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Determinants of Government Debt in ASEAN-5 Nations: An ARDL Analysis of Economic Factors

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ABSTRACT: In the context of the global health crisis and economic downturn, ASEAN nations experienced a significant rise in public debt, highlighting the need to examine key economic determinants for sustainable debt management. This study investigates the impact of budget balance, real interest rate, current account balance, and GDP growth on public debt in ASEAN-5 countries (Indonesia, Malaysia, the Philippines, Singapore, and Thailand) from 1990 to 2021. Using the ARDL model, the findings suggest that, except for Indonesia and Singapore, budget balance has a negative correlation with public debt in both the short and long run, while real interest rates exhibit a significant positive long-run relationship across all countries. The current account balance shows a significant positive relationship with public debt in Indonesia and the Philippines, whereas GDP growth reveals a positive long-run impact only in Singapore, with other countries showing a negative impact. In the short run, budget balance and interest rates have more immediate effects, while GDP growth and current account balances show delayed impacts, becoming more significant in the long run. Policy implications suggest that maintaining budget discipline and managing interest rates are key strategies for controlling debt, though country-specific approaches are necessary given the mixed effects of GDP growth and current account balances. The study acknowledges limitations such as data gaps and the exclusion of variables like inflation and exchange rates, which may affect the generalizability of the results across different economic conditions.

Keywords: public debt, budget balance, real interest rate, current account balance, GDP growth, ASEAN-5.

I. INTRODUCTION

In recent years, rising debt levels have become a concerning issue in the world. Debt has always been a hot and famous topic as it is always debatable in any global scenario due to its significant impact on the economy. Debt is one of the key elements in the economy as it helps speed up the economic growth of a country and also improves people's standard of living. However, according to the United Nations Secretary-General António Guterres [1], the debt issue has come to a critical point as in 2022, the global debt has reached an all-time high with a record of $29 trillion. This number has experienced a five-fold surge since the year 2000. The dramatic increase in debt levels has revealed how significant the governments of the countries are in accumulating this debt over this period.

In particular, developing countries are the ones that are facing the brunt of this crisis. They are more vulnerable to the impact of debt as debt is one of the crucial ways to increase a country's access to resources. However, such action might bring negative consequences such as leading the countries into the burden of repaying debt and risk of default, weakening currency and economic instability. Therefore, policymakers in developing countries need to be cautious as they play the key role in leading their country into the developed country or the abyss. Thus, it is also important to correctly determine and identify economic factors that impact the government debt in the country as it helps the government to manage debt and avoid debt crises.

Over the past 4 decades, the Association of Southeast Asian Nations (ASEAN) has achieved remarkable economic growth. From the 1970s to 1995, the average annual GDP growth rate of ASEAN countries was 6.6%,

which was higher than the average growth rate of other emerging nations which was about 3%. Remarkably, this expansion continued despite major international economic setbacks, such as the fall of the Bretton Woods system and the world recessions that struck in the early 1980s and early 1990s [2]. On top of that, ASEAN demonstrated resilience with a growth rate of 6% in 2000 after the Asian financial crisis. The regional economy sustained steady growth from 2000 to 2019, showcasing an impressive average annual growth rate of 5.7%. Today, ASEAN has become the third-largest regional economy in Asia and the fifth-biggest economy in the world [3].

However, with such a stronghold of economic growth and market, ASEAN also encounters such issues. According to [4], central government debt is one of the highlighted issues among the ASEAN countries as some of them were at risk of debt distress. Several factors have led ASEAN countries into such a position. During the financial crisis in 1997-1998, a sharp increase in government debts by the ASEAN government was a result of huge borrowing to bail out their financial and banking institutions [5]. Moreover, the global financial crisis of 2008-2009 led to an increase in government debt as the government increased its borrowing to stimulate economic growth. During the COVID-19 pandemic, ASEAN countries faced a large negative fiscal balance as the crisis reduced government revenues and at the same time increased government expenditure. According to [6], the average budget deficit of ASEAN-5 countries has increased from -2.22 in 2019 to -7.44% in 2020.

From a theoretical perspective, Keynesian fiscal policy theory acknowledges the importance of government engagement in fiscal policies which involve large-scale spending and borrowing in mitigating economic downturns. Its belief in the budget deficit would have a positive impact towards government debts as it will outweigh the negative impact in the short run. Furthermore, Keynesians also recognize the prominence of monetary policy in influencing the government debt levels in short-term effects. However, this viewpoint is debatable when contrasted with Neoclassical economic theory. The primary emphasis of neoclassical economics is on restrained government intervention and budget restraint. Neoclassicals contend that the greatest way to ensure the sustainability of government debt is to keep deficits to a minimum and a balanced budget over the long run.

Thus, in recent years, rising debt levels have become a critical issue for ASEAN-5 countries (Malaysia, Thailand, Indonesia, the Philippines, and Singapore), particularly in light of major economic disruptions such as the Asian financial crisis, the global financial crisis, and the COVID-19 pandemic. These countries, despite their impressive economic growth over the past four decades, face increasing vulnerabilities tied to government debt. This study addresses a key gap in the literature by focusing on the economic determinants of government debt in these nations, specifically examining the roles of budget balance, real interest rate, current account balance, and GDP growth from 1980 to 2022. While much of the existing research discusses global debt dynamics, there is limited analysis specific to ASEAN-5, especially regarding how these macroeconomic variables interact to shape debt outcomes. By applying the ARDL model, this paper contributes to the literature by providing insights into both short-run and long-run debt determinants in these countries. Understanding these relationships is crucial for policymakers as they seek to implement effective fiscal and monetary strategies to manage public debt and avoid debt crises. This study aims to fill the research gap by offering a focused examination of the factors that most significantly influence government debt in ASEAN-5, which can serve as a guide for more targeted and region-specific economic policymaking.

The remaining paper is organized as follows. Section 2 reviews both theoretical and empirical studies on central government debt, budget balance, real interest rate, current account balance and Gross Domestic Product (GDP) growth while the research framework, methods, and hypotheses are all discussed in section 3. Section 4 explains the results and findings and section 5 concludes the paper.

II. THEORETICAL REVIEW

1. KEYNESIAN THEORY

Keynesian economics, developed by John Maynard Keynes during the Great Depression, emphasizes the importance of aggregate demand in influencing economic output, employment, and inflation. According to Keynesian theory, government intervention is crucial, especially during economic downturns, to stimulate demand through fiscal policies like increased government spending [7]. This is directly related to the budget balance: Keynesians argue that during recessions, governments should run budget deficits by spending more than they collect in taxes to revive economic activity. However, these deficits, often financed by borrowing, result in increased public debt [8]. The theory suggests that such deficits are justified if they lead to higher GDP growth in the future. Nonetheless, persistent deficits increase the debt-to-GDP ratio, which indicates how much

the country owes relative to its economic output. Historical successes in government intervention during wartime, for instance, have demonstrated how a temporary rise in public debt can lead to economic recovery, but this must be balanced carefully to avoid unsustainable debt accumulation [9]. The Keynesian approach highlights that budget deficits are necessary to boost economic activity but can lead to long-term debt sustainability issues if not managed properly.

2. FISHERIAN THEORY

Fisherian theory was developed by Irving Fisher in the early 20th century. The Fisher (1930) shows the formula of the real interest rate.

$$r = i - \pi \qquad (1)$$

Where, r = Real interest rate, i = Nominal interest rate, π = Expected inflation rate.

