Griffith Business School

Submitted in fulfilment of the requirements of the degree of

Doctor of Philosophy

by

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February 2020
FISCAL POLICY, PUBLIC DEBT AND ECONOMIC PERFORMANCE IN DEVELOPING COUNTRIES: AN EMPIRICAL ANALYSIS

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Submitted in fulfilment of the requirements of the degree of Doctor of Philosophy
February 2020
STATEMENT OF ORIGINALITY

The research and discussion presented in this thesis have not previously been submitted for a degree or diploma in any university. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

Signed:

Singgih Gunarsa
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ABSTRACT

Since the Global Financial Crisis, interest in the use of fiscal policy by governments to stabilise economic activity, boost economic growth and achieve development objectives has grown. Consequently, however, governments run budget deficits which, in many countries, result in increased government debt. Since many governments in developing economies run budget deficits, the macroeconomic impact of fiscal policy and public debt sustainability remain a serious concern.

This thesis is an empirical study of four sub-topics of fiscal policy using macroeconomic time-series data from developing countries. The first chapter explores the decomposition of government expenditure in developing countries. It examines the impact of government expenditure composition based on function to economic growth using datasets from developing countries from 1973 to 2015. We applied a dynamic panel model approach, using system GMM, to study which component of government expenditure has a significant impact on growth. The results indicate that government expenditure in developing Asian countries has no significant association with growth. In terms of composition, public capital spending is positively associated with economic growth abstracting from possible offsetting effects that arise from how spending is financed (taxes or borrowing). Government interest payments show a negative relationship with growth in developing economies. Using a similar baseline model, the study also estimates sectoral government composition. The results show that public spending on education sector is negative and significant to growth. The negative coefficient on spending in the education sector implies that there is inefficient spending
in this sector of both allocation and outcome. On the other hand, in line with the existing theory, public health spending indicates positive association with economic growth in developing economies whereas defence spending is insignificant to growth.

The second chapter discusses the impact of fiscal policy namely, public debt and budget deficit on the real interest rate in developing countries from 1990 to 2015. The proposed model for this study is based on the Barro and Modigliani interest rate determination model, with several control variables based on the latest reviews. We employ a semiparametric approach to examine the non-linearity condition of fiscal policy and interest rates, and a dynamic panel model using a system GMM approach for linear estimation. The results show that all semiparametric estimates indicate little relationship between fiscal policy (public debt and budget deficit) and interest rates. Furthermore, the dynamic panel model, using linear regression estimates, finds that, by controlling related variables, both public debt and fiscal deficit correspond to a positive effect on interest rates in developing and emerging countries. The findings imply that higher interest rates may crowd out private consumption and, therefore, dampen the initial positive effect of government expenditure on growth.

Moreover, the effect varies if the interaction model is applied when the dataset is split into subsamples. For instance, the impact of rising public debt on interest rates is more significant under a high budget deficit and low financial depth condition. Similarly, a budget deficit also raises interest rates under a high budget deficit but not significant in low financial depth condition. Overall, the results are theoretically plausible and in line with previous studies.
The third chapter estimates the relationship between public debt and economic growth and tries to identify the effect of the economic crisis using an econometric model based on 25 developing Asian countries from 1970 to 2015. This model is developed from growth accounting relationships, with the inclusion of control variables based on the latest literature. The regression technique in this chapter employs dynamic panel models that have some well-known advantages over typical cross-sectional or time-series approaches. After highlighting key theoretical linkages and previous findings on the public debt-growth nexus, the study found a relatively weak negative relationship from a dynamic panel model. The results imply that a 10% increase in public debt is associated with growth reduction from 0.2% to 0.4%, which is macroeconomically significant.

The fourth and final empirical study in this thesis uses the latest fiscal and macroeconomic data from ten ASEAN countries to investigate their fiscal sustainability. This chapter examines whether Asian countries have satisfied their fiscal sustainability with the application of an intertemporal budget constraint (IBC) model. We also incorporate the impact of an ageing population on the intertemporal budget constraint model and study its effects on fiscal sustainability.

The results show that ASEAN countries require substantial effort to stabilise current debt levels. Using the debt reduction scenario from the IBC model to reduce debt to 25%, Indonesia needs a 1% primary surplus within ten years, whereas Vietnam and Malaysia would need around 3% to 4% primary surplus over GDP. Furthermore, this study also reveals that an ageing population in ASEAN countries has created pressure on fiscal

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policy through a consequent decrease in labour force growth. Despite relatively strong economic growth in ASEAN economies, our results suggest that substantially larger primary budget balances will be required to ensure future public debt sustainability.

Overall, this thesis lists and investigates a number of issues regarding the macroeconomic impact of fiscal policy in developing economies. The thesis suggests three main policy implications that are relevant to the empirical results of the above studies. One is the importance of increasing the quality of public spending, especially in choosing sectors that will benefit from long-term growth. Secondly—in order to minimise future fiscal risk arising from higher world interest rates or the realisation of contingent liabilities—the governments of developing countries must ensure that additional public debt is matched by high quality public spending. This should be done while strengthening budgetary institutions and practice, particularly in managing deficit and public debt. Prudent debt management includes managing the debt portfolio by calculating risk and cost that may increase sovereign credibility and maintain fiscal sustainability. The third main policy implication is developing a deep and liquid domestic market which can make a domestic financial market more resilient to external volatility and also be a potential source of funding.
ACKNOWLEDGMENTS

Praise to Almighty Allah (God) for His uncountable blessings, and peace be upon all His Messengers, including Prophet Mohammad.

Pursuing a doctorate has been my lifelong dream; however, this dream could not become reality without the support of many individuals and institutions. First and foremost, I would like to convey my gratitude to my primary supervisors, Professors Anthony (Tony) Makin and Ross Guest, for guiding me throughout the PhD program. They have directed me in working hard with passion and self-confidence, along with maintaining perseverance and personal development. I would like to extend my gratitude, also, to my Associate Supervisor, Associate Professor Nicholas (Nick) Rohde, who has supervised my research since the Graduate Diploma program. His support in methodology and econometric techniques has been insightful and useful in building my thesis chapter by chapter. With the ups and downs throughout my years of doctoral study, it is my pleasure to say that I am blessed to study under their consistent supervision. Without their tireless efforts, it would have been impossible for me to finish my thesis in time.

I am grateful to Griffith University for providing me with such excellent support programs during my period of study. Its Graduate Diploma program gave me my first taste of the research field in academic life and provided me with a solid foundation for the following doctoral program. I particularly thank Ms Susan McLeod and Ms Josephine Burling for their excellent support during my study. I also acknowledge Professor Fabrizio Carmignani for his critique and insight, particularly in macroeconomics, that refreshed
and developed my knowledge in this area. I greatly appreciate the tremendous administrative and academic support of Christopher Thillainathan, Lesley Ann Mack, Chanelle Moar and Mark Taylor, the Australia Award Student Contact Officers at Griffith University.

I also acknowledge the financial support of the Department of Foreign Affairs and Trade (Australia) through the Australia Awards Scholarship. This scholarship has not only supported me in the doctorate program but also in my graduate diploma in research. During my study, I also had the opportunity to join enrichment programs such as BAGUS (Bringing Australian Government Understanding to Students) and the Australia Award Indonesia project in budget planning for Indonesian officers.

Finally, I must express my sincerest and heartfelt gratitude to my family, especially my mother, to whom this thesis is dedicated. Her passing during my doctoral study was heartbreaking, but became my motivation for pushing through to finish my study in order to honour her loving memory. My wife, Nur Amaliah and my daughters, Hurin Alifia Zahra and Kamila Farah Dzakiyah, provided me with constant support throughout this rigorous process. Last but not least, I acknowledge my friends at ISAGU (the Indonesian Student Association of Griffith University) and all my distant family for their support and prayers.

Singgih Gunarsa

Gold Coast, 14 February 2020
THESIS RELATED RESEARCH OUTPUTS TO DATE

Paper published

Refereed conference presentations

Paper presented at HDR Symposium, Department of Accounting, Finance and Economics, Griffith Business School, 24 October.

# ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>2SLS</td>
<td>Two-stage least-squares</td>
</tr>
<tr>
<td>3SLS</td>
<td>Three-stage least-squares</td>
</tr>
<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
</tr>
<tr>
<td>ADF</td>
<td>Augmented Dickey–Fuller</td>
</tr>
<tr>
<td>AFC</td>
<td>Asian Financial Crisis</td>
</tr>
<tr>
<td>AK</td>
<td>Composite form of the production function with constant returns to scale</td>
</tr>
<tr>
<td>ASEAN</td>
<td>Association of South East Asia Nations</td>
</tr>
<tr>
<td>BIS</td>
<td>Bank for International Settlements</td>
</tr>
<tr>
<td>CE</td>
<td>Cointegration equation</td>
</tr>
<tr>
<td>CGE</td>
<td>Computable general equilibrium</td>
</tr>
<tr>
<td>CIs</td>
<td>Confidence intervals</td>
</tr>
<tr>
<td>EM</td>
<td>Estimation method</td>
</tr>
<tr>
<td>FDI</td>
<td>Foreign Direct Investment</td>
</tr>
<tr>
<td>FE</td>
<td>Fixed Effect model</td>
</tr>
<tr>
<td>FGLS</td>
<td>Feasible Generalised Least Squares</td>
</tr>
<tr>
<td>G-20</td>
<td>Group of Twenty</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross domestic product</td>
</tr>
<tr>
<td>GFC</td>
<td>Global financial crisis</td>
</tr>
<tr>
<td>GFS</td>
<td>Government finance statistics</td>
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<tr>
<td>GFSM</td>
<td>Government finance statistics Manual</td>
</tr>
<tr>
<td>GLS</td>
<td>Generalized least squares</td>
</tr>
<tr>
<td>GMM</td>
<td>Generalized method of moments</td>
</tr>
<tr>
<td>ILO</td>
<td>International Labour Organisation</td>
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<tr>
<td>IBC</td>
<td>Intertemporal Budget Constraint</td>
</tr>
<tr>
<td>IFS</td>
<td>International Financial Statistics</td>
</tr>
<tr>
<td>IMF</td>
<td>International Monetary Fund</td>
</tr>
<tr>
<td>LSDV</td>
<td>Least square dummy variable</td>
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<tr>
<td>OECD</td>
<td>Organization for Economic Cooperation and Development</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>OLS</td>
<td>Ordinary least squares</td>
</tr>
<tr>
<td>PMG</td>
<td>Pooled mean group</td>
</tr>
<tr>
<td>RE</td>
<td>Random effect model</td>
</tr>
<tr>
<td>RCK</td>
<td>Ramsey–Cass–Koopmans</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and development</td>
</tr>
<tr>
<td>SD</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>SUR</td>
<td>Seemingly unrelated regressions</td>
</tr>
<tr>
<td>SVAR</td>
<td>Structural vector autoregressive</td>
</tr>
<tr>
<td>SVEC</td>
<td>Structural vector error correction</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom of Great Britain and Northern Ireland</td>
</tr>
<tr>
<td>US</td>
<td>United States of America</td>
</tr>
<tr>
<td>VAR</td>
<td>Vector autoregressive</td>
</tr>
<tr>
<td>WDI</td>
<td>World Development Indicators</td>
</tr>
</tbody>
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### GLOSSARY OF VARIABLES

**Chapter 3: “Government spending composition and economic growth: an empirical assessment in developing economies”**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>GDP growth per capita</td>
<td>Economic growth, change in real per capita GDP.</td>
</tr>
<tr>
<td>Total public spending (% GDP)</td>
<td>Total expenditure to GDP, the ratio of expenditure on general government final consumption to GDP.</td>
</tr>
<tr>
<td>Current spending (% GDP)</td>
<td>Government current expenditure to GDP. The ratio of government expenses to GDP in providing goods and services. Such expenses include salaries, consumption of goods and services, interest payments.</td>
</tr>
<tr>
<td>Capital spending (% GDP)</td>
<td>Government spending as capital investment ratio to GDP. It consists of gross spending in non-financial assets such as fixed assets, inventories, valuables and non-produced assets. This spending also includes consumption of fixed capital.</td>
</tr>
<tr>
<td>Good and services spending (% total spending)</td>
<td>Goods and services expense ratio to total government expenditure. This expense contains goods and services utilised for market and non-market production of goods and services by general government.</td>
</tr>
<tr>
<td>Employment salary spending (% total spending)</td>
<td>Government employee compensation ratio to total expenditure. Employee compensation consists of wages and</td>
</tr>
</tbody>
</table>

xx
salaries of government employees, including payment in cash or in kind. It does not include social contributions from employees.

**Interest payment spending (% total spending)**

Interest payment ratio to total expenditure. Expense of government in interest payments incurred from liabilities such as deposits, securities, loans and accounts payable. These liabilities are the consequence of government borrowing from other entities.

**Subsidy and transfer spending (% total spending)**

Subsidy and transfer relative to total expenditure. Subsidy is payment by the government to other entities based on their levels of production of goods and services. Transfer is a grant from one government unit to another. It can be current or capital transfer.

**Defence sector spending (% total spending)**

General government expenditure on defence function relative to total expenditure. It consists of military defence (7021), civil defence (7022), foreign military aid (7023), defence R&D (7024) and other defence functions (7025)

**Education sector spending (% total spending)**

General government expenditure on education functions. It consists of pre-primary and primary education (7091), secondary education (7092), post-secondary and non-tertiary education (7093), tertiary education (7094), education not definable by level (7095), subsidiary services to education (7096), R&D in education (7097) and education n.e.c (70988)
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health sector spending (% total spending)</td>
<td>General government expenditure on health functions. It comprises medical products, appliances and equipment (7071), outpatient services (7072), hospital services (7073), public health services (7074), R&amp;D health (7075) and health n.e.c (7076)</td>
</tr>
<tr>
<td>Population growth</td>
<td>The percentage of population growth. The increase of a population in a country over, in this case, one year.</td>
</tr>
<tr>
<td>Inflation</td>
<td>Inflation, change in consumer price index.</td>
</tr>
<tr>
<td>Domestic investment (% GDP)</td>
<td>The change of domestic investment in the economy. It is proxied by the change in gross capital formation. Gross capital formation is the addition of fixed assets plus net changes in the level of inventories.</td>
</tr>
</tbody>
</table>

**Chapter 4: “Public debt, budget deficits and interest rates in emerging economies: An empirical analysis”**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest rate</td>
<td>Interest rate compilation of saving and lending rates.</td>
</tr>
<tr>
<td>Public debt</td>
<td>Total general government liability including loans and securities from domestic and external source divided by the GDP of the respective year.</td>
</tr>
<tr>
<td>Deficit</td>
<td>Budget deficit proxied by net lending and borrowing for the general government.</td>
</tr>
<tr>
<td>Growth</td>
<td>Real GDP growth per capita.</td>
</tr>
</tbody>
</table>
Inflation
Consumer price index.

Risk spread
Spread from local interest rate and short run interest rate data taken from treasury bills from three months to one year.

Financial depth
Liquid liabilities of the banking sector. Liquid liabilities are commonly used as an indicator of financial sector development in the economy. It consists of long-term deposits and assets: commercial paper, certificate of deposit and bonds (IFS).

Money supply
Real money supply growth. Ratio of broad money to GDP growth rate taken from the IFS.

Chapter 5: “Public debt in developing Asia: a help or hindrance to growth?”

Real growth per capita
Economic growth, change in real per capita GDP.

Average public debt (% GDP)
Total general government liability including loans, securities from domestic and external source divided by GDP of the respective year. On average, a five-year value.

Trade openness
Sum of export and imports as percentage of GDP.

Population growth
Total population growth per year in each country as a proxy for labour input

School enrolment
Secondary school enrolment as a human capital indicator.
Inflation
Consumer price index (CPI).

Working-age population
Workers’ share of population. Ratio of productive population (aged 15–64) to total population.

Domestic investment ratio
Gross fixed capital formation to GDP ratio. Capital investment includes land developments, purchases of capital such as machinery and plant equipment, construction of roadways, hospitals, schools private dwellings and industrial sites (World Bank).

Chapter 6: “Fiscal sustainability and ageing in ASEAN countries”

Public debt to GDP, $pd$
General government debt-to-GDP ratio. The current value at 2018 is used for the calculation.

Primary balance to GDP ratio, $pb$
Primary balance to GDP ratio. Current primary balance is used for comparison with the required primary balance from IBC formulae.

Real interest rate, $r$
Lending interest rate adjusted by the inflation rate.

Average of five years of the rate of employment growth.

Labour-productivity growth rate, change in output per hour worked. This study used an average of 10 years’ value to represent medium-term analysis.
Economic growth  Real GDP per capita growth.
CHAPTER 1. INTRODUCTION

This chapter contains five sections that serve as the foundation of the thesis by examining fiscal policy and macroeconomic performance in developing countries. Section 1.1 discusses the background and motivation for the research topic; it also briefly discusses the financial crisis and macroeconomic performance that lead to further research questions in this study. Section 1.2 summarises the research questions and is followed by the contribution of the study in Section 1.3. Section 1.4 briefly outlines the methodology used in this study. The final section, 1.5, explains the research outline, its findings, and presents a conclusion.

1.1 Research motivation and rationale

Since World War II, the global economy has been influenced by open international trading and financial systems that shift closed economies to being more open and transparent. The global economy and financial system are also becoming more integrated and have been at the core of multilateral economic policy. The impact of globalisation can be positive for economic growth and improve outcomes in development; however, it also has inherent and serious threats. For developing economies, the Asian Financial Crisis (AFC) of 1997–1998 is a significant example of the effects of rising globalisation when fundamental imbalances in fiscal policy and significant local currency depreciation triggered a financial crisis in Asia.

Market reaction and herding behaviour exacerbated the impact of the AFC through capital flow reversal, the sell-off of local assets, restricted bank credits and weak asset prices. This depressed economic activity in Asian economies ultimately led to a soaring
debts burden (Corsetti, Pesenti, & Roubini, 1999). The crisis started in South-East Asian countries such as Thailand, Indonesia, Malaysia and the Philippines, spread to Korea, Taiwan and Hong Kong and, finally, to other countries such as Brazil and Russia (Goldstein, 1998).

The bursting of the “dot-com” bubble in the United States in 2001 was another significant economic event to which US authorities reacted to avoid further crisis. Loose monetary policy was introduced by the US Federal Reserve over a prolonged period that eventually sparked a refinancing boom. Furthermore, China’s rise as global savings giant, as well as low world interest rates, also contributed to the refinancing boom that led to the subprime mortgage crisis. This crisis caused a global financial breakdown and ultimately led to an economic meltdown (see Taylor, 2007). This financial turmoil culminated in the Global Financial Crisis (GCF), which many have compared to the Great Depression of the 1930s (Eichengreen, 2015; Temin, 2010). The finance and banking crises that followed in Iceland and Ireland, and sovereign debt crises in Greece, Italy, Portugal, Spain and Ireland provided further evidence of the interconnectedness of the global economy.

1.1.1 Fiscal stimulus in the global economy

The first response of governments during the GFC to counter the turbulence was through monetary policy. Relevant authorities gradually lowered interest rates in the hope of increasing spending and lifting economies. However, the limitations of monetary policy soon became apparent as interest rates in advanced countries moved towards zero. Figure 1.1 depicts the non-weighted average value of the average policy rate. In 2018, the average policy rate was 0.85% for developed countries whereas, in this period, Switzerland, Sweden and Denmark had negative interest rates of −0.75, −0.5 and −0.65 respectively (BIS, 2018).
Governments faced the GFC by deploying fiscal policies that could aid economic recovery. Fiscal policies comprise a set of macroeconomic tools for intervening in the economy. Tax and spending are the primary tools for governments to achieve economic objectives such as enhancing economic growth, reducing inequality or stabilising during economic shocks. The government may deploy fiscal stimuli by reducing tax and/or increasing spending. Many countries implemented large-scale fiscal stimuli during the GFC, thereby creating the greatest fiscal expansion since WWII (Mauro, Romeu, Binder, & Zaman, 2015).

The scale of the GFC’s impact necessitated global policy coordination among the governments. G-20 policy makers agreed to coordinate the implementation of fiscal stimulus to boost economic momentum (Khatiwada, 2009). The main aim of fiscal stimulus was divided into three main areas. The first was spending on goods and services, such as spending on infrastructure projects (e.g. China, Germany, Portugal, Saudi Arabia and the US). The second was consumer-oriented fiscal stimulus such as personal tax cuts and cash transfers (e.g. Germany, New Zealand, Australia, China, France and Indonesia). Lastly were firm-oriented stimuli such as corporate tax cuts (e.g. Japan, Korea and Mexico) (Khatiwada, 2009).

The G-20 led this global fiscal expansion with the largest contribution to the global fiscal stimulus. The G-20 summit in Washington arrived at a consensus that aggressive fiscal measures such as cutting taxes and boosting government expenditure were needed to avoid economic downturn because they stimulated aggregate demand. China, Saudi Arabia and the US announced the biggest fiscal rescues as a percentage of GDP (Khatiwada, 2009). Altogether the G-20 contributed around 90% of the global fiscal stimulus—around US$2 trillion, or 1.4% of the world’s GDP. Asian and Pacific countries,
which comprise mainly developing economies, allocated 9.1% from their GDP. China executed the most extensive stimulus package at 12.7% of its GDP, keeping commodity prices relatively high and benefitting exporters such as Australia (ILO., 2010).

Figure 1.1 Average policy rate (in percentage)
Source: Bank of International Settlement.

Figure 1.2 shows historical economic growth for advanced and global countries. World economic growth, including that of developed countries, had a significant fall in output during the GFC. During this period, the growth of advanced countries dropped into negative territory, whereas the rest of the world, including developing economies, also experienced great shock but remained positive. However, as shown in Figure 1.3, government spending growth increased sharply after the crisis.

Fiscal policy has crucial role in stabilising economic turbulence, especially when monetary policy has already reached its limitations in several countries. However, as a consequence, the wider fiscal deficit and rising public debt have posed another threat to government budget sustainability.
The effectiveness of fiscal stimulus is still under debate. Contradictory theoretical predictions and a diversity of empirical evidence send mixed messages for fiscal effectiveness in a crisis (Hur & Park, 2018). There is evidence for developing countries that fiscal policy contributed to the recovery of Asian and Pacific economies (IMF, 2010). However, the major obstacle in examining fiscal policy, particularly in developing economies, is data availability. The standard approach by Blanchard and Perotti (2002) proposes a multiplier effect estimation that requires quarterly data in order to be valid.

However, Ilzetzki, Mendoza and Végh (2010) used a novel dataset of 44 countries and found that those with a flexible exchange rate, relatively open economy and high public debt have smaller fiscal multipliers. Furthermore, they argued that, in the long run, the impact of fiscal policy on growth is negative. The policy implication arising from the study is that fiscal stimulus can be counter-productive due to the increase in global financial integration and the adoption of a flexible exchange rate.

![Figure 1.2 Real GDP growth (in percentage)](image)

Source: World Economic Outlook, IMF
1.1.2 Public debt, fiscal deficit and fiscal sustainability

The debate on fiscal policy effectiveness and the consequences of increasing public debt has intensified since the GFC and the European sovereign debt crisis. Some suggest that countries should learn from the Great Depression and use expansionary fiscal policy to stabilise growth (see, among others, Krugman (1988) and Delong and Summers (2012)). Conversely, other economists suggest that public debt has an adverse effect on growth and recommend fiscal consolidation to restore confidence (Cochrane, 2011). Although there is no clear-cut conclusion to this debate, public debt accumulation continues to grow in most countries.

Figure 1.3 Government expenditure growth (in percentage)
Source: World Economic Outlook, IMF
Figure 1.4 shows the historical data on public debt in advanced countries. The world wars were the reason for governments raising bonds to finance war expenses and were the beginning of government fiscal policies. The GFC sparked the rise of debt again after WWII. The increase in public debt and deficit impairs a country’s fiscal stance. Some governments have implemented fiscal austerity to reduce spending and improve their public finances. Although, in the short run, austerity measures may improve a budget’s profile, the improvement in the economy remains fragile. For instance, cutting some programs such as for the labour market in a budget may not have a long-term benefit because it may eventually increase the unemployment rate (ILO, 2010).
Figure 1.5 shows historical data on public debt in emerging and developing economies. It shows that the level of public debt-to-GDP ratio in emerging countries is smaller than their advanced counterparts. However, the trend is increasing and the persistence of budget deficits over the long term is the reason for the increase in debt stock. According to the IMF, public debt in emerging and developing countries is projected to increase to around 60% in 2022, whereas, in advanced countries, public debt is expected to decline below 100% in 2022, down from around 225%.

The issue of fiscal sustainability emerges with such a rise in public debt and budget deficits. Fiscal sustainability is the ability of governments to continue a budget deficit with a stable government debt-to-GDP ratio (Blanchard, 1990). Therefore, large and persistent budget deficits that lead to a drastic increase in public debt are a symptom of unsustainable fiscal policy (Burger, 2005). Sustainability in fiscal policy can be measured...
in several ways: by the time-series property method to measure whether public debt has an explosive path; the fiscal response method to measure the cointegration between government revenue and government spending; debt burden to measure the threshold when public debt erodes growth.

