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IS PUBLIC DEBT ASYMMETRICALLY LINK TO FINANCIAL DEVELOPMENT IN MALAYSIA?

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ABSTRACT

This study investigates the asymmetric effects of public debt on financial development in Malaysia. Employing time series data for the period of 1980-2015 and nonlinear Autoregressive Distributed Lags framework, this study found that public debt levels are significantly linked to financial development in both short-run and long-run. The findings also conclude the existence of asymmetry effects between public debt and the financial development, and higher debt levels discourage financial development. Domestic lenders are major financier of the public debt and if government continue to incur large borrowing domestically, it would likely to crowd-out private sector because of first, it is reducing the availability of credit to private sector; second, banks may prefer to provide credit to government over private sector due to lower risk premium; and third, leads to more expensive borrowing to private sector due to increasing demand for credit from the public sector.

Contribution/ Originality
This research provides some important findings on the public debt in Malaysia and its impact to financial development. First, we observe the existence of asymmetry effects in Malaysia public debt; second, public debt in Malaysia has a significant link with the financial development in both short-run and long-run; and third, higher public debt levels tend to hinder the financial development. This study intends to contribute in further developing the theory of public debt – financial development nexus, as it could benefit in closing the literature gap and enhancing the policy analysis.

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1. INTRODUCTION

Financial system is crucial in allocating financial resources effectively and efficiently to successfully transform a country to a higher value-added and higher income country. The financial system development becomes more prominent than ever in supporting for the success of economic transformation amid a highly challenging environment. However, when government increasingly secures funds from domestic banks to finance the budget, the space of financing private investments has been limited by the rising demand for credits from the public sector. This will lead to the possible hike in interest rate for private sector to secure loans from banks (Mok and Ismail, 2015; Dreger and Reimers, 2016) or an expectation of increase in taxes to finance the repayments (Bahal *et al.*, 2018). Both conditions also can affect financial development negatively in term of rising costs of investments and hence, crowd-out private sector investments, and then affect the financial stability.

Generally, the public debt to GDP ratio is a common benchmark for investors to measure a country's ability in repaying its debt. The levels of ratio can affect the country borrowing costs and government bond yields. Malaysia is in an average public debt to GDP ratio equivalents to 48.43 and was recorded 53.20 in 2016. About an average 70 percent of total public debt is funded by domestic borrowings (Figure 1).

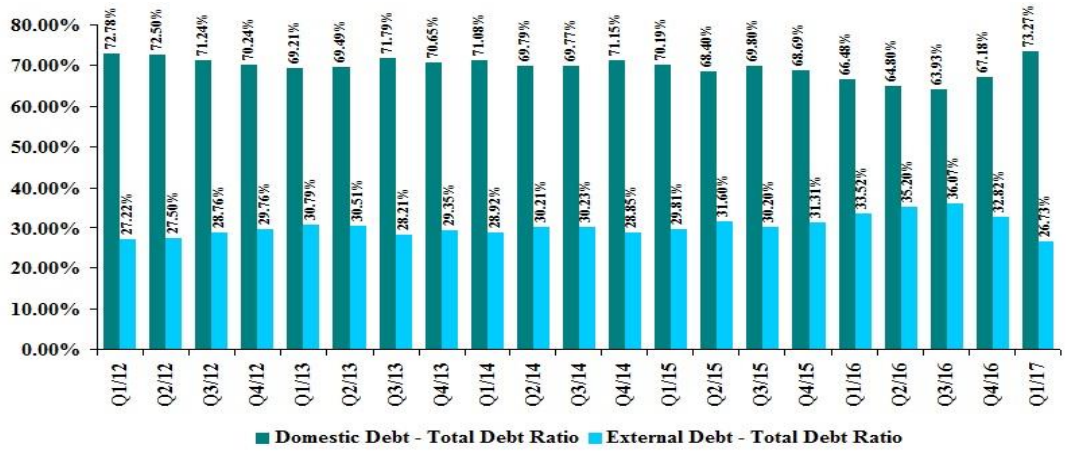

Figure 1: Public debt by domestic creditor vs. foreign creditor in Malaysia

Source: Based on data collected from Bank Negara, Malaysia

How public debt influences the financial sector in Malaysia? A key challenge is the Malaysian government increasingly prefers to borrow domestically. Large domestic savings in Malaysia allow the government to continue borrowing from banks and cushions government from currency risks by borrowing externally. This positive domestic public debt effect maybe is also due to the home bias effect, which is indeed, matters for public debt sustainability (Asonuma *et al.*, 2015) are crucial in safeguarding financial institutions' assets. Banks' home bias (domestic banks' preference in holding domestic public debt instruments than external public debt instruments) is may have played role in high domestic borrowing by the government as it reduces the exposure of domestic banks to the risks of foreign sovereign debt markets. Asonuma *et al.* (2015) found that home bias is positively associated with government domestic borrowing levels. Moreover, banks also see lend to the government allows them to increase their profit with low risk premium since government borrowing provides as a relatively safe asset (Hauner, 2009), especially government bonds can be safe collateral (Singh and Stella, 2012). But, Mismanagement in foreign currency denominated debt is dangerous, especially when compare to debt that denominated in a single home currency (Bordo and Meissner, 2006). This could also be one of the reasons for the Malaysian government to heavily considered

domestic sources of finance rather than external sources, especially since the debt crisis in mid-1980s and the financial crisis in 1997-98.

