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THE CAUSALITY BETWEEN STOCK MARKET AND BANKING SECTOR: EVIDENCE FROM DUAL BANKING SYSTEM

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ABSTRACT

The Stock market and Banking sectors have frequently been lumped together as one, and named the financial sector, even though they appear to be different in nature and in functions. Based on this assumption only a few studies have been undertaken to determine causality between them. Without knowing the accurate lead-lag relationship between these two important financial sectors, policy-makers would prescribe for them similar treatments. This could hurt either of these sectors. Both theoretical and empirical studies have not been able to resolve the controversy surrounding the direction of causality between the stock market and banking sector development. Therefore, the objective of this paper is to determine which financial sector leads, the stock market or banking sector. Using standard time series econometric method, monthly data covering a period of about 22 years were analyzed. The results indicate that stock market Granger-causes banking sector development, with GDP, sandwiched between them. Policy-makers who are desirous of developing the banking sector may do so through influencing (hitting) the stock market or economic growth. However, to develop the stock market, the main option available is to try and influence interest or exchange rates.

Keywords: Stock markets; Banking sectors; Standard time series; GDP

1. INTRODUCTION

Though the banking sector and the stock markets perform different roles in the economy, they are normally lumped together as the financial sector. For this reason, it is common in theory to come across causality between economic growth and financial development. The question is which financial development is being referred to here. It is not surprising that theoretically, findings are conflicting with respect to growth and finance relationship. Indeed, the results depend on which financial sector variables are being considered. In our humble opinion, the failure to accept that the nature of stock markets and banks are different has brought about these conflicting results. Peia and Roszbach (2014) observed that "there is no consensus as to whether the effect of financial development on growth is due to banks, stock markets or both."

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As far as the financial sector is concerned two theories readily come to one's attention. The "supply leading" hypothesis which favors financial development leading growth, and "demand following" in which economic growth leads financial development. And yet, there exist the "feedback hypothesis," where it is explained that causality between them is bidirectional (Luintel & Khan, 1999). In addition to conflicts in these theories, little is known about the relationship between stock markets and banking sectors.

Among the important roles played by the banking sector include savings mobilization, provision of short-term loans to individuals and firms, and provision of essential services such as letters of credit and guarantee. Banks also play a vital role in export and imports. On the other hand, the stock market provides a platform for companies to obtain long-term equity financing. In addition, stock markets provide income and liquidity to investors and also create avenues for risk-sharing among participants. Sahoo and Dash (2013) recognize that savings and investments are important for economic growth. Since savings and investments are the important roles of banking and stock market sectors respectively, it should be the concerned of policy-makers that these sectors are well developed. Sahoo and Dash (2013) also added that, since the stock market provide income to investors, and income leads to savings, the stock market should have a link with banking sector development.

Empirical work in the financial sector has not helped in solving the controversy. For instance, Nieuwerburgh et al (2005) report that stock market does not seem to have a long run relationship with banking sector development, whiles Pradhan et al (2014) find the opposite to be true. From the viewpoint of Pradhan et al (2014), the issue of cointegration and causality between stock market development and banking development has not been resolved. The motivation for this work is derived from the realization that both theoretical and empirical work has not been able to resolve the controversy surrounding the causal relationship between stock market development (SMD) and banking sector development (BSD). The main objective of this paper is to determine which financial sector development leads to a dual banking system. Would it be SMD or BSD?

Undoubtedly Malaysia offers the right environment for such a study. With Islamic and conventional banks operating side-by-side, the country has put together the right architecture for the smooth operations of the dual banking system. In addition, both Islamic and conventional stocks are available to meet the aspiration of various types of investors. Indeed, Malaysia is a financial center for both conventional and Islamic financial products, that attract investors globally. Monthly data covering from January 1996 to January 2016 was analyzed using standard time series econometric techniques. The major findings of this paper are;

I. Stock market development leads banking sector development
II. Stock market Granger causes economic growth, which in turn Granger causes banking sector development
III. The "supply leading" (see Hsueh, Hu, and Tu, 2013) and "demand following" hypothesis is confirmed when the financial sector is split into the stock market and banking sectors.

This paper contributes to the body of knowledge by restricting itself to one country that practices a dual banking system. Unlike Pradhan et al (2014) who used annual panel data, this paper employs monthly time series data focusing on one country only. Knowledge of the direction of causality between SMD and BSD would guide policy-makers;

a) in the use of scarce resources, in an attempt to improve the performance of these very important sectors of the economy
b) to realize that stock market and banking sectors are different, and must be treated differently

The remainder of this paper is organized as follows. Section 2 presents literature review, section 3 provides a description of data and variables, section 4 describes the methodology employed, section 5 looks at empirical results and discussions, and section 6 provides conclusion.

2. LITERATURE REVIEW

2.1. Theoretical Issues

It is easy to come across theories concerning the causal relationships between financial development and economic growth. The commonly known concepts in this regard are "supply leading" to indicate that financial development leads to economic growth, and "demand following" argument put up in support of economic growth leading to financial development. According to the proponents of the "supply leading" hypothesis, the development of the financial sector ensures mobilization of deposits and efficient allocation of financial resources to economic agents. Through this process, funds are put into productive utilization, leading to high economic growth. On the other hand, those who support the "demand following" hypothesis argue that the increased income resulting from economic growth requires the services of the financial sector. It is this demand for financial services that lead to the development of the financial sector. Again, there exists a third opinion. This is referred to as the "feedback hypothesis". According to this view, causality between financial development and economic growth is bidirectional and depends on the state of development of the country concerned.

However, the focus of this study is on causality between SMD and BSD. Both banking sector and the stock market are part of the financial sector albeit having different roles in an economy. In theory, their roles may be considered as complementary. Some have seen the stock market as having a negative influence on economic growth because of its effect in reducing savings. In this regard savings are diverted from the banks, making it difficult for banks to play their role as agents of financial resource allocation. On the contrary stock markets are regarded as important in an economy, and their effect on growth is realized through provision of liquidity, risk sharing, and diversification.

