060	9.20013	3955.234	0.00000
MKT	-0.00206	0.07940	-0.67493	7.09617	1767.073	0.00000
ΔINT	-0.00415	0.09107	-0.01193	8.38963	2975.064	0.00000
FX	-0.00034	0.05488	-3.72066	45.38474	189659.2	0.00000
MALAYSIA						
Return	0.00161	0.11898	0.34642	11.33330	6642.774	0.00000
MKT	-0.00206	0.07940	-0.67493	7.09617	1767.073	0.00000
ΔINT	-0.00418	0.06329	-1.83404	14.30163	13412.260	0.00000
FX	-0.00156	0.01953	-0.23522	16.96096	18537.310	0.00000
PHILIPPINES						
Return	0.00351	0.11449	0.91800	18.42685	17679.520	0.00000
MKT	-0.00206	0.07940	-0.67493	7.09617	1767.073	0.00000
ΔINT	-0.00795	0.22087	-0.61339	22.91204	29153.090	0.00000
FX	0.00025	0.01868	-0.47404	7.36460	1461.231	0.00000
SINGAPORE						
Return	0.00425	0.08634	-0.31125	8.26246	800.3068	0.00000
MKT	-0.00206	0.07940	-0.67493	7.09617	1767.073	0.00000
ΔINT	-0.00300	0.18481	-0.43431	6.78408	429.6015	0.00000
FX	0.00011	0.00846	0.01327	4.10142	34.5944	0.00000
THAILAND						
Return	-0.00492	0.16156	0.13978	11.09678	6235.419	0.00000
MKT	-0.00206	0.07940	-0.67493	7.09617	1767.073	0.00000
ΔINT	-0.00795	0.08598	-0.75942	8.29808	2885.768	0.00000
FX	-0.00055	0.02440	-1.88964	22.76527	38470.140	0.00000

Source: Authors' calculation. The data are collected from the Datastream database.

The series of continuously compounded returns namely "Return" were computed as $r_{i,t} = ln\,(p_{i,t}/p_{i,t-1})$. $r_{i,t}$ is the continuous compounded returns of variable i at month t and $P_{i,t}$ are the value of variable i at month t and month t-1, respectively. Table 1 reports the descriptive statistics for the rate of returns of bank stock, volatility, interest rate and exchange rate of each country. The results are explained as follow.

Firstly, Table 1 shows the description of the bank stock returns (Return) in our sample period and the market returns (MKT), exchange rate returns (FX) and the change in interest rates (ΔINT). All five countries have positive bank stock returns, excepted the case of Thailand[3]. Singapore has highest the rate of returns. Regarding volatility, standard deviation in Thailand is the highest follow by Indonesia, Malaysia, Philippines and Singapore, respectively. There is evidence of show positive skewness (or skewed to the right) in some countries. The kurtosis of all countries excess value of three or have a leptokurtic distribution. It can be observed from the results that the return distributions of all the variables show that significant departure from the normal distribution. The p-value of Jarque-Bera statistics exhibit that the null hypothesis of normality of the return distribution can be strongly rejected for all the variables. The average market returns are negative in most of countries because the effect of Asian crisis in 1998 that significantly affect the stock markets in the ASEAN countries.

Next, the mean of interest rate changes is negative in all cases. Philippines is the highest volatility of interest rate, while the lowest shows in Malaysia. For the change in foreign exchange rate, top of the mean exhibit in Indonesia but the lowest are Malaysia. Last point out in the table showed three risk factors are not normally distributed explaining by the Jarque-Bera test.

For the second part presents by pooling the data of all banks then separates into three groups based on bank size following by: 1). The large banks; the size is a greater than fifty million US dollars of total assets, consists of fifteen banks. 2). The medium bank; the size is between twenty to fifty million US dollars of total assets; consist of nine banks 3). The small bank; the size ranges between five to twenty million US dollars of total assets, which consist of twenty banks. This bank size data collected from balance sheet in 2014 from the DataStream database. The list of all banks and the details of classification are showed in Appendix.

However, the three riskiness factors are identical proxy and calculating in the first part that called "MKT", "INT" and "FX". The series of continuously compounded returns represents "Return" were equally computed previous part. Table 2 exhibits the descriptive statistics for the rate of returns of bank stock, market rate, interest rate and exchange rate of each bank size.