This theory suggests that fluctuations in the real interest rate significantly influence borrowing costs [10]. When the real interest rate increases (due to nominal interest rates exceeding inflation), borrowing becomes more expensive. For governments, this means higher interest payments on both new and existing debt, which can worsen the budget balance by increasing the burden of servicing public debt. A rise in real interest rates often leads to a larger portion of government revenue being allocated to interest payments, leading to more borrowing and a higher debt-to-GDP ratio [11]. Fisher's theory underscores the positive relationship between rising real interest rates and public debt, showing how inflation control and interest rate policies can directly impact a nation's debt levels [12]. In economies with high real interest rates, governments face increasing difficulty in maintaining debt sustainability.

3. MERCANTILISM

Mercantilism, an economic theory dominant in the 16th to 18th centuries, focuses on the accumulation of wealth through a trade surplus—where exports exceed imports. This is directly tied to the current account balance. In this view, maintaining a current account surplus (more exports than imports) leads to greater wealth accumulation and reduces the need for external borrowing [13]. Conversely, a current account deficit can result in rising public debt as countries borrow from abroad to finance their import needs. Mercantilist theory suggests that countries with consistent trade surpluses are less likely to rely on external debt, whereas those with trade deficits are more vulnerable to debt accumulation. Thus, there is a negative relationship between the current account balance and public debt: countries running surpluses (like China and Germany) typically manage lower public debt levels, while deficit countries are more prone to debt distress [14].

4. DEBT SUSTAINABILITY FRAMEWORK

The Debt Sustainability Framework (DSF) assesses external debt sustainability, particularly in low-income countries, by focusing on their capacity to meet future debt obligations without resorting to debt relief or default. A key element of this framework is the relationship between GDP growth and debt. According to the DSF, higher GDP growth facilitates debt management by increasing government revenues (through taxation) and reducing the relative burden of debt [15]. As GDP grows, a country's debt-to-GDP ratio naturally declines, making it easier for governments to service their debt. Historically, periods of robust economic growth have been associated with significant reductions in debt levels, as expanding economies generate more revenue and can borrow at lower interest rates. However, the DSF also recognizes that volatile and inconsistent GDP growth poses challenges for debt management. Countries with stagnant or declining GDP often struggle to maintain debt sustainability, as lower economic output limits the government’s ability to generate sufficient revenue to pay down debt [16].

III. EMPIRICAL REVIEW

1. PUBLIC DEBT AND BUDGET BALANCE

The study carried out by [17] determined the macroeconomic factors of external debt in Pakistan from 1976 to 2010 using annual time series data. Using the Auto Regressive Distributed Lag (ARDL) model, the researchers have revealed that there is a substantial and positive correlation between fiscal deficit and Pakistan's debt burden in the long run. While in the short run, the result indicates a statistically insignificant and negative relationship between fiscal deficit and Pakistan's debt burden through implementing the Error

Correction Model (ECM). Moreover, research from [18] has discovered an interesting finding when examining the dynamic relationship between budget balance (deficit) and government debt sustainability in the Iranian economy from 1974 to 2015 using multivariate time series. The study used the Vector Autoregressive (VAR) model has discovered a long-term stable relationship between budget balance (deficit) and government debt sustainability. Thus, the Iranian government need to reduce the budget deficit of the country. Another research conducted by [19] focuses on the debt-trap and non-debt-trap countries using panel data analysis exhibit a similar result. Through the use of the Fixed Effects Model (FEM) and Error Components Model (ECM), the finding revealed that budget balance (deficit) has a stronger positive relationship with external public debt in the debt-trap countries and a weaker coefficient relationship in the non-debt-trap countries. This shows a different debt management in debt and non-debt trap countries.

However, in Jordan, [20] investigated the relationship between budget balance (deficit) and public debt through time series data during 1992-2012. The finding used the Auto Regressive Distributed Lag (ARDL) approach. The findings show an interesting result as there is no causal relationship between budget deficit and public debt in either direction. Besides, the co-integration test from the findings supports the absence of a long-run relationship between both variables. Similar studies from [20] examine the relationship between budget balance (deficit) and government debt using quarterly data from 1947: Q1 to 2017: Q3. By using the Vector Autoregression Model (VAR), the finding discovers the rejection of the linear VAR model which indicates a nonlinear relationship between budget deficit and government debt in the U.S. It reveals the government response to debt is influenced by the economic condition. The relationship between budget balance (deficit) and government debt tends to be more linear during economic downturn and vice versa.

More recent studies have continued to investigate these relationships, reflecting current trends in public debt and economic factors. Research during the COVID-19 pandemic, for example, shows that many countries, particularly advanced economies, have experienced an unprecedented increase in budget deficits due to massive fiscal stimulus packages. Studies such as those by [56] and [57] show that in countries like the U.S. and Japan, there is a growing concern over the sustainability of public debt as deficits ballooned. These recent findings address unresolved issues by focusing on the role of extraordinary events (e.g., global health crises) and their long-term impact on fiscal health. Moreover, [58] has highlighted the increased reliance on central bank interventions and low-interest rates as temporary solutions to manage the rising debt levels. These recent studies contribute to the ongoing debate about the sustainability of public debt in the face of prolonged fiscal deficits, emphasizing the need for comprehensive long-term fiscal strategies beyond short-term interventions.

2. PUBLIC DEBT AND REAL INTEREST RATE

[22] Finding on macroeconomic factors that affect national debt in Greece's economy from 1998 to 2009. The research has used the Vector Autoregression Model (VAR) and Granger causality test in determining the factors. From the findings, it was discovered that long-term interest rates of 10-year government bond yields harm the current levels of Greece's national debt. The long-term interest rate driven by market speculation has led to the escalation of debt in Greece. Another research on determinants of public debt conducted by [23] using panel data on the EURO area also found similar results. Practising the panel Auto Regressive Distributed Lag (ARDL) model, their study elucidates a crucial correlation: the real interest rate exhibits a substantial and positive relationship with public debt. The outcomes highlight that increasing real interest rates have a significant impact on rising levels of public debt. This effect persists over both short and long-term periods. In Tunisia, [24] applied the Vector Error Correction Model (VECM) approach from 1986 to 2015. The analysis shows a significant result where real interest rate, trade openness and budget deficit are the main factors that led to the rise of debt in Tunisa. This indicates a strong positive relationship between real interest rates, trade openness, budget deficit and public debt.

However, studies from [25] have a different outcome. The findings aim to identify the relationship between interest rates and public debt in 252 countries. This study employs panel Generalized Method of Moments (GMM) regressions for balanced-panel data. The findings reveal that real interest rates have a positive relationship with public debt but are not statistically significant. Not only that, by using the Auto-Distributive Lag (ARDL) model, the research from [26] discovered the relationship between real interest rates and public debt in South Africa from 1994 to 2017. The findings reveal real interest rates are the key indicator of debt in the long run as there is a significant positive long-run relationship between both variables. However, in the short run, the researchers discovered there are no significant interactions or correlations between real interest rates and government debt.

Research by [59] in advanced economies has shown that the fiscal stimulus packages implemented to combat the economic fallout led to historically low real interest rates, which in turn, may delay the expected debt burden. This contrasts with pre-pandemic findings, where higher real interest rates were seen as a key driver of rising public debt. Additionally, studies by [60] in emerging markets have shown that the relationship between real interest rates and public debt became more complex due to central banks' heavy intervention to stabilize economies. These contradictions highlight that the relationship between real interest rates and public debt is influenced by a variety of factors, including the economic context, time horizon, and monetary policy interventions.