Since many researchers have normally considered the financial sector as one unit and tried to investigate its impact on other economic variables, little time has been devoted to finding the link between the stock market and the banking sectors. From the transmission mechanism of monetary policy, the hypothesis that increased income leads to accumulation of wealth by households in the form of stocks needs attention. This is a clear situation where economic agents move their savings and convert them into stocks. This phenomenon is bound to affect both the stock market and the banking sectors. Indeed, any transaction that involves the exchange between stocks and money would have implication for both sectors. Therefore, these sectors must be linked in one way or the other. Theoretically, there are no clear-cut relationships connecting the SMD and BSD. For this reason, we may have to consider referring to empirical analysis for the existence of causality between these important financial development indicators.

2.2. Empirical Review

Most empirical studies are related to investigating the causal relationship between financial development and economic growth. Such studies have employed either SMD or BSD, or both as to represent financial sector development. Enisan and Olufisayo (2009), Carp (2012), and Ngare, Nyamongo, and Misati, (2014) looked at the relationship between SMD and economic growth. Enisan and Olufisayo (2009) report that SMD is cointegrated with and Granger causes economic growth in Egypt and South Africa. Their finding was based on an analysis of seven African countries. For CoteD'Ivoire, Kenya, Morocco, and Zimbabwe, their findings indicate a bidirectional relationship between SMD and economic growth. Carp (2012) used annual data for Romania. He states that there is no direct long-term causal relationship between GDP growth rates, market capitalization and stock value traded, but do confirm the bidirectional correlation between GDP growth rates and stock turnover ratio. He also observed that market capitalization Granger causes economic growth. On their part Ngare, Nyamongo, and Misati, (2014) used a panel data from 36 African countries. They observed that countries with stock markets tend to grow faster than those without stock markets. In addition, they report that developed countries with stock markets tend to grow less than small countries with stock markets. Also, they present evidence showing that SMD has a positive effect on economic growth. In context of Malaysian market, Lau and Tan (2014) investigated the causal interplay between four major domains of energy supply i.e., oil, petroleum, gas and coal and economic growth (GDP) in Malaysia and detected that there are Long run relationships between GDP and energy supply (in oil and coal types). In another study by Jayaraman and Lau (2011) applied the recently developed panel analysis procedures to five major PICs, namely Fiji, Samoa, Solomon Islands, Tonga and Vanuatu with a view to assessing the impact of oil price on economic growth. They found that oil price, economic growth, and international reserve are cointegrated and there is no long-run causality relationship between these variables.

In contrast with the literature reviewed above, some researchers separated financial sector into banking and stock market sectors and analyzed their individual relationships with growth. For instance, Rousseau and Xiao (2007) in their analysis of China, find that size and sophistication of the banking sector have a significantly positive effect on output and fixed investment, while the stock market has no such effect. On their part, Peia and Roszbach (2014) report that SMD tends to cause economic growth, but observed a reverse causality between BSD and growth. Their results were based on the analysis of a time series data of 22 advanced countries. Analyzing 12 MENA countries using unbalanced Panel data, Naceur, Cherif, and Kandil (2014) indicate that banking and nonbanking development are affected differently by the different determinants used for their analysis. They added that growth does not promote banking, but promotes market liquidity. In the case of energy sources and economic growth, Lau et al. (2016) investigated the causal relationship between hydroelectricity consumption (HC), economic growth (GDP), and carbon dioxide ($CO2$) emission in Malaysia by applying the time-series techniques. The major finding for this paper is there is a long-run relationship exists between HC, GDP, and $CO2$ emissions.

At this point, the literature to be considered is related to the interaction between the banking and stock market sectors. Nieuwerburgh et al (2005) are the earliest among such papers. Investigating the relationship between financial development and growth in Belgium, using firm-level data for a long-time span of 1830-2000, find no evidence of a long run relationship between BSD and SMD. Lau and Fu (2011) empirically investigate the interrelationship between current account and the components of a financial account for the four crisis-affected Asian countries of Indonesia, Korea, the Philippines, and Thailand. Empirical results show that CA Granger causes FA suggesting that CA can be used as the control policy variable for the flows of capital in these countries. From Sahoo and Dash (2013) we read that financial development leads to higher mobilization of savings. Since savings is a measure of BSD, their finding may imply that financial development leads BSD. They used annual panel data consisting of 5 South Asian countries. The results of Vithessonthi (2014) indicate a positive association between SMD and banks' capitalization ratio and a negative association with their beta. However, he observed that BSD has no effect on banks' capitalization ratio even though it is positively related to their beta. His results were obtained using annual unbalanced panel data of listed banks in Thailand. His findings also reveal SMD induces instability by lowering banks' capitalization ratio and by increasing their beta. Lastly, Pradhan et al (2014) among others observed that SMD granger causes BSD in the long run. He arrives at this conclusion after analyzing 26 ARF ASEAN countries.

From the literature provided above, it is clear that both theory and empirical findings have failed to bring finality to the long run causal relationship between SMD and BSD. While Nieuwerburgh et al (2005) report of no long-run relationship between them, Pradhan et al (2014) observes SMD as leading BSD. Given the important roles played by these sectors in economic development, it is only fair that more empirical work is undertaken to further understand the relationship between them.

3. METHODOLOGY

In this study, econometric techniques have been adopted for the analysis. Conventional regression normally assumes a theoretical relationship between variables. It also decides and assumes causality by indicating that one variable is dependent and the others are independent. However econometric techniques make no such assumptions. It first determines whether variables under consideration have a long-run relationship, and then allow the data to decide which variable is endogenous and which is exogenous. Therefore, while regression assumes causality, econometric techniques endeavor to rely on the data to determine the lead-lag relationship among the variables. But the first steps towards determining cointegration is stationarity and VAR tests.