[3] The negative returns can be resulted of the uses of stock prices in calculation of returns. However, with this data limitation, the negative returns of Thai bank stock are not the main results that we use to draw the conclusion of this study.

Table 2 Summary descriptive statistics for bank size

Variable	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera Test	
					JB Statistics	Probability
Large Banks						
Return	0.00349	0.11424	0.07218	11.40307	9582.473	0.00000
MKT	-0.00206	0.07940	-0.67493	7.09617	2650.609	0.00000
ΔINT	-0.00510	0.10860	-0.67521	13.96132	16547.830	0.00000
FX	-0.00076	0.01985	-1.24555	23.72484	59113.280	0.00000
Medium Banks						
Return	0.00097	0.13816	0.15349	11.37701	5688.829	0.00000
MKT	-0.00206	0.07940	-0.67493	7.09617	2650.609	0.00000
ΔINT	-0.00667	0.14523	-0.81840	42.26136	125010.50	0.00000
FX	-0.00016	0.03061	-4.19346	89.25204	607977.20	0.00000
Small Banks						
Return	-0.00149	0.15048	0.12857	11.76226	13642.89	0.00000
MKT	-0.00206	0.07940	-0.67493	7.09617	2650.609	0.00000
ΔINT	-0.00570	0.13364	-0.81601	45.19295	316540.50	0.00000
FX	-0.00055	0.04108	-4.45312	71.85012	855690.50	0.00000

Source: Authors' calculation. The data are collected from the Datastream database.

Table 2 reports the return of sample period, rate of market rate, interest rate and change in foreign exchange rate. During the sample period, level of the mean returns from highest in the large banks and lowest in the small banks. The small banks have highest volatility and the large banks have lowest volatility. All bank sizes are positive skewness and these have kurtosis exceed the normal distribution value of three. Moreover, the JB-statistic also showed that null hypothesis of normality of the return distribution can be strongly rejected for all the variables.

3.2 Research Methodology

We first examine the stationary property of data using unit root tests. It is important to show that all variable must be stationary to avoid the spurious regressions problem. Hence, we performed four panel unit root tests. The results are show Tables 3 and 4 for the panel classified by countries and bank's sizes, respectively.

Table 3 Panel unit root test results of each country

Variable	Levin, Lin & Chu t*	Im, Pesaran and Shin W-Stat	ADF - Fisher Chi-Square	PP - Fisher Chi-Square
INDONESIA				
Return	-22.54010***	-26.73640***	652.60100***	1252.61000***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
MKT	-20.03750***	-24.99120***	592.77200***	1165.91000***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
ΔINT	-19.69120***	-29.06980***	730.81700***	1603.03000***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
FX	-31.89570***	-32.86260***	860.24100***	1247.27000***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
MALAYSIA				
Return	-16.00670***	-19.87000***	401.70800***	1030.73000***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
MKT	-8.44022***	-16.50870***	305.59600***	896.85500***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
ΔINT	-11.36680***	-17.02270***	319.66900***	878.85300***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
FX	-8.14636***	-19.72910***	396.34600***	1012.58000***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
PHILIPPINES				
Return	-6.75705***	-15.58180***	265.11300***	866.32100***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)

Table 3 Panel unit root test results of each country (Continued)

Variable	Levin, Lin & Chu t*	Im, Pesaran and Shin W-Stat	ADF - Fisher Chi-Square	PP - Fisher Chi-Square
MKT	-7.54916***	-14.76580***	244.47600***	717.48400***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
ΔINT	-10.10600***	-24.08560***	489.26100***	945.60200***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
FX	-6.98881***	-18.45580***	338.22100***	661.78500***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
SINGAPORE				
Return	6.95592***	-9.79362***	103.12000***	317.57200***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
MKT	-4.62290***	-9.04217***	91.67870***	269.05700***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
ΔINT	-12.32810***	-11.91860***	136.81800***	350.96200***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
FX	-6.80550***	-9.43212***	97.53990***	328.29600***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
THAILAND				
Return	-17.22030***	-21.42910***	447.81600***	1073.71000***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
MKT	-8.44022***	-16.50870***	305.59600***	896.85500***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
ΔINT	-10.31560***	-15.67090***	283.06000***	799.03100***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
FX	-13.72360***	-17.01440***	319.43900***	896.84800***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)

Note: The rate of returns of banks stocks (return) and foreign exchange (FX) was used for conduction the unit root tests. The rate of returns of the market index (MKT) and the change form of the interest rate (INT) were used analysis. Numbers in parentheses indicate the probability of failing to reject null hypothesis. ***, **, * indicate the significance level at 1%, 5% and 10%, respectively.