Given the rising levels of domestic public debt to GDP ratio, continue to increase government borrowing from the domestic banking sector might be critical for financial development. The discussion can be formed into meaningful addition to theoretical and empirical literature, particularly on the financial development analysis in Malaysia. Hence, the objective of this research is aims to quantify the relationship between public debt and financial development in Malaysia. More specifically, this research examines the possibility of asymmetric link between the public debt and financial development. The central findings of this study suggest the presence of asymmetry effects and public debt is harmful to financial development in Malaysia. A reduction in debt level allows banks to spare credits to finance more efficient private sector investment and stimulate growth. Although a higher rate of public debt provides additional incentive for banks to lend to the government at a lower risk premium. This can reduce the banks' willingness to finance the higher risk premium private sector and also leads to higher costs on borrowings.

Next section in this study is literature review. Then, follow by discussion on methodology and empirical framework. Then is empirical findings and final section is conclusion.

2. LITERATURE REVIEW

A large number of existing literatures have established the importance of financial development in economic growth (e.g., King and Levine, 1993; Levine, 1997; Arestis and Demetriades, 1997; Rajan and Zingales, 1998; Law and Singh, 2014) and many others examined the macroeconomic and institutional determinants of financial development (e.g., Levine, 1997, 1998; Beck, 2002; Claessens and Laeven, 2003; Rajan and Zingales, 2003; Ang, 2008; Law, 2009; Roe and Siegel, 2011; Law and Azman-Saini, 2012). In fact, there is insufficient research to study the effect of public debt on financial development. Public debt can have a positive effect on the profit of financial institutions (Hauner, 2009; Montes, 2013); anyhow, large public debt can also cause negative effect on bank efficiency and crowd-out private investments (Mok and Ismail, 2015). The relationship remains inconclusive yet several studies demonstrated it is harmful to financial development, for example Borensztein and Panizza (2008), Emran and Farazi (2009), Hauner (2009), Ismihan and Ozkan (2012), Ilgun (2016), etc. The effect is especially severe when the government fails to repay and chooses to default the debt. It could cause bank crises and credit crunches (Borensztein and Panizza, 2008). While Kumhof and Tanner (2005), Hauner (2009), Montes (2013) and Assoumou (2017) found they interact positively.

On the positive side, studies argue that the public debts (government bonds) provide security, high liquidity and a steady flow of profits that can strengthen the stability of the financial sector, i.e. Kumhof and Tanner (2005). Bank lending to government (as government bonds) can be considered as relatively predictable debt management and thus, can safeguard the banks' assets (Hauner, 2009; Dungey *et al.*, 2019). When banks have loaned large amount of savings to government, they possible to have better opportunity to safeguard their assets and relatively more profitable[1], and this tends to make banks increase the holding of government bond. The holding of government bonds allowed banks to offset the highly risky lending to the private sector. Borrowing to government also helps the banks to overcome the legal and institutional weakness by facilitating banks to use public debt as explicit collateral in repurchase agreements (Kumhof and Tanner, 2005). The availability of liquid

[1] Consider if the private loans are on average risk, the profitability should actually be higher on private loans and banks should be preferred to lend to private sector. Banks will only hold public debt to the extent that is useful to their operations. However, public debt is generally less risky than the private debt. If private loans are riskier, the lending rate will be higher because depositors will demand a risk premium from banks on riskier portfolios. Moreover, the administrative costs and taxes on the returns are often higher on private lending. Hence, the expected loss and costs of capital of private loans are also higher than public debt.

collateral plays a key role in developing a country's derivative markets as well as the payment and settlement systems (Hauner, 2009). Hence, keeping government debt is considered as safe investment for banks is critical in further improvements in financial development in developing countries. The holding of government bonds allowed banks to offset the much higher risks in private sector lending and also weak legal and institutional structure, especially in developing countries.