To determine cointegration it is important to know whether the entire variables are stationary or non-stationary in the level form. For cointegration, only non-stationary variables are required because they possess theoretical information. Stationary variables possess only random and short-term information but have lost the long-term information. The unit root test for stationarity is conducted using the augmented Dickey-Fuller (ADF) and Phillips-Peron (PP) test. Another technique for the unit root test is the Kwiatkowsi, Phillips, Schmidt, and Shin (KPSS). The next procedure is to determine the order of lag using the VAR test.

After ascertaining that variables are non-stationary, and the order of lag is determined, a cointegration test is performed. This is the stage where it would be known whether the variables have a long run relationship or not. Engle-Granger and Johansen techniques are employed for the cointegration test. While Engle-Granger tests the stationarity of the residual in determining cointegration, Johansen test provides cointegration by assigning hypothetical coefficients that make the error term stationary, to the variables. In addition, unlike Engle-Granger, Johansen is able to determine the existence of more than one cointegrations.

The regression required to determine the stationarity of the error term is given below;

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum \alpha i \, \Delta Y_t\text{-}i + \mathcal{E}_t$$

Where $\mathcal{E}_t$ is the white noise of the error term, $\Delta Y_{t-1} = Y_{t-1} - Y_{t-2}$, and $\Delta Y_{t-2} = Y_{t-2} - Y_{t-3}$. Stationarity is obtained if δ equals zero (o). In that situation, the t-statistic for Y_{t-1} would be less than the critical value of the estimation. As many lagged difference terms as necessary may be added to remove error term serial correlation. ADF(1), ADF(2),….ADF(5) indicate the lagged difference terms used in the estimation.

The next test to perform is the Long Run Structural Modelling (LRSM) where the estimated cointegrating vectors are subjected to exact-identifying and over-identifying restriction against theoretically expected values. Once it is established the variables are cointegrated, the determination of absolute exogeneity and endogeneity need to make. This was not provided by the cointegration tests. The Vector Error Correction Model (VECM) is equipped for such determination. The VECM, however, is unable to determine relative endogeneity and exogeneity of the variables, which is crucial in determining Granger causality.

To determine relative exogeneity and endogeneity the test required is Variance Decomposition (VDC) technique. This technique decomposes the variance of the forecast error term of a variable into proportions of shocks or innovations attributable to each variable including itself. The proportion of the variance that is explained by its own past innovations is used to determine the relative exogeneity or endogeneity of the variable. The variable with the highest explanation coming from its own past innovations is regarded as the most exogenous of all the variables. The other variable can then be arranged according to the degree of dependence on their own past shocks.

A graphical representation of the VDC test is known as the Impulse Response Function (IRF) test. It is designed to map out the dynamic response path of a variable due to a one period SD shock to another variable. The next important test that is required to be performed is the Persistence Profile (PP) test. It indicates the speed with which the variables return to equilibrium when they receive a system-wide shock.

4. DATA AND EMPIRICAL RESULTS

4.1. Data

The main variables for this paper are proxies for BSD and SMD. In previous literature, BSD has been represented by different proxies such as Deposits + Savings as a percentage of per real capital income, Currency in circulation, percentage of Gross domestic savings per GDP, Gross domestic private savings, Liquid liabilities per GDP, Bank credit to the private sector per GDP, and Broad money supply.

In literature proxies commonly used for SMD include Total market capitalization as a percentage of real per capita income, Number of shares listed, all shares price index, Value traded ratio (Value of shares traded/GDP), and the Turnover ratio (number of shares traded as a percentage of market capitalization).

Over the past several decades, the affiliation among the macroeconomic variables, movement of stock prices and banking sectoral development have well been documented in the literature (Prathan et. al 2014; Pilinkus, 2010; Garcia & Liu, 1999; Saiti and Masih, 2016; Saiti, 2017). It is often argued that stock prices and banking sector growth are determined by some fundamental macroeconomic variables. Therefore, macroeconomic variables can influence investment decisions and motivates many researchers to investigate the relationship between stock market prices, banking sector growth, and macroeconomic variables. Moreover, in this study, we want to see which variable is leading and which are following with the having impact macroeconomic variables.

Macroeconomic variables that have often been used and relevant to the financial sector include Per capita GDP, Inflation, Trade openness, National savings/GDP, Domestic investment per GDP, Gross domestic public savings, Real interest rates, Loans/total deposits, and Government consumption expenditure.

This study used monthly data from Malaysia covering January 1996 to January 2016. Malaysia is considered as a very important player in the global financial sector. It operates a dual banking system where Islamic and conventional banks exist side by side. Financial institutions are well developed and continue to evolve. The central bank, Bank Negara Malaysia has ensured the passing of many regulations and laws including Financial Services Act and the Shariah Governance Framework that regulates the activities of both conventional and Islamic banks. The Securities Services Commission is also responsible to oversee the activities of the stock market. Malaysia therefore with all its well-developed financial sector architecture, is well placed to be considered for this type of investigation.

The variable for stock market development is represented by the value of shares traded per GDP (SD). The data represents value traded in stocks of the construction sector reported on the main board of the Kuala Lumpur Stock Exchange. The value was divided by the industrial productions index to obtain SD. Industrial production index was used as a proxy for GDP because it was difficult obtaining monthly data for GDP. The use of industrial production index to represent GDP is well established in the literature (see Moody, Levin and Rehfuss, 1993). The construction sector is highly active in Malaysia. The demand for housing by individuals and families has been on the rise. In fact, a major portion of banks' lending is for the acquisition of homes. Hence investing in stocks of the construction sector is attractive to investors. The value traded in these stocks, therefore, reflects adequately the activities of the stock market. As the stock market develops, the value traded is expected to increase.
Domestic credit to the private sector is the proxy for banking sector growth (BD). Generally, when the banking sector is developing, it is expected that access to credit would improve. In this regard, individuals and firms in the domestic economy would have more access to loans as the banking sector is developing.