Table 4 Panel unit root test results of bank size

Variable	Levin, Lin & Chu t*	Im, Pesaran and Shin W-Stat	ADF - Fisher Chi-Square	PP - Fisher Chi-Square
Large Banks				
Return	-83.3400***	-82.6911***	3024.4000***	547.5380***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
MKT	-63.5161***	-70.9749***	2496.7000***	835.0540***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
ΔINT	-64.5910***	-85.7525***	2971.2700***	446.2290***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
FX	-66.2396***	-75.6853***	2853.6600***	456.2010***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
Medium Banks				
Return	-62.5521***	-64.0779***	1812.0100***	312.2740***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
MKT	-63.5161***	-70.9749***	2496.7000***	835.0540***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
ΔINT	-58.9272***	-72.2609***	1876.2200***	165.7860***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
FX	-52.3453***	-57.7120***	1690.5500***	317.9510***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
Small Banks				
Return	-91.2365***	-93.7554***	3983.4600***	671.6620***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
MKT	-63.5161***	-70.9749***	2496.7000***	835.0540***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
ΔINT	-66.1388***	-103.8440***	3985.7300***	651.6120***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
FX	-81.8820***	-85.0939***	3719.7300***	726.3190***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)

Note: The rate of returns of banks stocks (return) and foreign exchange (FX) was used for conduction the unit root tests. The rate of returns of the market index (MKT) and the change form of the interest rate (INT) were used analysis. Numbers in parentheses indicate the probability of failing to reject null hypothesis. ***, **, * indicate the significance level at 1%, 5% and 10%, respectively.

The results show that the level form of interest rate contains a unit root, hence, we adjust by the first differences of interest rate were tested and the result show in the table 3 and 4. Concluding, all four alternative tests rejects the null of a panel unit root in all variables, i.e. bank stock returns, market returns, changes in interest rates and exchange rate returns.

Next, we estimate unbalanced panel data model using the pooled, fixed effect, and random effect models. The model framework investigates the relationship among rate of market index, interest rate and exchange rate. The pool least square estimation is based on the assumption that there is no cross-section and time specific effect in the panel. Therefore, the common intercept can be used. This assumption neglects the heterogeneity or individually that may exist among five countries or three bank sizes (Gujarati, 2009; Hsiao, 2014). The pooled model is written as follow.

$$r_{it} = \alpha + \beta_1 MKT_{it} + \beta_2 \Delta INT_{it} + \beta_3 FX_{it} + \varepsilon_{it} \quad (1)$$
$$E(\varepsilon_{it}) \sim N(0, \sigma^2)$$

Where r_{it} is the return of bank stock for variable i at time t, MKT_{it} is the return of market index for variable i at time t, INT_{it} is the change in interest rate for variable i at time t and FX_{it} the return of exchange rate for variable i at time t. The coefficient α is the intercept term and ε_{it} is error term. Obviously, β_1, β_2, β_3 are the coefficient of market, interest and exchange rate, respectively.

Secondly, the least-squares dummy variable (LSDV) or fixed effects model and the random effects model are used when the pool least square model is not appropriate. Fixed effect model focuses particularly on the differential intercept dummy technique and OLS applied to a fixed effect model produces estimators followed in the equation (2).

$$r_{it} = \alpha_1 + \gamma_i D_{it} + \beta_1 MKT_{it} + \beta_2 \Delta INT_{it} + \beta_3 FX_{it} + \varepsilon_{it} \quad (2)$$

Where D_{it} = dummy variable for variable i at time t, α_1 is the intercept term, γ_i and β_1, β_2, β_3 coefficients of dummy and three factors.