Public debt allows more savings to be utilized because government bonds can increase the depositors' willingness to intermediate their savings into investment in a generally risky market (Kumhof and Tanner, 2005). Lacking of a benchmark yield curve in the underdeveloped bond markets in developing countries cause the market harder in pricing the credit risks and equities (Kumhof & Tanner, 2005), and leading to difficulty in diversification of risk exposures due to the derivative markets are also underdeveloped. Government bonds in these countries can facilitate the development by providing good benchmark yield curve to facilitate the pricing of corporate bonds and equities (Reinhart and Sack, 2000; Hauner, 2009).

In contrast, when banks are forced to hold large public debt, this can result in a negative outcome. Trade-off in banking sector efficiency and crowding-out effect on private investment are some of the major arguments (Ilgun, 2016). Moreover, imperfect competition between government and firms, and information asymmetric between banks and government is possible consistent with the expectation of asymmetry effects of public debt (Lau *et al.*, 2019). Banks are usually powerless to reject government's borrowing under such condition and again. This has no incentive in developing deposit and private credit markets. Safeguarding and reliable profits from government borrowings could reduce the banks' incentives to enhance efficiency and become too complacent to actively develop the banking market. Moreover, government intervenes in the pricing and loanable funds of banks could depress real interest rates and cause insufficient savings. This could have a negative impact on the availability of credit and the productivity of investments (Demetriades and Luintel, 1997), and hamper the financial sector deepening (Hauner, 2009). Low bank efficiency could lead to an increase deadweight loss which could be harmful to financial development (Fry, 1995). Hence, development in banking system may progress slowly when banks are consistently holding large public debt. Moreover, when the public debts are under attacks in the financial markets, banks can be vulnerable for holding these debts as major assets on their balance sheets (Jorda *et al*., 2014).

Theoretical assumption relates the financial sector and government intervention is inadequately implied in the market structure. The role of financial institutions to channel savings to investments is usually assumed as at zero costs in a perfectly competitive market (Demetriades and Luintel, 1997). Such assumption limits the analysis on the behavior of banks following government interventions. The arrival of government in the market will violate the implication of perfect competition. Government involvement in the credit market can influence the marginal cost and revenue structure of banks and in turn, shift the supply of funds to the markets. Furthermore, rising demand for loans by agencies from the public sector could raise the interest rate and a higher interest rate reduces private investment (Ismihan and Ozkan, 2012). The financial system in developing countries is always described as underdeveloped. As when banks become major lenders to the government in developing countries, this reduces the incentive for banks to develop the financial market (Hauner, 2009).

Imperfect competition in a perfectly competitive market following government interventions implies information asymmetric issue. Government can regulate the borrowings to the private sector to avoid information asymmetric; borrowings to government can be another case. Lau *et al.* (2019) in their study have concluded the existence of asymmetry effects in Malaysian government public debt. In the case of financing government budget, banks may not always know as much as they would like to know about the government compares to the information can obtain the private borrowers. It could be particularly difficult and expensive for banks to get sufficient information they need to know

about government and hence, it could involve higher transaction costs in getting the sufficient information.

Financial institutions' high government debt holdings are generally intended to offset the credit risk in private credit. However, legal and institutional imperfections are critically important too. No one can enforce the government if it is imperfect institutional. Kumhof and Tanner (2005) found that the amount of government debt held in financial institutions has a very strong negative link to the quality of law and institutions. The safety of the public debt portfolio is a precondition to banks and thus, country public debt management prudence is crucial for the health of its financial system. One of the other concerns connecting to this issue is when public debt is high; the repayment of debt is a subject of discussion. The market holds no information access to the decision of government and the market may act on their own expectation. Moreover, in the case when the government has defaulted the debt, creditor has limited legal rights against the government because many public assets are protected from the legal action and claimant by the creditor (Borensztein and Panizza, 2008), different from debt by private sector which the creditor can have strong legal rights in an insolvency case.

3. METHODOLOGY

3.1. Theoretical framework

The financial sector consists of financial institutions, majorly banks which collect household savings to finance investment by firm. Following Lau *et al.* (2019), assume that the investment in real physical capital stock, *K* is only financed through banks. In a competitive market with n banks, banks are competing among each other for household savings (deposit market) and lending for investments (credit market). In the competition for deposits, total n banks are competing in the market to maximize their profit and they faced with a saving supply function that is elastic with respect to the interest rate. The current savings that has intermediated to investment in *K* by bank- i is:

$$K_i = \varphi_i \ . \ S_i \qquad \text{..... (1)}$$

where K_i is the total quantity of resources being loaned by bank- i for investments and S_i is current savings that has deposited to the bank- i. φ_i represents the fraction of loanable S_i and $0 < \varphi_i \leq 1$. Obviously, $(1-\varphi_i)$ can be considered as statutory reserve imposed by the monetary authority on bank- i and it can affect the eligible amount of savings that bank- i can channel to investments.