3. PUBLIC DEBT AND CURRENT ACCOUNT BALANCE

The study from [19] on investigating the relationship of public debt in the debt trap and non-debt trap countries using panel data analysis has found interesting findings. By using the Fixed Effects Model (FEM) and Error Components Model (ECM), it discovers that there is a negative relationship between current account balance and public debt in debt-trap and non-debt-trap countries. However, in debt-trap countries, the coefficient between current account balance and public debt is weaker when compared to the non-debt-trap countries. Another research in EU countries discovered similar conclusions. [27] Findings on the determinants of debt using a panel data regression model have shown that the growth of the current account balance of payments leads to a reduction in public debt in EU countries. This indicates a negative relationship between current account balance and public debt. Moreover, [28] research investigated the composition of public debt in developing countries. Based on the almost balanced panel that covers 104 developing countries from 1994 to 2006, the finding unveils a negative coefficient between the current account balance and domestic debt share. This indicates that the countries that have a current account surplus are less likely to borrow abroad.

However, [29] analysed the relationship between current account balance and public debt in 31 middle- and high-income countries from 1993 to 2008. With the implementation of Auto auto-regressive model, the finding discovers that current account balance, government spending, education expenditure and GDP growth have a significant and positive influence on the public debt in middle-income group countries but insignificant in high-income group countries. [30] also have a similar finding to [29]. Their finding focused on the determinants of debt during the Covid-19 pandemic in the Eurozone shows a positive and significant relationship between current account balance on public debt. It has used general method of moments (GMM) models for their study. A point increase in current account balance would increase the public debt ratio from 0.12 to 0.13%.

[61] found that while many advanced economies experienced sharp declines in their current account balances due to disruptions in trade and investment flows, public debt levels rose significantly as governments increased spending to counter the economic fallout. Conversely, [62] observed that some emerging markets with healthier current account balances prior to the pandemic managed to mitigate their debt increases through trade surpluses and strong foreign investment inflows.

4. PUBLIC DEBT AND GDP GROWTH

[31] on examining the major determinants of public debt in 28 EU countries during the period 1995 to 2017 has found some interesting findings. Using the Pearson correlations and linear regression models, they have concluded that real GDP growth, FDI inflows and trade balance have a significant negative relationship on public debt while unemployment and population size positively impact public debt. [32] empirical study utilizing dynamic panel time-series analysis unearthed a substantial negative correlation between the debt-to-GDP ratio and real GDP growth in South America during the 1970 to 2007 period. This insightful research underscored a critical economic relationship wherein heightened economic growth had a marked impact in diminishing the burden of debt ratios. The findings suggest that as the real GDP grew, it exerted a notable influence, effectively alleviating the debt-to-GDP ratio within the region. Moreover, another research from [33] investigates the determinants of regional government debt in Russia from 2005 to 2017 and also has similar findings. Using the Ordinary least-squares (OLS) model, the study discovers the relationship between total debt-to-GDP and real GDP growth is inverse.

The research from [34] that conducted using a cross-country survey of 184 countries. Using the linear regression model, the study finds that in developing countries, public debt is significantly positively influenced by the oil abundance, economic growth rate, interest rate payments for foreign borrowings and the share of mineral rent while the defense spending and inflation rate, and unemployment rate does not have a significant impact on the developing country debt. However, research from [23] brings out an interesting finding. Using

the ARDL approach, the result shows that economic growth only negatively influences the public debt in the short run while there is no significant relationship in the long run.

[63] analyzed how the pandemic-induced economic contraction severely impacted debt levels, especially in advanced economies. This study suggested that during periods of economic distress, even countries with historically strong GDP growth faced rising debt levels due to massive fiscal stimulus packages. Conversely, [64] found that emerging markets, particularly those that maintained modest growth during the pandemic, managed to contain their debt levels through prudent fiscal management, thus confirming the critical role of sustained growth in maintaining debt sustainability.

IV. MATERIAL AND METHOD

1. HYPOTHESIS TESTING

The study proposes the hypothesis based on the empirical review in Section III where extensive research by [17-19] consistently support the notion that a nation's public debt is significantly impacted by budget balance. A budget deficit occurs when a government's spending surpasses its revenue, acting as a primary determinant affecting a nation's public debt. Hence, from the discussion in the empirical review, the hypotheses are stated as:

H1: The budget balance (surplus) has a significant negative relationship with the public debt in ASEAN-5.

Furthermore, A real interest rate signifies an adjusted interest rate accounting for inflation. Its significance lies in accurately reflecting the borrowing cost, thereby impacting a nation's debt dynamics the monetarism theory, along with the research conducted by [23] and [24], concurs on the significant and positive association between the real interest rate and public debt. Hence, the hypotheses are stated as:

H2: The real interest rate has a significant positive relationship with the public debt in ASEAN-5.

Moreover, A current account balance encapsulates a nation's global economic transactions. A deficit in this balance often prompts increased borrowing to offset the deficit. [19] and [27] discovered a significant adverse correlation between the current account balance and public debt in debt-trap countries and EU countries respectively. Hence, the hypotheses are stated as:

H3: The current account balance has a significant negative relationship with the public debt in ASEAN-5.

GDP growth signifies the percentage rise in a nation's Gross Domestic Product (GDP). Studies by [31], [32], and [33] underscore a notable negative correlation between GDP growth and public debt. Moreover, debt sustainability theory highlights the pivotal role of GDP growth in reducing public debt burdens. In the framework, past debt, budget balance, real interest rate, current account balance, and GDP growth are exogenous variables while public debt is the endogenous variable. Hence, the hypotheses are stated as:

H4: GDP growth has a significant negative relationship with the public debt in ASEAN-5.

Thus, to examine the determinants of public debt, the study uses the debt law of motion equations assumes the following [23].

$$pd_t = f(pd_{t-1}, bb_t, r_t, cab_t, gdpg_t) \qquad (2)$$

Where pd = public debt, 〖pd〗_(t-1) = past public debt, bb = budget balance, r = real interest rate, cab = Current account balance, and gdpg = Gross Domestic Product (GDP) growth are the variables. Equation 1 assumes public debt to be a function of past public debt, budget balance, real interest rate, current account balance and GDP growth.

2. DATA COLLECTION

This study incorporates a comprehensive time series analysis spanning 32 years from 1990 to 2021, focusing on the ASEAN-5 countries which are Malaysia, Indonesia, Philippines, Thailand, and Singapore. The study examines vital economic variables including public debt, budget balance, real interest rate, current account balance, and GDP growth for these nations. The primary sources utilized in gathering this data consist of reliable secondary sources such as the World Bank database, the Ministry of Finance Malaysia, the Ministry of Finance of the Republic of Indonesia, the Bureau of the Treasury, Philippines, Ministry of Finance, Thailand, and Monetary Authority of Singapore. In particular, the World Bank database serves as the main source as it contributes a substantial portion of the collected data. Interpolation techniques are employed to handle missing data in this study. This statistical method estimates missing or unobserved values within the range of existing data points, crucial for maintaining a continuous time series essential for accurate trend analysis and

forecasting. Interpolation fills gaps caused by non-reporting or inconsistencies, ensuring the dataset remains robust and allowing for a comprehensive analysis. By estimating missing values based on surrounding data, interpolation preserves the dataset's temporal structure, which is vital for detecting patterns and trends [35]. Empirically, interpolation has been widely used in econometrics to address missing data, enhancing the study's comprehensiveness [36]. However, limitations include the assumption that missing data follows existing patterns, which may not account for significant structural changes or irregularities, potentially leading to biased results. The use of data from 1990 to 2021 facilitates a detailed analysis of long-term economic trends, but challenges such as historical changes and incomplete data need careful management to ensure valid comparisons and accurate reflections of economic conditions.