The random effects model or error components model presented the distribution term. If the dummy variable in fixed effect model do not appropriate, the distribution or error term is added in the model so-called error components model. The model is to start with Eq. (3)

$$r_{it} = \alpha_{1i} + \beta_1 MKT_{it} + \beta_2 \Delta INT_{it} + \beta_3 FX_{it} + \mu_{it} \quad (3)$$

where α_{1i} computed by $\alpha_{1i} = \alpha_{1+}\, \varepsilon_i$: α_1 is intercept term and ε_i is a random error term with a mean value of zero and a variance of σ_ε^2. Hence, substitution α_{1i} in the equation (3), we got the equation (4)

$$\begin{aligned} r_{it} &= \alpha_1 + \beta_1 MKT_{it} + \beta_2 \Delta INT_{it} + \beta_3 FX_{it} + \varepsilon_i + \mu_{it} \quad (4) \\ &= \alpha_1 + \beta_1 MKT_{it} + \beta_2 \Delta INT_{it} + \beta_3 FX_{it} + \omega_{it} \\ \omega_{it} &= \varepsilon_i + \mu_{it};\ (\varepsilon_i) \sim N(0,\sigma_\varepsilon^2)\ ;\ (\mu_{it}) \sim N(0,\sigma^2)\ ;\ (\omega_{it}) \sim N(0,\sigma_\varepsilon^2 + \sigma^2) \\ E(\varepsilon_i \mu_{it}) &= 0 \end{aligned}$$

Where (ε_i) and (μ_{it}) represent the error terms which are normal distribution, mean equal zero and variance is constant $E(\varepsilon_i \mu_{it}) = 0$ reported that the individual error components are not correlated with each variable and are not auto-correlated across both cross-section and time series. The parameters in the model were estimated using the generalized least square estimation technique.

As a result, the crucial distinction between pooled, fixed and random effects is whether the best model how does determine the model by examination the F-statistic test (Wald Test) and Hausman test.

For the F-statistic test or Wald test, null hypothesis explained that $\alpha_1 = \alpha_2 = \cdots = \alpha_n = 0$ that is similarly intercept. Alternative hypothesis is $\alpha_1 \neq \alpha_2 \neq \cdots \neq \alpha_n \neq 0$, meaning the intercept is different. If the null hypothesis is accepted, so the pooled least square is the appropriate model in contrast using the fixed effect or random effect model.

For the Hausman test followed (Hahn & Hausman, 2000) which compared the best model between fixed and random effect after examining the pooled model is not appropriate. The null hypothesis showed in the random effect. It is not correlated with other independent variables these are $E(\varepsilon_i \mu_{it}) = 0$ in the equation (4). Alternative hypothesis is $E(\varepsilon_i \mu_{it}) \neq 0$. Conclusion, if the null hypothesis is rejected, uses the fixed effect model: otherwise, goes for the random effect model.

3.3 Hypothesis

3.3.1 Market Risk Variable

According to the capital asset pricing model (CAPM) (Sharpe, 1964; Lintner, 1965), the return on stocks can be explained as a function of a single factor, represented by the return on a market portfolio of assets. Empirical results from the CAPM indicate that market returns are typically measured by the stock market index. The theory shows that market or systematic risk has a positive effect on the required rate of stock returns, implying that market rate changes can influence bank stock returns.

$$H_a : \beta_1 = 0$$
$$H_b : \beta_1 > 0$$

Hypothesis 1: Market risk changes should increase (decrease) on higher (lower) bank stock returns in the ASEAN-5. This hypothesis implies that market risk has a positive impact on bank stock returns.

3.3.2 Interest Rate Risk

Previous papers have studied the interest rate risk on bank stock returns (Bae, 1990; Dinenis & Staikouras, 1998; Elyasiani & Mansur, 2004; Flannery, Hameed, & Harjes, 1997; Flannery & James, 1984). The empirical results pointed out that interest rates have a negative effect on bank stock returns. In addition, interest rate changes have an effect on bank balance sheets due to the broad categories of assets and liabilities. Kasman et al. (2011) found that "When the average duration period of assets in a bank is longer than that of liabilities, an unexpected increase in interest rates will negatively influence a bank's balance sheet." As a result, a rise in market interest rates will increase liabilities and may damage a borrower's credit risk. It could also reduce asset quality, leading to a decrease in bank capital and bank stock returns.