Suppose the output of banks is following the Cobb-Douglas form of production function, the standard constant returns to scale production function of bank- i can be written as the following:

$$Q_i = f(\varphi_i.S_i) = A(\varphi_i.S_i)^{\alpha} \qquad \text{..... (2)}$$

where $0 < \alpha < 1$. Equation (2) allows for substitutability among the inputs. The first order condition:

$$MP_s = \frac{\partial Q_i}{\partial S_i} = \alpha\left[A(\varphi_i.S_i)^{\alpha-1}\right] \qquad \text{..... (3)}$$

Assume the relative price of capital in term of consumption is assumed to be unity. When the market is perfectly competitive and in absent of asymmetric information, banks have no way to influence the interest rate in credit market, which implies that banks' lending profit is depend on the volume of loanable savings and total loaned savings. Hence, the lending profit of bank- i in a competitive market can be expressed by the following condition:

$$\pi_i = r_L . Q_i - r_D . S_i \qquad \text{..... (4)}$$

where r_D is interest rate paid by banks on household savings and r_L is the real rental price or interest rate imposed on capital by banks for non-financial sector firms in the market to acquire capital from banks. The long-term objective is to maximize the lending profit and hence, the profit maximization level condition is given by:

$$r_L . \frac{\partial Q_i}{\partial S_i} - r_D = 0 \Rightarrow r_L . \alpha \left[A(\varphi_i . S_i)^{\alpha - 1} \right] = r_D \qquad \text{..... (5)}$$

Literally, profit of banks is maximized when $r_L . \frac{\partial Q_i}{\partial S_i}$ is equal to interest rate paid for savers to deposit their money in the banks, r_D. However, the quantity of resources allocated by bank-i into the market is not only being available to businesses; it is also possible a source of credits for public sector. Hence, Equation (1) can also be expressed as:

$$I_i + \phi_i . B = \varphi_i . S_i \qquad \text{..... (6)}$$

where I_i represents the fraction of capital loaned for firms investments, B is government budget and $\phi_i . B$ is the proportion of the budget that government borrowed from bank-i. Assume there is no discrimination of interest rate in the credit market and thus, both private firms and public sector are paying the same cost in acquiring capital from banks. The current net revenue of bank-i from lending to firms and government less costs of borrowing from savers or the current profit from lending of is bank-i:

$$\pi_i = r_L . f(I_i, [\phi_i . B]) - r_D . S_i \qquad \text{..... (7)}$$

In this equation, $\phi_i . B$ is the public debt that is held by bank-i. Denoting by $D_i = \phi_i . B$, the level of public debt in bank-i, the lending profit is:

$$\pi_i = r_L . \left[A(I_i + D_i)^{\alpha} \right] - r_D . S_i \qquad \text{..... (8)}$$

And the profit maximization level condition with the presentation of public debt is:

$$r_L . \alpha \left[A(I_i + D_i)^{\alpha - 1} \right] = r_D \qquad \text{..... (9)}$$

Equation (8) and (9) are displayed that public debt is a factor as well as elasticity parameter to the profit and profit maximization condition of banks.

3.2. Empirical framework

The long-run model is specified as below:

$$FD_t = \alpha_0 + \alpha_1 Debt_t + \alpha_2 X_t + \varepsilon_t \qquad \text{..... (10)}$$

Where *FD* denotes financial development, *Debt* is public debt, X_t is a vector of other macroeconomic variables namely real gross domestic product (*GDP*) and interest rate, and, α are the long-run parameters, and ε is the error term. This is a time series study covers Malaysian data from 1980 to

2015. The dependent variable, financial development is measured by three different proxies, private credit as a share of GDP, broad money as a share of GDP and financial institutions efficiency index.

Public debt is also measured in three different types: first, total government debt as a share of GDP as measurement for total public debt; second, total external debt as a share of GDP measures public debt by foreign creditor; and third, total domestic debt as a share of GDP is the proxy for public debt by domestic creditor. The influence of public debt on financial development still was less investigated in existing literature. Moreover, the previous researches on the relevant scope are done by means of conventional econometric and the estimation techniques, nevertheless, is restricted to the symmetric assumption even macroeconomic variables could display an asymmetric relation.

Due to the assumption of imperfect competition and information asymmetric, it is possible asymmetric effects of public debt on financial development. Therefore, allowing for asymmetric modeling will be more appropriate and consequently improving the test power. Two control variables are real gross domestic product (real GDP) and interest rate. Real GDP is a common measurement for economic development. Interest rate is measured by the real deposit interest rate, a rate that paid for individuals or corporations on deposits by commercial banks.