3. VARIABLE JUSTIFICATION

3.1 Public Debt (PD)

Public debt is defined as the total outstanding debt that a government owes to its creditors. This includes money that is owned by foreign lenders like other governments and international financial institutions, as well as domestic lenders such as households, businesses, and bank institutions [16]. Usually, governments borrow money through the issuance of bonds or other securities, which will be paid back to the lender with interest at a later date. The level of public debt is often measured as a percentage of a country's GDP. In this study, the debt-to-GDP ratio served as the key variable to gauge a nation's public debt (Pd). This ratio offers a critical comparison between a country's public debt and its Gross Domestic Product (GDP) [53]. It acts as a pivotal indicator of a nation's capacity to repay its debts, crucial in assessing its economic stability and fiscal health. The debt-to-GDP ratio is expressed as a percentage.

3.2 Budget Balance (BB)

The definition of the government budget is a comprehensive breakdown of the payments received by the government such as taxes and other fees, and the spending from the government like transfer payments or purchases [37]. A budget deficit occurs when a government's spending exceeds its revenue while in contrast, a budget surplus occurs when a government's revenue exceeds its spending. This variable is measured as a percentage of GDP. The reason this study chooses to measure the budget balance as a share of GDP is that it helps in providing a clearer picture of comparing the ASEAN-5 countries' ability to finance it.

3.3 Real Interest Rate (R)

According to the [54], the real interest rate is known as the lending interest rate after being adjusted for inflation using the GDP deflator. Each country has different terms and conditions associated with lending rates. The formula for calculating real interest rates is $(i-P)/(1+P)$, where P is the inflation rate (as determined by the GDP deflator) and i is the nominal lending interest rate. This study chooses real interest rather than interest rate as the variable for the determinants of public debt. The reason is that it is difficult to obtain data on interest rates that reflect the actual market transaction as this study involves comparing interest rate across ASEAN-5 countries [38]. Hence, the real interest rate provides better comparison data as it standardized the measure by adjusting the inflation. Similar to the debt-to-GDP ratio, the real interest rate is expressed as a percentage in this study.

3.4 Current Account Balance (CAB)

The current account balance, as defined by [52], stands as a comprehensive ledger capturing a nation's interactions with the rest of the world. In economic terms, the current account balance records the total net exports of goods and services, net primary income, and net secondary income in the country's international transactions [39]. This indicator expressed as a percentage of GDP illuminates the effects of a nation's foreign exchange transactions on its financial stability and overall economic performance. Hence, this variable is crucial in providing insight into how a country's international transactions influence the public debt of ASEAN-5.

3.5 Gross Domestic Product Growth (GDPG)

The definition of GDP growth is the annual percentage growth rate of GDP at market prices based on constant local currency. GDP is the total of the gross value added by all producers who are citizens of the country, including any taxes imposed on products and deducting any subsidies that aren't factored into the product value. It is calculated without accounting for the depletion of natural resources or the depreciation of

fabricated assets [55]. In this study, the GDP growth is expressed in annual percentage and the market prices are based on the constant price in the U.S. dollar in 2015. The constant price is used to provide a more comprehensive understanding of the GDP growth in ASEAN-5. It helps in evaluating the long-term economic trends without the distortion caused by the inflation fluctuation in each country. Therefore, it could provide a clearer picture of the relationship between GDP growth and public debt.

4. DATA ANALYSIS

The time-series econometric model for this study is as follows:

$$pd_t = \alpha_0 + \alpha_1 pd_{t-1} + \alpha_2 bd_t + \alpha_3 r_t + \alpha_4 cab_t + \alpha_5 gdpg_t + \varepsilon_t \quad (3)$$

where the parameters α_1,…,α_5 stands for the slope coefficient, α_0 is the scalar, t is the period and ε_tis the white noise error term. To investigate the relationship between these factors and debt, the study employs the time series analysis based on the Autoregressive Distributed Lag (ARDL) framework introduced by [40] and [41]. The model is chosen due to its several advantages over other econometric models, particularly in handling mixed variables with different orders of integration, such as stationary and non-stationary data. Unlike traditional models like Vector Autoregression (VAR), which require all variables to be stationary [42]. This model's ability to estimate both short-term and long-term relationships is crucial for understanding how economic variables like public debt, budget balance, real interest rates, current account balance, and GDP growth interact over time [42]. It also allows for different lag lengths for each variable, capturing dynamic relationships effectively. The model's Error Correction Mechanism (ECM) further enhances its utility by analyzing how variables adjust to long-term equilibrium aftershocks. This allows the study to have a comprehensive on how these determinants affect debt over time. Thus, by inserting the variables of Equation (2), the ARDL model is formulated as follows:

$$\Delta pd_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta pd_{t-i} + \sum_{i=1}^{n} \alpha_2 \Delta bd_{t-i} + \sum_{i=1}^{n} \alpha_3 \Delta r_{t-i} + \sum_{i=1}^{n} \alpha_4 \Delta cab_{t-i} + \sum_{i=1}^{n} \alpha_5 \Delta gdpg_{t-i} + \beta_1 pd_{t-i} + \beta_2 bd_{t-i} + \beta_3 r_{t-i} + \beta_4 cab_{t-i} + \beta_5 gdpg_{t-i} + \varepsilon_t \quad (4)$$

where Δ is the first difference operator, α_0 is the constant term, α_1,… 〖,α〗 _5 represents the short-run coefficients, β_1,…,β_5 represent the long-run coefficients and εt is the white noise error term. To test the existence of short-run relationship and long-run relationships between the variables (Equation 4), the study formulates a hypothesis in Table 1 as follows:

Table 1. Hypothesis of long run and short run relationship.

H_0 = no short-run relationship	H_1 = short-run relationship exists
$\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5$	$\alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5$
H_0 = no long-run relationship	H_1 = long-run relationship exists
$\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5$	$\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5$

The decision to accept or reject the H0 or the existence of the long-run relationship depends on the outcome of the F-test. The null hypothesis of no cointegration is rejected when there is the computed F-test is greater than the upper bound. In contrast, the null hypothesis is accepted if the F-test is less than the lower bound. If the F-statistic falls between the bounds, no definitive conclusion can be drawn regarding cointegration. When cointegration between variables is established, the Autoregressive Distributed Lag (ARDL) is taken to further estimate the models.

V. RESULT AND DISCUSSION

1. UNIT ROOT TEST

Time series data is essential in this study. However, these data are typically raw and non-stationary, meaning that these data are hard to be predicted or modelled since they are unpredictable. This will lead to the result obtained may be erratic and unreliable [43]. Thus, to transfer the non-stationary data into stationary data, Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) unit root tests have been used.

Table 2. Results of ADF and PP unit root tests for Malaysia.