In the financial theoretical framework, higher risks are compensated by greater expected asset returns. Moreover, a study by Flannery & James (1984a) found a previous theoretical foundation for an analysis of bank risk and return. The authors explained that a firm holding nominal assets and liabilities is also affected by the composition of a bank's balance. As a result, it can positively influence the sensitivity of bank stock returns on changes in interest rate. Neuberger (1991) exhibited the positive influence of bank holding company stocks on changes in bond yield.

Interest rate percentage change can either positive or negative effect on bank stock returns depend on average duration of assets and liabilities.

$$H_a : \beta_2 = 0$$
$$H_b : \beta_2 \neq 0$$

Hypothesis 2: Interest rate risk has a positive (negative) impact on bank stock returns.

3.3.3 Foreign Exchange Rate Risk

Few literature studies have focused on foreign exchange rates and bank stock returns. Prasad and Rajan (1995) showed that exchange rate changes affect banks in three ways: 1) future cash flow; 2) the value of local currency from net foreign operations; and 3) the translation of gains and losses when converted into local currency. Former researchers have reported that the banks' negative relationship with exchange rates could be explained by the amount of foreign currency in the bank balance sheet (assets and liabilities). Movement of the foreign exchange rate translates into gains or losses based on the net foreign position. Kasman et al. (2011) exhibited that "The depreciation of local currency may lead to damage in the bank balance sheet and the deterioration of the bank equity may result in a decline in the bank stock returns." Alternatively:

In basic financial theory, changes in the foreign exchange rate should be compensated by higher returns. Therefore, higher risks will result in the required increase in returns. Unexpected movement in exchange rates can influence the performance of banks directly by translating into gains or losses from the net foreign position. Choi et al. (1992) found that significant exchange rate sensitivity for money centre banks will increase foreign loans, resulting in the banks having fewer quality loans. As a result, banks are at greater risk from loans, and require an increase in the rate of stock returns as well.

Foreign exchange rate change can either positive or negative effect on bank stock returns depend on net foreign position on balance sheet.

$$H_a : \beta_3 = 0$$
$$H_b : \beta_3 \neq 0$$

Hypothesis 3: The foreign exchange rate has positive (negative) impact on the bank stock returns.

4. Empirical Results

4.1 Panel Data Model Classified by Country

The impact of market risk variable, interest rate and exchange rate on bank stocks returns is the first separated by country using panel regression technique. The results from the Wald tests for redundant fixed effect and Hausman test indicated that the suitable of the random effect models in all five countries' portfolio. Therefore, Table 5 exhibits the results from the random effect models (Eq.4). Empirical results show that the estimated coefficients of the market return, i.e. β_1, are statistically

significant at a 1% level of significant and positive in all countries. In the hypothesis 1, the null hypothesis are rejected in all countries and bank sizes. The coefficients of market risk is highest in case of Thailand where a one-percentage increase in the market condition leads to a 1.13628 percentage increase in bank stock return. Otherwise, the Philippines has the lowest sensitivity when the market conditions raised (one percentage change in market return leads to a 0.67337 percentage changing in bank stock return).

On the other hand, the interest rate risk is not significant for Malaysia, Indonesia and the Philippines. The coefficients of interest rate sensitivity (β_2) are positive and statistically significant for Singapore and Thailand. The results implied that interest rate higher risks are compensated by greater expected asset returns. Considering Hypothesis 2, the effects are rejected the null hypothesis in some countries.

Table 5 Results of Panel Estimation from three risk factors by Country

Model	α_i	β_1	β_2	β_3	Adjusted R^2
INDONESIA	0.00218	0.86557***	-0.01513	0.32797***	0.22919
	(0.41490)	(0.00000)	(0.62100)	(0.00000)	
MALAYSIA	0.00342	0.89864***	0.03097	-0.10967	0.35296
	(0.08970)	(0.00000)	(0.32840)	(0.29850)	
THE PHILIPPINES	0.00429	0.67337***	-0.00926	0.22331**	0.22380
	(0.07490)	(0.00000)	(0.40230)	(0.01350)	
SINGAPORE	0.00575	0.68317***	0.04661***	0.33286	0.41961
	(0.02250)	(0.00000)	(0.00070)	(0.28000)	
THAILAND	-0.00302	1.13628***	0.07881**	0.35552***	0.33178
	(0.00550)	(0.00000)	(0.01520)	(0.00380)	

Note: Numbers in parentheses indicate the probability of failing to reject null hypothesis. ***, **, * indicate the significance level at 1%, 5% and 10%, respectively.