Control variables used include GDP, interest rate, and exchange rate. These variables do have effects on both the stock market and banking sector variables. As already intimated, the proxy for GDP is the industrial productions index. There are mixed findings regarding the effect of GDP on the financial sector as a whole and on the banking and stock market sectors individually. We expect causation to come from either GDP to these variables, or from the variables to GDP. The exchange rate (XR) is the number of Malaysian Ringgits per USD. According to the International Fisher effect, a depreciation of the home currency is a result of rising inflation and interest rates. This may have two effects on the financial sectors. Firstly, capital may flow into the home country to take advantage of the high returns from the rising interest rates. Secondly capital may flow out of the home country for fear of the depreciation. Hence interest rates may have a positive or negative impact on the financial sector.

Interest rate (IR) is represented by the average lending rate offered by commercial banks on all loans in Malaysia. The high-interest rate is expected to slow down the activities on the stock market, as this is detrimental to investments. However, banks may benefit from high-interest rates as the interest spread is expected to widen. On the other hand, firms and households could also decide not to borrow at higher rates, and this can hurt banking development. All data were obtained from Thompson Reuters' Data Stream.

4.2. Empirical Results

The main objective of this paper is to determine, between Stock Market Development (SMD) and Banking Sector Development (BSD), which leads. The descriptive statistics of all variables involved in the analysis are presented in Table 1.

Table 1: Descriptive Statistics

Variables	SD	BD	GDP	IR	XR
Mean	18.47663	800085.3	91.37573	6.562767	3.516022
Median	14.71618	667018.1	94.88000	6.120000	3.648000
Maximum	79.24155	1655330.	142.7000	13.54000	4.545000
Minimum	2.490588	289998.0	45.67000	4.440000	2.479000
Std Deviation	13.80729	375723.1	25.19716	2.128380	0.436208

Note: SD, BD, GDP, IR, and XR represent stock market development, banking sector development, gross domestic product, interest rate, and exchange rate respectively.

It seems the most volatile of all the variables is BD with a very high standard deviation. It implies two scenarios. Firstly, available credit to the private sector monthly cannot be guaranteed by banks. Supply of credit may be above or below the average by about RM 290,000 million. Secondly, availability of borrowers from the private sector may not be guaranteed, and demand for loans fluctuates from the average by RM 290,000. This does not augur well for proper financial planning for the banks, as well as for firms. XR seems to be least volatile of all the variables. Presentation of correlation between the variables is found in Table 2. Correlation between BD and GDP, and between IR and GDP appear to be very high, with a value higher than 0.80. Correlation between XR and IR, and between XR and BD seem to be lowest.

Table 2: Correlation between variables

Variables	SD	BD	GDP	IR	XR
SD	1.0000	-0.1819	-0.1950	0.2659	-0.4545
BD	-0.1819	1.0000	0.9050	-0.7287	0.0998
GDP	-0.1950	0.9050	1.0000	-0.8495	0.1172
IR	0.2659	-0.7287	-0.8495	1.0000	-0.0930
XR	-0.4545	0.0998	0.1172	-0.0930	1.0000

Note: SD stands for stock market development, BD represents banking sector development, GDP means gross domestic products, whereas IF signifies interest rates and XR indicates exchange rates

The ADF test requires that all variables are non-stationary in their level forms i.e. I (1), and stationary in their first differenced forms. All variables were converted into logarithmic forms, and their differenced forms took prior to the unit root test. The results of Table 3 show that all the variables were non-stationary in their level forms.

Table 3: Augmented Dickey-Fuller Unit Root Test for Level form variables

VARIABLE	ADF	VALUE	T-STATS	CV	RESULTS
LSD	ADF(5) =SBC	-164.7247	-3.3134	-3.4292	Non-Stationary
	SDF(5)=AIC	-150.6872	-3.3134		
LBD	ADF(3) =SBC	865.3091	-2.0537	-3.4292	Non-Stationary
	SDF(2)=AIC	877.2867	-2.2761		
LGDP	ADF(3) =SBC	398.3056	-2.8897	-3.4292	Non-Stationary
	SDF(3)=AIC	408.8338			
LIR	ADF(2) =SBC	636.0792	-2.2116	-3.4292	Non-Stationary
	SDF(2)=AIC	644.8527			
LXR	ADF(1) =SBC	520.4229	-2.4832	-3.4292	Non-Stationary
	SDF(5)=AIC	527.8803	-2.7014		

Notes: Variable is stationary if T-stats > CV and non-stationary if otherwise

Table 4: Augmented Dickey-Fuller (ADF) Unit Root Test for Differenced form variables

VARIABLE	ADF	VALUE	T-STATS	CV	RESULTS
DIB	ADF(3) =SBC	-166.6451	-10.3558	-2.8734	Stationary
	SDF(1)=AIC	-159.3240	-13.2895		
DXD	ADF(2) =SBC	865.1381	-4.8384	-2.8734	Stationary
	SDF(3)=AIC	872.9090	-4.2041		
DGDP	ADF(2) =SBC	397.7044	-9.5252	-2.8734	Stationary
	SDF(2)=AIC	404.7150	-9.5252		
DLR	ADF(1) =SBC	635.8883	-7.5593	-2.8734	Stationary
	SDF(1)=AIC	641.1463	-7.5593		
DER	ADF(1) =SBC	517.4601	-10.9763	-2.8734	Stationary
	SDF(4)=AIC	523.4589	-5.9924		

Notes: Variable is stationary if T-stats > CV and non-stationary if otherwise

Table 4 provides the results of the differenced form variables. According to the outcome, all the variables are stationary in their differenced form. It would have been appropriate to confirm the results of the ADF test with PP and KPSS if the results were conflicting.

4.2.1. Lag Order Selection

Optimal lag order of auto-regression (VAR) test is reported in Table 5. A lag order selected indicates how the extent to which variables are affected by their past values. This step has a significant input in performing cointegration test. Thus, without knowing the specific number of lag we can’t proceed to the next step. We can’t see the constant result from the unit root test that also allows us to test the cointegration among the variables. Prior scheduled the cointegration test, we need to govern the direction of the vector autoregression (VAR) meaning that a number of lags to be executed. From the result of the VAR model, we try to get the maximum value for SBC and AIC and need to find the consistent direction of lag. If we get the p-value is more than 5% then we no need to continue anymore and have the consistent direction of lag. If the outcomes are in mix box, then we are also allowing to select the lower order but must need to ensure that there was no serial autocorrelation. Following this criterion presented a conflict because AIC and SBC selected lag order 3 and 1 respectively. In order not to lose a large degree of freedom, we decided on 2 as the optimal lag order.