Variables	ADF test Level	Statistics First difference	PP test Level	Statistics First difference	Order of Integration
PD	−3.526*(0.0540)	−3.928**(0.0231	−3.452*(0.0628)	−3.988**(0.0203)	I(1)
BB	−2.655(0.2609)	−4.908***(0.0023)	−2.454(0.3468)	−4.902***(0.0023)	I(1)
R	−6.908***(0.0000)	−7.779***(0.0000)	−6.804***(0.0000)	−16.061***(0.0000)	I(0)
CAB	−1.640(0.7533)	−3.857**(0.0276)	−1.636(0.7548)	−7.019***(0.0000)	I(1)
GDPG	−4.222**(0.0119)	−7.160***(0.0000)	−5.335***(0.0008)	−17.271***(0.0000)	I(0)

Note: Significance level 1%, 5% & 10% are represented by ***, ** and *, respectively

Table 2 displays the unit root test in Malaysia for the level and first differences via trend and intercept. Based from the result, the ADF test demonstrated where only R and GDPG are stationary at level I(0) whereas PD, BB, and CAB are stationary in first difference I(1). While from the result in PP, the finding is similar as only R are stationary at first level I(0) while other variables become stationary at first difference I(1). Both ADF and PP test has showcase these variables are stationary at level I(0) and first difference I(1).

Table 3. Results of ADF and PP unit root tests for Indonesia.

Variables	ADF test Level	statistics First difference	PP test Level	Statistics First difference	Order of Integration
PD	−3.288*(0.0870)	−6.972***(0.0000)	−3.288*(0.0870)	−9.721***(0.0000)	I(1)
BB	−3.182(0.1065)	−6.515***(0.0000)	−3.131(0.1171)	−7.032***(0.0000)	I(1)
R	−5.546***(0.0004)	−2.906(0.1780)	−5.546***(0.0004)	−17.916***(0.0000)	I(0)
CAB	−2.005(0.5759)	−4.973***(0.0020)	−2.016(0.5700)	−5.530***(0.0016)	I(1)
GDPG	−4.017**(0.0186)	−3.812**(0.0315)	−3.954**(0.0214)	−16.492***(0.0000)	I(0)

Note: Significance level 1%, 5% & 10% are represented by ***, ** and *, respectively.

Through the observation in table 3, it can be see that the ADF test for the data in Indonesia show only GDPG are stationary at the level I(0). While for PD, BB, R, and CAB are integrated of the first difference I(1). In the result in PP, R and GDPG are stationary at level I(0) while the others variables are stationary in first difference. Thus, the results from both the ADF and PP tests indicate that some variables are stationary at level I(0), while others exhibit stationarity after taking the first difference I(1).

Table 4. Results of ADF and PP unit root tests for Philippines.

Variables	ADF test Level	Statistics First difference	PP test Level	Statistics First difference	Order of Integration
PD	−2.028(0.5629)	−5.304***(0.0009)	−1.898(0.6314)	−5.305***(0.0009)	I(1)
BB	−1.953(0.6020)	−4.380***(0.0082)	−1.744(0.7071)	−4.378***(0.0083)	I(1)
R	−0.471(0.9985)	−5.517***(0.0007)	−5.672***(0.0003)	−22.685***(0.0000)	I(0)
CAB	−3.020(0.1431)	−7.701***(0.0000)	−3.083(0.1279)	−8.899***(0.0000)	I(1)
GDPG	−5.121***(0.0013)	−9.250***(0.0000)	−5.121***(0.0013)	−10.634***(0.0000)	I(0)

Note: Significance level 1%, 5% & 10% are represented by ***, ** and *, respectively.

The Table 4 shows the unit root test in Philippines. The ADF test results reveals that CAB and GDPG demonstrates stationary at level I(0). In contrast, PD BB and R exhibit first difference integration I(1). Meanwhile, the PP test results indicate that R and GDPG are stationary at level I(0), whereas the remaining variables achieve stationary at first difference I(1). Consequently, both ADF and PP test highlight the variables show stationary at level I(0) and first difference I(1).

Table 5. Results of ADF and PP unit root tests for Thailand.

Variables	ADF test Level	Statistics First difference	PP test Level	Statistics First difference	Order of Integration
PD	−0.985(0.9953)	−4.042***(0.0040)	−0.628(0.9883)	−4.042***(0.0040)	I(1)

BB	−1.118(0.6957)	−5.592***(0.0001)	−1.013(0.7360)	−5.592***(0.0001)	I(1)
R	−1.930(0.3149)	−8.467***(0.0000)	−2.371(0.1578)	−8.553***(0.0000)	I(1)
CAB	−2.791*(0.0715)	−4.947***(0.0004)	−2.468(0.1328)	−4.966***(0.0004)	I(1)
GDPG	−3.800***(0.0071)	−5.350***(0.0001)	−3.731***(0.0084)	−10.925***(0.0000)	I(0)

Note: Significance level 1%, 5% & 10% are represented by ***, ** and *, respectively.

In the Thailand, according to the ADF test results in table 5, GDPG are stationary at level I(0),while PD, BB, R and CAB exhibit first differences integration I(1). In contrast, the PP test outcomes reveal that no variables achieve stationarity at level I(0), indicating first differences I(1) for all the variables. Hence, ADF test underscore the presence of variables showing stationarity at both levels I(0) and first differences I(1) while only PP test show the variables stationary only in first differences I(1).

Table 6. Results of ADF and PP unit root tests for Singapore.

	ADF test statistics		PP test Statistics		
Variables	**Level**	**First difference**	**Level**	**First difference**	**Order of Integration**
PD	0.331(0.9756)	−3.210**(0.0304)	0.364(0.9780)	−3.758***(0.0081)	I(1)
BB	−1.438(0.5507)	−6.256***(0.0000)	−1.347(0.5950)	−6.273***(0.0000)	I(1)
R	−5.094***(0.0002)	−6.259***(0.0000)	−5.109***(0.0002)	−10.495***(0.0000)	I(0)
CAB	−3.234**(0.0274)	−5.087***(0.0003)	−3.099**(0.0370)	−9.354***(0.0000)	I(0)
GDPG	−4.947***(0.0004)	−7.511***(0.0000)	−4.928***(0.0004)	−15.527***(0.0000)	I(0)

Note: Significance level 1%, 5% & 10% are represented by ***, ** and *, respectively.

While for the variables data in Singapore, table 6 displayed that R, CAB and GDPG are stationary at level I(0), while on PD and BB are stationary at level I(1) in ADF test. Conversely, the PP test also have the same finding where R, CAB and GDPD also achieve stationary at level I(0), while the other variables achieve stationary at first difference I(0). This show the existence of variables stationary at both levels I(0) and first difference I(1) at both ADF and PP tests.

From the table 2,3,4,5, and 6, the data in the ASEAN-5 countries are mixed order of integration. Thus, ARDL models are the most suitable as it can analyses the relationship between variables that are stationary at level I(0) and stationary at first difference I(1).

2. ESTIMATION RESULT OF ARDL MODEL

Tables 7, 8, 9, 10, and 11 present the long-term and short-term effects of the budget balance (BB), real interest rate (R), current account balance (CAB), and Gross Domestic Product growth (GDPG) on public debt (PD) in the ASEAN-5 countries.

Table 7. ARDL estimation result of Malaysia.