This study applies the nonlinear Autoregressive Distributed Lags (NARDL) suggested by Shin *et al.* (2014) to examine the existence of asymmetric relationship between financial development and public debt. Consider the following asymmetric long-run relationship model:

$$FD_t = \alpha_0 + \alpha_1^+ Debt_t^+ + \alpha_1^- Debt_t^- + \alpha_2 X_t + \varepsilon_t \quad \text{..... (11)}$$

$Debt$ in Equation (11) is decomposed into $Debt^+$ and $Debt^-$, represent partial sum of increases and decreases in public debt as:

$$Debt_t^+ = \sum_{j=1}^{t} \Delta Debt_j^+ = \sum_{j=1}^{t} \max(\Delta Debt_j, 0) \quad \text{..... (12)}$$

and

$$Debt_t^- = \sum_{j=1}^{t} \Delta Debt_j^- = \sum_{j=1}^{t} \min(\Delta Debt_j, 0) \quad \text{..... (13)}$$

To capture the short-run and long-run asymmetries, both partial sums of positive and negative are included into the standard ARDL model. Hence, the NARDL model is formulated as below:

$$\Delta FD_t = \gamma_0 + \gamma_1 FD_{t-1} + \beta_1^+ Debt_{t-1}^+ + \beta_1^- Debt_{t-1}^- + \beta_2 X_{t-1} + \sum_{i=1}^{p} \eta_i \Delta FD_{t-1} + \sum_{i=0}^{q} (\theta_i^+ \Delta Debt_{t-1}^+ + \theta_i^- \Delta Debt_{t-i}^-) + \sum_{i=0}^{r} \phi_i \Delta X_{t-1} + \varepsilon_t \quad \text{..... (14)}$$

where p, q, and r are lag orders for dependent and exogenous independent variables. First, by using the Wald F test, this study tests a long-run relation among the variables with null hypothesis $\gamma_1 = \beta_1^+ = \beta_1^- = \beta_2 = 0$ (Pesaran *et al.*, 2001). In the presence of long-run relation, short-run and long-run asymmetries will be examined. The null hypothesis for long run asymmetry is $\beta_1^+ = \beta_1^-$ while the long-run coefficients are $\alpha_1^+ = -\beta_1^+ / \gamma_1$ and $\alpha_1^- = -\beta_1^- / \gamma_1$ respectively. In addition, the short-run adjustment for a positive and a negative shock in public debt is captured by $\sum_{i=0}^{q} \theta_i^+$ and $\sum_{i=0}^{q} \theta_i^-$. Hence, for the short-run asymmetry, the null hypothesis is $\sum_{i=0}^{q} \theta_i^+ = \sum_{i=0}^{q} \theta_i^-$. If both the short-run and long-run symmetries are not rejected, then Equation (14) will become symmetric ARDL as below:

$$\Delta FD_t = \gamma_0 + \gamma_1 FD_{t-1} + \beta_1 Debt_{t-1} + \beta_2 X_{t-1} + \sum_{i=1}^{p} \eta_i \Delta FD_{t-1} + \sum_{i=0}^{q} \theta_i \Delta Debt_{t-1} + \sum_{i=0}^{r} \phi_i \Delta X_{t-1} + \varepsilon_t \quad \text{..... (15)}$$

If either only the short-run symmetry is rejected or only the long-run symmetry is rejected; NARDL model is then be specified as:

$$\Delta FD_t = \gamma_0 + \gamma_1 FD_{t-1} + \beta_1 Debt_{t-1} + \beta_2 X_{t-1} + \sum_{i=1}^{p} \eta_i \Delta FD_{t-1} + \sum_{i=0}^{q} (\theta_i^{+} \Delta Debt_{t-1}^{+} + \theta_i^{-} \Delta Debt_{t-1}^{-}) + \sum_{i=0}^{r} \phi_i \Delta X_{t-1} + \varepsilon_t \quad \text{..... (16)}$$

$$\Delta FD_t = \gamma_0 + \gamma_1 FD_{t-1} + \beta_1^{+} Debt_{t-1}^{+} + \beta_1^{-} Debt_{t-1}^{-} + \beta_2 X_{t-1} + \sum_{i=1}^{p} \eta_i \Delta FD_{t-1} + \sum_{i=0}^{q} \theta_i \Delta Debt_{t-1} + \sum_{i=0}^{r} \phi_i \Delta X_{t-1} + \varepsilon_t \quad \text{..... (17)}$$

where Equation (16) represents there is short-run asymmetric and Equation (17) suggests the existence of long-run asymmetric. The asymmetric responses of FD to positive and negative variations of $Debt$ (positive and negative shocks) are captured by the positive and negative multipliers respectively as follows:

$$m_h^{+} = \sum_{j=0}^{h} \frac{\partial FD_{t+j}}{\partial Debt_t^{+}},\ m_h^{-} = \sum_{j=0}^{h} \frac{\partial FD_{t+j}}{\partial Debt_t^{-}},\ h=0, 1, 2, \ldots \quad \text{..... (18)}$$

Note that as $h \to \infty, m_h^{+} \to \alpha_1^{+},\ m_h^{-} = \alpha_1^{-}$, which are the asymmetric long-run coefficients.