Table 5: Order of lag selection

Selected order of lag	AIC	SBC	Adjusted LR P-value	CV
2	2287.6	2191.2	(0.000)	5%

4.2.2. Cointegration

An E-G cointegration test result is presented in table 6. By performing this phase, we would able to know whether the variables are cointegrated (move together) or not at long-run meaning they have a theoretical relationship or not. The selection criterion is to find out whether the highest values of AIC and SBC rejects the null of no cointegration, by comparing their corresponding t-statistics with the critical value (CV). The null is rejected only if the t-static is greater than the CV Masih, Al-Elg, & Madani (2009); Narayan (2004). Under normal circumstances, both AIC and SBC must complement each other. However, the results show that, while AIC indicates the existence of cointegration, SBC provides the reverse, indicating no cointegration (as highlighted in table 6). LL and HQC are generated from the Microfit software 5. These can also be used for determining cointegration but most of the studies used AIC and SBC Pesaran, & Pesaran, (2010); Pesaran, & Shin, (1999). However, they were not considered that purpose in this study.

Table 6: E-G Cointegration test for variables LSD LBD LGDP LIR and LXR

Selection Criteria	Statistics	LL	AIC	SBC	HQC
DF	-6.4135	-136.6312	-137.6312	-139.3756	-138.3339
ADF(1)	5.8390	-136.6113	-138.6113	-142.1003	-140.0168
ADF(2)	-5.5826	-136.5381	-139.5381	-144.7715	-141.6463
ADF(3)	-5.3396	-136.4932	-140.4932	-147.4711	-143.3042
ADF(4)	-4.8607	-136.3468	-141.3468	-150.0691	-144.8605
ADF(5)	-4.1643	-135.0320	-141.0320	-151.4988	-145.2484

95% critical value for the Dickey-Fuller statistic = -4.4752

Notes: Engle-Granger test is checked as ADF test. If stationary (CV>T-STAT), we have cointegration & no cointegration if otherwise.

These conflicting results make Johansen's cointegration technique relevant. In addition, the Johansen test is able to capture the existence of more than one cointegrations. Results of Johansen test are presented in Tables 7, (a) for Maximal Eigenvalue Matrix, and (b) for Trace Stochastic Matrix.

Table 7: Johansen Cointegration results for variables LSD LBD LGDP LIR and LXR

(a) LR Test Based on Maximal Eigenvalue Stochastic Matrix

Null	**Alternative**	**Statistics**	**95% CV**	**90% CV**
r = 0	r = 1	121.8237	29.9500	27.5700
r <= 1	r = 2	39.0203	23.9200	21.5800
r <= 2	r = 3	15.4352	17.6800	15.5700
r <= 3	r = 4	4.3230	11.0300	9.2800
r <= 4	r = 5	1.0606	4.1600	3.0400

(b) Cointegration LR Test Based on Trace Stochastic Matrix

Null	**Alternative**	**Statistics**	**95% CV**	**90% CV**
r = 0	r >= 1	181.6628	59.3300	55.4200
r <= 1	r >= 2	59.8391	39.8100	36.6900
r<= 2	r>= 3	20.8188	24.0500	21.4600
r<= 3	r>= 4	5.3836	12.3600	10.2500
r<= 4	r>= 5	1.0606	4.1600	3.0400

Notes: The statistics refer to Johansen-Juselius's log-likelihood maximal eigenvalue and trace statistics. From the above results, we select one cointegrating vector based on the Eigenvalue and trace statistics at 95% level. A number of cointegrating vectors are represented by r.

From the above results, we can see that every table has null and alternatives. Now we can observe the first row where the null hypothesis is no cointegration meaning r = 0. We fail to reject the null hypothesis when test statistic is lesser than the critical value. Furthermore, we reject the null hypothesis when test statistic is greater than the critical value. Thus, we need to get at least one cointegration to go the following level and after getting cointegration we can stop. Both results seem to indicate that there are two cointegrations among the variables.

From the perspective of the International Fisher Effect, a country's currency with high-interest rate should depreciate and would experience an outflow of capital to the country of the foreign currency. It is, therefore, possible that LSD, LBD, LIR, and LXR would cointegrate in the long run. The second cointegration would involve all the five variables. The relationship amongst these variables is not spurious or accidental. Hence the behavior of any variable can be used to predict that of the others. Such a long run relationship is good for policy making.

4.2.3 Long-Run Structural Modelling (LRSM)

Table 8 contains the results of the Long Run Structural Modelling (LRSM) tests. Here we test the coefficients of the cointegrating vectors against their theoretical values, by first restricting the LSD to equal 1 in the exact-identification process. The rest of the variables became insignificant as the t-ratios were below 2.0. Then in the over-identification test, the coefficients of the rest of the variables were restricted to zero (0). The null hypothesis of the restriction being true was rejected, indicating that the variables are significant, and should be included in the model.