	Dependent Variable: PD			
Variables	**Coefficients**	**Std. Error**	**t-Statistic**	**Prob.**
Long run				
BB	-8.798937***	1.573702	-5.591233	0.0000
R	1.948516***	0.638627	3.051101	0.0055
CAB	-0.691225**	0.278160	-2.484987	0.0203
GDPG	-4.294076***	1.001515	-4.287578	0.0003
C	37.00011***	5.944968	6.223769	0.0000
Short run				
PD(-1)	-0.145097***	0.028667	-5.061436	0.0000
BB(-1)	-1.276702***	0.139400	-9.158568	0.0000
R	0.282724***	0.066665	4.240994	0.0003
CAB	-0.100295*	0.050374	-1.990986	0.0580
GDPG	-0.623059***	0.077678	-8.021079	0.0000
C	5.368615***	1.617747	3.318575	0.0029

Table 8. ARDL estimation result of Indonesia.

	Dependent Variable: PD			
Variables	**Coefficients**	**Std. Error**	**t-Statistic**	**Prob.**
Long run				
BB	2.146527***	0.395518	5.427128	0.0004
R	0.677508***	0.180344	3.756750	0.0045
CAB	0.323524	0.228852	1.413684	0.1911
GDPG	-1.871032***	0.425443	-4.397842	0.0017
C	41.91240***	2.388712	17.54603	0.0000
Short run				
PD(-1)	-2.433116***	0.372093	-6.539005	0.0001
BB(-1)	5.222749***	0.888515	5.878063	0.0002
R(-1)	1.648457***	0.356351	4.625930	0.0012
CAB	0.787172	0.557798	1.411214	0.1918
GDPG(-1)	-4.552438***	1.296944	-3.510128	0.0066
C	101.9777***	17.77862	5.735976	0.0003

Table 9. ARDL estimation result of Philippines.

	Dependent Variable: PD			
Variables	**Coefficients**	**Std. Error**	**t-Statistic**	**Prob.**
Long run				
BB	-7.148565***	1.869259	-3.824277	0.0014
R	7.935860***	2.395288	3.313113	0.0041
CAB	1.830769**	0.750484	2.439452	0.0260
GDPG	-2.667323	1.732728	-1.539377	0.1421
C	8.266244	19.07682	0.433313	0.6702
Short run				
PD(-1)	-0.368088***	0.104963	-3.506832	0.0027
BB	-2.631304***	0.535698	-4.911919	0.0001
R(-1)	2.921098***	0.952778	3.065874	0.0070
CAB	0.673885*	0.369709	1.822743	0.0860
GDPG(-1)	-0.981811	0.583871	-1.681554	0.1109
C	3.042708	7.263560	0.418900	0.6805

Table 10. ARDL estimation result of Thailand.

	Dependent Variable: PD			
Variables	**Coefficients**	**Std. Error**	**t-Statistic**	**Prob.**
Long run				
BB	-14.47277***	4.511407	-3.208038	0.0075
R	2.736115	2.276466	1.201913	0.2526
CAB	-1.821455	1.140862	-1.596561	0.1363
GDPG	-4.277014	3.933437	-1.087348	0.2982
C	29.27820	16.83481	1.739147	0.1076
Short run				
PD(-1)*	-0.194892*	0.092824	-2.099583	0.0576
BB(-1)	-2.820631***	0.826040	-3.414643	0.0051
R(-1)	0.533248*	0.266928	1.997719	0.0689
CAB**	-0.354988***	0.110974	-3.198829	0.0076
GDPG(-1)	-0.833557	0.485624	-1.716467	0.1118
C	5.706097*	3.005543	1.898524	0.0819

Table 11. ARDL estimation result of Singapore.

Dependent Variable: PD Case 2: Restricted Constant and No Trend				
Variables	**Coefficients**	**Std. Error**	**t-Statistic**	**Prob.**
Long run				
BB	-4.849779**	2.089216	-2.321339	0.0405
R	8.032612	7.529123	1.066872	0.3089
CAB	-0.874429	1.411508	-0.619499	0.5482
GDPG	14.70426	11.95845	1.229613	0.2445
C	10.58960	100.3176	0.105561	0.9178
Short run				
PD(-1)	0.246278	0.177069	1.390861	0.1918
BB(-1)	1.194394**	0.464110	2.573514	0.0259
R(-1)	-1.978256**	0.795623	-2.486423	0.0302
CAB(-1)	0.215353	0.399352	0.539255	0.6005
GDPG(-1)	-3.621337***	0.845344	-4.283863	0.0013
C	-2.607986	26.50212	-0.098407	0.9234

2.1 Public debt (PD) and budget balance (BB) in ASEAN-5

Table 7, 8, 9, 10, and 11 shows the long-run and short-run impacts of budget balance (BB), real interest rate (R), current account balance (CAB), Gross Domestic Product growth (GDPG) on the public debt (PD) in ASEAN-5. From the result from these tables, it discovers an interesting result that the budget balance in Malaysia, Philippines, and Thailand have a negative and significant impact on the public debt in long-run. In Malaysia (Table 7), a 1% decrease (surplus) in budget balance corresponds to a substantial 11.40% increase in public debt. Similarly, in the Philippines (Table 9), the long-run coefficient for budget balance indicates that a 1% decrease in budget balance (surplus) is associated with a 7.15% raise in public debt. While in Thailand (Table 10), the long-run coefficient for budget balance suggests an even more pronounced impact, with a 1% reduction in budget balance (surplus) leading to a 14.47% growth in public debt.

However, based on the result findings in short run, Malaysia, Philippines, Thailand reveals a similar finding as in long-run where it has a negative significant relationship between budget balance and public debt. A 1% decrease in budget balance (surplus) in Malaysia will lead to a 1.28% increase in public debt (Table 7). While in Philippines and Thailand (Table 9 and 10), a 1% decrease in budget balance (surplus) will result in an increase of 2.63% and 2.82% in public debt.

These results align with the findings in [17, 19] and the hypothesis of the Keynesian theory, which found that budget balance has negative impact on the public debt. This shows that when the expenditures exceed its revenues, the governments tend to cover the budget balance (deficit) through borrowing money. This result accumulates the public debt of the countries to finance the ongoing expenses [9].

While in Indonesia (Table 8), the finding shows an interesting finding where a positive and significant relationship exists between budget balance and public debt in the long run and the short run. For long-run, a 1% increase in budget balance (surplus) corresponds to a substantial 2.15% increase in public debt. While in the short run, the result shows 1% increase in budget balance (surplus) will result in a substantial 5.22% in public debt. This result is in accordance with the concept of fiscal sustainability which posits that budget balance has negative impact on the public debt. According to the findings in [44], it suggests that Indonesia has exercise fiscal policy procyclical in 1970 to 2009. Fiscal policy procyclical is a type of responsiveness on business cycles that contradicts with the counter cyclical. In counter-cyclical, the government usually increases the government expenditure and reduce tax to stimulate the economy during the recession. However, in terms of procyclical, the government tends to increase the tax and reduce the expenditure during the recession [45]. Thus, it can explain why there is a positive relationship between budget balance and public debt. When the economy is running fiscal policy procyclical, the government might increase the expenditure despite the expansion in economy where the country is running budget surplus, thus the public debt will continue to rise as well. Moreover, [44] also highlights the political regimes, changes in macroeconomics condition and the asymmetry in fiscal policy led to the positive result.

While in the case of Singapore (Table 11), the negative coefficient of -4.849779 indicates that as 1% if budget balance decrease, the public debt is expected to increase about 4.85%. This reveals a negative relationship between budget balance and public debt in long-run. This result follows the Keynesian hypothesis.