Moreover, the results indicate that the coefficient estimate for foreign exchange rate returns, i.e. β_3 are strongly statistically significant for Indonesia, the Philippines and Thailand. The maximum sensitivity in foreign exchange rate is demonstrated by Thailand, with a one-percentage increase in the foreign exchange rate leading to a 0.35552 rise in bank stock returns. The bank balance sheet can be explained by the rationale of the results. The unexpected movement in exchange rates can

influence the performance of banks directly by translating into gains or losses from the net foreign position. At the point when the foreign exchange liabilities surpass assets, deterioration in the local currency may prompt harm to the bank asset report and a decline in the equity of bank stocks. It is implied that exchange rate sensitivity for money centre banks will increase foreign loans, resulting in the banks having fewer quality loans. As a result, banks are at greater risk from loans, and require an increase in the rate of stock returns as well. In the opposite operation, the appreciation in the local currency may enhance in the bank assets account then equity of the bank stocks increase. The null hypothesis 3 is rejected in Malaysia and Singapore.

4.2 Panel Data Model Classified by Bank Size

The sensitivity of market risk premium, interest rate and foreign exchange rate on bank stock returns divided by large, medium and small banks are showed in the Table 6. The Wald tests and Hausman tests also support the uses of the random effect model in all bank sizes' portfolio. The panel estimation's results still confirm the sensitivity of the market condition to the stock returns in all bank sizes. However, the market risk is highest (lowest) in the large (small) banks' portfolio. The null hypothesis 1 is rejected in all sizes.

Table 6 Results of Panel Estimation from three risk factors by Bank Size

Model	α_i	β_1	β_2	β_3	Adjusted R^2
Large Banks	0.00499	0.98843***	0.01073*	0.49370***	0.40329
	(0.00130)	(0.00000)	(0.05190)	(0.00030)	
Medium Banks	0.00184	0.90329***	-0.00239	0.42799**	0.33510
	(0.47120)	(0.00000)	(0.89260)	(0.00000)	
Small Banks	0.00002	0.82820***	-0.00220	0.28135***	0.21079
	(0.99330)	(0.00000)	(0.88690)	(0.00000)	

Note: Numbers in parentheses indicate the probability of failing to reject null hypothesis. ***, **, * indicate the significance level at 1%, 5% and 10%, respectively.

In the aspect of interest rate risk, the results indicate that there is positive and significant relationship only in the large banks, while the medium and small banks are insensitive in the interest rate changes. The results are contrasting to the duration hypothesis which imply that the interest rate risk should have negative impact on the bank stock returns. However, this finding is consistent with

previous studies in Thai's banks by Sukcharoensin (2013). Sukcharoensin (2013) explains that these results come from stickiness of bank borrowing rate (deposit rate) while the lending rate is sensitive the changes in bond yield. However, Small banks have limited market power to significantly change the lending rate to widening their profit margin. Hence, the interest rate risk is not significant for the small banks. However, for the large bank large, the high market power could provide ability of bank to increase profit margins when interest rate increases.

Considering the estimating results on the coefficients of foreign exchange rate sensitivity, there is strong evidence that the exchange rate risk positively affect the bank stock returns 1% confidence level in every cases. The null hypothesis 3 is rejected all sizes. Therefore, the results imply that the fluctuation in exchange rate play an important role in the ASEAN stock market. Comparing between each bank size portfolio, large banks are the highest sensitivity to the exchange rate change. These results implicitly showed that the large bank are more linked to foreign exposure compared to those of the medium and small banks.

5. Conclusion

This paper investigates the risk sensitivities in bank stock return using panel data model of bank-level data in the ASEAN-5 countries. An international risk factor model is employed to investigate the impact market, interest rate and foreign exchange rate risks on the bank stock returns.