3.3. Data and variables

All data are sourced from Bank Negara Malaysia (BNM), Department of Statistics Malaysia (DoS) and Economic Planning Unit of Malaysia (EPU), World Development Indicators (WDI) of World Bank and International Financial Statistics (IFS) of International Monetary Fund (IMF). The data have been expressed in natural logarithm term for the estimation. Table 1 is descriptive statistics. The statistics suggest that public debt by domestic creditor, which is more than two times the public debt by foreign creditor in the average, remains as the largest proportion of Malaysia's total public debt. Its variation is also higher compared to the public debt by foreign creditor.

Table 1: Descriptive statistics of variables

Variable	N	Mean	SD	Max.	Min.
Private Credit as Share of GDP	36	99.526	25.295	155.248	42.715
Broad Money as Share of GDP	36	118.947	19.803	140.761	64.377
Financial Institutions Efficiency Index	36	0.668	0.146	0.855	0.263
Total Public Debt	36	41.839	12.682	69.380	17.530
Public Debt by Domestic Creditor	36	28.819	12.787	57.306	12.600
Public Debt by Foreign Creditor	36	13.020	4.094	22.656	4.929
Real Deposit Interest Rate	36	2.087	2.132	8.466	-2.315
GDP (mil.)	36	496925.4	276249.1	1062810.0	147438.4

4. EMPIRICAL RESULTS

The NARDL estimation starts with unit root tests. Then, employs standard ordinary least squared (OLS) on Equation (14) with the general-to-specific approaches to trim the model. Next, tests the

significance of cointegration relationship in the trimmed model with Wald F test. And finally, examines both long-run and short-run asymmetry in the cointegrated model. Table 2 is the unit root tests results generated by augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) test to test the unit root. The results demonstrate that financial development proxies, public debt measurements and GDP are I(1). While real deposit interest rate is I(0) and there is no I(2) variable. The results find that all variables are stationary and integrated of order 1, and valid for the bounds test.

Table 2: Results of ADF and PP unit root tests

Variable	Augmented Dickey-Fuller		Phillips-Perron	
	I(0)	I(1)	I(0)	I(1)
Private Credit as Share of GDP	-2.588	-4.520***	-2.593	-4.539***
Broad Money as Share of GDP	0.449	-5.661***	0.746	-6.472***
Financial Institutions Efficiency Index	-0.122	-3.024***	0.533	-2.992***
Total Public Debt	-1.541	-3.180**	-2.227	-3.067**
Public Debt by Domestic Creditor	-0.962	-3.651**	-1.564	-3.634**
Public Debt by Foreign Creditor	-3.705**	-4.180**	-3.585**	-4.196**
GDP	-1.251	-4.785***	-1.410	-4.785***
Real Deposit Interest Rate	-4.009**	-6.126***	-4.012**	-6.179***

Notes: *, **, and *** denote significance at 10%, 5%, and 1% respectively

The bounds Wald F test and a diagnostic test are present in Table 3. This study employed general-to-specific approach to trim the insignificant lags from the model before bounds testing procedure. The results of the maximum lag order are as showed in table. Both private credit as share of GDP and broad money as a share of GDP are cointegrated with for all three measures of public debt in the long run. While the third indicator, the financial institutions efficiency index is found to have co-movement only with public debt by domestic creditor in the long run. Selected models also do not suffer from the autocorreation and heteroscedasiticy problem, and all are meet the normality assumption.

Table 3: Results of Bound tests and diagnostic tests

	Total Public Debt	Public Debt by Domestic Creditor	Public Debt by Foreign Creditor
Private Credit as Share of GDP			
Lags	2	2	3
Bounds Test			
W_{test}	17.455***	6.285***	9.831***
Diagnostic Tests			
χ^2_{SC}	1.020	4.510	1.147
χ^2_{HET}	9.493	6.371	20.739
χ^2_{NOR}	3.986	3.668	0.097
Broad Money as Share of GDP			
Lags	3	2	4
Bounds Test			
W_{test}	10.723***	7.896***	19.913***
Diagnostic Tests			
χ^2_{SC}	2.252	1.410	27.338
χ^2_{HET}	23.20	16.585	28.286
χ^2_{NOR}	0.334	0.559	18.300
Financial Institutions Efficiency Index			
Lags	-	3	-
Bounds Test			
W_{test}	-	7.546***	-