Nevertheless, in the short run, the result shows a positive significant relationship between budget balance and public debt. A 1% decrease in the budget balance (surplus) would lead to a 1.19% increase in public debt. This might be due to where the Singapore government tend to increase the borrowing to meet certain long-term objectives such as issuing debt for market development and finance some national infrastructure (Government of Singapore, 2024). Thus, the government might continue to facilitate debt despite having a budget surplus.

Moreover, based on the coefficient information, it shows the impact of the budget balance on public debt. In the long-run, the result shows that Thailand have the highest coefficient 14.47%, following by Malaysia 8.80%, Philippines 7.15%, Singapore 4.85%, and the lowest is the Indonesia with 2.15%. This indicates that the change in budget balance in Philippines and Malaysia has a substantial impact on the public debt in the long-run. Thus, to sustain the public debt, the government in Malaysia, Philippines, Thailand, and Singapore need to design an appropriate borrowing strategy or cutting the expenditures [46]. While observing on the short-run relationship, it actually reveals that budget balance have a really low impact on the public debt as all ASEAN-5 coefficient value are below 3% from Thailand 2.82%, Philippines 2.63%, Malaysia 1.28%, and the lowest, Singapore 1.19%. However, Indonesia is exceptional in this case as the budget balance have a solid 5.22% impact on public debt in short run.

The variation in these relationships across the ASEAN-5 countries reflects the distinct fiscal policies and economic conditions of each nation. Malaysia, the Philippines, and Thailand exhibit a consistent Keynesian response where deficits lead to higher debt, indicating a traditional fiscal approach where deficits necessitate borrowing. Conversely, Indonesia's procyclical fiscal policy may exacerbate debt accumulation even in times of surplus, suggesting a need for more balanced fiscal management. Singapore's mixed results highlight a strategic use of debt that may align with long-term economic objectives, demonstrating a more nuanced approach to fiscal policy.

2.2 Public debt (PD) and real interest rate (R) in ASEAN-5

The observation on the finding between the relationship for real interest rate (R) and public debt (PD) show a long-run positive relationship in all ASEAN-5 countries. Based on the Table 7, real interest rate in Malaysia shows a positive yet significant relationship with public debt where a 1% increase in interest rate could lead to 1.95% increase in public debt in long run. While similar finding in Indonesia and Philippines where there is significant positive relationship between interest rate and public debt in long run. In Indonesia (Table 8), the long-run coefficient for real interest reveals that a 1% rise in real interest rate is associated with a 0.68% increase in public debt. While Table 9 show 1% increase in real interest rate in Philippines could cause a 7.94% increase in public debt. In Thailand and Singapore, findings show a positive relationship between real interest rate and public debt in Table 10 and 11 where 1% increase in real interest rate would result in an increase in public debt for 2.74% and 8.03% respectively. However, despite of the positive relationship, the finding is not significant as the probability is 0.2526 and 0.3089 respectively for Thailand and Singapore.

For the short-run, all ASEAN-5 also reveals a similar finding in long run with a significant positive relationship. In Malaysia and Indonesia, both finding reveals when a 1% increase in real interest rate, the public debt will raise 0.28% and 1.65% respectively (Table 7 & 8). While for the Philippines and Thailand, a 1 % increase would lead to a rise of 2.91% and 0.53% respectively (Table 9 & 10). However, Singapore reveals an uncommon result in short run where it has a negative significant relationship where 1% increase in real interest rate actually lead to a 1.98% of reduction in public debt (Table 11). In the circumstances of Singapore, the negative significant short run relationship might be due to the policy implemented by Singapore in proceed borrowing to investment long-term despite the change of real interest rate.

Thus, the result in ASEAN-5 except for the short-run in Singapore are aligned with the Fisherian theory as the increase of real interest rate could result in an increasing in the borrowing cost for the government. Thus, when the real interest rate increases, the government needs to allocate a larger portion of the budget to service the debt and the cost of borrowing too. This scenario has the potential to contribute to an escalation in public debt, as highlighted in the work of [47]. Moreover, studies conducted by [22-24] accordance with the finding in Malaysia, Indonesia and Philippines where the relationship between both variables are significantly positive. While for Thailand and the long-run result in Singapore, the results are akin with [25] indicating a positive association between both variables, although not statistically significant.

Besides, the coefficient information shows the impact of the real interest rate on public debt. The result shows that in the long run, Singapore have the highest coefficient follow by Philippines, Thailand, Indonesia and lastly Malaysia. This reveals that the public debt in Singapore and Philippines are more sensitive to the changes in real interest rate compared to Malaysia, Thailand and Indonesia. Looking on the short run, the

impact of real interest rate on public debt is minimal compared to long-run where the coefficient is lower than 3%. Thus, to sustain the public debt of the country, government should monitor the interest rate fluctuation to mitigate the impact on public debt.

2.3 Public debt (PD) and Current Account Balance (CAB) in ASEAN-5

The findings regarding the relationship between the current account balance (CAB) and public debt (PD) reveals that there is negative significant relationship for Malaysia, Thailand and Singapore in long run. Based on the result in these countries, the long-run coefficient for current account balance indicates that 1% decrease in current account balance (surplus) is associated with an increase of 0.69% public debt in Malaysia (Table 7). While in Thailand (Table 10), a 1% decrease in current account balance (surplus) corresponds to 1.82% increase in public debt in long-run (Table 11). Similarly, the negative coefficient in Singapore indicates that as 1% current account balance (surplus) decrease, the public debt is expected to increase about 0.87%.

In the short run, Malaysia and Thailand have the same findings in the long run where there is a negative significant relationship between current account balance and public debt. For both of the countries (Table 7 & 10), the findings exhibit that when current account balance faces a 1% increase, this will result in a 0.10% and 0.35% reduction in public debt respectively. Yet, as regards as Singapore (Table 11), the result shows a positive relationship that negate with the findings in long run. Nevertheless, the result is insignificant which shows a 0.6005 probability value.

Thus, this result is consistent with mercantilism which implies that an imbalance in the current account deficit could contribute to a rise in public debt. This is because a current account deficit signifies that the country is spending more on foreign goods and services as well as investments than it is earning [48]. Consequently, the deficit is typically covered by borrowing from abroad, potentially leading to an increase in the country's public debt. Besides, studies from [19, 27, 28] is accordance with the finding from Malaysia, Thailand and Singapore where there is negative relationship between both variables in long run.

While looking on Indonesia and Philippines (Table 8 and 9), the finding show a new result as both countries have a positive relationship between current account balance and public debt in the long-run and short-run. In Indonesia, the long-run coefficient for Indonesia shows that 1% increase in current account balance (surplus) could lead to a 0.32% rise on public debt while the short run showcases a 0.79% rise which is more impactful when 1% increase in current account balance (surplus). However, both findings are not significant. In the case of Philippines, a 1% increase in current account balance (surplus) could lead to an increase of 1.83% and 0.67% on public debt in long-run and short-run respectively. This result has contradicted with intertemporal approach and the result from the other countries. However, the low coefficient for the current account balance in Indonesia and Philippines suggest that the changes in the current account balance have a limited impact on public debt. Thus, as there are various of economics determinants that would affect the public debt of the country, it might affect the relationship of the current account balance and public debt.

In addition, comparing the coefficient between these countries, the result indicates that Philippines has the highest follow by Thailand, Singapore, Malaysia and lastly Indonesia. These results suggest that Philippines are more sensitive to the changes in current account balance compared to the other countries. However, the short-run indicates that Indonesia is more sensitive to the changes in current account balance as its coefficient compared to other ASEAN-5. Therefore, the government should take action in monitoring the changes in the current account balance.