Advanced countries before the GFC had relatively sustainable economies but with indications of fiscal fatigue. Using a fiscal reaction and debt burden approach, Ghosh, Kim, Mendoza, Ostry, and Qureshi (2013) argue that the primary balance in 23 advanced economies could keep up with the increase in public debt. A marginal response of the primary balance to lagged debt was detected due to a non-linearity relationship. Primary balance is positive at a moderate level of debt and declines considerably at debt above 100%.

Reinhart and Rogoff’s (2010) study is regarded as the most debated study in the field regarding the public debt burden. Using a simple spreadsheet calculation with an extensive sample database, they argue that, when the debt-to-GDP ratio is above 90%, growth starts to decline. This study has sparked further research—some supporting it and others refuting it—on the findings on non-linearity.¹

The impact of fiscal policy on economic growth continues to be a topical subject in macroeconomics. Governments with deficit budgets continue to try to push their economies while recovery of the global economy has experienced unprecedented slowness since the GFC. Meanwhile, multinational institutions such as the IMF and

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¹ Using a more robust method, Kumar and Woo (2015) support the findings of Reinhart and Rogoff (2010). Conversely, Caner, Grennes and Koehler-Geib (2010) suggest that data from 101 sample countries (75 developing and 26 developed) show the threshold of debt to GDP ratio was 77% for the full sample before there was a deteriorating impact on growth, while the sample of developing countries indicates a lower threshold of 64%. Herndon, Ash and Pollin (2014) claim that countries which have a debt-to-GDP ratios of more than 90% have positive growth rates of 2.2% and not negative rates of 0.1% as depicted by Reinhart and Rogoff (2010).
OECD have repeatedly revised growth downward as a reflection of the relatively bleak prospects of economic growth.

1.2 Identifying the research questions

The principal focus of this thesis is empirical. Specifically, it applies econometric techniques to examine the impact of fiscal policy on the economic performance of developing economies. There are four empirical studies in this thesis and the relevant chapters are motivated by the background research detailed in the previous subsection. Each study is self-contained and has a dedicated section referring to each of the research questions outlined below.

The first research question in this thesis is, “Do government spending components in developing countries influence growth?” This chapter will examine the effect of public spending and its component on economic growth. Many studies have examined the impact of government spending on growth resulting in a multiplier (see Tanzi and Zee, 1997, for the survey). Many of these studies have found a negative effect of government spending on economic growth effect (Martins and Veiga, 2014; Afonso and Furceri, 2010; Asimakopoulos and Karavias, 2016). However, the impact of spending elements on economic growth may have different results. This chapter focuses on the components of government spending.

The second research question is, “Does fiscal policy affect interest rates in developing countries?” To answer this question, I used a data base of 53 developing countries over the period 1970–2015. The increased activity of governments in debt procurement
through borrowing or debt offering in developing economies has rekindled research interest on the impact of fiscal policy on interest rates. However, the results of both theoretical and empirical studies have been inconclusive. Apart from the previous chapters, this chapter uses more financial indicators along with macroeconomic indicators to typify the monetary sector of the economy. However, data availability in this sector is limited; therefore, the data utilised spans the period 1990–2015.

This leads to the third research question in this study: “Has public debt in developing Asia helped or hindered economic growth?” This third chapter uses empirical evidence from developing Asian countries which have been the main engine of global growth. The region accounts for two-thirds of global economic growth driven by the robust growth of countries such as China, India and Indonesia. Fiscal deficit seems to be a primary fiscal tool in this region, not only for economic stabilisation but also to achieve long-term economic growth. However, persistent fiscal deficits lead to increasing public debt stock.

With access to global capital markets, governments have actively searched for funding through bond issues which result in rising public debt. The impact of increasing public debt on economic growth can be detrimental in several ways, such as increased interest rates and reduced private investment. However, the impact of public debt on growth in this region has gained little attention. Therefore, we will empirically examine the long-term effects of public debt on economic growth in this region and suggest policy implications.

The fourth research question is, “How sustainable is the public debt in developing Asian countries, specifically in ASEAN?” The importance of sustainable public finance has
received intense attention following the GFC. Sustainability analysis assesses whether the fiscal stance of governments can continue indefinitely without the consequences of devastating debt. Where government budget constraints hold in present value terms, the fiscal stance is sustainable in the long run. Conversely, if fiscal imbalance occurs, macroeconomic and fiscal conditions need to be adjusted to satisfy the budget constraint condition (Makin, 2010). Given the negative impact of a persistent budget deficit, it is important for governments to practise prudent fiscal policy (Afonso & Jalles, 2016). This chapter examines individual countries in the ASEAN community using the intertemporal budget constraints formula. We use simple yet effective methods to detect fiscal imbalances in this region before they become unsustainable and lead to insolvency.

1.3 Contribution of the study

This thesis contributes to the literature on the macroeconomic impact of fiscal policy, specifically on economic growth and interest rates in developing countries. Its contribution is two-fold. Firstly, it seeks to explain fiscal phenomena in developing and emerging countries. Such classifications of countries are derived from the World Bank and the IMF are based on middle income and emerging market categories. Many studies have examined evidence from developed economies; however, case studies from emerging and developing countries have been overlooked by researchers (Hur and Park, 2018). The robust economic growth of developing countries has shadowed the role of fiscal policy among them, hence receiving little attention. A focus on developing countries also minimises data heterogeneity and may concentrate focus on fiscal policies implemented within this group.
Secondly, this thesis provides various econometric techniques in time series data to estimate and answer the research questions. The different methods are necessary for testing the robustness of the results. The panel data is estimated using dynamic panel data and checked using several estimators to achieve robust results. A semi-parametric approach is introduced in the second empirical study to analyse fiscal policy’s impact on interest rates. Furthermore, the fourth question is estimated using spreadsheet analysis based on fiscal sustainability formulae. In summary, the thesis provides applied econometrics as a reference for policymaking in public sector.

1.4 Research methodology

This section discusses the general overview of the methodology used in the thesis. The thesis employs several techniques to address each research question.

The first empirical study uses a dynamic panel model that exclusively utilises a system generalized method of moments (GMM) estimator to examine the relationship between fiscal spending and economic growth in developing countries. To find more observations, 53 countries were included in the database from 1970 up to 2015. Using similar five-yearly non-overlapping averages, the database has been reduced into 11 waves. The system GMM method is suitable for the database with a small-$t$ (time-series) and large-$n$ (cross-section). The post-estimation test in this chapter consists of a Arellano-Bond serial correlation test and a Hansen J test for instrument validity.

The second empirical study employs two techniques to estimate the baseline model of interest rates and fiscal policy. In examining non-linearity, the study applies semiparametric estimation from Baltagi and Li (2002). This methodology can flexibly
study the fixed effect from parametric indicators to the dependent variable. It is
commonly used in the field of foreign trade but is still useful in other macroeconomic
subjects. Following the semiparametric method, the chapter continues with linear
estimation using the dynamic panel model to study the impact of fiscal policy on interest
rates. The database in this study consists of 53 developing and emerging countries
spanning 1990–2015. The financial indicators are included in this study to represent the
effect of monetary sectors on the interest rate.

In addressing the third research question, the chapter used various econometric techniques
to estimate a time-series database. It analysed a sample of 28 developing Asian countries
spanning 1970–2015. The growth accounting form was applied with the inclusion of
public debt-to-GDP ratios in the explanatory variables. The database eliminated the
business cycle effect by using a non-overlapping generation average on a five-year basis;
the non-overlapping method is common in growth modelling. The model estimation in
this chapter focuses on the panel OLS, fixed effect, random effect as well as dynamic
panel modelling using the difference GMM technique from Arellano and Bover (1995).
The GMM method is useful in handling endogeneity issues that occur in growth model
estimation. The use of lag of dependent variables and instrumental variables may reduce
the endogeneity problem in the model.

The fourth empirical study uses debt stabilisation formulae to discuss the fiscal condition
of developing ASEAN countries. The chapter also discusses the effect of ageing
populations on fiscal sustainability in the ASEAN region. Two databases were involved
in this chapter: the macroeconomic database retrieved from the World Bank and the IMF,
and the labour database from the United Nations (UN) population division and
International Labour Organisation (ILO). The UN and ILO databases provide the long-term projection data for general and productive populations, including labour participation rates. This data is essential for calculating the projected growth that is important for estimating fiscal stance in a simulated future.

1.5 Thesis structure and findings

The final section of this introductory chapter explains the roadmap of the thesis, which consists of seven chapters that conceptually divide into three categories: description, theoretical linkages and empirical evidence. The introductory chapter is descriptive: it defines the background and motivation behind this study. Chapter Two explains the theoretical background of the four empirical analyses. The theoretical discussions cover classical and Keynesian theory regarding economic growth and the role of fiscal policy. The Ricardian equivalence is also relevant to explaining the effect of fiscal policy on interest rates and growth. Intertemporal budget constraint is also included in this theoretical chapter in the analysis of fiscal sustainability.

The empirical studies start with Chapter Three, which explains the effect of government spending on economic growth in developing countries. Using public expenditure data from IMF Government Financial Statistics, the chapters study the impact of government spending and its component on economic growth. Overall government current consumption has a negative but not significant relationship with economic growth, whereas capital expenditure shows a positive relationship with it. However, each component has a different impact on growth when current spending is decomposed. For instance, interest rate payment spending may decrease growth in the long term. While, salary spending on government staff has positive impact.
Other current spending component which has a positive and significant impact on growth is expenditure on goods and services. With sectoral spending, the results show that health spending has positive implications for growth and that defence spending is not significant for growth. Interestingly, education spending in developing countries has negative impact on growth. This result does not align with theory, but it is possibly due to the inefficiency of spending in the education sector. This condition warrants further research, which may yield different results when greater detail on spending in single countries is revealed.

Chapter Four discusses the second empirical study of the thesis. Using the financial indicator from IMF International Finance Statistics and macroeconomics variables from the World Bank, I estimate the relationship between fiscal policy and interest rates in developing countries. Application of the semiparametric technique reveals only a minor relationship between public debt, budget deficit and interest rate. Furthermore, linear analysis was conducted on the impact of public debt and budget deficits on interest rates. The results were consistent: both public debt and budget deficits have a significantly positive effect on interest rates with a relatively small magnitude. Baseline model estimates suggest that a 1% increase in public debt increases the interest rate by three to five basis points in the long term. On the other hand, a 1% increase in the budget deficit is related to an interest rate increase of around 62 to 63 basis points.

The interaction model is also applied in this chapter to study different contexts of the effects of public debt and budget deficit on interest rates. This involves splitting the database using dummy variables according to a specific classification: high and low deficit level and high and low financial depth level. In summary, a higher budget deficit
level influences the impact of public debt and deficit on the interest rate. Furthermore, financial depth is also an important factor for determining the impact of public debt on the interest rate. This implies the need to develop a domestic financial market to buffer the fiscal effect on the interest rate.

Chapter Five investigates the impact of public debt on economic growth in developing Asian countries. The public debt data in this empirical study is “central government” public debt. Many studies have used “general government” public debt due to the consolidated value of local and central governments. However, many countries in Asia prohibit local governments from borrowing directly from domestic or international capital markets. In these circumstances, central governments may borrow on behalf of local governments to fund projects.

Moreover, in terms of data availability, central government debt is more widely available than general government debt for developing countries. This study found that government debt has a consistently negative coefficient in all specifications. However, the negative impact of public debt is significant in multivariate estimation in both random effect and the dynamic panel model. From these results, a 10% increase in public debt relates to a decrease in economic growth of between 0.2% to 0.4%. These results are quite detrimental to the economy if we consider their compounding effect in the long term.

Chapter Six studies fiscal sustainability and population ageing in ASEAN countries. Apart from the large panel data analysis from the previous chapter, this chapter focuses on an individual analysis of six ASEAN countries. The assessment of fiscal stance in these six countries is calculated through public debt stabilisation formulae. The impact of
population ageing can be measured with the growth calculation production function. This analysis focusses on one aspect of fiscal pressure from ageing: the effect of slower labour force growth on future real GDP growth. In addition, our results suggest that significantly larger primary budget balances will be required to ensure future public debt sustainability. For instance, slower labour force growth in Singapore impacts the primary surplus by around 1% of GDP; for other ASEAN countries, the figure is below 1%.

Finally, Chapter Seven provides a synopsis of the thesis along with discussion of the limitations of, and avenues for, further research. The policy implication is also discussed in this chapter based on the empirical results. The summary structure of this thesis is presented in Figure 1.6 below.
Figure 1.6 Thesis structure

Chapter 1
• Introduction
  • Background and research motivation

Chapter 2
• Fiscal policy, interest rates and economic growth
  • Theoretical analysis of linkages

Chapter 3
• Government spending composition and economic growth in developing economies: An empirical analysis

Chapter 4
• Public debt, budget deficits and interest rates in developing countries: An empirical analysis

Chapter 5
• Public debt in developing Asia: A help or hinderance to growth?

Chapter 6
• Fiscal sustainability and ageing: The case of ASEAN countries

Chapter 7
• Conclusion and policy implications
CHAPTER 2. LITERATURE REVIEW

2.1 Introduction

This chapter examines the theoretical framework of the empirical chapters in the thesis. As mentioned in the introduction, the overall theme of this thesis concerns the role of fiscal policy in macroeconomic performance, such as long-term growth and interest rates, so it first examines the theoretical literature behind the effect of fiscal policy on macroeconomic variables. This leads to the follow-up question of how government spending theoretically affects economic growth. The final consideration is what the measurement of fiscal sustainability according to the theoretical literature.

The chapter is organised as follows. Section 2.2 explains the theoretical growth model and briefly discusses classical and neoclassical frameworks as well as endogenous growth theories. Section 2.3 discusses the role of government in the growth theories. It also surveys relevant literature regarding how fiscal policy affects growth in selected theories such as neoclassical, Keynesian and Ricardian equivalence, including the crowding-out effect and rational expectation. Section 2.4 outlines the theoretical framework of each empirical chapter in the thesis along with the empirical studies that support each branch of its theoretical approach. Section 2.5 concludes the chapter with summary remarks.

2.2 The theories of economic growth

Classical economists have provided the essential foundations of modern economic growth theories such as competitive approaches and equilibrium dynamics, the law of diminishing returns, the distinction between with human and physical capital, and the
relationship between population growth and per capita income (Malthus, 1798; Ricardo, 1817; Smith, 1950). However, Ramsey's (1928) treatment of household optimisation over time is considered the essential departure point of growth theories in the modern era. Ramsey’s model of separable utility consumer function is a key element of growth models as refined by Cass (1965) and Koopmans (1965) (Barro & Sala-i-Martin, 2004). Moreover, Harrod (1939) and Domar (1946) developed Ramsey's model to integrate Keynesian elements with the components of economic growth in a production function that has little substitution capability among inputs.

Another notable contribution in economic growth theory comes from Solow (1956) and Swan (1956). They developed a production function based on the neoclassical assumptions of the diminishing returns of inputs, constant return to scale and smooth substitution among inputs. Using the dynamic behaviour of the economy, the Solow-Swan production function, when combined with the constant saving rate rule, generated a simple and robust growth model (Barro & Sala-i-martin, 2004). In the mid-1980’s, amid concern of a global economic slowdown, research in economic growth emerged once again with the studies of Romer (1986) and Lucas (1988). Their contribution to modern growth theory is known as endogenous growth theory (Agell, Lindh, & Ohlsson, 1997).

2.2.1 Classical growth theories

As mentioned in the introduction, economists from the eighteenth and nineteenth centuries namely, Adam Smith, Robert Malthus and David Ricardo founded classical growth theory. For instance, Ricardo (1817) proposed that growth builds from the rate of technological progress and trade. Smith (1950) states that technological progress depends on an accumulation of capital that increases mechanisation and the division of labour, and
that capital accumulation is influenced by profit, both in level and in trend (Higgins, 1968). Malthus (1798), meanwhile, proposed the relationship dynamic between economic development, population growth and fertility.

The baseline framework of such classical theories lies in the elements of production function: investment, profit determinants, technological progress, the labour force and the wage system. Therefore, the classical theory of growth shares a similar production function of the stock of capital, labour force, land and level of technology (Barro and Sala-i-martin, 2004). This classical production function implies that an increase in profit increases investment, adding capital to the existing stock; this is followed by technological improvement. The increased capital accumulation in the private sector results in salary and wages increases that stimulate population growth. Increased population accelerates the demand for food that is produced by labour and capital in the agriculture sector.

However, according to the classical view, diminishing returns may lead to static growth. For instance, diminishing returns on land may cause a rise in food prices due to rising labour costs. This will increase rent and eventually reduce profit. When profit declines, so does private investment, followed by reduced technological progress. Eventually, population growth slows, as does capital accumulation. Whenever population growth becomes constant and capital accumulation is zero, a stationary state occurs.

The limitation of the classical framework of economic growth is twofold. Firstly, it does not address the role of entrepreneurship in the production function. Secondly, technological progress is mainly dependent on investment and savings (Higgins, 1968).
2.2.2 Harrod-Domar growth model

Harrod (1939) and Domar (1946) attempted to include Keynesian analysis in the aggregate production function. Their growth production function states that growth is determined by the net of the national saving and output ratio and the capital and output ratio. The model explains that the growth rate is determined by the savings rate times the marginal product of capital minus depreciation. Furthermore, the model assumes constant marginal return on capital. The simplified Harrod-Domar growth theory is:

\[
\frac{\Delta Y}{Y} = s - \frac{c}{c} - \delta
\]

(2.1)

Where, \(\frac{\Delta Y}{Y}\) is the change of GDP or GDP growth, \(s\) is national saving ratio, \(c\) is capital-output ratio and \(\delta\) is depreciation. According to the Harrod-Domar model, a nation can pursue economic growth by increasing the saving rate and the marginal product of capital or by reducing the depreciation rate (Hochstein, 2006). Furthermore, the model also suggests that an increase in investment generates more growth.

In less developed countries, income is lower, so savings cannot replace exhausted capital goods. Therefore, the accumulation of physical capital goods is low, resulting in lower economic progress (Todaro & Smith, 2009). The Harrod-Domar view regarding less developed countries has its limitations. The theory implies that these nations should seek external sources of higher growth, such as foreign aid or private investment. However, the use of external borrowing sources has historically created repayment problems for less developed countries which may have detrimental effects on economic growth (Todaro & Smith, 2009).
2.2.3 Neoclassical growth theory

The limitations of the Harrod-Domar model sparked further studies on economic growth in order to address its shortcomings. In the late 1950s, neoclassical growth theory was developed. This theory attempted to explain the growth production function by taking into account the elements of capital accumulation, labour or population growth, and productivity. Neoclassical theory contributes to modern growth theory by introducing the concept of aggregate capital stock, aggregate production function and the utility function for representative consumers.

\[ Y = AK^\alpha L^{1-\alpha} \]  

Equation (2.1) represents the standard disposition of the neoclassical growth model where \( Y \) is GDP, \( K \) is capital stock and \( L \) is labour. In the above equation (2.2), \( A \) represents labour productivity with exogenous growth. The neoclassical view acknowledges technological progress but this is outside the equation as residual. In Equation (2.2), \( \alpha \) denotes elasticity of output. Another important aspect of the neoclassical growth model is diminishing returns on both input labour and capital.

The fundamentals of the Solow-Swan growth model

The significant contributors to the neoclassical view of economic growth are Solow (1956) and Swan (1956), who extended the Harrod-Domar model. The model of Solow and Swan is based on the neoclassical assumption of decreasing returns of capital. It considers the producer aspect of the economy that focuses on capital accumulation rather than considering the consumer aspect of the economy. The Solow-Swan model is also known as the exogenous growth model, which considers labour as a factor of production and does not assume a fixed capital-labour ratio (Reyes, 2011).
The Solow-Swan model assumes a closed economy and no government intervention with a continuous timeframe in the model. In Equation (2.2), \( \alpha \) is the elasticity of output valued at \( 0 < \alpha < 1 \). The economy is fully employed and the initial values in the production function are set: \( A(0), K(0), L(0) \). Thus, the number of workers and the level of technology grow at \( n \) and \( g \) rates are:

\[
L_t = L(0)e^{nt} \tag{2.3}
\]
\[
A_t = A(0)e^{gt} \tag{2.4}
\]

Here, the effective units of labour, \( A_t \) and \( L_t \), grow at the rate \( (n + g) \). The capital depletes overtime at the constant depreciation rate of \( \delta \). On the other hand, saving occurs when only a fraction of output is consumed \( (cY_t \text{ with } 0 < c < 1) \); hence, the fraction of saving is \( s = 1 - c \) for investment.

\[
\dot{K}_t = s.Y_t \cdot \delta K_t \tag{2.5}
\]

The dot above \( K \) is the derivative with the respect to time. The production function of \( Y(K,AL) \) has constant return to scale and can be transformed into output per labour input thus:

\[
y_t = \frac{Y_t}{A_t L_t} = k_t^\alpha \tag{2.6}
\]

The Solow-Swan model is concerned with the dynamic of capital intensity, which is the capital stock per unit of effective labour \( (k) \). The derivative overtime framework is displayed in the Solow-Swan model as:

\[
\dot{k}_t = sk_t^\alpha - (n + g + \delta)k_t \tag{2.7}
\]

The first term equation (2.5) represents the actual investment in unit effective labour \( (sk_t^\alpha = sy_t) \). The second term \( ((n + g + \delta)k_t) \) represents the break-even investment or the required investment to avoid \( k \) from declining.

In the Solow-Swan model, steady state occurs whenever \( k = 0 \) in equation (2.5). Thus, in steady state:
\[ s k_t^\alpha = (n g + \delta)k_t \]  
(2.8)

\[ k^* = \left( \frac{s}{n + g + \delta} \right)^{1-\alpha} \]  
(2.9)

Since the model predicts that economies converge in a steady state condition from any departing condition, the equilibrium is deemed to be stable (Todaro & Smith, 2009).

The Solow-Swan model argues that economies have a tendency to experience higher growth when short-term capital per worker is smaller relative to long-term capital per worker, which is in line with the principle of diminishing returns on capital (Barro & Sala-i-martin, 2004). Each country may have different population growth, savings rates and stages in production; these may affect the steady level of capital and output per worker. Therefore, the Solow-Swan model is useful for explaining economic growth across nations and regions (Barro & Sala-i-martin, 2004; Savvides & Stengos, 2008).

The Solow-Swan growth model also explains the role of technology in economic growth. In this model frequent increases in the input does not lead directly to higher growth in the long-term. The inputs will have diminishing returns because adding one unit of input produces less in previous input units, leading ultimately to stagnant growth (Savvides & Stengos, 2008). Technological progress may offset the diminishing returns on capital so that the model can allow accumulation of inputs in production and increase positive growth in the long run (Arvanitidis, Petrakos, & Pavleas, 2007).

The Solow-Swan model is widely used in empirical studies, including in this thesis, due to its simplicity and strong predictability. However, the model is limited because of the absence of an investment function. Furthermore, the model’s analysis of long-term growth depends only on exogenous factors—technological progress and population...
growth—and does not explain other determinants that relate to long-term per capita growth (Acemoglu, 2009; Barro & Sala-i-martin, 2004).

2.2.4 **Endogenous growth theories**

Endogenous growth theories developed because of the limitations of neoclassical growth theories which claim that long-term growth depends only on exogenous factors. The wave of endogenous growth studies started with the works of Arrow (1962), Sidrauski (1967) and Uzawa (1965). Under the endogenous growth model, it is possible for a nation to experience constant positive steady-state growth with zero labour and technology growth. In the one-sector model, the above condition can be achieved by maintaining private returns to capital above zero over time, whereas, in two-sector models, it can be attained through the separation of the endogenous accumulation of human capital.

Human capital is introduced as a component of capital goods that does not display diminishing returns. Accordingly, the declining growth rate to zero can be averted without such diminishing returns on capital. Furthermore, the endogenous growth takes into account the role of purposive research and development (R&D) on technological change within the growth framework. Long-term growth can be pursued if the economy promotes technological innovations (Grossman & Helpman, 1991; Howitt, 1999).

**AK endogenous growth model**

The AK model is a simple endogenous growth model that only considers one sector; it also explains the constant positive growth rate of output (Jones and Manuelli, 1990). The important distinction of the AK model, apart from its neoclassical view, is the absence of diminishing returns on capital (Barro & Sala-i-Martin, 2004). Without diminishing
returns, the AK model explains sustainable growth without arriving at the steady state condition. Referring to Equation (2.2), with \( \alpha = 1 \), the labour component is taken out of the production function. The term “capital” consists of both physical and human capital.

\[
Y = F(K) = AK \tag{2.10}
\]

Where \( A \) is a constant that represents the level of technology and \( K \) is both physical and human capital. When Equation (2.10) is transformed into output per capita \((y)\), it is determined by constant \( A>0\):

\[
y = F(k) = Ak \tag{2.11}
\]

Where \( k \) denotes capital per worker; using the Solow-Swan transitional dynamic model

\[
\frac{\dot{k}}{k} = \frac{sf(k)}{k} - (n + g+\delta) \frac{k}{k} \tag{2.12}
\]

we substitute \( f(k) = A \).

\[
\gamma K = \frac{\dot{k}}{k} = sA - (n + g+\delta) \tag{2.13}
\]

Where \( n \) is the rate of population growth, \( g \) is the rate of technological progress and \( \delta \) is the depreciation rate of capital. The number of effective units of labour grows at the rate \((n + g)\). The break-even term is \((n + g+\delta) \frac{k}{k}\). In the AK model, the economy can attain long-term sustained growth without the need to postulate exogenous technological progress \((g = 0)\), therefore:

\[
y = \gamma K = sA - (n+\delta) \tag{2.14}
\]

Since output is linear for \( K \), the growth of capital per worker is also the growth of output per capita. Therefore, the output per capita grows with total factor productivity \((A)\) and savings \((s)\) and declines in the capital labour ratio \((n+\delta)\). So long as \( A>(n+\delta)\), the economy will grow forever at a constant rate without postulating exogenous technological progress.
The simple approach of the AK growth model eventually raises questions regarding its prediction of long-term growth. The treatment of human capital in parallel with physical capital is still debatable. For instance, increasing spending on education (human capital) will not have the same effect on output as increasing spending on physical capital. There is a limit to the positive effect on growth through spending on education that only increases educational enrolment (Savvides & Stengos, 2008).