Diagnostic Tests			
χ^2_{SC}	-	3.945	-
χ^2_{HET}	-	22.984	-
χ^2_{NOR}	-	0.919	-

Notes: *, **, and *** denote significance at 10%, 5%, and 1% respectively. W_{test} indicates Wald test for cointegration, and the critical values are obtained from Narayan (2005) Case III for k = 4, n = 37:1% (4.428, 6.250), 5% (3.202, 4.544), and 10% (2.660, 3.838). $\chi^2_{SC,}$ $\chi^2_{HET,}$ and χ^2_{NOR} denote serial correlation, heteroscedasticity, and normality of error terms. Table 3 only reports the valid models

Table 4 shows the Wald F test results and long run estimation for both short run (W_{SR}) and long-run (W_{LR}) asymmetries to indicate the existence of asymmetric model, and Table 5 presents the short-run estimation on Equation (14). As for long run, statistically significant WLR results for private credit and broad money suggest that these financial development proxies are responded asymmetrically to changes in all three public debt measurements in the long-run. While financial institution efficiency only found to have statistically significant asymmetrical respond with public debt by domestic creditor. While for short-run, the WSR results for all, except the cases of private credit-public debt by foreign creditor and broad money-public debt by domestic creditor, are also significantly rejects the null hypothesis of short-run symmetry. In sum, this paper concludes that short-run and long run asymmetries are existed in most of the cases, concludes the asymmetrically link between public debt and financial development in Malaysia, the findings are consistent with Lau *et al.* (2019).

From the above tables, we noticed that the long run coefficient associated with positive changes of debt ($debt^+$) is positive and insignificant, while the long run coefficient associated with negative changes of debt ($debt^-$) is negative and significant. The magnitude of $debt^-$ is also larger than $debt^+$. These conditions imply that reduces in debt could strengthen the private credit, as well as private credit is more responsive to the reducing debt. Therefore, a lower debt is better for private credit. For broad money as a share of GDP (broad money), it displays some similarity to private credit in term of the magnitude and sign: in the long-run, it improves when debt increases, it hurts financial development; when debt decreases, and it boost financial development. The results also suggest that changes in broad money are more response to the decreasing debt. While for public debt by foreign creditor (external public debt), the results suggest that the short-run and long-run asymmetry effects are taken for a longer period and the signs of both changes of debt (debt+ and debt-) are negative. These, suggest that, rising at the rate of public debt by foreign creditor could hinder financial development.

Overall, government borrowing (public debt) in Malaysia is found to have negative impact on financial development. This negative link outcome is also consistent with studies including Bordo and Meissner (2006), Hauner (2009), Ismihan and Ozkan (2012), Mok and Ismail (2015) and Ilgun (2016). The findings suggest that the government continues to borrow domestically could cause diminishing effect to financial development. When domestic lenders are major creditor to the government and if the government continues to incur large borrowing domestically, it could be likely to crowd out private sector in three ways. First, it is reducing the availability of credit to private sector; second, banks may prefer government sector over the private sector due to lower risk premium; and third, leads to more expensive borrowing to the private sector due to increasing demand for credit from the government. Higher public debt by domestic creditor crowding out the size of credit resources to private sector which is crucial for economic activities and resources efficiency. As such, a reduction in debt level allows banks to divert more credit resources to the private sector to finance investment and stimulating economic activities; increase in the efficiency of resources allocation. With higher bank efficiency, it tends to reduce dead weight loss (DWL) and encourages financial development.

Table 4: Results of long-run asymmetry and short-run asymmetry test

	Total Public Debt	Public Debt by Domestic Creditor	Public Debt by Foreign Creditor
Private Credit as Share of GDP			
Lags	2	2	3
Long-run Asymmetry			
Public $Debt^{+}_{t-1}$	0.575	0.159	0.019
Public $Debt^{-}_{t-1}$	-1.636*	-0.878**	0.053**
W_{LR}	3.978*	3.318*	10.810***
Short-run Asymmetry			
W_{SR}	21.747***	11.392***	0.056
Broad Money as Share of GDP			
Lags	3	2	4
Long-run Asymmetry			
Public $Debt^{+}_{t-1}$	0.702*	-0.701**	-0.095**
Public $Debt^{-}_{t-1}$	-1.618**	0.940	-0.072**
W_{LR}	5.338**	3.003*	21.692**
Short-run Asymmetry			
W_{SR}	8.383**	0.539	24.968**
Financial Institutions Efficiency Index			
Lags	-	3	-
Long-run Asymmetry			
Public $Debt^{+}_{t-1}$	-	1.501***	-
Public $Debt^{-}_{t-1}$	-	-2.557***	-
W_{LR}	-	19.988***	-
Short-run Asymmetry			
W_{SR}	-	6.159**	-

Notes: *, **, and *** denote significance at 10%, 5%, and 1% respectively. W_{LR} and W_{SR} indicate Wald test for cointegration, long-run asymmetry and short-run asymmetry respectively., and the critical values are obtained from Narayan (2005) Case III for k = 4, n = 37:1% (4.428, 6.250), 5% (3.202, 4.544), and 10% (2.660, 3.838). Table 4 only reports the valid models