2.4 Public debt (PD) and Gross Domestic Product Growth (GDPG) in ASEAN-5

In the analysis between GDP growth (GDPG) and public debt (PD), the finding reveals a consistent negative correlation in all ASEAN-5 countries except for Singapore. In examining Table 6 and Table 7, Malaysia and Indonesia have shown a statistically significant negative relationship, indicating that a 1% increase in GDP growth could lead to a 4.29% and 1.87% reduction in public debt in the long run respectively. While for Philippines (Table 8) and Thailand (Table 9), both of the countries also suggest a negative relationship between GDP growth and public debt, with a 1% rise in GDP growth corresponding to a 2.67% and substantial 4.28% decrease in public debt in long run. However, the findings are not statistically significant.

Whilst in short-run, the analysis exhibit that all ASEAN-5 countries have a negative relationship between the two variables. In Malaysia and Indonesia (Table 7 and 8), both has shown a strong significant relationship as a 1% increase in GDP growth would help in reducing the public debt for 0.62% and 4.55% respectively. While on Philippines, Thailand and Singapore (Table 9, 10 and 11), it reveals a 0.98%, 0.83% and 3.62% respectively when there is 1% increase in GDP growth. But the findings are insignificant.

Therefore, the above findings are justified with the debt sustainability framework, as the increase in GDP growth could help in reducing the debt due to that the economic growth could help in increase the tax revenue of the country and helps in paying down the debt [16]. In addition, the result is also supported by the studies conducted by [49], [31-33, 50] which discovers the inverse relationship between public debt and GDP growth.

In the case of Singapore, it shows an interesting finding as it contradicted with the result in other observed countries in the long run. The analysis of the relationship between GDP growth and public debt indicated a positive relationship, although it did not reach statistical significance. The long-run coefficient for GDP growth shows that 1% increase in GDP growth could cause a 14.70% increase in public debt (Table 10). Despite the result being in accordance with the studies conducted by [34], it has opposed the debt sustainability framework by IMF and the above journal findings. According to the [51], Singapore does not incur debt for recurrent spending needs but instead borrows to meet specific long-term objectives such as infrastructure projects. These projects will result in a valuable asset that will match the debts or even in greater value. Thus, even the Singapore's public debt (debt-to-GDP ratio) seem to be high, however there is no net debt in Singapore. In result, the findings show a positive relationship between GDP growth and public debt are due to how the Singapore's government in utilizing the debt into investment.

Furthermore, according to the coefficient among Malaysia, Indonesia, Philippines, Thailand and Singapore, the studies analyse that Singapore has the highest coefficient, followed by Malaysia, Thailand, Philippines and Indonesia. For the short run, Indonesia is more sensitive on the GDP growth as it has the highest coefficient. Thus, this implies that Singapore is more responsive to the change in GDP growth in long-run while Indonesia in short run when compared to the other countries. In result, policymakers could prioritize in increasing the GDP growth as it could contribute to reducing the debt of the country.

Moreover, the analysis reveals how real interest rates, current account balances, and GDP growth influence public debt across ASEAN-5 countries. A consistent positive relationship between real interest rates and public debt in Malaysia, Indonesia, and the Philippines highlights how rising borrowing costs can escalate debt levels, reinforcing the Fisherian theory that higher interest rates increase debt servicing costs. Conversely, Singapore's unusual short-term negative relationship suggests that its strategic investment in long-term projects mitigates the immediate impact of interest rate fluctuations. The negative association between current account balances and public debt in Malaysia, Thailand, and Singapore aligns with mercantilist views, where surpluses reduce borrowing needs, whereas Indonesia and the Philippines exhibit a positive relationship, indicating a minimal impact from external balances on their debt. GDP growth generally correlates negatively with public debt, supporting the debt sustainability framework by enhancing revenue and reducing debt burdens. However, Singapore's positive correlation reflects its strategic use of debt for investments, which, despite increasing debt levels, does not signal fiscal distress due to its focus on long-term growth.

The study presents insights into the dynamics between public debt and various economic factors in ASEAN-5 countries, but it also has notable limitations. One significant limitation is the reliance on secondary data, which may introduce issues related to data accuracy, consistency, and timeliness. Secondary data often comes from diverse sources, potentially leading to inconsistencies or measurement errors that could affect the robustness of the results. Additionally, the use of a specific econometric model, while effective in examining long-run and short-run relationships, may not fully capture the complexity of the data or account for model-specific limitations. The ARDL model, for example, assumes linear relationships and may not adequately address non-linear dynamics or structural breaks in the data.

External factors such as political instability and global economic trends also play a crucial role in shaping public debt dynamics but are often challenging to quantify and incorporate into econometric models. Political instability can lead to abrupt changes in fiscal policies or economic conditions, impacting public debt in ways not fully captured by historical data. Similarly, global economic trends, such as fluctuations in commodity prices or shifts in international trade policies, can influence national economic conditions and public debt, potentially distorting the results if not adequately account for.

VI. CONCLUSION

This study investigates the influence of economic variables on government debt within the ASEAN-5 countries by examining the relationship of budget balances, real interest rates, GDP growth, and the current account balance. The findings indicate that Malaysia, the Philippines, and Thailand experience a negative impact of budget balances on public debt, highlighting a traditional Keynesian response where deficits drive borrowing. Conversely, Indonesia's procyclical fiscal policies result in a positive relationship between budget balances and public debt, suggesting a need for more balanced fiscal management. Singapore's mixed results reflect a strategic use of debt to support long-term economic objectives, even in the presence of a budget surplus. Policy recommendations derived from these results emphasize the need for modified approaches to public debt management. Governments should focus on aligning fiscal policies with economic cycles—ensuring that budget deficits do not unnecessarily inflate debt, as seen in Malaysia and Thailand. For Indonesia, adopting counter-cyclical policies could mitigate the negative effects of procyclicality. Additionally, managing real interest rates is vital, as they significantly influence borrowing costs, with higher rates generally increasing public debt. Singapore's unique case suggests that strategic debt issuance for long-term projects can be beneficial, but careful management is required to balance short-term and long-term fiscal goals. Future research should build on these findings by incorporating additional variables such as demographic trends, political stability, and exchange rate fluctuations, which may further explain the complexities of public debt determinants. Limitations of the study include data insufficiencies and the need for more comprehensive variables, suggesting future research should consider factors like demographics, political stability, and exchange rates for a nuanced understanding of public debt determinants.

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Authors' contribution

The study was conducted by a team of four authors, each contributing significantly to different aspects of the research. Lee Kai Lun and Zaki Ahmad were primarily responsible for writing the main manuscript text, as well as collecting and analyzing the data. Mohammad Helmi Bin Hidthiir supervised the conceptualization of the manuscript and provided oversight throughout the research process. Mustazar Mansur and Ayman Abdalla Mohammed Abubakr contributed to the development of the research framework, assisted with data collection, and proofread the manuscript. Additionally, Mastora Sahal Gomaa Sahal played a substantial role in drafting the manuscript and critically revised it to ensure the inclusion of key intellectual content.

Data Availability Statement

The datasets used or produced in this study can be obtained from the corresponding author upon reasonable request.

Conflict of Interest

The authors declare that they have no relevant financial or non-financial interests to disclose.

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