Romer growth model

This section will discuss an endogenous growth approach that addresses technological spill-overs. Romer (1986) argued that capital accumulation can increase the stock of generally available knowledge. Such knowledge is known as “learning by doing” which, in turn, develops a technological spill-over. Technological spill-overs or leaks mean that firms tends to imitate production improvements from other firms; thus, at an aggregate level, firms benefit from each other’s accumulated experience (Todaro & Smith, 2009.)

Like the Solow-Swan approach, this theory assumes perfect competition between firms (Kneller, 1998). Romer, however, is distinguished from the Solow model by assuming the existence of technological spill-overs where economy-wide capital stock affects outputs at an industry level. This, in turn, may increase return to scale at an aggregate level (Todaro & Smith, 2009). According to Romer (1986), the output of firm \((i)\) is not only the function of the capital and labour of firm \((i)\) but also of the aggregate economy of capital stock \((K)\). Following Barro and Sala-i-Martin (2004), the Romer model is explained by the Cobb-Douglas production function as follows:

\[
Y_i = AK_i^\alpha K^\beta L_i^{1-\alpha}
\]

(2.15)
Here, $0 < \alpha < 1$ and $\beta \geq 0$. For every given $K$, the output function displays a constant return to scale in the firm ($i$) inputs $K_i$ and $L_i$. A spill-over effect exists and is positive if $\beta > 0$. Assuming symmetry across industries for simplicity, each industry uses a similar level of capital and labour. Therefore, the aggregate production function is:

$$Y = AK^{\alpha} \beta L^{1-\alpha}$$

(2.16)

This expresses that aggregate output $Y$ is the function of $K$ and $L$. $\beta > 0$ increasing returns applies at an economy-wide level. Therefore, based on Romer’s growth model, the individual level production function has neoclassical properties of constant returns and diminishing returns on capital. However, at the economy-wide level, the production function is absent from neoclassical properties because of externality, specifically in technological spill-overs.

**Two sector endogenous growth model**

The definition of capital in the neoclassical view consists of physical and human capital that translate into one parameter, $K$. In this section, we discuss human capital\(^2\) as a distinct production function in a two-sector model. The two-sector growth model states that, to avert diminishing returns on capital, the endogenous accumulation of human capital must be separated in the production function. Human capital investment is determined using utility to maximise household function and utilises different technology for producing consumable goods. Using two setups from the Cobb-Douglas production function, we follow Rebelo (1991) to express the two-sector endogenous production function:

$$Y = C + \dot{K} + \delta K = A.(vK)^{\alpha}.(uH)^{1-\alpha}$$

(2.17)

\(^2\) Human capital is a term that represents skills, education, health, competencies and other characteristics of labour that may enhance productivity (Acemoglu, 2009).
\[
\dot{H} + \delta H = B. [(1 - \nu). K^\eta]. [(1 - u). H]^{1-\eta}
\]  
(2.18)

Where \(Y\) denotes output goods (gross physical capital investment and consumption goods); \(A, B > 0\) are technological parameters; \(\alpha (0 \leq \alpha \leq 1)\) and \(\eta (0 \leq \eta \leq 1)\) are the shares of physical capital to output in each sector; \(\nu (0 \leq \nu \leq 1)\) and \(u (0 \leq u \leq 1)\) are the fraction of physical and human capital in the production function. In Equation (2.18), \((1-\nu)\) and \((1-u)\) are the input of physical and human capital into education to produce human capital. This equation also shows that the components of producing human capital differ from the components in producing goods. Both of the model equations (2.17) and (2.18) are developed using the Cobb-Douglas production function; therefore, both models exhibit constant return to scale in the quantity of the two capital inputs. Hence, both show steady state growth similar to the AK model of growth (Barro & Sala-i-martin, 2004).

Simplified steady state consumption function is:

\[
\lambda c = \frac{1}{\sigma} [A (\frac{uH}{vK})^{1-\sigma}]
\]

(2.19)

In Equation (2.19), the steady-state condition requires that \(H\) and \(K\) increase at the same rate. Therefore, the marginal product of physical capital is constant and long-term sustainable economic growth is achieved.

Fiscal policy or government intervention is not required in the two-sector growth model. Fiscal policy may, in fact, create a problem in a dynamic optimisation framework with perfect competition. However, fiscal policy may impact human capital through government spending so that it only influences the production function through one-off shifts in parameters \(A\) and \(B\) in Equations (2.17) and (2.18) respectively. Fiscal policy will thus have the same effect as in the AK one-sector growth model (Kneller, 1998).
Summary

The literature shows that a large number of studies have been dedicated to determining economic growth. However, each perspective has its benefits and drawbacks in explaining the growth process within a country. The neoclassical perspective is well known in growth modelling due to its practicality and strong predictive abilities. Diminishing returns in the neoclassical growth model show that it is only profitable for a firm to invest when technology increases in the economy. On the other hand, in the endogenous growth model, diminishing returns have minimal effect on output. Growth increases whenever a firm invests in factors of production. Both offer different approaches and implications for fiscal policy. The neoclassical approach restricts fiscal policy to the creation of technological change, whereas the endogenous growth model states that fiscal policy may encourage inputs in factors of production to pursue long-term economic growth. The next section discusses the role of fiscal policy in more detail, based on several theoretical approaches such as the neoclassical and Keynesian.

2.3 Public sector in the growth theories

According to the growth frameworks in the previous chapter, government can help boost economic growth by providing goods and services to the private sector so that private investment rises to an optimal level. This section will specifically discuss the role of government fiscal policy in spending and public debt. The role of fiscal policy will be discussed from several theoretical perspectives, not only neoclassical but also the Keynesian approach to the role of government in the economy.
2.3.1 The neoclassical framework of fiscal policy

From the neoclassical perspective, government is classified as the “benevolent social planner” tasked with maximising the utility of a representative agent who works, consumes and saves.\(^3\) The agent is an independent actor within the economy who has a utility function based on private consumption and leisure. Government provision of goods and services is an outer factor of the agent’s utility function. Assuming a closed economy, neoclassical theory suggests that the government would have a budget deficit by financing a temporary increase of government spending with the emphasis on maintaining a constant tax rate to minimise economic distortion.

Government spending must equal the present value of tax raised, determining the intertemporal budget constraint condition. A budget deficit occurs when expenditure is high and a budget surplus when it is low. Accordingly, any deficit raised is matched by non-distortionary tax; therefore, such anticipated fiscal policies have no effect on short- and long-term economic growth (Hemming, Kell, & Mahfouz, 2002). However, Barro (1979) argues that default-free debt may assist a smooth tax rate to finance the deficit. The neoclassical model is based on the idea that the government allocates tax over time to minimise economic distortion rather than by varying taxation levels with expenditure.

The role of fiscal policy via government spending is explained using the Cobb-Douglas production function below:

\[
Y = AK^\alpha L^{1-\alpha} G_t^n
\]  

(2.20)

\[\text{\textsuperscript{3}}\text{Mankiw (2013) argues that the benevolent social planner is a hypothetical character who has perfect market information and full authority to influence the activity of agents in the economy.}\]
Where \( G_Y \) denotes productive government spending assumed to be non-rival and non-excluded public goods. Variable \( G_Y \) is produced with technology similar to the private sector because, according to neoclassical theory, all productive goods have an homogenous effect on growth (Barro & Sala-i-martin, 2004). Government spending elasticity is represented by \( \beta \) (0<\( \beta \)<1) and all elements in the equation display diminishing returns. As mentioned earlier, government spending is fully financed by non-distortionary taxation (\( G = \tau \)); \( G = G_Y + G_c \) with \( G_c \) as government consumption.

\[
Y = C + I + G
\]

(2.21)

Where \( Y \) is output, \( C \) is consumption, \( I \) is investment and \( G \) is total government spending.

Using \( I = \dot{K} + \delta K \) and \( G = \tau \), the growth model of capital can be derived thus:

\[
\dot{K} = Y - C - \delta K - \tau
\]

(2.22)

The dot above parameter \( K \) is the derivative with the respect to time. The household utility function in a neoclassical framework is a function of private consumption and government spending, with each perfectly balancing the other. Household utility can be maximised thus:

\[
\lambda c = \frac{1}{1 - (1 - \sigma)(1 - \xi)} [\alpha A K^{\alpha L^{1-\alpha} G_Y^\beta} - \delta - \rho]
\]

(2.23)

Equation (2.23) shows that the growth rate of consumption is constant whenever the level of government expenditure and capital-labour ratio is constant. Differentiating the production function with respect to time and substituting the growth of technology, population and government expenditure, Equation 2.8 also shows the growth rate as zero:

\[
\frac{Y}{Y} = \frac{\dot{A}}{A} + \frac{\dot{K}}{K} + (1 - \alpha) \frac{\dot{L}}{L} + \beta \frac{\dot{G}_Y}{G_Y} = 0
\]

(2.24)

The result of population growth and technology growth is also zero, \( \frac{\dot{A}}{A}, \frac{\dot{L}}{L} = 0 \). If we differentiate the government budget constraint, the growth of spending is also zero \( \frac{\dot{G}_Y}{G_Y} = 0 \). Government fiscal policy in spending in this model is ineffective due there being no
impact on economic growth. The shifting of spending allocation from productive spending to consumption spending also has no impact on long-term growth.

The role of government is effective in the neoclassical endogenous growth model. Using the AK approach, Barro (1990) develops a simple public policy model within the endogenous growth model. The baseline of the model uses an assumption identical to the neoclassical growth model. The AK production function, in this regard, is aided by government spending variable, namely $G_y$, as follows:

$$Y = \dot{AKG}_y^\beta$$

(2.25)

$\beta$ is $0<\beta<1$. There is a constant return on capital but the increase of public goods experiences diminishing returns. If the household utility function is maximised then the steady state growth of consumption function is:

$$\lambda_c = \frac{1}{1 - (1 - \sigma)(1 - \delta)}[\alpha \dot{G}_y^\beta - \delta - \rho]$$

(2.26)

Equation (2.26) shows that the growth rate of consumption is a positive constant due to the constant in all elements of the function. This is because there is no growth in technology or in the level of government spending. In an equilibrium condition, productive government expenditure promotes the marginal product of capital and thus increases the growth rate. The steady state of growth means that government expenditure is increasing but is subject to diminishing returns. The slope of productive government spending is $\beta$, whereas government consumption expenditure is not significant for growth since it is outside the Euler equation.

However, Cashin (1995) argues that this type of government consumption may also have a positive impact on long-term growth because the component of government consumption must be treated as an input in the production function. In conclusion, shifting
components of spending toward more productive sectors from non-productive ones may further benefit the steady state growth rate.

2.3.2 Ricardian equivalence

The controversy surrounding discretionary fiscal policy was discussed in the years of the early modern European wars. Classical economists often refer to 17th and 18th-century economic conditions as essential to public finance theory. This was the period when the United Kingdom rose as an empire that could engage in war with its Continental rivals. The period of the Napoleonic wars forced the British to use national debt to finance the war effort. In this period, when the economy of Great Britain was dominated by trade with its allies, economists were not in favour of government policy which could create a barrier to free trade and industrialisation (Bell, 2009).

Government debt issuance was the preferred option in financing a war budget. David Ricardo (1817) was concerned with rising debt for this purpose; hence, the Ricardian equivalence theorem. Barro revived Ricardo’s concerns regarding the options of financing war either through debt or temporary tax\(^4\) (Hakes and McCormick, 1996). The Ricardian theorem states that there is no difference between the two options because government debt is similar to postponed taxes. If the government borrowed to finance its deficit, taxes would, in the long run, have to increase to cover the principal and interest on the debt. With the rational expectation of future tax rises, households would increase their savings and their spending would not affect economic activity (Kónya & Abdullaev, 2009).

\(^4\) Hakes and McCormick (1996) argued that Adam Smith proposed an idea similar to Ricardian equivalence whether government bonds are net wealth or whether tax rebates are saved. Smith arrived at a similar conclusion using a less rigorous mathematical approach.
Consequently, Ricardian equivalence holds that budget deficits do not affect interest rates.

The Ricardian equivalence argument is a combination of two fundamental theories: that of government budget constraints, and the permanent income hypothesis (Elmendorf and Mankiw, 1999). The budget constraints theory explains that, if government expenditure stays the same, lower taxes today imply higher taxes in the future. The permanent income theory states that consumers make long-term income decisions by evaluating their present cash flows. Based on this same principle, citizens who buy bonds can earn interest from the government. Conversely, the government imposes taxes on those same citizens; therefore, the net wealth is zero (Barro, 1974).

The perfect form of Ricardian equivalence assumes that:

- Government covers its debt by future taxation.
- Both government and households have similar planning horizons.
- Lump-sum tax policy applies.
- There is a perfect capital market whereby both households and government borrow at the same rate in the absence of borrowing constraints.

The assumptions of Ricardian equivalence are crucial to validating its hypothesis. Thus, any violations of these invalidate the Ricardian hypothesis (Seater, 1993). However, Barro (1974) argued that, although their assumptions are quite restrictive, Ricardian principles provide a useful framework for an effective fiscal policy for the economy. Ricardian agents have the rational expectation of anticipating changes in budget financing and neutralising their impact on the economy. Therefore, the fiscal multiplier will be zero:
private savings will fully offset the public deficit and national savings remain unchanged. Interest rates in this case are also unchanged and will not respond to variations in government fiscal policy (Barro, 1984; Hakes & McCormick, 1996; Kotlikoff, Razin, & Rosenthal, 1990).

In supporting Ricardian equivalence, Barro uses the overlapping generation model (1974) to show the link between current and future generations regarding intergenerational altruism, where the current generation chooses to reduce consumption in anticipation of public debt increasing future taxes. Future generations are left responsible to pay that taxation; hence, the intergenerational redistribution effect is nullified.

However, Feldstein (1976) challenged the assumptions of Ricardian equivalence, arguing that there are important factors—such as economic and population growth—that are omitted in Barro’s research on Ricardian equivalence; these may bias the results. Many also criticised the underlying assumptions of Ricardian equivalence as hard to hold in the real world, with the perfect form of Ricardian equivalence being relatively limited (see for example, Barsky, Mankiw, & Zeldes (1986); Kotlikoff et al. (1990)).

2.3.3 Fiscal policy in Keynesian theory

One of the goals of fiscal policy in Keynesian theory is macroeconomic stabilisation. The government can use expansionary fiscal policy during economic downturns and contractionary fiscal policy during economic expansion. The government can use fiscal policy to influence aggregate demand through a change in spending. Therefore, the Keynesian model is referred to as a demand-side model.
Consider the textbook Keynesian macroeconomic model:

\[ Y = C + I + G + (X - M) \]  (2.27)

where \( Y \) = GDP, \( C \) = consumption, \( I \) = investment, \( G \) = government expenditure, \( X \) = expenditure on exports and \( M \) = expenditure on imports.

In its simplest form, the Keynesian model puts forward basic assumptions such as price rigidity and excess capacity to determine the output from aggregate demand. Fiscal expansion has a multiplier effect on the economy: the multiplier measures the change in output (\( \Delta Y \)) related to the change in government expenditure (\( \Delta G \)), which can be represented as \( \Delta Y / \Delta G \). When \( G \) and \( Y \) move in the same direction, the multiplier is positive, also meaning that an increase in government expenditure increases \( Y \) as an output. However, it is possible that the multiplier of \( G \) is not positive and can decrease other components of \( Y \). If this condition occurs, \( Y \) will be unchanged despite the increase of \( G \). In other words, there will be a crowding-out effect due to the increase in \( G \) (Mankiw, 2013). If the multiplier value is greater than 1, the responsiveness of consumption to current income has a greater effect for spending expansion than a tax cut. However, if a spending increase is equal to a tax increase, the multiplier is exactly 1 or is a balanced budget multiplier (Hemming, Mahfouz, & Kell, 2002)

The role of fiscal policy in the scope of macroeconomics is demonstrated by the aggregate demand (AD) and aggregate supply (AS) frameworks. Figure 2.1 shows an equilibrium level of the AD and AS curves, assuming a shock in the domestic economy where the equilibrium level shifts from \( E_0 \) to \( E_1 \). The government then has two main options for
adjusting the shock. The first allows an automatic stabiliser \(^5\) to shift the economy back towards its equilibrium. The government does not impose a discretionary policy and leaves the economy to adjust itself within the existing system. The automatic stabiliser can enhance the economy and push the AD curve to the right, back to the equilibrium level (E0). However, since the shock may have a severe effect on people’s welfare, the speed of adjustment needs to be fast enough to minimise the impact. Therefore, the government may add, or choose instead, the second option of a discretionary macroeconomic policy to speed up the recovery process from the economic shock.

![Figure 2.1 AD-AS curve with demand shock](source: Carmignani (2015))

For the second discretionary macroeconomic policy option, the government increases public spending to top up the application of the automatic stabiliser and push the AD curve back to its previous equilibrium level. Therefore, if the economy deviates from its

---

\(^5\) An automatic stabiliser is a measure by a policy maker which is included in the fiscal system and can be triggered to counter the effect of a macroeconomic shock. Examples are interest rate reduction from the monetary authority or unemployment subsidies and welfare support from the fiscal side (Carmignani, 2015).
long-term equilibrium due to a demand shock, a counter-cyclical fiscal policy can help it recover equilibrium. “Counter-cyclical” means that fiscal policy is only expansionary during a recession period and then contracts during an expansionary period. However, fiscal policy is effective for stabilising the fluctuation when the multiplier of government expenditure in the economy is positive. The higher the value of the multiplier, the better it is for adjustment (Barro, 1984; Gale & Orszag, 2003; Stiglitz, 1997; Stonecash, Gans, King, & Mankiw, 2011).

2.3.4 Crowding-out effect

An extension of the simple Keynesian model also explains the crowding-out effect from changes in interest and exchange rates. The effect of crowding-out is dependent on several factors: openness of the economy, exchange rate regime, price stickiness and sensitivity to investment and money demand on the interest rate (Hemming et al., 2002). The example of the interest rate is where the budget deficit is financed by government interest-bearing bonds; government borrowing increases the demand on loanable funds and therefore raises the equilibrium of the interest rate. Investment thus declines.

The increase in the interest rate can also appreciate the exchange rate, with exports thus declining. With both investment and net exports decreasing, the net effect of the increase in $G$ is to decrease output. Therefore, during an economic shock, the increase in $G$ only further depresses the economy with negative multipliers from other factors (Elmendorf & Mankiw, 1999). With the above controversy about fiscal policy, it is necessary to measure the size of the fiscal multiplier value. Some would argue that, if the multiplier is positive but smaller than the fiscal policy, it will not effectively stabilise the economy (Stonecash et al., 2011).
Many empirical studies have identified the crowding-out effect of $G$ on private consumption. Aiyagari, Lawrence, Christiano, and Eichenbaum (1992) and Baxter and King (1993) have investigated government expenditure’s shock effect on various macroeconomic indicators using the neoclassical growth model with constant return to scale. Their studies found that government expenditure is associated with declining private consumption. Easterly and Rebelo (1993) used a large panel dataset of 125 countries to find that budget deficit has negative relationship with private investment. Furthermore, using a panel dataset of 145 countries, Furceri and Sousa (2011) also identified the crowding-out effect of budget deficits on private consumption and investment. In a more recent study, Anyanwu, Gan, and Hu (2017) examined the crowding-out effect of government borrowing in 28 oil-dependent countries over 1990–2012. Their results found that government debt has a negative relationship to private sector investment but no significant impact on the bank lending rate.

However, in less developed countries, the results of the crowding-out effect of fiscal policy on private investment are mixed (Atukeren, 2005). Erden and Holcombe (2005) investigated the crowding-out effect by applying pooled linear regression to a panel of developing countries. The results showed that public spending has a positive impact on private investment. However, by using a developed countries dataset, the results show a contrasting result: public investment crowds out private investment. They argue that the different size of government expenditure and a less developed domestic capital market may have contributed to the mixed results. Furthermore, public spending in developing countries provides infrastructure that compliments investment in the private sector. However, more detailed data is needed to further explore this relationship.
2.3.5 Rational expectation and risk premiums

The shortcomings in the Keynesian view, particularly in its microeconomic foundations, are the basis of an emerging neoclassical approach. While neoclassical theory focuses on the supply side effect, there are several aspects that have implications for the demand side.

Rational expectation

The Keynesian approach relies heavily on the concept of adaptive expectations where a rational agent tends to bring forward expectations and make adjustments to variables. From the perspective of rational expectations, the long-term impact of fiscal policy will also matter in the short term. Therefore, in this case, temporary and permanent fiscal policies will differ in their effects on output. For instance, temporary fiscal policy that has no long-term effect will not change the expectations of economic agents. Conversely, permanent fiscal policy influences their expectations because economic agents expect the initial interest rate increase to become persistent and more extensive in the future (Krugman & Obstfeld, 2003).

Risk premiums and sovereign credibility

In an era of global financial integrity, risk premiums on interest rates are an important channel of public debt influence to fiscal multiplier. As the accumulation of public debt rises due to persistent fiscal deficit, increasing risk premiums that reflect the default risk or inflation risk will magnify a crowding-out effect through interest rates (Miller, Skidelsky, & Weller, 1990). This emphasises the effectiveness of temporary fiscal policy over permanent change because temporary policy has less risk for the accumulation of
public debt relating to fiscal sustainability. Furthermore, in an open economy, the risk of fiscal expansion can also build concern about a government’s future solvency and may lead to a reduction in foreign investment and capital outflow (Hemming et al., 2002).

Government credibility affects risk premiums: when it has a record of poor fiscal prudence, temporary fiscal policy that is announced becomes permanent and the domestic interest rate will likely incorporate risk premiums. When forward-looking agents expect public debt to be high, they will increase their savings to anticipate paying higher taxes (Sutherland, 1997). The anticipation of such an adjustment may create a contractionary effect that offsets expansionary policy at a particular point in time. Perotti (1999) states that, when public debt level is high, distortionary taxes magnify the negative wealth impact of unconstrained households: this may outweigh the positive effect of fiscal expansion on household income and consumption. There will thus be expansionary fiscal contraction.

2.4 Fiscal policy and macroeconomic performance: theoretical linkages

In the previous section, we discussed the main theoretical background of this thesis, starting with growth theories and the role of fiscal policy in economic growth. This section will explain these background theories that translate into each relevant empirical study that build this thesis. Section 2.4.1 explains the theoretical approach—the endogenous theory of government spending and growth which is the baseline of the first empirical study of this thesis. Section 2.4.2 discusses the conventional approach that explains the relationship of fiscal policy (public debt and budget deficit) to the interest rate. Section 2.4.3 discusses the theoretical approach for the third empirical study
regarding public debt and economic growth. Lastly, Section 2.4.4 discusses the concept of fiscal sustainability and population ageing, the topic of the fourth empirical study. Each section also has a table of literature survey summary in the Appendix to Chapter 2.

2.4.1 The composition of government spending and growth

As discussed in the previous section, neoclassical endogenous growth theory provides a foundation for types of government spending that can foster long-term economic growth. Productive governments that apply public capital spending can promote growth both directly and indirectly. Government provision of capital can directly impact growth by adding capital stock to the production process. Furthermore, spending on capital also raises the marginal productivity of factors in the private sector (Barro, 1990; Tanzi & Schuknecht, 1997).

Government expenditure consists of several components that may have different effects on long-term growth. Devarajan, Swaroop, and Zou (1996), and Kneller (1998) propose a neoclassical growth model that considers multiple forms of public goods. Consider that there are two productive public goods—\( G_{Y1} \) and \( G_{Y2} \)—in the economy. Using the Cobb-Douglas production function, the simple production function is:

\[
Y = AK^\alpha G_{Y1}^\beta G_{Y2}^\lambda
\]  

Equation (2.28) shows the different government spending effects on growth. Each spending component has a different effect, each with its own parameters (\( \beta \neq \lambda \)). The government spending components (\( G_{Y1} \) and \( G_{Y2} \)) are always fully funded by non-distortionary tax. The allocation is \( G_{Y1} = \emptyset GY \) and \( G_{Y2} = (1-\emptyset)Y \), with \( \emptyset \) as the ratio of
each instance of spending to aggregate spending. We can maximise the utility of household function to derive the steady-state growth of consumption thus:

\[
\lambda c = \frac{1}{1 - (1 - \sigma)(1 - \xi)} \left[ A(\phi G_{Y_1})^\beta (1 - \phi G_{Y_2})^\lambda - \delta - \rho \right]
\]  \hspace{1cm} (2.29)

Productive expenditure \(G_{Y_1}\) and \(G_{Y_2}\) through the marginal product of capital has an impact on the rate of growth. The magnitude of influence from each instance of government spending depends on its relative productivity and its share of the government’s budget. For example, if \(G_{Y_1}\) has a greater elasticity value than \(G_{Y_2}\), the former will not be immediately more productive for long-term growth if the budget allocation of \(G_{Y_1}\) is larger than \(G_{Y_2}\).