Table 5: Results of NARDL estimation

	Total Public Debt		Public Debt by Domestic Creditor			Public Debt by Foreign Creditor	
	Private Credit	Broad Money	Private Credit	Broad Money	Efficiency Index	Private Credit	Broad Money
Lag	2	3	2	2	3	3	4
FD_{t-1}	-0.266***	-1.148***	-0.603***	-0.814***	-0.476***	-0.667***	-3.773***
Public $Debt^{+}_{t-1}$	0.153	0.806*	0.096	-0.571**	0.715***	0.013	-0.361**
Public $Debt^{-}_{t-1}$	-0.435*	-1.858**	-0.530	0.766	-1.219***	0.035**	-0.274**
GDP_{t-1}	0.041	-1.025	-0.033	1.957***	-1.979***	1.021***	3.142***
RDR_{t-1}	0.082***	0.177***	-0.058***	0.093***	-0.030***	0.100***	0.209**
ΔFD_{t-1}					-0.471*	0.204	2.475***
ΔFD_{t-2}							1.737***
ΔFD_{t-3}							1.462***
ΔFD_{t-4}							0.700**
Δ Public $Debt^{+}$	0.925***	3.271***			0.539***	-0.061**	-0.443**
Δ Public $Debt^{+}_{t-1}$	0.451*	1.360**		1.350***	-0.586**		0.256***
Δ Public $Debt^{+}_{t-2}$	0.320	1.065			-0.309		0.378***
Δ Public $Debt^{+}_{t-3}$		0.984*					0.223**

Δ Public Debt$^{+}_{t-4}$							0.266**
Δ Public Debt^{-}	-3.087***	-4.922***	-2.255***	-2.591**	-1.336*		-0.171
Δ Public Debt$^{-}_{t-1}$	-0.641			2.095	1.556	-0.055***	0.312***
Δ Public Debt$^{-}_{t-2}$	1.280***	3.251***		2.690*			0.376***
Δ Public Debt$^{-}_{t-3}$		2.097			-1.942***		0.262**
Δ Public Debt$^{-}_{t-4}$							0.206**
ΔGDP			-1.209***			-0.515	
ΔGDP_{t-1}	0.874*	2.911**			1.038**		-2.435**
ΔGDP_{t-2}	0.735*	3.354**			1.014**		-1.217*
ΔGDP_{t-3}		3.490**			0.439		-0.899
ΔGDP_{t-4}		2.554**					
ΔRDR	0.033***		0.020**			0.063***	0.246**
ΔRDR_{t-1}	-0.030***	-0.137***	-0.028***	-0.068***	0.033***	-0.055***	-0.266***
ΔRDR_{t-2}		-0.060**	-0.014*	-0.025*	0.014**	-0.039***	-0.318***
ΔRDR_{t-3}						-0.016**	-0.176**
ΔRDR_{t-4}							-0.199**
Constant	0.052	12.549	2.689	-14.795**	18.659***	-7.026***	-10.954**

Notes: *, **, and *** denote significance at 10%, 5%, and 1% respectively. FD denotes financial development, the dependent variable; Debt indicates the variable of interest, the public debt; RDR is the sign of real deposit rate. Table 5 only reports the valid models

5. CONCLUSION

This study intends to examine the relationship between public debt and financial development in Malaysia. Specifically, this study aims determine whether there is existence of asymmetric effect in the relationship. Government increasingly prefers to borrow domestically would be challenging to Malaysian financial development. Rising levels of domestic public debt level might be critical for financial development despite domestic sources can cushion government from the currency risks – lending to the government allowed banks to offset the risk of lending to private sector and risk of foreign exchange. However, this could also reduce the banks' incentives to enhance efficiency and be harmful to financial development. Applied time series data and nonlinear Autoregressive Distributed Lags (NARDL) framework, this study found that financial development and government debt have significant cointegrating relationship and concludes that higher public debt has a negative effect on financial development in short-run and long-run. The results are also present evidence suggesting the existence of asymmetry effects. Overall, the findings of this study suggest that reducing in public debt levels is better for financial development. Despite banks keeping of public debt as a safe investment is critical to the financial development as this allows banks to offset the much higher risks in private sector lending. So, stable public debt can act as a pillar to support the development of financial market. However, if the domestic lenders mainly focus on the government and if government continues to incur large borrowing domestically, it may diminish the financial sector deepening and may actually delay the serious issues until the debt levels have reached dangerously high levels. It would be very beneficial for researchers to further develop the theory of public debt – financial development nexus, as this would contribute greatly to close the gap and enhance the policy analysis.

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