Table 8: Exact-identifying and over-identifying restriction on the cointegrating Vector

Variable	(1) EXACT-IDENTIFYING	(2) OVER-IDENTIFYING
LSD	1.0000 (*NONE*)	1.0000 (*NONE*)
LBD	-15.9345 (57.3554)	.0000 (*NONE*)
LGDP	39.0781 (147.9272)	.0000 (*NONE*)
LIR	15.6989 (65.6488)	.0000 (*NONE*)
LXR	-118.4457 (65.6488)	.0000 (*NONE*)
CHSQ(4)	None	33.2597 (.000)

Notes: The results above show the maximum likelihood estimates subject to exact identifying (Panel A) and over-identifying (Panel B) restrictions. We will go for exact identification on the following steps.
**significant at 95% confidence level

4.2.4. Vector Error Correction Model (VECM)

After ascertaining the existence of a theoretical relationship between SD, BD and the other control variables, it is still not known which variable is exogenous or endogenous. Unlike the traditional regression method, exogeneity and endogeneity cannot be assumed. The Vector Error Correction Model (VECM) technique is used for such a determination. The models below are used in the estimation.

$$DSD = C + \beta_1 DSD + \beta_2 DGDP + \beta_3 DIR + \beta_4 DXR + e_{t-1}$$
$$DBD = C + \beta_1 DSD + \beta_2 DGDP + \beta_3 DIR + \beta_4 DXR + e_{t-1}$$
$$DGDP = C + \beta_1 DSD + \beta_2 DBD + \beta_3 DIR + \beta_4 DXR + e_{t-1}$$
$$DIR = C + \beta_1 DSD + \beta_2 DBD + \beta_3 DGDP + \beta_4 DXR + e_{t-1}$$
$$DXR = C + \beta_1 DSD + \beta_2 DBD + \beta_3 DGDP + \beta_4 DIR + e_{t-1}$$

Note that the equality sign does not make any variable endogenous or exogenous. It only shows that until the test is carried out any variable can be endogenous. The error correction term (ECT) e_{t-1} represents the long run relationship. To maintain long run equilibrium, e_{t-1} should be statistically zero. Hence the equation in which the β_5 is not significant, indicates that such equation is a cointegrating one. This further implies that the variable on the left side of that equation is endogenous. Additionally, rejecting the null that the variable is exogenous, with a p-value less than 5% critical value is an indication of an endogenous variable.

Normally the coefficient of the ECT β_5 should be negative to ensure short-term distortions move towards the achievement of equilibrium in the long run. A positive β_5 is not common in VECM results. Though β_5 is positive when DBD and DGPD are tested for endogeneity, the significance of the tests is given prior attention.

Table 9: Vector error correction estimates for stock market development, banking sector development, GDP, lending rate and exchange rate

Ecml(-1)	Coefficient	Standard Error	T-Ratio (Prob)	CV	Result
DSD	-.2182	.0441	-4.9520(.000)**	5%	Endogenous
DBD	.0028	.0008	3.7785(.000)**	5%	Endogenous
DGDP	.0123	.0048	2.5914(.010)**	5%	Endogenous
DIR	.0019	.0018	1.0851(.279)	5%	Exogenous
DXR	.0060	.0028	2.1192(.035)*	5%	Exogenous

Notes: * denote significance at 5%, ** significance at 1%, P>5% denotes exogenous, P<5% denotes endogenous

At least the error correction in one of the equations should be significant for the validity of the cointegration relationship. The significance of less than 5% indicates that the variable on the left-hand side of that equation is endogenous. Report of the VECM test is presented in Table 9. SD, BD, and GDP were found to be endogenous, whereas IR and XR were exogenous.

4.2.5. Variance Decomposition (VDC)

Granger causality requires that rather than absolute exogeneity and endogeneity, we should know the relative exogeneity and endogeneity of the variables. For instance, between the endogenous variable SD, BD, and GDP, which is the most and least endogenous? Again, from the exogenous ones IR and XR, which is more exogenous than the other. The VDC analysis provides solutions to these questions. Causality is be determined by ranking the variables in terms of strength of causation. This is accomplished through the VDC. As explained earlier the variance of each variable is decomposed based on its dependence on the innovations of all the variables including that of itself. The variable whose variance has the highest dependence on its own innovation is the most exogenous or strongest. Through this criterion, the order of the variables from the strongest to the weakest is determined. In this way, the lead-lag relationship would be known.

There are two types of VDC analysis, the orthogonalized and the generalized. The orthogonalized is normally biased in favor of the order in which the variables are arranged. For this reason, the generalized VDC method was employed in this study. Results of the VDC are presented in Table 10. We calculated the dependence of each variable on its own innovation, using variance decomposition estimates of the 12th, 24th, and 36th month. According to the results, among the endogenous variables, banking sector development (BSD) is the most endogenous, followed by GDP and then stock market development.

In the case of the exogenous variables, interest rate (IR) is more exogenous than exchange rate (XR). This result confirms what was obtained in the VECM technique. Taking into consideration the results of the VDC above, lead-lag relation indicates that Interest rate leads all the variables, followed by the exchange rate, Stock market development, GDP, and then Banking sector development, in that order. Below is a representation of the Granger causal chain among the variables.

GRANGER CAUSALITY CHAIN

LBD ←←← LGDP ←←← LSD ←←← LXR ←←← LIR

Contrary to the findings of Arestis, Demetriades, and Luintel (2001), and Beck and Levine (2004), who indicate that both stock and banking sector can promote growth, these results show that only the stock market Granger causes growth. Again, the results show that at all horizons considered, stock market leads growth, which contradicts the findings that causality between them is bidirectional (see Marques, Fuinhas, and Marques, 2013). Moreover, these results differ from the work of Pradhan et al (2017), as their findings support long-run banking sector development having a significant impact on growth. Causality runs from interest rate to stock market unlike bidirectional causality between them observed by Jammazi et al (2017). This result confirms the findings of Hacker, Karlsson, and Mansson (2014), that nominal interest rate differentials Granger cause exchange rate in the long run. Considering exchange rate and economic growth, the results are in agreement with the findings of Koitsiwe and Adachi (2015), that exchange rate Granger causes growth.