However, how a sector is classified as productive is also subject to ongoing debate\(^6\). The current consensus is that public investment, specifically in infrastructure such as roads, transportation and communication, is productive spending due to its growth-enhancing effects (Tanzi & Zee, 1997).

**Empirical literature review regarding government expenditure and growth**

Empirical studies in this area have shown that infrastructure has a positive impact on growth of output. For instance, Aschauer (1989) reported that core infrastructure spending had positive implications for growth in the US economy. Easterly and Rebelo (1993), Canning (1999) and Demetriades and Mamuneas (2000) have also found that public investment has a positive impact on growth.

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\(^6\) Productive public spending may vary depending on the returns on a public project, the source of funding for the specific project and the balance of the share of private and public capital within the project (Christie, 2014).
Landau (1986) examined the impact of government consumption spending on economic growth without the defining productive or non-productive sectors. In his study, government consumption is total government spending minus public investment and transfer, derived from 104 countries from 1961 to 1980. The results show that government consumption expenditure has a negative relationship with the per capita growth rate. The result is also similar when the database is split into high and upper-middle income countries. However, the relationship of government consumption to growth becomes positive and significant in lower-middle income economies.

Easterly and Rebelo (1993) comprehensively examined the relationship between fiscal policy and the rate of growth using a database of 119 countries from 1970 to 1988. The aggregate analysis of this study found that general government investment has a growth-enhancing effect. Decomposing total investment, the results showed that transport and communication investment have a positive effect on growth. However, government spending on housing and education are not significant for growth.

Bassanini and Scarpetta (2002) studied the determinants of growth in OECD countries over the period 1971–1988. Their study used pooled mean group (PMG) analysis to determine the effect of growth variables, including government spending elements. This technique explains cross-country differences in growth and the evolution of growth performance in each country. The results suggest that government expenditure at an aggregate level may hinder growth at a certain level. Furthermore, public spending on health, education and research has a significant impact on growth; however, the funding aspect of sectoral spending requires further investigation.
More broadly, spending on human capital can also be classified as productive spending. Empirical studies have demonstrated that public spending related to building a stock of quality human capital, such as education and health care, also supports growth in the long run (see, for instance, Garcia-Milà and McGuire (1992)). However, many studies have found that the growth-enhancing effect of education and health spending is less robust. One possible reason, according to Gramlich (1994), is the difficulty of determining the human investment of spending in the education and health sectors from general consumption spending.

The lag effect of education on growth is also difficult to determine; the long lag period may cause the growth-enhancing effect to become insignificant (Semmler, Greiner, Diallo, Rezai, & Rajaram, 2007). A positive impact of education on growth is found in studies from Cullison (1993), Blankenau and Simpson (2004) and Easterly and Rebelo (1993). Conversely, Baldacci, Clements, Gupta, and Cui (2008) used a dataset from 118 developing countries to find that public spending on human capital has a positive impact on education and health capital that thus promotes long-term growth.

In decomposing government spending, Devarajan et al. (1996) were among the first to divide the dataset into two clear country groups: developed and developing. The latter group consisted of 43 developing countries spanning 1970–1990; the developed group comprised 21 sample countries over a similar period. In the former group, productive government spending such as on education significantly hampered growth. Inefficient budget allocation in developing countries may have caused this negative correlation. However, contrasting results were found in the developed-country dataset: productive
spending had a positive effect on growth while non-productive spending inhibited growth. Devarajan et al. (1996) argue that the main reason for the negative impact in the developing countries group is that the initial level of productive spending allocation in developing countries is already high, so that the increase of spending in this area may crowd out other spending allocation and hence be counter-productive.

Acosta-Ormaechea and Morozumi (2013) used a dataset of 56 countries to capture the effect of government expenditure from 1970 to 2010. They are aware that the impact of government spending may depend on the development level of a country, it thus being necessary to disaggregate the sample dataset. The study showed that the education sector has a growth-enhancing effect, notably when social protection spending (non-productive) is reduced to compensate for the education sector. However, the result is less robust if the model is regressed against the full sample of countries.

Afonso and Jalles (2014) examine the decomposing effect of government spending on economic growth using a panel dataset of 155 countries from the OECD and emerging market countries. They directly investigate the impact of each expenditure without having a classification of productive or non-productive sectors. The baseline model is estimated against emerging countries and OECD country samples. The results show that expenditure on social security has low positive effect on growth in OECD countries, while health and education spending have a stronger positive impact on growth. Meanwhile, in an emerging market country group, only education spending has a significantly positive impact on growth.
Gemmell, Kneller, and Sanz (2016) provide new findings about the impact of government spending decomposition on long-term growth in OECD economies. Using the Kneller, Bleaney, and Gemmell (1999) model extension and Bleaney, Gemmell, and Kneller (2001) dataset, they found that the education, transportation and communication sectors promote long-term growth. Furthermore, spending on health and housing also has a positive relationship on economic growth. However, there is an insignificant relationship between military spending and economic growth.

Laboure and Taugourdeau (2018) examine the effect of the composition of government expenditure on the real growth output of 147 countries consisting of low-, middle- and high-income countries. The model estimates by a dynamic panel using system GMM estimators with a database covering the period 1970–2008. The results confirm that government expenditure has a significant effect on economic growth. For low-income countries, total government expenditure promotes economic growth. However, total government expenditure has a significantly negative impact on growth in middle- and high-income countries. The composition of government expenses, such as the consumption of goods and services, salaries and interest rate expenses, have negative impacts on growth. At the functional level, spending on education, health and defence has a growth-enhancing effect. The most productive spending is on education, with a high positive coefficient—especially in low-income countries. However, in high-income countries, no functional expenditure is necessarily productive.

Therefore, not all components of government spending have a similar effect on growth. Many studies have compared and contrasted each element’s direct or indirect impact on
long-term economic growth. The results are mixed, both regarding the effect of spending and the impact of expenditure at different development stages. Furthermore, regarding the first research question “Do government spending components in developing countries influence growth?”, we are particularly interested in investigating each component of current public expenditure in the economy to avoid the debate on what to categorise as productive or non-productive spending. Furthermore, studies focused on developing economies are still limited. Therefore, this thesis bridges the gap by investigating the effects of public spending components in emerging economies.

2.4.2 Public debt, budget deficit and interest rates

The use of public debt to finance government spending also influences the interest rate. To understand the mechanics of interest rates, we must first study the determinants of the interest rate in the broader economy. The Investment Saving and Liquidity Preference Money Supply (IS-LM) framework explains the relationship between goods and the money market, with interest rates playing a central role (Hicks, 1937). The goods and services consumed represent the output side of the economy, and the money market, credit and other financial instruments represent its financial side (Cebula, 1987).

![Figure 2.2 Fiscal policy under the IS-LM framework](image)

Source: Carmignani (2015)
The IS curve derived from the Keynesian output function is similar to Equation 1. The components of the IS curve are household consumption ($C$), government consumption/expenditure ($G$), investment ($I$) and net trading ($X-M$). Household consumption is composed of autonomous ($C_0$) consumption and a consumption function that depends on the marginal propensity to consume ($c$) and disposable income ($YD = Y-T$). The tax component ($T$) is based on the level of production ($T = T_0 + \tau Y$). Investment is the function of autonomous investment and the interest rate ($I = I_0 - dY$). The negative coefficient implies that the higher the interest rate, the more unlikely the private sector will invest (see Blanchard, Dell’Ariccia, and Mauro (2010)).

The LM curve represents the equilibrium point in the money market’s financial side. The equilibrium condition is met when the supply of real money ($\frac{M}{P}$) equals the demand for money ($Y*\lambda(i)$); thus, the equation is:

$$ \frac{M}{P} = Y*\lambda(i) \quad (2.30) $$

Where $Y$ is output and $\lambda(i)$ is the interest rate; $M$ is the nominal money supply, and $P$ is the price level. The above equation states that an increase in income ($Y$) also raises demand in real money supply. Assuming that demand is fixed, the rise in income also relates to the rise in interest rate; hence, the LM curve is the increasing function of income. The equilibrium point between the IS and LM curves marks the equilibrium of the interest rate level. An expansionary fiscal policy will shift the IS curve to the right and push the output and interest rate level higher. However, the rise of interest rates as described in the LM context has a negative effect on private investment and thus on overall income. Therefore, to affect the economy, the multiplier of fiscal policy on the demand side must
be substantially higher than the offsetting effect from the rising interest rate (Blanchard et al., 2010).

Figure 2.2 reflects the role of fiscal policy in the IS-LM framework. The equilibrium condition shifts the IS curve to the right-hand side in response to expansionary fiscal policy, resulting in higher output and a higher interest rate. However, the crucial point of this theoretical framework is how large is the magnitude of the rise in the interest rate caused by expansionary fiscal policy. The rise in the interest rate is of concern because it may reduce private investment that may eventually slow economic growth. Therefore, in this framework, fiscal policy is more effective if it has a substantially larger multiplier than economic growth to offset the negative effect of rising interest rates.

Monetary policy is effective in normal circumstances due to the more straightforward implementation and fast response of the government. However, there is a specific condition where monetary policy becomes ineffective as a counter-cyclical policy, when it no longer has the capacity to stimulate the economy because the interest rate is too low, or near zero, which is known as the liquidity trap (Blanchard et al., 2010; Jannsen, Potjagailo, & Wolters, 2015).

A liquidity trap occurs when there is a significantly large-scale demand shock that shifts the IS curve to the left. Rational agents expect a negative impact and subsequently increase their savings and reduce investment substantially. The liquidity trap effect worsens the economy if followed by deflation, which often occurs in the short term during the demand shock period.
Figure 2.3 Fiscal policy and liquidity trap under IS-LM framework
Source: Carmignani (2015)

Figure 2.3 reflects the schematic movement of the IS-LM curve under liquidity trap conditions. During the negative demand shock, the monetary authority eases the interest rate downward until near zero level. In this situation, expansionary fiscal policy is an option for recovering the output and pushing the IS curve upward. The liquidity trap condition is a rare occurrence; hence, the recent economic crisis resulting in a zero condition is being underestimated and overlooked in the economic literature (Chung, Laforte, Reifsneider, & Williams, 2012).

Theoretically, however, the effect of fiscal policy on interest rates is similar to the earlier discussion of fiscal policy’s efficacy for economic growth. There are neoclassical and Keynesian strands on one side and the neutrality effect of public debt under Ricardian equivalence on the other side.
Empirical literature review regarding fiscal policy and interest rate

Each school of thought has been backed by empirical results. For instance, Makin (1983), Hoelscher (1983), Mascaro and Meltzer (1983), Monadjemi (1989), Giannaros and Kolluri (1989) and Findlay (1990) provide evidence that fiscal deficit has no significant effect on interest rates, hence supporting the Ricardian view. On the other hand, studies by Feldstein (1982), Tran and Sawhney (1988), Wachtel and Young (1987), Kolluri and Giannaros (1987), Zahid (1988) and Al-Saji (1991) report that increasing a budget deficit has a positive impact on long-term interest rates. The choice of methodology, sample period and variable selections are the principal factors producing these contrasting results.

Knot and de Haan (1999) introduced a new approach by studying the effect of the relationship between the budget deficit and interest rate in Germany. Their study showed that the announcement of a budget deficit has a positive impact on interest rates. The leading cause of this positive relationship is the concern of the crowding-out effect on investment from increasing public debt in Germany. In a similar European case, Ewing and Yanochik (1999), using the cointegration method, found that a budget deficit in Italy increases the yield spread between long-term government bonds and the benchmark treasury T-bill rate. This result also showed that a budget deficit has a deteriorating effect on long-term growth through a crowding-out effect on private investment.

The latest study from Cebula (2019) shows the relationship between public debt and long-term interest rates using US finance and economic data from 1973 to 2016. Based on econometrics techniques such as AR/2SLS and ML_ARCH, the results show that federal deficits, both primary and aggregate, have a significant and positive influence on long-term interest rates—in this case, government bond yields. This study also measures
revenue—personal taxation income—that also puts significant upward pressure on the interest rate. Over the long-term, the study suggests that, should the government fail to limit the widening budget deficit, the negative impact on real output is more profound through the crowding-out effect on finance for households, the private sector and local governments. The important policy implications of managing the budget deficit and personal income tax in the US may help ease pressure on long-term interest rates, reducing the cost of borrowing from a declining bond yield.

In the group of developing countries, the issue of interest rate determination has been increasingly important. This is because many developing and emerging countries have been financially reforming by removing barriers on capital flows and accessing global capital markets (Edwards & Khan, 1985). Before financial reform, the interest rate in developing countries was artificially low, resulting in a weak impact of budget deficits on the real interest rate\(^7\). In more recent studies, Aisen and Hauner (2013) found a robust positive effect of a budget deficit in developing countries compared to advanced countries. This study confirms the neoclassical perspective.

Malešević Perović (2018) examines the impact of public deficits and interest rates in 11 countries from Central and Eastern Europe. More detail of this empirical review is presented in Chapter 5. The 11 countries are classified as developing nations with the database spanning the decade 2006–2015. This study uses a novel static spatial panel model based on Belotti, Hughes, and Mortari (2017) that measures panel regression with

\(^7\) Easterly and Schmidt-Hebbel (1993) argue that the low interest rate is due to financial repression from the monetary authority. Following financial reform, interest rates in many countries—such as Argentina, Chile, Morocco, Thailand and Pakistan—have risen, adjusting to the market level. The simulation shows that domestic debt financing increases domestic interest rates in the above countries, varying from 0.1 to 3 percentage points over GDP.
spatial effects analysis. The results show that the fiscal policy has a significantly positive impact on long-term interest rates with different magnitudes. Public debt raises long-term interest rates in the range of 3.6 to 7.5 bps for every 1% of increase. This result is higher than most previous effects, between 2 to 5 bps. The primary balance effect to long-term interest rates is higher. For a 1% increase of primary deficit, the long-term interest rate increases between 22 and 28 bps. Furthermore, this study also reports that the indirect effect of the primary deficit on long-term interest rates is significant and large. This result shows the importance of spatial interdependence in empirical studies in this field and that countries cannot be treated as spatially independent merely to enhance the specification of the model.

2.4.3 Public debt and economic growth

Following the topic of fiscal policy and interest rates, the focus now shifts to the below-the-line aspect of government budgets: budget funding. Its components are the sale of assets and government debt. Since the sale of assets has limited capacity, governments tend to fund their budget deficit by issuing public debt. Debt issuance is not a popular topic for the general public. However, Buchanan (1966) reported that the debate regarding government debt between politicians and researchers is a fierce battleground.

Moreover, Azzimonti, de Francisco, and Quadrini (2014) indicate that, since 1980, the dynamics of an upward trend are changing due to the integration of global financial markets. They argue that economies tend to borrow more if they are better integrated into the capital market. Therefore, the critical issues of the debate are the impact of public debt on mounting debt accumulation in the financial market, real economic performance and fiscal sustainability.
The study of the impact of public debt on economic growth builds on the theory of growth. Following Checherita-Westphal and Rother (2012), this study starts from the basic Solow-Swan model that has become popular in growth accounting due to its logical presentation and clear rationale. This model explains that long-term economic growth is a result of investment in capital, labour or population growth and the productivity increment, known as the productivity factor or technological progress. Extending the Cobb-Douglas production function, the Solow-Swan growth function, including public debt as an additional input factor, is:

\[ Y = A[L^\alpha K^{1-\alpha}]^{1-\beta}PD^\beta \]  

(2.31)

\( Y \) is real GDP, \( A \) is technological progress, \( L \) is labour, \( K \) is capital and \( PD \) is the public debt level. The coefficient \( \alpha \) is the contribution amount of labour to GDP and \( \beta \) represents public debt in the share of total output. Function (2.31) also can be expressed as:

\[ Y = AL^\alpha(1-\beta)K^{(1-\alpha)(1-\beta)}PD^\beta \]  

(2.32)

This study focuses on real GDP growth per capita; therefore Equation (2.32) is converted into per capita terms by dividing both sides with \( L \), with \( \frac{Y}{L} \) representing growth per capita:

\[ \frac{Y}{L} = AL^\alpha(1-\beta)K^{(1-\alpha)(1-\beta)}PD^\beta \]  

(2.33)

We then change the form of Equation (2.33) into a logarithm thus:

\[ \ln \left( \frac{Y}{L} \right) = \ln A + (\alpha - \alpha \beta - 1)lnL + (1 - \alpha - \beta - \alpha \beta)lnK + \beta PD \]  

(2.34)

To simplify Equation (2.34), we can set \( \mu = \alpha - \alpha \beta - 1 \) and \( \rho = 1 - \alpha - \beta - \alpha \beta \) and the equation will become:

\[ \ln \left( \frac{Y}{L} \right) = \ln A + \mu lnL + \rho lnK + \beta PD \]  

(2.35)

We now have a linear equation of growth and debt, so we can rewrite Equation (2.35) as:
\[ g_t = \ln A_t + \mu X_t + \beta PD_t \]  \hspace{1cm} (2.36)

where \( g \) is the real growth rate per capita and \( X \) is a set of control variables.

The Solow-Swan baseline model is the cornerstone of neoclassical theory as mentioned in the previous section (2.3.1). It provides balance in the theory and its empirical applications are more widely used in growth accounting studies.

**Empirical literature review regarding public debt and growth**

Many studies have found that the long-term relationship between public debt and economic growth tends to be negative. In neoclassical theory, growth models with a component of public agents issuing debt for their expenditure tend to show a negative relationship between debt and growth. From the classical perspective, Modigliani (1961), following the analysis of Buchanan (1976) and Meade (1958), pointed out that the next generation will experience the burden of current public debt arising from a decreasing flow of income from the lower stock of private capital.

Modigliani (1961) also argued that national debt might also influence the increase of long-term interest rates due to the reduction of private capital. However, the negative impact of debt may be reduced or offset if government expenditure is on a project that contributes to real income for future generations—for example, productive government capital expenditure.

Diamond (1965) applied the growth model by adding the effect of taxes on capital stock, thus differentiating between internal and external debt. Diamond (1965) concluded that internal or external public debt reduces savings, ultimately reducing growth. Moreover,
increasing public debt forces taxes to rise to finance the additional debt, in turn affecting individual utility in the long run. He further argued that internal debt might also further reduce capital stock due a substitution of government debt for capital in individual portfolios.

Adam and Bevan (2005) analysed an integrated model of government budget constraint and debt financing in a sample of developing countries. They found that high-debt stock can worsen the impact on economic growth. Furthermore, the stock of public debt can also influence the impact of government expenditure on economic growth. The increase in productive government expenditure can only result in a positive impact on economic growth when the stock of public debt is at a low level.

The impact of a high level of public debt on economic growth has an important monetary effect. Elmendorf and Mankiw (1999) suggested that public debt accumulation can affect growth through the rise of long-term interest rates. If the government continues to issue debt, the long-term interest rate will rise. The higher interest rate can crowd out investment and dampen growth. With a high sovereign bond yield, private capital flows into the public sector.

This condition may also push up private interest rates and reduce spending in both firms and households. There are many studies that focus on the relationship of public debt and long-term interest rates to sovereign bond yields. Although the results are varied, many suggest that a high debt and deficit may contribute to rising sovereign long-term interest rates and wider bond-yield spread (Ardagna, Caselli, & Lane, 2007; Codogno, Favero, & Missale, 2003; Laubach, 2009).
Several studies also reveal a positive relationship between public debt and economic growth. For instance, Uzun, Karakoy, Kabadayi, and Emsen (2012) examine the impact of foreign debt on per capita GDP growth in 19 transitional economies. Using the ARDL model, they find that the foreign public debt in transition economies has a positive long-term relationship with economic growth. Greiner (2011) also finds a positive coefficient in the case of developed countries. However, the positive relationship only occurs under the condition of balanced rule, implying that budget deficit policy moves toward zero levels. The growth of public debt stock is thus less than other macroeconomic variables.

Abbas and Christensen (2007) similarly report that domestic public debt in low-income and emerging countries has a positive and significant relationship with GDP growth per capita through increased efficiency in investment. The authors examine the growth and debt nexus using the dynamic panel model—general method of moments (GMM) techniques. Furthermore, they argue that the positive impact of domestic debt is determined by three factors: the debt should be marketable, have a positive real interest rate, and not be subject to the banking system.

In a more recent study, Afonso and Ibraimo (2019) have investigated the macroeconomic impact of public debt in Mozambique. They studied public debt parameters with macroeconomic variables such as real output growth, general price level, the treasury bill rate and the lending rate using quarterly data from 2000 to 2016. The results report different impacts of categories of public debt on real output. For instance, external public

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8 Transition economies are countries that reform their economic system from social economies into more liberal systems. Under IMF classification 2000, there are 29 countries with transitional economies (Uzun et al., 2012).
debt has a short-term positive impact which is negative in the long run. Conversely, domestic debt in Mozambique hinders growth in both the short run and long run. These results confirm the study by Mbate (2013) which found that growth is deteriorated by public debt through declining capital accumulation and private sector growth; they also confirm Schclarek (2004), who reports the persistent negative impact of public debt on real output growth.

Linking to the theories and previous studies above, we try to answer the third research question of this thesis namely “Has public debt in developing Asia helped or hindered economic growth?” by finding the research gap. Developing Asian countries are known as one of the important sources of global growth. As the region also has experienced economic crises and forced the government to increase debt, the relationship of public debt and growth in this region seems under researched. Therefore, we focus the study in this region empirically through econometrics techniques.

2.4.4 Sustainability of fiscal policy

Prior to the GFC, fiscal stimulus was still preferred by some governments to pursue long-term growth. Many developing countries are still implementing stimulus or expansion despite their positive growth (Marialuz & Moreno, 2016). To remain fiscally sustainable, these countries must be solvent: their debt must be repaid at some point in the future. Therefore, a primary budget balance (general budget balance minus payment of interest rates) is the key determinant of debt dynamics analysis (Camarero, Carrion-i-Silvestre, & Tamarit, 2015).
The concept of fiscal sustainability refers to the possibility of the government retaining current expenditure and revenue without an eventual long-term change. The pioneers in this field are Hamilton and Flavin (1986), who provided the basic idea for tackling sustainability analysis. Their seminal paper suggests the properties of government debt and primary surplus series. The stationary property of the public debt series implies that public debt will converge to zero without any detectable explosive path. Therefore, the stationary property of public debt and primary surplus are necessary for achieving sustainability.

The basic model of fiscal sustainability is derived from the intertemporal budget constraint (IBC) thus:

\[ G_t + rPD_t = R + PD_t - PD_{t-1}, \quad t = 1,2,3.. \]  

(2.37)

where \( G_t \) is expenses, \( R_t \) is government revenue, \( PD_t \) is public debt and \( r \) is the interest rate. Equation (2.37) shows that government revenues and the newly issued public debt equally cover government spending and debt servicing. Reordering Equation (2.37) yields:

\[ G_t + (1 + r)PD_t = R + PD_t \quad t = 1,2,3.. \]  

(2.38)

This equation states the budget constraint for period \( t \) as well as the subsequent period.

The forward budget restriction is constructed from Equation (2.38) thus:

\[ PD_t = \sum_{t=1}^{\infty} \delta_i (R_{t+i} - G_{t+i}) + \lim_{t \to \infty} \delta_{t+i}B_{t+i}, \]  

(2.39)

where \( \delta_i = \prod_{s=0}^{t} 1/(1 + r_{t+k}) \)

The right-hand equation can represent the public expectation of government debt. If the government is expected to repay the debt to creditors while retaining the current expenditure and tax structure, then the values of current debt must be equal to the present
value of all future non-interest surpluses. Furthermore, the government may not use a Ponzi scheme to finance the budget deficit; this is where the government rolls over the debt by issuing another debt (Bohn, 1995).

The fiscal sustainability test has been conducted in the past decade using two main strands of empirical testing. Firstly, using this basic model, Hamilton and Flavin (1986) constructed a univariate approach that implements the property analysis of the budget balance series, as did Wilcox (1989) with the stochastic property of public debt data. On the other hand, Hakkio and Rush (1991) developed the bi-variate approach that examines the cointegration relationship between government revenue and expenditure, including interest rate payments.

Empirical literature review regarding fiscal sustainability

Pioneer contributors unified the univariate and multivariate test of fiscal sustainability. Trehan and Walsh (1991), following Hakkio and Rush (1991), reported that cointegration testing on the primary deficit and public debt, with the stationary property of the primary deficit, are sufficient for examining the IBC condition. Hakkio and Rush (1991) and Quintos (1995) conducted cointegration testing of expenditure and revenue for US data, reporting that IBC as a fiscal sustainability indicator had been satisfied; however, they detected several breakpoints in the sub-periods where the fiscal sustainability condition was not found. Bravo and Silvestre (2002) investigated fiscal sustainability using time-series public expenditure and revenue for 11 European countries. The results show that

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9 Hamilton and Flavin (1986) conducted stationarity testing for budget deficit and public debt data in the US to identify the explosive path of deficit and public debt.
fiscal sustainability holds only in France, Germany, Austria, the Netherlands and the UK; other countries in the sample do not meet the sustainability condition.