The empirical results show that the estimates of market risk are statistically significant and positive for all types, which confirm the important role of market condition in explaining bank stock returns. Similarly, the fluctuation of foreign exchange from a change shows strong statistically significant evidence in most cases suggesting that the sensitivity in exchange rate is an indeed important factor in determining bank stock returns and that depreciation causes decrease in bank stock returns in contrast, when appreciation can increase returns by opposite operation. For the interest rate sensitivity, Singapore and Thailand have a positive significant; otherwise, other types are insignificant. Moreover, in the large banks have high sensitive in the interest rate risk; hence, large bank can set up the lending rates and enjoy high profit cause high market power than medium and small banks.

In sum, the results from this study provide the important recommendation for both investors and bankers to closely monitor the foreign exchange rate and market condition since both of risks can be explaining bank stock returns in ASEAN-5. Additionally, the bank manager may have adequately hedged their foreign exchange exposure to manage the fluctuation in exchange rate that can affect bank profitability.

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Appendix Bank Size by Total Assets in Balance Sheet 2014

	Indonesia	Total Assets (end-2014) us$	Bank Size
1	Bank Mandiri	68,700,089	Large Bank
2	Bank Rakyat Indo	64,618,116	Large Bank
3	Bank Central Asia	44,445,853	Medium Bank
4	Bank Negara	33,581,382	Medium Bank
5	Bank CIMB Niagatbk	18,793,201	Small Bank
6	Bank Danamon Indo	15,706,736	Small Bank
7	Bank Permatatbk	14,956,759	Small Bank
8	Bank Pan Indonesia	13,920,050	Small Bank
9	Bank Intl Indonesia	11,537,337	Small Bank
10	Bank OCBCnisp	8,316,231	Small Bank
11	Pt Bank Bukopintbk	6,379,256	Small Bank
12	Bank Tabungan	6,051,541	Small Bank
13	Pt Bank Mega Terbuka	5,381,340	Small Bank

	Malaysia	Total Assets (end-2014) us$	Bank Size
1	Malayan Banking Bhd	182,868,605	Large Bank
2	CIMB Group Berhad	118,371,260	Large Bank
3	Public Bank Bhd	98,857,065	Large Bank
4	RHB Capital Berhad	62,724,634	Large Bank
5	Hong Leong Fin	59,226,469	Large Bank
6	Hong Leong Bank Bhd	53,052,032	Large Bank
7	AMMB Joldingsberhad	38,244,194	Medium Bank
8	Affin Holdings Bhd	19,063,617	Small Bank
9	BIMB Holdings Berhad	15,147,879	Small Bank
10	Alliance Financial	15,195,005	Small Bank

Appendix Bank Size by Total Assets in Balance Sheet 2014 (Continued)

	Philippines	Total Assets (end-2014) us$	Bank Size
1	BDOunibank	41,527,212	Medium Bank
2	Metropolitan Bank	35,716,962	Medium Bank
3	Bank of the Phil.	32,291,488	Medium Bank
4	Philippine Nat'l Bk	13,949,229	Small Bank
5	China Banking Corp	10,508,943	Small Bank
6	Rizal Commercial Bkg	10,234,639	Small Bank
7	Security Bank	8,857,054	Small Bank
8	Union Bank	9,892,102	Small Bank

	Singapore	Total Assets (end-2014) us$	Bank Size
1	Oversea-Chinese	302,694,720	Large Bank
2	United Overseas Bank	231,302,525	Large Bank
3	DBS Group Holdings	332,353,069	Large Bank

	Thailand	Total Assets (end-2014) us$	Bank Size
1	Bangkok Bank Limited	83,822,478	Large Bank
2	Krung Thai Bank Pcl	83,137,557	Large Bank
3	Siam Commercial Bank	82,055,843	Large Bank
4	Kasikornbankplc	72,498,309	Large Bank
5	Bank of Ayudhyapcl	36,668,076	Medium Bank
6	Thanachart Capital	31,138,705	Medium Bank
7	TMB Bank Pcl	24,532,445	Medium Bank
8	Tisco Financial	9,646,737	Small Bank
9	CIMB Thai Bank Pcl	8,304,313	Small Bank
10	Kiatnakin Bank	7,278,771	Small Bank