Table 10: Variance Decomposition Estimates (Generalized)

	Horizon	**LSD**	**LBD**	**LGDP**	**LIR**	**LXR**	**TOTAL**	**RANK**
LSD	12	92%	2%	0%	3%	3%	100%	3
LBD	12	22%	77%	0%	0%	1%	100%	5
LGDP	12	6%	1%	89%	1%	3%	100%	4
LIR	12	2%	2%	0%	96%	0%	100%	1
LXR	12	2%	4%	0%	0%	93%	100%	2
	Horizon	**LSD**	**LBD**	**LGDP**	**LIR**	**LXR**	**TOTAL**	**RANK**
LSD	24	91.9%	2%	0%	3%	3%	100%	3
LBD	24	30%	70%	0%	0%	0%	100%	5
LGDP	24	10%	0%	85%	1%	4%	100%	4
LIR	24	3%	2%	0%	94%	0%	100%	1
LXR	24	3%	5%	0%	0%	92.1%	100%	2
	Horizon	**LSD**	**LBD**	**LGDP**	**LIR**	**LXR**	**TOTAL**	**RANK**
LSD	36	92%	2%	0%	3%	3%	100%	2
LBD	36	32%	67%	0%	0%	0%	100%	5
LGDP	36	11%	0%	84%	1%	4%	100%	4
LIR	36	4%	3%	0%	93%	0%	100%	1
LXR	36	3%	5%	0%	0%	91%	100%	3

4.2.6. Impulse Response Function (IRF)

The IRF provides a graphical representation of the VDC. It shows the impact on other variables when one variable receives a one standard error shock. Due to interconnectivity between endogenous variables, a shock received by anyone such variable, affects it and the other variables. What IRF seem to achieve is identify a shock to a specific variable and observe changes that occur in other variables. On a normalized IRF scale, zero (0) represents a steady-state. Therefore, responses traced above or below zero indicates destabilization resulting from shocks.

Figure 1 presents the impact on other variables when SD receives one standard error (SE) shock. Whiles SD is highly destabilized, the other variables remain fairly stable. The response path of SD is seen to suspend about 0.4 units above the steady-state. Perhaps an indication that stock market shocks cause less destabilization to the banking sector, economy, interest rates, and the foreign exchange market.

A one standard error shock to BD suspends its response path at about 0.0055 units above the steady-state. Except for GDP which is fairly stable, the remaining variable undergoes various degrees of changes in response to this shock. Figure 2 illustrates the phenomenon. Since most banking transactions are connected to interest rates, it should be expected that shocks in the banking sector would certainly cause some adjustment in interest rates. Banking sector shocks also have the tendency of influencing capital flows, inwardly or outwardly. Exchange rate shocks are therefore to be expected under banking destabilization.

Figure 3 shows that all other variables exhibit changes with a positive-slope impulse response above the steady-state, when GDP receives a shock, except SD. An exception, however, is seen the way SD respond to this shock. SD reacts to the shock on GDP by chatting a downward path from left to right below the steady-state. Undoubtedly this graph suggests that GDP greatly influences interest rates, exchange rates, the stock market, and the banking sector.

Unlike the preceding shocks in variables described above, IR is fairly stable after receiving a one standard error shock. As shown in figure 4, responses from GDP and XR are almost close to the steady-state. The major change, however, is observed in SD and BD, which are respectively below and above the steady-state. It is possible that movement of financial resources between the stock market the banking sector is greatly influenced by interest rate shocks.

Lastly, in figure 5, the impulse responses of the variable are shown when EX is exposed to a similar shock. Initially, EX is destabilized but quickly returns to the study state. No such changes are observed in GDP and IR variables. On the other hand, the impact on banking and stock market are great, with both exhibiting responses below the steady state initially. However, SD moves above the steady-state just when XR approaches same. One may infer that managers of the economy keep a close watch on exchange rate movements, as seen under exchange rate-controlled economies.