Bohn (1995) can also be considered a pioneer contributor in unifying the univariate and multivariate approaches of fiscal sustainability. Bohn (2005) uses both methods of fiscal sustainability assessment to identify the non-Ponzi scheme condition and introduces the fiscal reaction function (FRF) approach\(^\text{10}\). Using a long period of more than 200 years of US primary deficit and debt data, he showed that, historically, the US fiscal condition has been sustainable. Using a model similar to Bohn (1995), Do Rosario Correia et al. (2008) examined the FRF in the case of Portugal. They found that, in some subsamples, fiscal sustainability is not maintained and that a new regime follows a period of unsustainable deficits.

Beqiraj, Fedeli, and Forte (2018) examined public debt sustainability using FRFs from Bohn (1995) in 21 OECD countries from 1991 to 2015. Using panel data unit root testing and cointegration, the study analyses the short- and long-term reaction of fiscal function to rising public debt. They report that the cointegration between public debt and public primary balance is found on the time-series panel data. The results show that the long-term discretionary fiscal response to the increase of public debt is negative. This explains why OECD governments do not respond accordingly to the rise of debt and hence do not satisfy the intertemporal budget constraint (not sustainable). In the short-term, asymmetrical policy response also explains policy intervention and why new debt

\(^{10}\) Fiscal reaction function from Bohn (1995) is an alternative approach to assess fiscal sustainability without satisfying a specific general equilibrium model and specifying agent preferences. The co-integration relationship of revenue and expenditure is not necessary for proving the Non-Ponzi scheme is satisfied. Any finite order integration separate from expenditure and revenue can also lead to fulfilment of IBC conditions (Do Rosario Correia, Neck, Panagiotidis, & Richter, 2008).
occurring during the output gap is positive. However, when the output gap is negative, the response is similar and is not reversed.

The interest rate-growth differential (IRGD)

From the intertemporal budget constraint with the non-Ponzi schemes, we can derive the interest rate-growth differential formula. This approach states that if a government runs a budget deficit and accumulates debt through issuing bonds, sustainability levels can be achieved as long as the interest rate on the debt is lower than the economy’s growth rate (Adams, Ferrarini, & Park, 2010). With this simple formula, the interest rate-growth differential is essential for understanding long-term fiscal sustainability. This approach states that higher interest rates indicate higher payments on government debt, whereas higher economic growth leads to a lower debt-to-GDP ratio by increasing the denominator. In formal terms, the equation is:

$$\Delta PD_t = (r_t - g_t)PD_{t-1} - PB_t,$$

(2.40)

Where $g_t$ is real economic growth and $PB$ is the primary balance. The above equation states that, given the primary balance and initial debt ratio, an increase in the public debt ratio is positively linked to the interest rate-growth differential. Furthermore, the IRGD approach states that if a government runs a budget deficit and accumulates debt through bond issuance, sustainability levels can be achieved as long as the interest rate on the debt is lower than the economic growth rate. Government revenue will respond by growing at a higher rate than the accumulated debt.

Many studies using IRGD find a different pattern for low-income countries and developed market economies. Low-income and developing countries have persistently negative rate differentials, while developed countries with developed financial markets tend to have
positive differentials (Escolano, Shabunina, & Woo, 2017). On the other hand, Turner and Spinelli (2011) also found positive differentials for developed countries and projected them as becoming higher in the future. These findings seem to suggest that less developed countries do not have any concerns regarding debt sustainability. However, Escolano et al. (2017) explain that, in less developed countries, the interest rate is artificially low because of low transparencies and repression by domestic authorities. Nevertheless, when developing countries’ markets integrate more into the global financial market, the interest rate will adjust and may increase positively to the differential value.

**Ageing population and fiscal sustainability**

Recently, increasing life expectancy and declining fertility have influenced an increasingly ageing population. This population is not only the ratio of an old, dependent group relative to the working age; it is also those very old within the general aged population (Jensen & Bo Nielsen, 1995). In the near future, an ageing population will affect social and economic variables, including fiscal policy. For instance, ageing will change the labour force structure with an increased dependency ratio of labour productivity shifting consumption/saving decisions. Moreover, the ageing population will increase pressure on government budgets, particularly on age-related expenditure such as pensions, health and other related services, a narrowing tax base and, ultimately, rising concern about public debt sustainability (Sutherland, Holler, & Merola, 2012).

The demographic change to an ageing population occurs more rapidly in advanced countries. Dramatic demographic changes in Europe have been projected. The European Commission (2018) reports that Europe is the oldest continent in terms of its old-age dependency ratio and will remain thus until 2070. The old-age dependency ratio in Europe
was 29.2% in 2015 and is expected to increase to 54.2% in 2070. In Japan and China, the old-age dependency ratio is projected to reach 53.3% and 69.6% respectively.

As the literature suggests, an ageing population has a multidimensional effect on the economy and welfare. However, studies linking the ageing population to fiscal sustainability analyses are still limited. Several studies have examined the ageing population from the perspective of budgeting pressure. Jensen and Bo Nielsen (1995) used Denmark as a study case, examining the effect of the ageing population and sustainable fiscal policy through two scenarios: short-sighted policy (pay-as-you-go) and far-sighted policy (advance funding). The former means applying varying tax rates in order to serve the needs of age-related spending. The results show that future tax is likely to decline in the first 10 to 15 years and the rise in the next 20 to 25 due to the baby boomers demographic achieving old age. The far-sighted scenario, with its advanced financing in the government budget, is more prone to politics and is highly influenced by current economic conditions.

Castro, Maria, Félix, and Braz (2017), using the concept of a pay-as-you-go pension system in a dynamic general equilibrium model with overlapping generations, have investigated the macroeconomic effect of ageing in Europe. Their results suggest that its ageing population may have a significantly negative impact on real output and private consumption. However, the magnitude of this depends on the policy options in maintaining debt sustainability. For instance, the impact of an ageing population on output is higher if the government opts to increase social security premiums. A suggested policy implication of the study is that government may need to pursue mixed policies in
addressing the macroeconomic impact of an ageing population, policies that can acceptably share the budget burden across current and future generations.

While other studies use projections and scenarios to predict the macroeconomic effect of population ageing, Afflatet (2018) tries to study whether an ageing population is already impacting public debt sustainability. This study examines three European countries—Norway, Switzerland and Iceland—from 1980 to 2015. Using a panel time-series, fixed-effect model, the result reveals no empirical evidence that the ageing population of the sample countries affects public debt. However, Afflatet (2018) states that the non-significant results are due to a breathing space period resulting in a low-level dependency ratio. Raffelhüschen (2001) predicted that the so-called “breathing space” in Europe would mostly last until 2015 and increase strongly thereafter to create fiscal pressure.

Based on the theoretical frameworks and previous empirical studies, there are various methods to investigate fiscal sustainability. Related to the fourth research question “How sustainable is the public debt in developing Asian countries, specifically in ASEAN?”, we focus mainly only on ASEAN countries which have been know as the growth sourc in the region but only have relatively little attention in this field. With more simple arithmetic approach of debt stabilization and the effect of ageing population, the study will provide important contribution to the body of literature.

2.5 Conclusion

This chapter contains reviews of related theory and previous empirical studies that serve as the background for empirical chapters which stand independently but are under one
theme of the effects of fiscal policy on macroeconomic performance in developing countries. From the 18th century, there has been no consensus on the impact of fiscal policy on economic growth. The literature in this area is, however, growing after several economic crises. According to different theoretical perspectives, the role of fiscal policy can be detrimental, positive or even neutral for economic growth. Fiscal policy has distinct components such as government expenditure, fiscal balance and public debt, each of which influences the economy in its own way. Factors affecting empirical results in this field include a country’s level of development, the composition and structure of debt, institutional quality, datasets, selection of control variables and research methodology.

Despite strong growth in the literature on fiscal deficits and public debt, empirical work on the impact fiscal of policy on macroeconomic performance in developing and emerging countries is limited. Developing and emerging economies deserve more attention from researchers because they are the major source of global economic growth. Exploring the role of fiscal variables that influence economic growth has essentially motivated the current research.
**APPENDIX TO CHAPTER 2**

Table A2.1 Summary of the empirical studies reviewed for government spending composition and growth

<table>
<thead>
<tr>
<th>Author</th>
<th>Country and period</th>
<th>Dependent variable</th>
<th>Explanatory variables</th>
<th>Methodology</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gupta et al. (2005)</td>
<td>39 low-income countries 1990–2000</td>
<td>Real GDP growth rate per capita</td>
<td>Current spending and capital spending</td>
<td>Seemingly unrelated regression technique</td>
<td>Fiscal consolidation is achieved by decomposing selected current expenditure and has positive effect on growth. Capital spending and public investment contributes to long-term growth.</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Sample Size</td>
<td>Time Period</td>
<td>Dependent Variable</td>
<td>Independent Variables</td>
<td>Methodology</td>
</tr>
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<tr>
<td>Acosta-Ormaechea &amp; Morozumi (2013)</td>
<td>56 countries (low, medium and high income) 1970–2010</td>
<td>Real GDP per capita</td>
<td>Aggregate government expenditure, total expense, non-financial assets. Sectoral spending; defence, health, education, social protection. Transport and telecoms</td>
<td>Dynamic panel model (System GMM)</td>
<td>Reallocation of spending from current to capital expenditure has positive impact on growth. Education spending has positive impact on growth at the expense of other sectoral spending.</td>
</tr>
<tr>
<td>Authors</td>
<td>Sample Size and Type</td>
<td>Dependent Variables</td>
<td>Methodology</td>
<td>Key Findings</td>
<td></td>
</tr>
<tr>
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</tr>
<tr>
<td>Chu et al. (2018)</td>
<td>59 (low-middle income and high-income countries) 1993–2012</td>
<td>Real GDP growth rate per capita</td>
<td>Productive and non-productive government expenditure</td>
<td>OLS, Fixed Effect and Dynamic Panel model (GMM)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Shifting the budget allocation from non-productive to productive spending promotes growth in the long-term. Positive condition also exists in low-middle income country groups.</td>
<td></td>
</tr>
<tr>
<td>Martins &amp; Veiga  (2014)</td>
<td>156 countries 1980–2010</td>
<td>GDP per capita growth; human development index</td>
<td>Aggregate government spending</td>
<td>Dynamic panel model (System GMM)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Aggregate government expenditure deteriorates long-term growth. However, it has a positive impact on human development index.</td>
<td></td>
</tr>
<tr>
<td>Gemmell et al. (2016)</td>
<td>17 OECD countries 1970–2009</td>
<td>Real GDP growth per capita</td>
<td>Sectoral public spending; education, health, housing, social welfare, defence, economic services. General public service</td>
<td>ARDL</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>There are positive and robust relationships between transport, communication and education spending and economic growth. The allocation of spending on these sectors is still sub-optimal.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total expenditure has significantly negative impact on growth. Government consumption also has negative impact on growth and government investment has no significant impact.</td>
<td></td>
</tr>
<tr>
<td>Wang (2011)</td>
<td>31 countries 1986–2007</td>
<td>Real GDP growth per capita</td>
<td>Health care expenditure</td>
<td>Panel VECM, Quantile regression</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Expenditure growth will promote economic growth. According to quantile regression results the influence of expenditure growth is varied; for instance, health care expenditure increases growth in middle income countries whereas,</td>
<td></td>
</tr>
</tbody>
</table>
The study provides evidence of non-linear relationship between government expenditure and growth. Above the threshold (18%), government expenditure hinders economic growth for full sample dataset whereas developed and developing countries’ thresholds are 18% and 19% respectively.

<p>| Source: Author |
| Notes: Ordinary Least Square (OLS), Seemingly unrelated regression (SUR), Generalised Method of Moments (GMM), Vector Error Correction Model (VECM), Least square dummy variable estimator (LSDV), Autoregressive Distributed Lag (ARDL). |</p>
<table>
<thead>
<tr>
<th>Author</th>
<th>Country and period</th>
<th>Dependent variable</th>
<th>Explanatory variables</th>
<th>Methodology</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinoshita (2006)</td>
<td>19 industrial countries</td>
<td>Long-term interest rate</td>
<td>Public deficit and public debt</td>
<td>General equilibrium model</td>
<td>Public debt-to-GDP has positive but relatively small impact on long-term interest rate.</td>
</tr>
<tr>
<td>Faini (2006)</td>
<td>9 European Union countries 1979-2002</td>
<td>Long-term interest rate</td>
<td>Primary balance and public debt</td>
<td>3 SLS</td>
<td>Primary balance has positive impact (3 bps). Public debt impact is not significant.</td>
</tr>
<tr>
<td>Chinn &amp; Frankel (2007)</td>
<td>4 European countries including UK &amp; US 1988-2006</td>
<td>Real interest rate paid for government debt</td>
<td>Public debt, change in public debt</td>
<td>FE</td>
<td>Stock of public debt has positive impact on interest rate (6 bps). Expected change of debt also positive and significant (11 bps).</td>
</tr>
<tr>
<td>Ardagna et al. (2007)</td>
<td>16 OECD countries 1960-2002</td>
<td>Long-term interest rate</td>
<td>Primary balance, public debt</td>
<td>DGLS</td>
<td>Primary balance effect on interest rate is in range 10-12 bps whereas positive impact of public debt on interest rate is 1 bps.</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Sample Description</td>
<td>Dependent Variable</td>
<td>Independent Variables</td>
<td>Estimation Method</td>
<td>Findings</td>
</tr>
<tr>
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</tr>
<tr>
<td>Baldacci &amp; Kumar (2010)</td>
<td>31 Advanced and emerging market countries 1980-2007</td>
<td>Sovereign bond yield</td>
<td>Budget balance, primary balance and public debt</td>
<td>FE</td>
<td>Budget deficit has positive impact on growth (30 bps); the change in public debt also has positive impact on interest rate (20 bps)</td>
</tr>
<tr>
<td>Hauner &amp; Kumar (2011)</td>
<td>G7 panel countries 1960-2005</td>
<td>Long-term interest rate</td>
<td>Budget deficit</td>
<td>SEM</td>
<td>Impact of budget deficit to interest rate is significant but very small in magnitude.</td>
</tr>
<tr>
<td>Claeys, Moreno, &amp; Suriñach (2012)</td>
<td>35 OECD and emerging market countries 1990-2005</td>
<td>Long-term interest rate</td>
<td>Public debt</td>
<td>FE, OLS</td>
<td>Public debt significantly raises domestic interest rate 2 bps at most.</td>
</tr>
<tr>
<td>Aisen &amp; Hauner (2013)</td>
<td>60 advanced and emerging market economies 1970-2006</td>
<td>Interest rate</td>
<td>Budget balance</td>
<td>GMM</td>
<td>Increase in budget deficit raises interest rate 26 bps. The impact is severe under conditions such as high deficit or low financial depth.</td>
</tr>
<tr>
<td>Gruber &amp; Kamin (2012)</td>
<td>19 OECD countries 1988-2007</td>
<td>Long-term interest rate</td>
<td>Primary balance and public debt</td>
<td>FE</td>
<td>Primary balance has positive effect on interest rate by 7 bps whereas public debt effect is 1 bps both real and expected value.</td>
</tr>
<tr>
<td>Dell’Erba &amp; Sola (2016)</td>
<td>17 OECD countries</td>
<td>Long-term interest rate</td>
<td>Primary balance and public debt</td>
<td>FAP</td>
<td>Primary balance and public debt positive impact only 1 bps.</td>
</tr>
<tr>
<td>Cebula (2019)</td>
<td>United States 1973-2016</td>
<td>Long-term interest rate</td>
<td>Budget deficit (total and primary) and personal income tax</td>
<td>Autoregressive 2SLS, ARCH</td>
<td>The budget deficit, both total and primary, has positive impact on long-term interest rate</td>
</tr>
<tr>
<td>Malešević Perović (2018)</td>
<td>11 Central and Eastern European</td>
<td>Government bond yield</td>
<td>Public debt and budget deficit</td>
<td>Spatial Effect Model</td>
<td>Public debt has positive impact on interest rate (3.5–7.5 bps). Primary</td>
</tr>
<tr>
<td>Gamber &amp; Seliski (2019)</td>
<td>United states</td>
<td>Long-term interest rate</td>
<td>Projected government debt</td>
<td>DSGE</td>
<td>The projected debt has positive impact on government debt (2–3 bps)</td>
</tr>
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Source: Author

Notes: Ordinary Least Square (OLS), Fixed Effect (FE), Dynamic Generalised Least Square (DGLS), Generalised Method of Moments (GMM), Vector Error Correction Model (VECM), Least square dummy variable estimator (LSDV), Autoregressive Distributed Lag (ARDL), Two Stage Least Square (2SLS), Autoregressive Conditional Heteroscedasticity (ARCH), Dynamic Stochastic General Equilibrium (DSGE), Factor Augmented Panel (FAP).
Table A2.3 Summary of the literature review on public debt and economic growth (Chapter 5)

<table>
<thead>
<tr>
<th>Author</th>
<th>Country and period</th>
<th>Dependent variable</th>
<th>Explanatory Variables</th>
<th>Methodology</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chalk &amp; Tanzi (2002)</td>
<td>12 European countries 1970-1998</td>
<td>Public investment to GDP</td>
<td>Government debt-to-GDP</td>
<td>Panel OLS, FE, RE</td>
<td>10% increase in average debt-GDP ratio leads to an increase in real interest rates by 0.6% points and a decrease in public investment of over 0.25% of GDP. The rise in public debt leads to lower public investment, crowds out private capital and raises interest rates.</td>
</tr>
<tr>
<td>Nguyen, Clements, &amp; Bhattacharya (2003)</td>
<td>55 low-income countries, 1970-1999</td>
<td>Real per capita income growth</td>
<td>External debt-to-GDP ratio</td>
<td>Panel OLS, System GMM</td>
<td>The decline in external debt is associated with increase in growth. Public investment also increases if debt is reduced.</td>
</tr>
<tr>
<td>Presbitero (2006)</td>
<td>152 developing countries, 1977-2002 (middle and low-income countries)</td>
<td>GDP per capita growth, Interest rate</td>
<td>Government debt-to-GDP, debt service, debt to export ratio</td>
<td>OLS, difference GMM, system GMM</td>
<td>Debt service has negative relationship to investment. The negative impact of debt is stronger in low-income countries.</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Sample Size</td>
<td>Key Variables</td>
<td>Methods</td>
<td>Findings</td>
<td></td>
</tr>
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<td>-----------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Abbas &amp; Christensen (2007)</td>
<td>93 Emerging market economies</td>
<td>GDP growth per capita</td>
<td>Domestic debt-to-GDP ratio</td>
<td>Interaction model shows after 35% of bank deposit ratio to GDP; domestic debt deteriorates growth through crowding-out channel.</td>
<td></td>
</tr>
<tr>
<td>Bordo, Meissner, &amp; Stuckler (2010)</td>
<td>49 emerging and developed countries, 1880–2003</td>
<td>Expected growth loss</td>
<td>Foreign currency debt, capital inflow ratio to GDP</td>
<td>Increase in foreign currency debt relates to the increase of debt and currency crisis. The effect depends on reserve base and country’s credibility.</td>
<td></td>
</tr>
<tr>
<td>Abbas, Belhocine, ElGanainy, &amp; Horton (2010)</td>
<td>174 countries, 1791–2009</td>
<td>GDP growth rate (PPP)</td>
<td>Government debt-to-GDP ratio</td>
<td>Negative pattern of growth and public debt found. High growth countries have lower debt ratio whereas slow growth countries have higher debt burden</td>
<td></td>
</tr>
<tr>
<td>Caner et al. (2010)</td>
<td>99 developing and developed countries</td>
<td>Real GDP growth</td>
<td>Government debt-to-GDP ratio</td>
<td>Non-linearity of growth and debt exists in developed and developing countries. Threshold for developed countries is 77% before debt hinders growth; threshold for developing countries is 65% debt-to-GDP ratio.</td>
<td></td>
</tr>
<tr>
<td>Cecchetti, Mohanty, &amp; Zampolli (2011)</td>
<td>18 OECD countries, 1980–2010</td>
<td>Real GDP growth per capita</td>
<td>Government debt-to-GDP ratio (public, private and household)</td>
<td>The threshold for government debt is 85%. Private sector threshold is 90%. Household threshold is 85%.</td>
<td></td>
</tr>
<tr>
<td>Pattillo, Poirson, &amp; Ricci (2011)</td>
<td>93 developing countries</td>
<td>Per capita GDP growth</td>
<td>Public debt-to-GDP growth</td>
<td>Countries with average public debt level will experience 30–50% growth decline if public debt is doubled.</td>
<td></td>
</tr>
<tr>
<td>Checherita-Westphal &amp; Rother (2012)</td>
<td>12 European countries</td>
<td>Per capita GDP growth</td>
<td>Gross public debt-to-GDP growth</td>
<td>Non-linearity effect of debt to growth is found. The turning points on average are 90–100% before public debt hinders.</td>
<td></td>
</tr>
</tbody>
</table>
Budget deficit has linear impact on economic growth. Public debt has negative impact on growth until 90%. Above 90%, the impact is not statistically significant. Non-linearity is found between growth and public debt. The thresholds of public debt are 82%, 86% and 91% from 1, 3, 5 years forward, respectively. The study reports that there are possibly two thresholds of public debt before growth deteriorates (40% and 70% to GDP). Fiscal consolidation should be considered carefully due to its negative impact on long-term growth. Little evidence found regarding non-linearity of public debt and growth in the long run controlling government institution quality. Public debt has negative effect on economic growth (linear impact. However, when productive spending controlled, the impact of debt becomes positive to growth. Public debt threshold is around 30% using spreadsheet analysis. However, it is not robust using non-linear estimation. Therefore, non-linearity is not in the dataset.

<table>
<thead>
<tr>
<th>Author(s) (Year)</th>
<th>Sample Description</th>
<th>Dependent Variable</th>
<th>Independent Variable</th>
<th>Methodology</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presbitero (2012)</td>
<td>92 middle and low-income countries</td>
<td>Per capita GDP growth</td>
<td>Public debt-to-GDP ratio</td>
<td>Difference GMM, system GMM</td>
<td>Public debt has negative impact on growth. Budget deficit has linear impact on economic growth.</td>
</tr>
<tr>
<td>Padoan, Sila, &amp; Van den Noord (2012)</td>
<td>28 OECD countries, 1960-2011</td>
<td>Per capita GDP growth rate</td>
<td>Public debt-to-GDP ratio</td>
<td>FE, GMM</td>
<td>Non-linearity is found between growth and public debt. The thresholds of public debt are 82%, 86% and 91% from 1, 3, 5 years forward, respectively.</td>
</tr>
<tr>
<td>Elmeskov &amp; Sutherland (2012)</td>
<td>12 OECD countries, 1965-2010</td>
<td>Per capita GDP growth rate</td>
<td>Government gross financial liabilities</td>
<td>OLS and Bootstrapping</td>
<td>The study reports that there are possibly two thresholds of public debt before growth deteriorates (40% and 70% to GDP). Fiscal consolidation should be considered carefully due to its negative impact on long-term growth.</td>
</tr>
<tr>
<td>Kourtellos et al. (2013)</td>
<td>82 developed and developing countries, 1980-2009</td>
<td>Real GDP growth (average 10 years)</td>
<td>Public debt-to-GDP ratio</td>
<td>PST with 2SLS and GMM</td>
<td>Little evidence found regarding non-linearity of public debt and growth in the long run controlling government institution quality.</td>
</tr>
<tr>
<td>Teles &amp; Cesar Mussolini (2014)</td>
<td>74 countries (OECD and non-OECD)</td>
<td>Real GDP growth</td>
<td>Debt-to-GDP, Primary surplus, government expenditure</td>
<td>OLS and GMM</td>
<td>Public debt has negative effect on economic growth (linear impact. However, when productive spending controlled, the impact of debt becomes positive to growth.</td>
</tr>
<tr>
<td>Égert (2014)</td>
<td>44 advanced and emerging countries, 1790-2009</td>
<td>Real GDP growth (average 10 years)</td>
<td>Public debt-to-GDP ratio</td>
<td>Descriptive analysis Non-linear bivariate threshold model</td>
<td>Public debt threshold is around 30% using spreadsheet analysis. However, it is not robust using non-linear estimation. Therefore, non-linearity is not in the dataset.</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Sample</td>
<td>Dependent variable</td>
<td>Independent variable</td>
<td>Methodology</td>
<td>Summary</td>
</tr>
<tr>
<td>---------------------------------</td>
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<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Eberhardt &amp; Presbitero (2015)</td>
<td>27 advanced and developing countries 1800-2010</td>
<td>GDP per capita growth</td>
<td>Public debt-to-GDP ratio</td>
<td>Polynomial specification on panel data regression</td>
<td>Extensive fiscal consolidation through austerity policy is not beneficial for long-term growth.</td>
</tr>
<tr>
<td>Fincke &amp; Greiner (2015)</td>
<td>7 developed countries 1970-2012</td>
<td>GDP per capita growth</td>
<td>Public debt-to-GDP ratio</td>
<td>Spline regression, Pooled OLS</td>
<td>No evidence to support non-linearity effect on growth. However, in linear model, public debt strongly hinders economic growth</td>
</tr>
<tr>
<td>Pescatori et al. (2014)</td>
<td>19 advanced countries 1875-2012</td>
<td>Real GDP per capita growth</td>
<td>Public debt-to-GDP ratio</td>
<td>Spreadsheet analysis with thresholds scenario</td>
<td>Specific debt thresholds are not found in dataset. Debt trajectory is important to measure the debt effect on growth. Higher public debt is related to higher growth volatility</td>
</tr>
<tr>
<td>Proaño et al. (2014)</td>
<td>16 OECD countries 1981-2013</td>
<td>GDP per capita growth</td>
<td>Sovereign debt-to-GDP ratio</td>
<td>Dynamic panel threshold</td>
<td>Non-linear effect of debt on growth is not found. However, financial market stress may amplify the negative impact of debt to growth.</td>
</tr>
<tr>
<td>Siddique, Selvanathan, &amp; Selvanathan (2016)</td>
<td>40 highly indebted poor countries 1970-2007</td>
<td>GDP growth per capita</td>
<td>External debt-to-GDP ratio</td>
<td>MG, PMG, ARDL</td>
<td>HIPC group has difficulty servicing their debt. Therefore, reducing external debt is beneficial to growth.</td>
</tr>
<tr>
<td>Ahlborn and Schweickert, Dynamic panels address issues related (2018)</td>
<td>European countries (3 clusters)</td>
<td>GDP growth per capita</td>
<td>Public debt-to-GDP</td>
<td>FE and 2 SLS</td>
<td>Under-developed European countries have linear negative effect on public debt to growth whereas developed countries have non-linear relationship between public debt and growth.</td>
</tr>
<tr>
<td>Tran (2018)</td>
<td>14 emerging economies 1999-2016</td>
<td>GDP growth per capita</td>
<td>Public debt-to-GDP, Government bond yield</td>
<td>Panel threshold regression</td>
<td>The public debt threshold to growth was found at 30%. Should public debt rise above 30%, default of public debt will likely occur.</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Sample Size</th>
<th>Sample Period (Year)</th>
<th>Variables</th>
<th>Econometric Model</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dombi &amp; Dedák (2019)</td>
<td>167 countries</td>
<td>2000–2007</td>
<td>GDP growth per capita, Government debt</td>
<td>RCK model</td>
<td>Public debt has negative impact on growth. Public debt burden also depends on saving rate and population growth,</td>
</tr>
<tr>
<td>Afonso &amp; Ibraimo (2019)</td>
<td>Mozambique, 2000Q1–2016Q4</td>
<td>GDP growth per capita</td>
<td>Government debt ratio to GDP, Government debt service ratio to GDP</td>
<td>VAR, variance decomposition</td>
<td>External debt has short-term positive effect on growth (2 quarters) but not significant in the long run. Domestic debt has negative impact on economic growth. Debt service variables have stronger negative impact on growth. Repayment of debt reduces resources and leads to currency depreciation.</td>
</tr>
</tbody>
</table>

Source: Author  
Notes: Ordinary Least Square (OLS), Dynamic Ordinary Least Square (DOLS), Fixed Effect (FE), Feasible Generalised Least Square (FGLS), Generalised Least Square (GLS), Generalised Method of Moments (GMM), Panel Structural Threshold regression (PST), Mean Group (MG), Pooled Mean Group (PMG), Ramsey-Cass-Koopmans (RCK).
Table A2.4 Summary of the literature review on fiscal sustainability and population ageing (Chapter 6)

<table>
<thead>
<tr>
<th>Author</th>
<th>Country and period</th>
<th>Dependent variable</th>
<th>Explanatory Variables</th>
<th>Methodology</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Makin (2005)</td>
<td>ASEAN economies</td>
<td>Government debt-to-GDP</td>
<td>Primary balance, interest rate, economic growth</td>
<td>IBC formulae</td>
<td>Most ASEAN countries have sustainable public debt condition due to high economic growth, low-level debt ratio and low interest rate.</td>
</tr>
<tr>
<td>Celasun, Debrun, &amp; Ostry (2006)</td>
<td>5 emerging economies</td>
<td>Government debt-to-GDP</td>
<td>Primary balance</td>
<td>DSA model, SGMM</td>
<td>Public debt in Turkey and Argentina is not sustainable and needs</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Country/Region</td>
<td>Methodology</td>
<td>Variable</td>
<td>Findings</td>
<td></td>
</tr>
<tr>
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<td>--------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Karam &amp; Hostland (2006)</td>
<td>Emerging market countries</td>
<td>Government debt-to-GDP</td>
<td>Primary surplus</td>
<td>DSA, Based on fiscal projection, without prudent fiscal planning, emerging market economies will face rising debt burden.</td>
<td></td>
</tr>
<tr>
<td>Qin, Cagas, Ducanes, Magtibay-Ramos, &amp; Quising (2006)</td>
<td>The Philippines (1993Q1-2004Q2)</td>
<td>Government debt-to-GDP</td>
<td>Budget balance</td>
<td>IBC analysis, Philippines public debt has followed the sustainability condition. However, the simulation over 5 years ahead reports the need for fiscal adjustment, specifically on revenue side.</td>
<td></td>
</tr>
<tr>
<td>De Mello (2008)</td>
<td>Brazil 1995-2004</td>
<td>Public debt</td>
<td>Primary balance</td>
<td>Cointegration, ECM, Brazil needs substantial primary surplus to achieve public debt sustainability in the</td>
<td></td>
</tr>
</tbody>
</table>
future. In addition, fiscal consolidation also needed by managing current expenditure.

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Country/Period</th>
<th>Variables (Dependent, Independent)</th>
<th>Method(s)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do Rosario Correia et al. (2008)</td>
<td>Portugal 1842-2004</td>
<td>Public debt, Government revenue</td>
<td>Government expenditure, Primary balance</td>
<td>Trace test, cointegration, ECM Long time series suggests that Portugal has experienced unsustainable fiscal stance in some periods. Regime shifts also contribute to fiscal stance in Portugal.</td>
</tr>
<tr>
<td>Budina &amp; Van Wijnbergen (2009)</td>
<td>Turkey</td>
<td>Public debt, Government revenue</td>
<td>Government expenditure, Primary balance, output gap</td>
<td>Monte Carlo simulation Current fiscal consolidation will result in decline in public debt-to-GDP below 50% at end of projection period (10 years). However, pension spending is factor that may reduce fiscal sustainability.</td>
</tr>
<tr>
<td>Fincke &amp; Greiner (2011)</td>
<td>6 European countries 1970-2008</td>
<td>Public debt ratio to GDP</td>
<td>Primary balance</td>
<td>Unit root testing, cointegration Netherlands performs sustainable fiscal policy with decline in public debt. Germany and Portugal, despite their rising public debt, retain fiscal sustainability. Austria, Italy and</td>
</tr>
</tbody>
</table>
France are in range of fiscal sustainability but weaker than other sample countries.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Country/Period</th>
<th>Variable/Model</th>
<th>Policy Focus</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sakuragawa and Hosono (2011)</td>
<td>Japan, 1981–2009</td>
<td>Government debt-to-GDP</td>
<td>Primary balance</td>
<td>Public debt in Japan can be stabilised in 20 years only if the government achieves surplus in 10 years and continues 2.2% surplus after 10 years.</td>
</tr>
<tr>
<td>Afonso &amp; Jalles (2012)</td>
<td>18 OECD countries 1970–2010</td>
<td>Public debt ratio to GDP</td>
<td>Government revenues and expenditure</td>
<td>Most countries have failed the solvency IBC condition. Cointegration relationship between debt and government revenue and expenditure only exists in 6 countries.</td>
</tr>
<tr>
<td>Makin &amp; Arora (2012)</td>
<td>States in India 2006–2009</td>
<td>Public debt</td>
<td>Primary balance, interest rate and economic growth</td>
<td>Most states in India do not satisfy public debt stabilisation formulae. Primary surplus is the main policy focus to improve their fiscal condition.</td>
</tr>
<tr>
<td>Ghosh et al. (2013)</td>
<td>23 Advanced countries 1970–2007</td>
<td>Public debt</td>
<td>Primary balance, interest rate and economic growth</td>
<td>Public debt and primary balance in non-linear relationship. Primary balance declines in</td>
</tr>
<tr>
<td>Authors (Year)</td>
<td>Country/Region</td>
<td>Variable(s)</td>
<td>Measure(s)</td>
<td>Method(s)</td>
</tr>
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<td>----------------------------------------</td>
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</tr>
<tr>
<td>Arai and Nakazawa (2014)</td>
<td>Japan</td>
<td>Public debt-to-GDP ratio</td>
<td>Primary surplus</td>
<td>OLG</td>
</tr>
<tr>
<td>Miyazaki (2014)</td>
<td>Australia and Sweden (1980Q1-2007Q4)</td>
<td>Public debt-to-GDP ratio</td>
<td>Government expenditure and Government revenue</td>
<td>Unit root test, GLS, DOLS</td>
</tr>
<tr>
<td>Castro et al. (2017)</td>
<td>Portugal</td>
<td>Public debt to GDO</td>
<td>Real GDP growth, Government expenditure</td>
<td>DSGE</td>
</tr>
<tr>
<td>Lee et al. (2017)</td>
<td>Developing Asian countries</td>
<td>Government expenditure</td>
<td>Government revenue, fiscal balance</td>
<td>IBC formulae with growth projection</td>
</tr>
<tr>
<td>Study</td>
<td>Countries/Period</td>
<td>Variables</td>
<td>Methodology</td>
<td>Findings</td>
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</tr>
<tr>
<td>Dolls et al. (2017)</td>
<td>27 European countries 2010–2030</td>
<td>Government revenues, Government expenditure</td>
<td>MSM</td>
<td>On average, public fiscal balance is likely to decrease 6%. The main fiscal burden is the increase of old-age related spending. In some cases, the effect is countered by increasing tax or social contributions.</td>
</tr>
<tr>
<td>Paret (2017)</td>
<td>Emerging market countries</td>
<td>Public debt, Primary balance, Output gap</td>
<td>OLS, System GMM</td>
<td>The low fiscal reaction to rising debt in some emerging countries is caused by counter-cyclical measures. Origin of debt is not related to unsustainability conditions.</td>
</tr>
<tr>
<td>Beqiraj et al. (2018)</td>
<td>21 OECD countries 1991–2015</td>
<td>Public debt, Primary balance, Output gap</td>
<td>Panel root test, ECM</td>
<td>Primary surplus and public debt is cointegrated. However, fiscal reaction function is negative sign for the accumulation of debt, hence fiscal</td>
</tr>
</tbody>
</table>
sustainability is not satisfied.

Source: Author
Notes: Ordinary Least Square (OLS), Dynamic Ordinary Least Square (DOLS), Fixed Effect (FE), Feasible Generalised Least Square (FGLS), Generalised Least Square (GLS), Generalised Method of Moments (GMM), Error Correction Model (ECM), Dynamic Stochastic General Equilibrium (DSGE), Micro Simulation Model (MSM), Intertemporal Budget Constraint (IBC), Present Value Intertemporal Budget Constraint (PVBC).
CHAPTER 3. GOVERNMENT SPENDING COMPOSITION AND ECONOMIC GROWTH IN DEVELOPING ECONOMIES: AN EMPIRICAL ANALYSIS

3.1 Introduction

Rising fiscal activism during periods of crisis has once again shone the spotlight on government spending, an essential tool for intervention in the economy. This tool is used to achieve such long-term government objectives as redistribution of income, robust economic growth and economic stabilisation during downturns. Global fiscal stimulus policies during economic crises have been used by governments in an attempt to stabilise their economies; this has revived interest in studies of fiscal activism. However, the merits of fiscal spending for economic growth are still debatable. A large budget deficit has been associated with a negative spill-over onto economic growth resulting from increased taxes, printing money and increased public debt. The seminal work by Barro (1990) reported that government consumption adversely impacts economic growth.

Furthermore, Fischer (1993) indicated that a large budget deficit, inflation and distortion of the foreign exchange market have an adverse effect on growth. Fiscal policy’s influence on economic growth also depends on the crowding-out effect of fiscal expansion on domestic investment and consumption. Many studies examining the impact of fiscal policy on growth have identified the adverse effect of government spending on economic growth (see, for example, Ilzetzki et.al (2010) and Cogan, Cwik, Taylor, and Wieland (2010)). On the other hand, a number of studies have also found a positive
relationship of government spending specifically related to productive sector spending (Afonso and Alegre, 2011; Agénor and Neanidis, 2011; Benos, 2009).

In addition, existing studies mainly focus on developed countries or a merged data set of developed and developing countries. These samples can be used to achieve as many observations as possible to increase the precision of estimations. However, the data’s heterogeneity provides little information for understanding the process and impact of how fiscal policy in developing countries influences output.\textsuperscript{11} There are significant differences between developing and developed countries in the composition and operation of public expenditure policies that influence growth—for instance, the structure of governments and their policy priorities (Bose et al., 2007).

**Government spending in developing economies**

In developing economies, government plays an important role in fostering growth because private sectors are largely underdeveloped and make a relatively small contribution (Abdon, Estrada, Lee, & Park, 2014). Therefore, fiscal policy in developing countries may influence both short- and long-term economic growth. Furthermore, there is evidence of sizeable fiscal stimuli implemented during the Global Financial Crisis (GFC). Governments in developing Asian countries increased fiscal spending and cut taxes to overcome the decline in exports and aggregate demand, thus stimulating fast-track recovery from the GFC (Ferrarini, Ramayandi, & Jha, 2012; Hur and Park, 2018).

\textsuperscript{11} Dedicated studies for developing countries include Landau (1986); Bose, Haque, and Osborn (2007) Devarajan et al. (1996) and Chu, H"olscher, and McCarthy (2018).
Overall government expenditure in emerging and developing countries has remained steady over the past five years, averaging around 31% of their GDP, significantly less than that of advanced countries at 38% of their GDP in the last five years. The main difference between advanced and developing countries is the trend in government expenditure. In advanced countries, it is declining after reaching a peak in 2009 during the GFC. Conversely, in emerging and developing countries, fiscal consolidation seems to be on hold. After the GFC, the overall trend particularly increased in emerging and developing Asia. China, as the biggest economy in Asia, has continued its fiscal stimulus to mitigate its growth slowdown (IMF, 2019).
Figure 3.2 General government composition in developing countries, 2000–2018
Source: IMF, Fiscal Monitor, 2019
Notes: Consists of 40 emerging and developing countries from Asia, Europe, Latin America and Africa.

Figure 3.2 shows the public spending components in developing economies from 2000 to 2018. In the selected spending components above, the “Other” spending components consist of subsidy and transfers that have a higher allocation of government spending. Wages (compensation to employees) and bills (use of goods and services) have been relatively stable in the past decade. According to the IMF (2019), the declining trend of government spending is due to crowding out by the transfer of wages and interest rate expenses.

With the variation of spending allocations within government expenditure, the main research question is to identify which spending allocation promotes or obstructs growth in developing countries. This study may provide policy implications for which sector the government should prioritise to support long-term economic growth.
The central objective of this study is to empirically examine the impact of government spending in developing economies on economic growth. In this paper, a database of 52 developing countries is used to minimise the data heterogeneity for the period 1970 to 2015. The study examines the spending components allocated in each sector that have a strong and significant influence on per capita GDP growth, based on pioneer work in fiscal studies such as Modigliani (1961) and Diamond (1965). Following Landau (1986) and Devarajan et al. (1996), the study focuses on government expenditure. Instead of separating the expenditure into productive or non-productive groups, this study decomposes spending following the classification of expenditure structure in the latest GFSM using more recent available data.

The study employs a dynamic panel model to better address the potential issue of endogeneity, given the heterogeneity in the cross-country panel dataset (Acosta-Ormaechea & Morozumi, 2013). Therefore, the main contributions of this study are, firstly, to use more detailed and recent data with current econometric techniques to analyse the implication of government expenditure on growth. Secondly, its focus on developing countries is crucial to producing correct policy recommendations for developing economies due to the difference in policy characteristics for advanced and developing countries. The structure of the chapter is organised as follows: Section 3.2 contains a literature survey; Section 3.3 describes econometric methodologies and model specification; Section 3.4 explains data and describes variables; Section 3.5 reports the main results; Section 3.6 provides the study’s conclusions.
3.2 Previous empirical studies

The impact of fiscal policy on economic growth has been widely explored in the literature of economics\textsuperscript{12}. The neoclassical growth model has been the background theory for how fiscal instruments affect growth. According to Solow (1956), exogenous technological progress is essential for determining growth. Physical or human capital investment affects growth only in transitional periods or when the economy is not in a steady state condition (Mankiw, Romer, & Weil, 1992). The growth boost, in this case, may be temporary as the economy develops to a higher level. Fiscal policy may have a role in stimulating physical or human capital that can eventually enhance growth, although it does not permanently change growth in the long run\textsuperscript{13}.

The channels of fiscal policy that influence growth can be summarised thus:\textsuperscript{14}

- Difference in production efficiency between the public and private sectors may influence growth through intersectoral flows (positive).

- Fiscal policy may stimulate innovation, research and development that may enhance productivity (positive).

- Public investment or education may stimulate private sector production. These production externalities assume that the private sector ignores public inputs in their business decisions (positive).

- The income redistribution of fiscal policy may also have an impact on long-term growth. The channels of redistribution include social welfare protection policy,

\textsuperscript{12} See Zagler and Dümecker (2003) for a survey.
\textsuperscript{13} Baxter and King (1993) used a general equilibrium model to discover that fiscal policy in the US may not be able to provide permanent growth change; nevertheless, the realised effect of fiscal policy may take 20 years to occur.
\textsuperscript{14} Gemmell (2001) provides detailed channelling of the effectiveness of fiscal policy in the neoclassical growth framework.
savings rate policy, overcoming capital market imperfections as well as the enforcement of private property rights (positive).

- The crowding-out effect of unproductive public expenditure on productive public and private investment may also influence growth in the long run (negative).

3.2.1 Economic components of government spending

Many empirical studies suggest that—especially in advanced economies—the short-term impact of fiscal policy on economic growth is relatively small; some have even suggested it is negative (Alesina & Perotti, 1995; Alesina & Tabellini, 1990). However, the breakdown of government spending may have a different influence on growth. Disaggregating government expenditure into several categories is useful for studying the impact of government spending on economic growth, specifically for policy recommendations.

Traditionally, the category of spending can be broadly divided into productive and unproductive spending (Barro, 1990; Turnovsky & Fisher, 1995). Productive spending is complementary to the production process, increasing marginal productivity in the private sector and stimulating growth. In contrast, unproductive spending is not directly related to production and may reduce growth. Productive spending—such as government investment—promotes growth, while unproductive spending—government current consumption—hinders growth (Zagler & Dürnecker, 2003).

Extending Barro’s (1990) endogenous growth model, Devarajan et al. (1996) used output elasticities to examine the relationship of productive and unproductive government spending to economic growth. Utilising data from 43 developing countries over 20 years,
they found that the relationship between capital expenditure and growth is negative. The negative coefficient occurs due to the excess expenditure of capital crowding out current expenditure. Devarajan et al. (1996) concluded that the long-term impact of government spending components depends on the combination of each productive and unproductive item of expenditure and its relative proportion to the total budget.

Lee (1995) used 89 samples from developed and developing countries to argue that government consumption slows long-term growth. Landau (1986) and Grier and Tullock (1989), using cross-sectional data from 104 and 115 countries respectively, also confirmed that growing government consumption has a negative relationship to economic growth. Further analysis of spending components by Afonso and Furceri (2010) indicates that social welfare spending, government consumption and subsidies have a negative correlation to growth, based on their research on 28 OECD countries from 1970 to 2004. Based on studies of 15 European Union countries, Romero-Ávila and Strauch (2008) also confirm the negative and significant results of expenditure components on growth.

A more recent study has questioned the efficacy of productive government spending on economic growth. Using panel data of OECD countries, Boehm (2019) examines the effect of government spending on capital and current economic growth. The hypothesis is that government spending on capital is productive (Ilzetzki, et.al, 2010); however, the estimation evidence suggests different results. Boehm (2019) reports that government capital spending has a significantly smaller multiplier than current spending in OECD countries. The policy implications of this study suggest that fiscal stimulus packages that contain large government capital spending may not be as effective in stimulating the economy as previously believed.
3.2.2 Sectoral government spending and growth

Turning to the functional decomposition of public spending, the critical focus from a number of papers is on the education sector. After Lucas (1988) defined the important role of human capital to growth, education has been widely acknowledged to foster growth. For instance, using sample data from OECD countries, Gemmell et al. (2016) confirm that the allocation of public spending in education and infrastructure has a positive impact on long-term output. However, Holtz-Eakin (1992) has suggested a contrasting result, arguing that the positive impact of education on growth diminishes when controlled for specific regional special effects. Devarajan et al. (1996) also found a negative relationship between spending in the education sector and economic growth. They argued that excessive expenditure on the education sector in some countries has inefficient and unproductive results.

Benhabib and Spiegel (1994) and Miyakoshi, Tusukuda, Kono and Konayagi (2010) have found relatively weak evidence of a correlation between education spending and growth. Furthermore, Blankenau and Simpson (2004) report that the impact on economic growth of government spending in the education sector depends on other factors such as the government’s size and its tax structure. These mixed results can be attributed to data outliers in the cross country sample and/or differences in model specification, specifically in the use of certain control variables (Baldacci, et.al.,2008).

15 Other studies related to education spending and growth include Kaganovich and Zilcha (1999). They study the interrelation of public spending between the education sector and social security. The study argues that a higher allocation in education correlates to higher output.
Health has a positive impact on growth, since a healthy person works better, harder and longer (Well, 2007). Therefore, it is important for governments to pay more attention to their health sectors for long-term sustainable growth. However, empirical results vary across studies. Piabuo and Tieguhong (2017) find a significant long-term direct effect of health spending on economic growth in African countries. This result supports the policy of allocating 15% of budget to the health sector in five African economies. Aschauer (1989), studying the US economy, indicated that health spending, integral to the productive sector, promotes economic growth in the long run. In contrast, Wang (2011) argues that the impact of health expenditure depends on the level of income. In low-income countries, health expenditure may hinder economic growth because, due to fiscal limitations, health spending may crowd out other productive spending, thus leading to declining growth.

Facchini and Seghezza (2018) use a new dataset for France spanning 1870 to 2010 to find that health expenditure has promoted long-term growth in France. Other functional spending also contributing to growth is that on property rights protection, which commonly exists in budget allocations in developed countries. Interestingly, the results also report that social expenditure and spending on education are not significant to long-term economic growth: the impact of education on economic growth is not captured by government spending, therefore warranting further study.

As mentioned in several studies, government military spending and social spending may also contribute to growth. Barro (1990) points out that military-related spending can enhance investment and promote growth through channels of property rights. Empirical evidence, however, provides ambiguous results. For instance, Smith, Willenbockel, and
Dunne (2005) argue that there is no robust empirical evidence, either negative or positive, that links defence spending to economic growth. However, in a recent study, d’Agostino, Dunne, and Pieroni (2018), using 109 samples of low-income countries, show a robustly adverse effect of military spending on economic growth after addressing endogeneity issues through instrument-variables regression.

Many studies have examined the interdependence between government sectoral spending and growth—for example, productivity on health spending can be affected by spending on education and infrastructure, and vice versa. From an empirical perspective, such complementarities occur because each item of spending may have no direct impact on growth. However, some spending is contingent on its interaction with other variables in relation to economic growth (Semmler et al., 2007). Furthermore, the impact of infrastructure spending on growth is determined not only by the coefficient but also by the quality of education (Agénor, 2008).

### 3.3 Methodology and model specification

This chapter now introduces the econometric models and discusses data and estimation frameworks.

**Basic model specification**

In studying the relationship between public spending and growth, there is no widely accepted model for standard analytical frameworks (Landau, 1986). Therefore, the best approach to addressing the research questions is by using a simple production function.
This study develops the model specifications following the Sollow-Swan model thus:\textsuperscript{16}

\[ Y_{it} = f(K_{it}, L_{it}) \]  \hfill (3.1)

Equation (3.1) states that the level of real output \((Y)\) depends on capital \((K)\)—both physical and human—and the labour force or population \((L)\) available in the economy. Productivity is determined by the use of technology and the efficiency of a factor of production in use. Accordingly, per capita productivity also depends on per capita stocks of capital, the hours of work per capita.

Following the theoretical foundation of Landau (1986) and Kormendi and Meguire (1985), the standard growth equation relates the conditional convergence of growth, the initial level of income per capita, the ratio of investment to GDP and human capital augmented with government spending components. Accordingly, the aggregate production function is:

\[ Y_{it} = f(K_{it}, L_{it}, G_{it}) \]  \hfill (3.2)

Note that \(G\) is a relevant government spending component. Here, we can establish the empirical model to explain correlations implicit in Equation (3.2) thus:

\[ y_{it} - y_{it-1} = \beta_1 y_{t-1} + x_{it}'\beta_2 + \lambda_t + \gamma G_{it} + u_i + \epsilon_{it} \]  \hfill (3.3)

If we expand the control variables, where:

1. \(i\) represents the country \((i = 1, \ldots, n)\) and \(t\) denotes the period \((t = 1, \ldots, n)\).