Figure 1

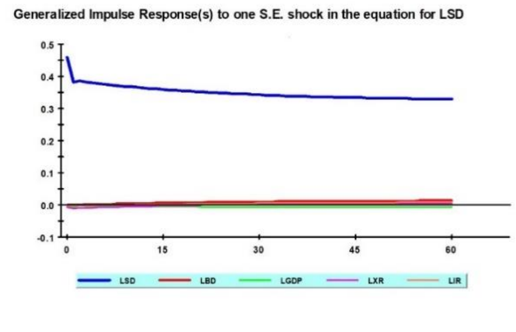


Figure 2

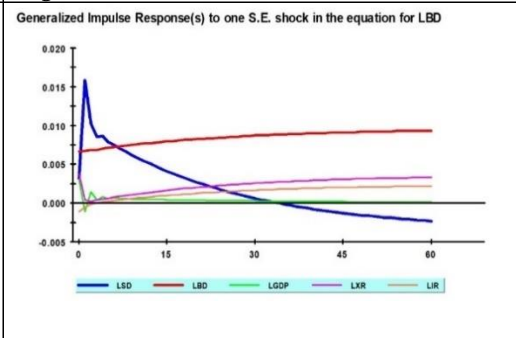


Figure 3

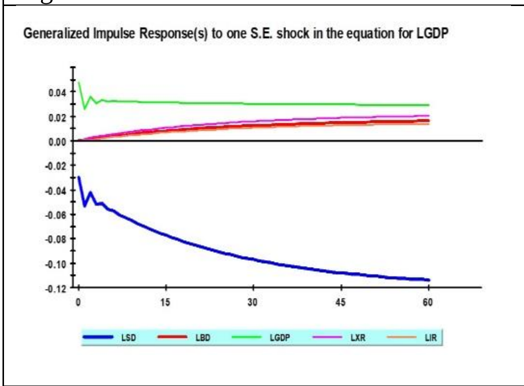


Figure 4

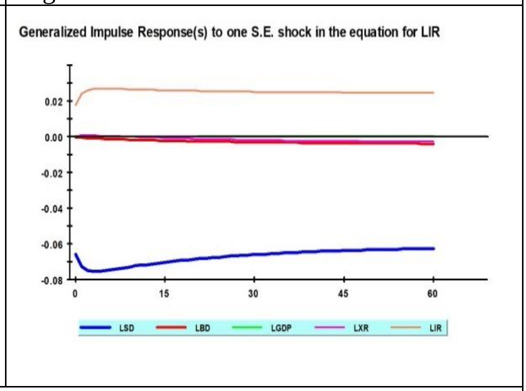
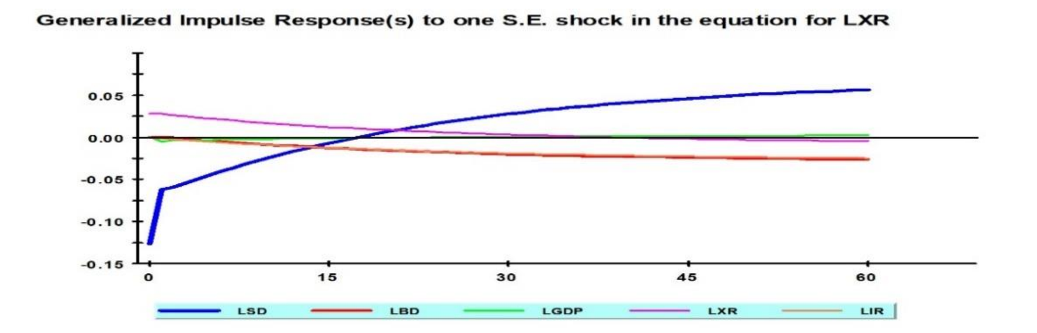


Figure 5



4.2. Persistence Profiles

The phenomenon of interest in persistence profile test is to observe how long it takes for the cointegrating variables to return to equilibrium after simultaneously receiving a system-wide shock (Masih, Al-Elg and Madani, 2009). This test is unlike in IRF because here, all the variables receive the shock together at the same time.

Figure 6

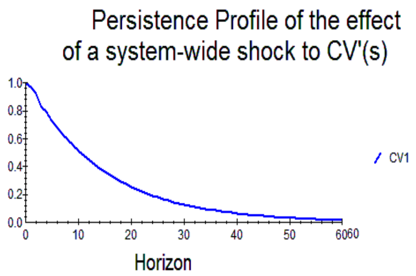
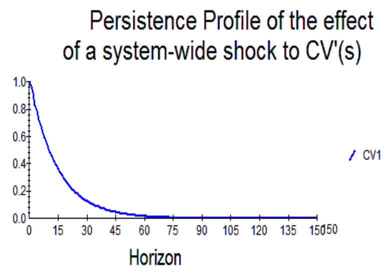


Figure 7



In other words, persistence profile measures the impact of a system-wide shock on the long run relationship. Such shocks are external in nature and may include financial crisis, political turmoil, oil price shocks, news or even war. Figures 6 and 7 both measure the persistence profile, but with Figure 7 having a longer horizon. The results show that on the average it would take about sixty (60) months for the variables to return to cointegrating equilibrium when they receive a system-wide shock.

5. CONCLUSION AND POLICY IMPLICATION

In this paper, the main objective is to investigate the causality between stock market and banking sector developments. Both financial sectors have unique roles in ensuring that an economy develops. Whiles many are of the view that their roles are complementary, others see them as opposing each other. Banks are efficient in mobilizing surplus financial resources and allocating such funds to individuals and firms that need them. On the other hand, stock markets are efficient in providing long-term funds, liquidity and risk-sharing avenues for firms and investors. It should, therefore, be in the interest of policy-makers that both sectors are performing well.

However, the exact understanding as to which sector, banking or stock market lead is yet to be known. In theory, the financial sector has mostly been considered as one unit, and only a few studies have focused on the relationship between banks and the stock market. Perhaps one would have thought that empirical work would have provided some solutions to this problem. Despite the small level of work done in this area, the results are conflicting. Some findings suggest no long-run relationship between them, but others find a stock market to be a leading banking sector development (Nieuwerburgh et al (2005), and Pradhan et al (2014)). Hence the motivation for this paper is to make a modest contribution to this field of knowledge. This paper contributes to the body of literature by being the first to conduct such work focusing mainly on one country that practices a dual banking system, Malaysia. Standard econometrics time series techniques have been employed to arrive at these findings;

1. Stock market development leads banking sector development, with economic growth sandwiched between them.
2. Stock market Granger causes economic growth, which in turn Granger causes banking sector development.

3. The “supply leading” and “demand following” hypothesis are both proven when the financial sector is split into the stock market and banking sectors. Hence economic growth leads banking but lags stock market.

Our findings have important implications for finance researchers, investors, regulators, policymakers and practitioners, as the progress of the finance industry continues around the world. In the field of development, economics has a great importance to understand the policy implications of the lead-lag relationship of stock market development and banking sector development with the impact of some selected macroeconomic variables (Cheng 2012; Boulila and Trabelsi, 2004). Our above-mentioned results lead to the following policy implications:
Policy-makers must realize that the two sectors of the financial system are different and so strategies towards their development must not be same. According to the findings, policy-makers seeking to develop the banking sector can do so by focusing attention on influencing (hitting) either stock market development or GDP, since both variables Granger-cause banking development. Moreover, in order to economic growth, attention must have to give the policies that promote banking sector development. We need to ensure an efficient allocation of financial resources together with sound regulation of the banking system. Definitely, a sound banking system helps to raise the confidence among the savers so that resources can be efficiently utilized to increase the productivity of the economy. Thus, the banking system should be simplified, and fees should be decreased so that greater number of population can enter in the bank. Hence, the banking products should be simplified and well diversified so that non-financial institution also can enter bank Marcelin and Mathur, (2014).

According to the result, to develop the stock market, they would have to hit either exchange rate or interest rate. To increase the productivity of the economy and to ensure the smooth-functioning of the financial system, a reliable and credible stock market system is indispensable Yartey, (2008). Adopting such a strategy would ensure that policy-makers use their resources judiciously.
As we see from the results, macroeconomic variables have an impact on the financial system of Malaysia, so the policy maker should be taking care of that. The exchange rate has a greater effect on Malaysian economy, so the policy-maker should control it. If exchange rate and the interest rate is promising that will help to attract foreign investors. Moreover, if foreign investment comes to the economy, the activities of the stock market and banks will increase and that will ultimately lead to economic growth Herwartz and Walle (2014).

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