2. On the left-hand side, \(y_{it} - y_{it-1}\) is the real per capita growth rate as the dependent variable. We took difference in log of real GDP level to generate income growth.

\textsuperscript{16} See Barro (1990) for empirical studies using the neoclassical growth model.
3. $y_{t-1}$ is lagged growth per capita.

4. $G$ is the public spending component.


6. Domestic investment (gross capital formation).

7. Inflation rate.

8. $u_t$ indicates fixed effects and $\epsilon_{it}$ is error term; whereas $\beta_1, \beta_2$ and $\gamma$ are unknown parameters.

The control variables were selected based on the growth literature and previous case studies. The growth models mostly used initial income variables as a proxy for the convergence effect as stated in the Solow-Swan model (Solow, 1956). Population growth is used to control the demographic effect on growth, whereas domestic investment using gross capital formation captures the effect of capital accumulation on economic growth (Afonso & Jalles, 2014; Bayraktar & Moreno-Dodson, 2015). Lastly, inflation is included in the model based on the log change of the consumer price index (Asimakopoulos & Karavias, 2016; Kumar & Woo, 2015).

Econometrics methods

To estimate the baseline model, a dynamic panel model using the GMM estimator was applied due to its ability to address the country’s fixed effects and potential endogeneity given the heterogeneity aspects of the panel data. Instead of the difference GMM technique, system GMM techniques were used in my analysis. The difference GMM methods developed by Holtz-Eakin, Newey, and Rosen (1988) and Arellano and Bond

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17 See appendix to Chapter 3 for further definitions and data sources.
(1991) may contain finite sample biases that cause the estimated coefficient to be imprecise (Staiger & Stock, 1997).

Moreover, the finite sample biases are likely found in the context of empirical growth estimations.\(^{18}\) This leads to the use of system GMM, developed by Arellano and Bover (1995) and Blundell and Bond (1998), that implements difference GMM estimation combined with the regression in difference and regression in the level value in a system where the two equations are separately instrumented.

The right-hand side variables in a growth regression may not be exogenous because they often influence each other, growth or other factors not included as a control in the empirical equation. In this case, the dynamic panel model provides rigorous steps for treating endogeneity in the model variables to achieve reliable results (Arellano & Bond, 1991). Furthermore, a two-step system GMM estimation is applied, requiring the first difference in all variables with all standard errors to be panel corrected (Beck & Katz, 1995).

The application of the GMM technique may generate a proliferation of instruments which can overfit endogenous variables, thus leading to unreliable results. Roodman (2009) suggests restricting the number of lagged levels used in the instrument matrix or collapsing the instrument matrix or a combination of the two to reduce the number of instruments. Accordingly, we apply the system GMM with a combination of lag restrictions and restricting the number of instruments to avoid identification issues.

A number of post-estimation tests were conducted to ensure the validity of the model analysis. Firstly, an Arrelano-Bond test was conducted to examine whether the error term is not serially correlated, which assumes the orthogonality condition. Secondly, the validity of the various instruments was examined using estimations from a Hansen test.

3.4 The dataset and descriptive analysis

To represent the categories of developing countries, the study used specifications for middle income countries and retrieved 52 countries for the database. The main reason is that the World Bank has stated that grouping developing countries as a category has become less relevant. Therefore, it is useful to use the current GNI per capita as an indicator of development. In this case, middle-income countries are those with a GNI per capita of between $1,006 and $12,235. The period of the database spans 1973–2015. The main reason for selecting this period is to gather as many observations as possible using the existing database. The complete description of the data category is available in the appendix to this chapter.

Government expenditure data

This study focuses specifically on the government expenditure side with its decomposition of capital and current expenditure. In order to study the spending composition effect on economic growth, a dataset based on the IMF’s Government Financial Statistics database was developed. The fiscal database on the IMF website is based on the GFSM2014. The GFSM standard does not classify expenditure into capital

19 The list of countries can be found in the appendix to Chapter 3.
and current expenditure. However, we follow Acosta-Ormaechea and Morozumi (2013) to proxy the capital expenditure using the net investments in non-financial asset data and governments’ current expenditure using the government expense data. While many studies use the aggregation of expenditure, we allow interactions of each expenditure component on economic growth. Here, the current expenditure components are compensation for employees (wages), use of goods and services, interest payments, subsidies and transfers. We normalise the expense components with the ratio to total expenditure.

This study also analyses the impact of government expenditure by sector on economic growth. Based on GFSM spending by function, there are ten categories of spending by function in the government budget. However, the availability of data is the main challenge, especially for the sample of middle-income economies. Therefore, this study focuses on the sectoral effect of government spending on growth and examines spending in the education, health and defence sectors. Sectoral spending shares are normalised with the ratio of total expenditure. The functional spending is categorised as current spending in the budget structure according to the GFSM 2014. It also possible that there is capital spending within functional spending—for instance, spending on physical goods such as equipment under education spending or health equipment under health sector spending. However, this study measures only the aggregate allocation as mentioned in the GFSM category.

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20 Bleaney et al. (2001), Devarajan et al. (1996) and Kneller et al. (1999) separate expenditure into productive and non-productive components. whereas Bayraktar and Moreno-Dodson (2015) divide the classification of public spending into core and non-core groups.
The Government Financial Statistic database contains several levels of institution. At the aggregate level, the institutional level is based on the central government (CG) and the general government (GG) levels. Some countries provide more detailed data for lower levels of government, such as state and local. However, the availability of this data is limited, so the focus is on the GG level in the principal analysis.

While some studies use the CG level for their analysis, the focus on the GG level here primarily considers the degree of decentralisation policy. The level of decentralisation is different across the components of public spending. For instance, defence is centralised policy while education and health are mostly decentralised. Therefore, using the CG level may not accurately capture the impact of the spending component at the national level. Moreover, Acosta-Ormaechea and Morozumi (2013) argue that the trend for decentralisation over time may create more problematic analysis in the panel dataset if using CG level data.

**Macroeconomic data**

The macroeconomic data come from two primary sources: the IMF and the World Bank. The main dependent variable is real GDP growth per capita from the IMF’s World Economic Outlook database. Other macroeconomic variables such as population growth, inflation and capital formation are retrieved from the World Bank's World Development Index.

**Descriptive analysis**

This section investigates the pattern and trend of public spending in developing countries that may provide helpful information when interpreting econometric estimations in this
chapter. Table 1 summarises descriptive statistics for all regressors in this paper. Real GDP growth per capita in developing countries averaged around 2% per annum in the observed period. However, the volatility was quite high with a standard deviation of 4.9% and values ranging from −13% to 26%. This indicates frequent episodes of both rapid development and sharp decline of growth in this region. Government expenditure in the developing countries sample averaged around 27% of GDP, with a high variation of value ranging from 5% to 80% which was less than advanced economies, which are mostly above 30% of GDP.

For the decomposition of public expenditure in the sample of developing countries, current expenditure on average has been allocated around 22% of GDP, whereas capital expenditure has a lower average allocation of around 4% of GDP. On the current expenditure side, the highest allocated budget funds are subsidy and transfers and employee compensation averaging around 31% and 29% of total expenditure. In the sectoral allocation, the education and defence sectors received, on average, around 14% and 10% of the total expenditure, while the health sector on average has 8% of total expenditure allocation.

Figure 3.3 represents the historical trend of real GDP per capita growth and total public spending relative to GDP based on five-year averages with local polynomial trends shown by the red line. The grey represents a 95% confidence interval around the estimation value. Economic growth in developing countries is, on average, quite robust at a positive level. The growth is at the lower end of around 2% in the period 1980–1990 but increased significantly after the Asian Financial Crisis, reaching around 3.5%. Furthermore,
declining volatility and negative growth over time has become less prevalent in more recent years.

The total government expenditure in the basket countries shows positive trends over time. In the early period, total government expenditure averaged around 18% of GDP. After 1990, the average value as a ratio to GDP rose to around 27.5%. The variation of total government expenditure in the database, which is still high in recent years, depicts the different fiscal capacity of each economy in the basket countries.
Table 3.1 Descriptive statistics – estimation sample

<table>
<thead>
<tr>
<th>Variable</th>
<th>#Obs</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total public spending (% GDP)</td>
<td>272</td>
<td>26.78422</td>
<td>11.32838</td>
<td>4.516041</td>
<td>79.26121</td>
</tr>
<tr>
<td>Current spending (% GDP)</td>
<td>272</td>
<td>22.54389</td>
<td>10.1992</td>
<td>3.169211</td>
<td>72.62464</td>
</tr>
<tr>
<td>Capital spending (% GDP)</td>
<td>270</td>
<td>4.27174</td>
<td>4.60195</td>
<td>-4.53089</td>
<td>28.69672</td>
</tr>
<tr>
<td>Good and services spending (% total spending)</td>
<td>268</td>
<td>21.59502</td>
<td>14.12799</td>
<td>3.47078</td>
<td>72.24133</td>
</tr>
<tr>
<td>Employment salary spending (% total spending)</td>
<td>265</td>
<td>29.28269</td>
<td>12.72143</td>
<td>3.748197</td>
<td>63.45242</td>
</tr>
<tr>
<td>Interest payment spending (% total spending)</td>
<td>268</td>
<td>12.0376</td>
<td>9.311009</td>
<td>0.00513</td>
<td>55.02531</td>
</tr>
<tr>
<td>Subsidy and transfer spending (% total spending)</td>
<td>225</td>
<td>30.94234</td>
<td>17.98228</td>
<td>0.015434</td>
<td>69.26795</td>
</tr>
<tr>
<td>Defence sector spending (% total spending)</td>
<td>220</td>
<td>10.24162</td>
<td>8.165826</td>
<td>0.645426</td>
<td>55.02006</td>
</tr>
<tr>
<td>Education sector spending (% total spending)</td>
<td>200</td>
<td>13.9316</td>
<td>4.503634</td>
<td>5.02373</td>
<td>30.40528</td>
</tr>
<tr>
<td>Health sector spending (% total spending)</td>
<td>208</td>
<td>8.514034</td>
<td>3.995454</td>
<td>1.274094</td>
<td>21.01929</td>
</tr>
<tr>
<td>Population growth</td>
<td>457</td>
<td>0.559141</td>
<td>0.801616</td>
<td>-3.90527</td>
<td>2.872989</td>
</tr>
<tr>
<td>Inflation</td>
<td>381</td>
<td>18.44523</td>
<td>65.21009</td>
<td>-13.1744</td>
<td>951.9621</td>
</tr>
</tbody>
</table>

Domestic investment (% GDP) | 311  | 0.441461 | 19.40762 | -169.168 | 93.3589 |

Sources: IMF, World Bank

Notes: The table gives descriptive statistics for the estimation sample based on a sample of 52 developing countries. Each observation is a five-year average between 1973 and 2015—there are thus nine waves in total.

Figure 3.4 shows the historical development of capital spending and current spending in developing countries. Capital spending adopts a net concept that equals acquisition minus disposal and consumption of fixed assets, plus net acquisition of valuable and non-producing assets (GFSM, 2014).
Figure 3.4 Current expenditure and capital expenditure (in percentage to GDP)
Source: Government Financial Statistics, IMF
Notes: The figures display the link between current expenditure and capital government expenditure with time in our sample of developing countries. Capital and current expenditure are given on the vertical axes and the year is presented on the horizontal axes. Each data point represents a five-year average. A non-parametric trend is fitted in red and a 95% confidence interval is shown in grey.

The net investment in non-financial assets equals the acquisitions minus disposals of fixed assets, minus consumption of fixed capital, plus changes in inventories, plus the net acquisition (acquisitions minus disposals) of valuables and non-producing assets. The variation of capital spending is high over time, with countries such as the Maldives and Bhutan committing more than 20% of their public spending on capital expenditure. However, on average, capital spending has been relatively stable with a mean value of 4.3% of the GDP. On the other hand, current spending indicates an increasing trend over time from around 17% of GDP in the 1980s to 23% in later years.

The trend in public expenditure, specifically current expenditure, is driven by its components. The trends in expenditure are depicted in the panel of figures below. One of the main components of current expenditure is wages (compensation to employees). The trend of wages over time is relatively stable and shows a slight decline in the 2010 period. The consumption of goods and services is relatively stable over time with a mean value
of around 21% while interest payment expenses have a visible inverted curve that peaked around 1990.

The Asian Financial Crisis may have contributed to the interest payment trend. Subsidies and transfers, on the other hand, show a positive trend over time. Countries such as Indonesia and India have spent around 60% of their total expenditure on subsidies and transfers. In a country such as Indonesia, the subsidy scheme has been subject to fiscal reform; however, transfers to local government due to its decentralisation policy is still increasing. Therefore, the positive trend of subsidies and transfers may contribute to the upward pattern in current expenditure for developing countries.

Figure 3.5 Current spending budget decomposition (percentage to total expenditure)
Source: Government Financial Statistics, IMF
Notes: The figures display the link between current expenditure components with time in our sample of developing countries. Current expenditure components are given on the vertical axes and the year is presented on the horizontal axes. Each data point represents a five-year average. A non-parametric trend is fitted in red and a 95% confidence interval is shown in grey.
Figure 3.6 shows the trend of sectoral public spending over time. From the three sectors being observed for public spending, the education sector has a greater allocation than health and defence, with an increasing trend over time. The health sector shows a stable trend and the defence sector declines over time. However, the allocation to the defence sector is more than the health sector, with a mean value of 10% versus 8%, respectively.

Figure 3.6 Expenditure decomposition by function (percentage to total expenditure)
Source: Government Financial Statistics, IMF
Notes: The figures display the link between sectoral expenditure and time in our sample of developing countries. Sectoral expenditure components (education, health and defence) are given on the vertical axis and the year is presented on the horizontal axis. Each data point represents a five-year average. A non-parametric trend is fitted in red and a 95% confidence interval is shown in grey.
3.5 Estimation results

3.5.1 Capital expenditure, current expenditure and growth

According to Gupta, Clements, Baldacci, and Mulas-Granados (2005), the composition of public expenditure has its own impact on growth; therefore, we examine the impact of each component of public expenditure individually with the set of standard regressors. The system GMM technique was performed on the set of non-overlapping five years’ average panel data for the 53 developing countries.

Table 3.2 summarises the regression results on government expenditure components and presents the estimation result of the main regression model. Column 1 starts with the impact of total expenditure on economic growth in developing countries. The result indicates that the total expenditure (to GDP ratio) reduces economic growth in developing countries but not significant.

Column 2 shows the relationship between capital expenditure and economic growth. As expected, there is a positive impact on government capital spending to real output per capita in developing countries. The coefficient of capital expenditure is positive and highly significant, contrasting the negative association from Devarajan et al. (1996). The magnitude of the impact is with 10% increase in capital expenditure boosting growth.

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21 The standard regressors in this study include initial GDP, inflation, population growth and gross capital formation. Afonso and Jalles (2014) use initial GDP, education, population growth and domestic investment while Acosta-Ormaechea and Morozumi (2013) employ initial GDP and human capital as a set of controls.

22 There is an assumption that fiscal can influence growth only with lags effect (see Aghion, et.al (2009)). However, Acosta-Ormaechea and Morozumi (2013) found consistent results between contemporaneous effects of fiscal policy and lags effects. Accordingly, we conducted model estimation using selected fiscal spending components in similar baseline model. The results show that capital spending has significant growth enhancing effect, whereas spending in education and health are also consistent with the baseline model but not significant (see Table A3.3 on the appendix).
around 0.19%. The result confirms with other study based on data from advanced
countries, the significantly positive level of government capital expenditure confirms the
previous empirical results of Easterly and Rebelo (1993), Cashin (1995) and Acosta-
Ormaechea and Morozumi (2013). For developing countries, Landau (1986) and Bose et
al. (2007) found the association positive and significant.

Table 3.2 The impact of government expenditure in developing countries

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV: real GDP growth per capita</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lagged Growth</td>
<td>-0.0115</td>
<td>0.0030</td>
<td>-0.0162***</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.006)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>Total public spending (% GDP)</td>
<td>-0.0190</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital spending (% GDP)</td>
<td></td>
<td>0.0161***</td>
<td>-0.0322***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.005)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Current spending (% GDP)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-0.0322***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.004)</td>
</tr>
<tr>
<td>Population growth</td>
<td>-0.0064**</td>
<td>-0.0088***</td>
<td>-0.0079***</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.002)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Inflation</td>
<td>-0.0174***</td>
<td>-0.0221***</td>
<td>-0.0180***</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.005)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Lagged domestic investment (% GDP)</td>
<td>0.0009***</td>
<td>0.0005**</td>
<td>0.0002</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
</tbody>
</table>

Observations: 208  204  208
Number of countries: 50  50  50
Number of instruments: 38  38  38
Arellano-Bond AR(1) test (p-value): 0.0055  0.0087  0.0056
Arellano-Bond AR(2) test (p-value): 0.1955  0.1630  0.1616
Sargan test (p-value): 0.0081  0.1149  0.0140
Hansen J-stats (p-value): 0.1256  0.5305  0.1096

Notes: Estimations in Columns 1–3 are dynamic panel data models using the system
GMM technique. The dependent variable is real GDP per capita growth. Each
government expenditure component was estimated individually using the standard set
regressors and controls. All explanatory variables were treated as endogenous. Their
lagged values were used as instruments. Two-step results used robust standard errors
corrected for finite sample. To address the proliferation of instruments, the combination
of lag restriction and collapse command were performed. Time dummies and a constant
term were included but are not reported. Standard errors in parentheses *** p<0.01, **
p<0.05, * p<0.1.

Column 3 examines the impact of current expenditure (expense to GDP ratio) on
economic growth. In the presence of the control variables, the correlation between current
expenditure and growth appears negative, and highly significant. The current spending in developing economies is, on average, around 30% of their GDP but the impact on growth is 10% increase of current expenditure is associated with 0.32% growth. Furthermore, the breakdown of current expenditure may have a different outcome which will be discussed in the next regression model.

Control variables also show expected coefficient sign. Population growth shows indirectly indicates the size of the countries. Therefore, the higher the growth the lower GDP percapita growth given the specific increase of GDP (Afonso and Jalles, 2014). The significant and negative impact of inflation to growth is caused by the high level of inflation in developing countries within the sample (see Christie (2012) for similar results). Lagged domestic investments indicates positive relationship to growth in most models.

Post-estimation diagnostic tests were also conducted. Dynamic panel models rely on an assumption regarding the structure of the error term and also the instruments in our model that consist of lagged dependent and independent variables. The Arrelano-Bond (AR) test was conducted for serial correlation and the assumption requiring the presence of AR(1) errors but not AR(2) is satisfied. The over-identification tests with Hansen statistics also indicate no sign of incoherent instrumentation for Models 1, 2 and 3.

3.5.2 Current expenditure components and growth

The total current expenditure impact from Table 3.2 is statistically insignificant; however, not all components of expense have a similar impact on growth. Table 3.3 reports the estimation results of current expenditure components. According to GFSM, there are
eight components of expense in government budget structures. However, we only examined four components of current expenditure in this section: consumption of goods and services, interest payments, transfer and subsidies, and employee compensation (wages).

Table 3.3 Current expenditure composition and growth in developing countries

<table>
<thead>
<tr>
<th>DV: real GDP growth per capita</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagged Growth</td>
<td>-0.8188</td>
<td>-1.9524**</td>
<td>-0.7908</td>
<td>0.0627</td>
</tr>
<tr>
<td></td>
<td>(0.570)</td>
<td>(0.802)</td>
<td>(0.832)</td>
<td>(1.315)</td>
</tr>
<tr>
<td>Interest payment spending (%</td>
<td>-0.0999*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total spending)</td>
<td>(0.052)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment salary spending (%</td>
<td>0.1166*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total spending)</td>
<td>(0.070)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good and services spending (%</td>
<td></td>
<td></td>
<td>0.0915***</td>
<td></td>
</tr>
<tr>
<td>total spending)</td>
<td></td>
<td></td>
<td>(0.034)</td>
<td></td>
</tr>
<tr>
<td>Subsidy and transfer spending</td>
<td></td>
<td></td>
<td></td>
<td>0.0048</td>
</tr>
<tr>
<td>(% total spending)</td>
<td></td>
<td></td>
<td></td>
<td>(0.035)</td>
</tr>
<tr>
<td>Population growth</td>
<td>-1.4948**</td>
<td>0.4927</td>
<td>-1.0638</td>
<td>-0.8918</td>
</tr>
<tr>
<td></td>
<td>(0.642)</td>
<td>(0.881)</td>
<td>(0.814)</td>
<td>(0.925)</td>
</tr>
<tr>
<td>Inflation</td>
<td>-0.4286</td>
<td>-3.008***</td>
<td>-2.940***</td>
<td>-0.5479</td>
</tr>
<tr>
<td></td>
<td>(0.525)</td>
<td>(0.309)</td>
<td>(0.249)</td>
<td>(0.763)</td>
</tr>
<tr>
<td>Lagged domestic investment (%</td>
<td>0.1070***</td>
<td>0.0977***</td>
<td>0.0648**</td>
<td>0.1592***</td>
</tr>
<tr>
<td>GDP)</td>
<td>(0.024)</td>
<td>(0.027)</td>
<td>(0.032)</td>
<td>(0.044)</td>
</tr>
</tbody>
</table>

| Observations                  | 187       | 184       | 186       | 160       |
| Number of countries           | 39        | 38        | 38        | 38        |
| Number of instruments         | 33        | 33        | 30        | 28        |
| Arellano-Bond AR(1) test(p-   | 0.0172    | 0.0080    | 0.0103    | 0.0200    |
| value)                        |           |           |           |           |
| Arellano-Bond AR(2) test(p-   | 0.4649    | 0.9659    | 0.5086    | 0.5869    |
| value)                        |           |           |           |           |
| Hansen J-stats (p-value)      | 0.2522    | 0.3168    | 0.4303    | 0.4839    |

Notes: Estimations in Columns 1–4 are dynamic panel data models using the system GMM technique. The dependent variable is real GDP per capita growth. Each government expenditure component was estimated individually using standard set regressors and controls. All explanatory variables were treated as endogenous. Their lagged values were used as instruments. Two-step results using robust standard errors corrected for finite sample. To address the proliferation of instruments, the combination of lag restriction and collapse command were performed. Time dummies and a constant term were included but are not reported. Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.
The results show that interest payment expense has a negative and significant influence on growth with a magnitude of 0.1% reduction of growth for every 1% increase of interest expense. This is a considerably lower negative impact than 0.5% from Gupta et al. (2005). Government employee salary payments have a positive effect on growth with weak significant effect. on the other hand, government consumption of goods and services has a positive effect on growth and is statistically significant at a 99% confidence level. Furthermore, transfers and subsidy expenses are insignificant for enhancing output which aligned with Afonso and Jalles (2014).

To validate the model specification, the Arellano-Bond test was conducted to determine if the error term fulfils the assumption of a dynamic panel model. The presence of AR(1) errors are detected from the test results but not AR(2). Therefore, the assumption of error correlation in the four models is satisfied. To validate instrument checks, a Hansen test was conducted to test the null hypothesis over-identifying instruments are valid. The test has resulted in the rejection of H0 that concludes the validity of instruments in the model.

3.5.3 Sectoral expenditure and growth

In terms of the effect of sectoral decomposition on growth, the effect of sectoral spending on health, education and the military sector was disaggregated. The GFSM 2014 divides sectoral (or functional) spending into ten categories. However, the focus is on the above three sectors because they can represent the core spending and consideration in the data availability for developing countries.

Table 3.4 reports the estimation results of sectoral expenditure’s impact on economic growth in developing countries. Using a similar dynamic panel model through system
GMM estimation, the study examines the impact of each sectoral spend on output per capita. The result found that the education sector’s spend has a detrimental effect on growth, with negative and statistically significant results at a 99% confidence level. This result contradicts existing theory which states that education is the main factor in human capital and growth (Barro, 1996).

Table 3.4 Sectoral government expenditure and growth

<table>
<thead>
<tr>
<th></th>
<th>DV: real GDP growth per capita</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagged Growth</td>
<td>-0.7104</td>
<td>-1.7873</td>
<td>-0.6183</td>
<td></td>
</tr>
<tr>
<td>Education sector spending (% total spending)</td>
<td>-0.3149***</td>
<td>(0.121)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health sector spending (% total spending)</td>
<td>0.1313**</td>
<td>(0.061)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defence sector spending (% total spending)</td>
<td>-0.0500</td>
<td>(0.065)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population growth</td>
<td>-0.1008</td>
<td>-0.1801</td>
<td>-1.248***</td>
<td></td>
</tr>
<tr>
<td>Inflation</td>
<td>-1.0646**</td>
<td>-1.4495***</td>
<td>-0.778***</td>
<td></td>
</tr>
<tr>
<td>Lagged domestic investment(%GDP)</td>
<td>0.1347***</td>
<td>0.1385***</td>
<td>0.1355***</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>144</td>
<td>147</td>
<td>170</td>
<td></td>
</tr>
<tr>
<td>Number of countries</td>
<td>40</td>
<td>42</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Number of instruments</td>
<td>32</td>
<td>37</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Arellano-Bond AR(1) test(p-value)</td>
<td>0.0226</td>
<td>0.0255</td>
<td>0.0118</td>
<td></td>
</tr>
<tr>
<td>Arellano-Bond AR(2) test (p-value)</td>
<td>0.3035</td>
<td>0.1759</td>
<td>0.1918</td>
<td></td>
</tr>
<tr>
<td>Hansen J-stats (p-value)</td>
<td>0.3394</td>
<td>0.2178</td>
<td>0.2009</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Estimates in Columns 1–3 are dynamic panel data models using the system GMM technique. The dependent variable is real GDP per capita growth. Each government expenditure component was estimated individually using the standard set regressors and controls. All explanatory variables were treated as endogenous. Their lagged values were used as instruments. Two-step results used robust standard errors corrected for finite sample. To address the proliferation of instruments, a combination of lag restriction and collapse command was performed. Time dummies and a constant term were included but are not reported. Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.
However, previous studies such as Landau (1986) and Devarajan et al. (1996) also found a negative correlation of education spending with growth. There are two arguments for the negative relationship. Firstly, the negative coefficient describes the inefficiency of public spending in the education sector in developing countries due to a weak correlation between spending and education enrolments and quality of education (Landau, 1986).

There is also a possibility that the budget allocation in the education sector is redundant and crowds out other budget allocations in the developing economies (Devarajan et al., 1996) Secondly, the aggregate data in the estimation may not reflect the composition effect of capital and current spending within the education sector. In a country-specific case or smaller country groups, the coefficient can be positive and significant.23 On the other hand, public health spending shows positive effect on growth with 95% confidence level. This result follows the argument that spending in health can improve human capital which ultimately benefits economic growth (Devarajan et al., 1996, Afonso and Jalles (2014))

3.6 Conclusion

This study examines the potential linkage between government expenditure composition and economic growth in 51 developing countries for the period 1973–2015. To address the business cycle effect during the long-term sample period, non-overlapping averages of five years were performed.

23 Despite the negative impact of aggregate education to growth, Devarajan et al. (1996) found that the capital expenditure in the education sector has a growth-enhancing effect. On the other hand, Bose et al. (2007) used the budget breakdown of sectoral data from 30 countries to find that expenditure on education, specifically in capital expenditure, enhanced growth.
The findings suggest that total expenditure in developing countries decreases economic growth, although statistically insignificant. If we look into the expenditure component, capital expenditure indicates a positive and significant coefficient effect to growth. On the other hand, current spending has a decreasing and significant impact to economic growth. Further disaggregating current spending, the study found that spending on goods and services has a positive effect and is significant for per capita output. Interest payment expense has a detrimental impact on growth with highly significant effects. Interestingly, The compensation of employee expense has a positive effect on growth but is statistically weak.

Moving to sectoral spending, the study found that education expenditure has a significant and negative impact on growth. However, the result should not be interpreted as the education sector being unproductive. The negative effect may imply the inefficiency of education spending in developing economies. It may also be that education pulls people out of the workforce, resulting in temporarily reduced output. However, further study is needed to explore the sectoral spending in more detail data on a country case basis. Defence sector spending has a negative and significant effect on growth, whereas the health sector’s effect on growth in developing economies is positive and significant.
### APPENDIX TO CHAPTER 3

#### Table A3.1 Variables in government expenditure composition and economic growth

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP growth per capita</td>
<td>Economic growth, change in real per capita GDP</td>
<td>World Development Index (WDI), World Bank</td>
</tr>
<tr>
<td>Total public spending (% GDP)</td>
<td>Total expenditure to GDP, the ratio of expenditure on general government final consumption to GDP.</td>
<td>WDI, World Bank</td>
</tr>
<tr>
<td>Current spending (% GDP)</td>
<td>Government current expenditure to GDP. The ratio of government expense to GDP in providing goods and services. Government expense includes, for instance, salaries, consumption of goods services, interest payments.</td>
<td>Government Finance Statistics (GFS), International Monetary Fund (IMF)</td>
</tr>
<tr>
<td>Capital spending (% GDP)</td>
<td>Government spending as capital investment ratio to GDP. It consists of gross spending on non-financial assets such as fixed assets, inventories, valuables and non-produced assets. This spending also includes consumption of fixed capital.</td>
<td>GFS, IMF</td>
</tr>
<tr>
<td>Good and services spending (% total spending)</td>
<td>Goods and services expense ratio to total government expenditure. This expense contains goods and services utilised for market and non-market production of goods and services by general government.</td>
<td>GFS, IMF</td>
</tr>
<tr>
<td>Employment salary spending (% total spending)</td>
<td>Government employee compensation ratio to total expenditure. Employee compensation consists of wages and salaries of</td>
<td>GFS, IMF</td>
</tr>
<tr>
<td>Category</td>
<td>Description</td>
<td>Source</td>
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<td>-----------------------------------------------</td>
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<tr>
<td>Interest payment spending (% total spending)</td>
<td>Interest payment ratio to total expenditure. Expense to government from interest payments incurred from liabilities such as deposits, securities, loans and accounts payable. These liabilities are the consequences of government borrowing from other entities.</td>
<td>GFS, IMF</td>
</tr>
<tr>
<td>Subsidy and transfer spending (% total spending)</td>
<td>Subsidy and transfer relative to total expenditure. Subsidy is payment by the government to other entities based on their levels of production of goods and services. Transfer is grant from one government unit to another. It can be current or capital transfer.</td>
<td>GFS, IMF</td>
</tr>
<tr>
<td>Defence sector spending (% total spending)</td>
<td>General government expenditure on defence function relative to total expenditure. Consists of military defence (7021), civil defence (7022), foreign military aid (7023), R&amp;D defence (7024) and other defence functions (7025)</td>
<td>GFS, Classification of Functions of Government (COFOG), IMF</td>
</tr>
<tr>
<td>Education sector spending (% total spending)</td>
<td>General government expenditure in education function. Consists of pre-primary and primary education (7091), secondary education (7092), post-secondary and non-tertiary education (7093), tertiary education (7094), education not definable by level (7095),</td>
<td>GFS, COFOG, IMF</td>
</tr>
<tr>
<td>Indicator</td>
<td>Description</td>
<td>Source</td>
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<tr>
<td>subsidiary services to education</td>
<td>(7096), R&amp;D in education (7097), education n.e.c (7098)</td>
<td></td>
</tr>
<tr>
<td>Health sector spending (% total</td>
<td>General government expenditure on health function. Comprises medical products, appliances and equipment (7071), outpatient services (7072), hospital services (7073), public health services (7074), R&amp;D health (7075), health n.e.c (7076)</td>
<td>GFS, COFOG, IMF</td>
</tr>
<tr>
<td>spending)</td>
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<tr>
<td>Population growth</td>
<td>Percentage of population growth. Increase of population in a country over a certain period of time. The period is of one-year’s duration.</td>
<td>WDI, World Bank</td>
</tr>
<tr>
<td>Inflation</td>
<td>Inflation, change in consumer price index.</td>
<td>WDI, World Bank</td>
</tr>
<tr>
<td>Domestic investment (% GDP)</td>
<td>Change of domestic investment in the economy. It is proxied by the change in gross capital formation. Gross capital formation is addition of fixed assets plus net changes in the level of inventories.</td>
<td>WDI, World Bank</td>
</tr>
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<tr>
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<tbody>
<tr>
<td>1.</td>
<td>Armenia</td>
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<td>2.</td>
<td>Albania</td>
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<td>Algeria</td>
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<td>Belarus</td>
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<td>7.</td>
<td>Bahamas</td>
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<td>8.</td>
<td>Bosnia</td>
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<td>10.</td>
<td>Bhutan</td>
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<td>12.</td>
<td>Cambodia</td>
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<td>13.</td>
<td>Colombia</td>
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<td>Cuba</td>
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<td>16.</td>
<td>Equatorial Guinea</td>
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<td>17.</td>
<td>Fiji</td>
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<td>51.</td>
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<td>52.</td>
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</tbody>
</table>

Note: Based on middle income country grouping by the World Bank
Source: World Bank
Table A3.3 Lagged selected spending components and growth.

<table>
<thead>
<tr>
<th>DV: real GDP growth per capita</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagged Growth</td>
<td>-0.0082***</td>
<td>-2.9324***</td>
<td>-2.4326***</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.638)</td>
<td>(0.269)</td>
</tr>
<tr>
<td>Lagged Capital spending (% GDP)</td>
<td>0.0052**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lagged Education Spending</td>
<td></td>
<td>-0.0805</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.056)</td>
<td></td>
</tr>
<tr>
<td>Lagged Health Spending</td>
<td></td>
<td></td>
<td>0.0288</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.108)</td>
</tr>
<tr>
<td>Population growth</td>
<td>-0.0095***</td>
<td>-3.0153***</td>
<td>0.3601</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.312)</td>
<td>(0.301)</td>
</tr>
<tr>
<td>Inflation</td>
<td>-0.0016</td>
<td>-0.0032</td>
<td>-1.5807***</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.588)</td>
<td>(0.404)</td>
</tr>
<tr>
<td>Lagged Domestic investment (% GDP)</td>
<td>0.0009***</td>
<td>-0.0702</td>
<td>0.1173***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.054)</td>
<td>(0.013)</td>
</tr>
</tbody>
</table>

Observations: 168 120 114
Number of countries: 39 39 41
Number of instruments: 38 38 30
Arellano-Bond AR(2) test (p-value): 0.0979 0.1427 0.1900
Hansen J-stats (p-value): 0.3283 0.1925 0.1895

Notes: Estimations in Columns 1–3 are dynamic panel data models using the system GMM technique. The dependent variable is real GDP per capita growth. Each government expenditure component was estimated individually using the standard set regressors and controls. All explanatory variables were treated as endogenous. Their lagged values were used as instruments. Two-step results used robust standard errors corrected for finite sample. To address the proliferation of instruments, the combination of lag restriction and collapse command were performed. Time dummies and a constant term were included but are not reported. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.
CHAPTER 4. PUBLIC DEBT, BUDGET DEFICITS AND INTEREST RATES IN EMERGING ECONOMIES: AN EMPIRICAL ANALYSIS

4.1 Introduction

With the rise of fiscal activism following the Global Financial Crisis (GFC), public debt for financing national budget deficits to create fiscal stimulus has risen sharply. Governments with access to both international and domestic financial markets can be flexible in both the amount raised and the timing for incurring public debt. The downside to increasing public debt is increasing pressure on the budget: this may push interest rates up and reduce the government’s future capacity for spending. There is, moreover, a link between public debt and fiscal profligacy. It is believed that the latter is associated with high debt sustainability risk, translating into rising long-term interest rates (Kaya, 2013). Therefore, managing a prudent fiscal policy is often referred to as “public debt sustainability”. Whenever a public debt is at a sustainable level, the risk premium required from investors is also manageable without risk to the economy (De Mendonça & Nunes, 2011; De Mendonça & Machado, 2013).

The interest rate may also impact the economy: for instance, a higher interest rate may reduce investment, restrain spending on interest-sensitive durable consumption and reduce consumption from negative wealth. The total cost of such adverse impacts is not easy to measure. However, according to Engen and Hubbard (2004), the cost to the economy depends on the degree to which fiscal policy expansion increases the interest
rate. From 1990 to 2017, the average public debt-to-GDP ratio in developing and emerging economies was quite volatile. Figure 4.1 shows the average value of the public debt-to-GDP ratio in a dataset of emerging and developing countries. The accumulation of debt in developing countries has been affected by the Asian Financial Crisis (AFC) through to the GFC. Although their level of debt is less than in advanced countries, the pace of debt accumulation in emerging and developing countries is quite alarming. Through access to the global capital market, countries such as India, Indonesia, Thailand and Vietnam can acquire debt relatively easily. Figure 1 shows that, after the AFC, there was significant accumulation of debt, demonstrating the considerable finance needed for fiscal stimulus policies. The GFC also impacted debt accumulation, although the build-up was less than during the AFC.

![Figure 4.1](image-url)  
**Figure 4.1 Historical government debt-to-GDP ratio in emerging and developing countries**  
Source: Fiscal Monitor, IMF  
Notes: The figure displays the government debt-to-GDP ratio over time in the sample of 53 developing countries. Government debt-to-GDP is shown on the vertical axis and the year is on the horizontal axis. Each data point represents a non-weighted average in each period. The figure is produced using STATA 13.
Figure 4.2 presents the government budget balance per GDP ratio in 53 emerging and developing countries during the period 1990–2015. It shows the average annual value for this dataset. Within the period observed, deficit budget balances predominate. In the 1990s, African countries—particularly Kenya, Zambia and Botswana—had high budget deficits of 8.7%, 7.9% and 7.5% respectively. Some smaller countries, like Algeria, Seychelles and Bahrain, achieved budget surpluses after 2005 with levels around 13.5%, 7.1% and 6.5% respectively. The trend towards budget deficits is more prevalent in recent years, with the average deficit around 2.5% of GDP. The highest are Egypt, Kenya and Zambia with deficits of 10.7%, 8.9% and 8.7% of GDP respectively.

**Figure 4.2 Government budget balance in emerging and developing countries 1990–2015**

Source: Fiscal Monitor, IMF

Notes: The figure displays general government budget balance to GDP ratio over time in our sample of 53 developing countries. Budget balance to GDP is shown on the vertical axis and the year is on the horizontal axis. Each data point represents a non-weighted average in each period. The figure is produced using STATA 13.

Figure 4.3 is a historical graph of the real interest rate in both emerging and developing countries during the period 1990–2015. The movement of real interest is relatively choppy following financial market dynamics. On average, the real interest rate during the
AFC spiked at around 12%, with the highest in Uruguay at 46% and Mongolia at 30%. During the GFC, the interest rate also soared to 10% on average, with Iraq and Madagascar among the highest at 44% and 33% respectively.

Figure 4.3 Real interest rate in developing and emerging countries 1990–2015
Source: Fiscal Monitor, IMF
Notes: The figure displays real interest rate level with time in our sample of 53 developing countries. Real interest rate is shown on the vertical axis and the year is on the horizontal axis. Each data point represents a non-weighted average in each period. The figure is produced using STATA 13.

Overall, budget deficits and the accumulation of public debt in developing countries are lower than in advanced countries. However, several developing countries experienced crises events that triggered a rise in interest rates through premium risk. For instance, debt crises in Brazil (1998–1999), Turkey (2000–2001) and Argentina (2002) have a similar pattern whereby soaring public debt accumulated at unprecedented levels, resulting in significant risk premiums (Tran, 2018). Recent experiences in European countries—Portugal, Italy, Greece, Ireland and Spain—demonstrate that their fiscal deterioration led
to higher interest rates that threatened their fiscal sustainability. The real long-term interest rate climbed above 7% in crisis countries and large fiscal deficits were blamed. Fiscal austerity was hence prescribed to bring back low interest rates and fiscal sustainability (Kaya, 2013).

Despite the longstanding debate concerning the effect of fiscal policy on interest rates, the results of empirical studies have been inconclusive. Although emerging markets and developing economies (EMDE) have had little attention, some known features include higher perceived sovereign default risk and weaker policy credibility (Blanchard, 1990). With persistent budget deficits among EMDE and the build-up of debt stock, the effect of fiscal policy on interest rates in the EMDE remains a topic of study.

To explore this issue, we used various techniques to examine the impact of fiscal policy on the interest rate. We cover the 53 countries classified as emerging and developing economies from 1990 to 2015. This study contributes to the literature by focusing on emerging and developing economies to minimise data heterogeneity in fiscal policy management. It proposes a different approach to examining the relationship between fiscal policy and interest rates by implementing semiparametric analysis and robust dynamic panel estimates. Unlike previous studies—with the exception of Dell’Erba and Sola (2016)—this study extends the data to the post-crisis era.

The structure of this chapter is as follows. The introduction is followed by the literature review which provides a brief background theory of interest rates and public debt (Section 4.2). Section 4.3 surveys findings from previous empirical studies. The chapter continues by explaining the methodology to solve the problem and the econometrics techniques.
involved (Section 4.4). Section 4.5 discusses the data and variables explained by empirical results. Section 4.6 discusses the findings and the chapter ends with a conclusion.

4.2 Fiscal policy and interest rates

Studies on public debt and long-term interest rates were more extensive as the US sharply increased its deficit in the early 1980s. Ricardian equivalence theory prompted researchers to study the impact of the rising budget deficit in the US. However, the theories of the relationship between public debt and interest rates were divided between the conventional view and Ricardian equivalence. Figure 4.4 shows Gale and Orszag’s (2003) summary of the difference of the channelling effect of fiscal policy on the interest rate.

From the Ricardian point of view, an increase in the budget deficit leads to private savings fully offsetting the deficit; other variables thus also remain unchanged. Some studies confirm Ricardian equivalence and find that fiscal policy has no effect on the interest rate (Barro, 1989; Evans, 1985). On the other hand, from the conventional perspective, the budget deficit is not fully offset by national savings. Therefore, increasing it affects national savings, interest rates and other macro variables. Canzoneri, Cumby, and Diba (2002) argue that there is a positive relationship between fiscal variables and interest rates. However, the magnitude of the effect of fiscal policy on interest rates depends on many factors—for instance, the source of deficit funding or capital mobility. This study is based on conventional theory, assuming a small and open economy.
Figure 4.4 Budget deficit effect on interest rate theoretical framework
Source: Gale and Orzag (2003)

Conventional theory not only has contrasting opinions but empirical studies also arrive at mixed conclusions. These inconclusive results are mainly sourced from econometric and technical aspects of building the reduced form specification. The expected fiscal position is considered an essential parameter in the reduced form specification. The researcher who pioneered the use of expected fiscal variables is Feldstein (1986). Using the US database, he applied the forward-looking financial market assumption and argued that the interest rate is more likely to respond to an expected budget deficit value than the current value. Furthermore, market participants build their returns based considering the future status of fiscal policy, such as budget deficit persistency or public finance sustainability.

However, implementing the expected fiscal variable within the model’s specification is challenging. The data of expected variables is not readily available. Some institutions,
such as the US Congressional Budget Office, provide long-term independent projections; the OECD provides near-term projections that can be used in this field of study. In emerging and developing countries, projections are limited. To solve this problem, a recent study has considered the assumption of an extreme adaptive expectation, where the future condition is equal to the current one. This implies that the variable has a random walk with zero drift specification. With a horizon of up to a year and using growth non-overlapping averages, the expected variables, being highly correlated, can be proxied by current variables (Aisen & Hauner, 2013).

4.3 Findings from previous studies

Many studies have identified a strong relationship between public debt and the long-term interest rate. Early contributors who confirmed the conventional view are Feldstein and Eckstein (1970), who investigated the relationship between deficit and public debt under a conventional theoretical framework. Their study’s estimations used OLS and instrument variable regression. The sample was US data from the period 1954–1969; the key findings were that public debt in the US has a positive and significant influence on the interest rate.

The increased US deficit in the early 1980s was investigated by Barth, Iden, Russek, and Wohar (1991). Barth et al. (1991) focused on the impact of deficit/public debt on the main macroeconomic variables, with the principal emphasis on public debt. They reported that deficits in the US occurred mainly during war and recession. However, after analysing 42 research papers, the results remain inconclusive. In more recent surveys, Bernheim (1989) and Elmendorf and Mankiw (1999) also found inconclusive results.
They argued that each strand of interest rate theory always has some solid empirically-based studies to rely on—in other words, both theoretical arguments are plausible.

Gale and Orszag (2003) analysed empirical literature regarding the impact of public debt on the long-term interest rate. Like Barth et al. (1991), Gale and Orszag (2003) found mixed results. They compared nominal ten-year US rates with real rates that include CPI in the dataset. Based on this survey, they highlight the importance of the forward-looking nature of the financial market in the empirical analysis. Most studies that used the expected fiscal variable found a significantly positive relationship between public debt/deficit and the interest rate. Gale and Orszag (2003) argue that the expected budget deficit when testing the correlation between budget deficit/public debt and interest rates is essential because it represents investors’ fiscal expectations.

Studies of the expected budget deficit in public debt and interest rates were undertaken by Canzoneri et al. (2002) and Engen and Hubbard (2004) using projection-based datasets from the Congressional Budget Office and the Office of Management and Budget. These studies explored the relationship between the forecast fiscal deficit and the expected interest rate. The advantage of using expected values instead of current value is the ability to conceal a long-term dataset of fiscal policy from another external factor that relates to the business cycle (Gale & Orszag, 2003). Both studies use overlapping datasets and find a relatively similar positive and significant impact on the budget deficit. Canzoneri et al. (2002) and Engen and Hubbard (2004) report that a 1% increase in the budget deficit leads to an increase in the interest rate of around 19 to 45 basis points. On the other hand, the impact on the interest rate of increasing the public debt-to-GDP ratio was relatively small.
Responding to the results of Engen and Hubbard (2004), Shapiro (2004) and Parker (2004) argue that Engen and Hubbard underestimate the impact of public debt on the interest rate. Parker (2004) states that the impact of interest rate increases could put pressure on the economy, whereas, Shapiro (2004) argues that the cumulative effect of the public debt could be significant on the economy.

Laubach (2009) explores the public debt and interest rate linkage by using the expected values of budget deficit, debt and the interest rate. He found simultaneity issues from the business cycle and automatic stabiliser that challenged the analysis of the true relationship between public debt and the interest rate. Furthermore, the reaction of the monetary authority in response to the business cycle was a complex challenge due to the application of monetary easing during the recession which could result in a lower interest rate during a rising budget deficit. The data in his study consisted of a five-year projection of a ten-year forward rate, a five-year forward rate and ten-year yield treasury. The projection values were assumed to eliminate the cyclicality effect on the database. The author used OLS and instrument variables regression for the database spanning 1976–2006.

Laubach (2009) argued that the relationship between public debt and the interest rate was positive and statistically significant. A 1% increase in the deficit debt-to-GDP ratio raises the interest rate by 25 basis points, whereas the increase in public debt-to-GDP ratio is two to three basis points and increases the interest rate by 1% on public debt.

Hauner and Kumar (2011) observed the relationship between government budget deficit and the interest rate along with the globalisation of the financial market. A structural
model was developed, and the dataset of G7 countries was set from 1960 to 2005. Hauner and Kumar (2011) argued that the impact of fiscal deficit was relatively small on the long-term interest rate and also depended on the fiscal concept used in the model. They found that the concept of expected fiscal policy was the only one that has a significant effect on interest rates, rather than the current one. They concluded that the panel analysis had a higher impact compared with the individual country analysis.

Studies of the relationship between public debt and interest rates often use single equation models fitted by OLS or vector autoregression (VAR) as their methodology (Gale & Orszag, 2003). Aisen and Hauner (2013) offered an alternative approach to econometrics by examining the relationship between debt and interest rates. They employed GMM to conduct an estimation of a time-series dataset for 60 advanced and emerging market countries. Three significant results emerged from this study. Firstly, the effect of a budget deficit on the interest rate for the complete panel is 26 bps per 1% of increase. Secondly, different countries had results in different outputs. For example, countries with emerging markets tend to have a larger and more significant increase in public debt than economically advanced countries. The final result was that only a large budget deficit had a significant effect on the interest rate in an economy. Domestic financing also played an essential role in the budget deficit’s impact on the interest rate. Furthermore, they reported that the less developed the financial market, the more significant the impact of increasing public debt on the interest rate. Aisen and Hauner (2013) also pointed out that research regarding public debt and the interest rate focuses mainly on developed countries; developing and emerging countries receive less attention.
Recent studies utilise a real-time database, retrieved from data that is available at the time of a policy’s implementation and which includes current data and data projections. This data is considered important for policy makers in making point-in-time decisions. Dell’Erba and Sola (2016) use real-time data to study long-term interest rates and the public debt nexus to overcome the issue of reverse causality to match the forward-looking approach. The applied methodology for this study was the factor augmented panel from Giannone, Lenza, and Reichlin (2008). This approach allows the model to retain consistent estimations of the parameters and to study the heterogeneity of cross-country reactions to global shock. The results indicate that public debt has a small but significant effect on the interest rate within the range of one to two basis points. However, the effect of fiscal deficit on the long-term interest rate is much greater. Dell’Erba and Sola (2016) demonstrated that the effect of the budget deficit varied from 5 to 51 basis points. The stronger effect derived from countries that have relatively little financial integration and a fragile fiscal capacity, confirming the conclusion of Aisen and Hauner (2013).

Using real-time data collection, Dautovic (2017) examines the Ricardian equivalence condition in 20 OECD countries, using Arellano-Bond GMM estimators to investigate the relationship between public debt and long-term interest rates between 1992 and 2008. Aisen and Hauner (2013) used a similar technique to address endogeneity issues. Dautovic (2017) argued that the application of the dynamic model is essential for eliminating estimation problems such as endogeneity and serial correlation. Based on the dynamic model specification, he found that fiscal deficits do not have a significant crowding-out effect of rising interest rates on investment.
In a more recent study, Gamber and Seliski (2019) used dynamic stochastic general equilibrium to examine the fiscal effect of long-term interest rates on the US economy. The reduced form specification suggests that a 1% increase in the federal debt is associated with a rise in the interest rate of two to three basis points whereas the projected fiscal deficit influences a rise in the interest rate by 15 to 19 basis points. The higher impact by a projected budget deficit suggests that market participants perceive the US budget deficit to be persistent in the long run.

4.3.1 The fiscal effect of interest rates through risk premium

Capital asset pricing states that risk-free returns and risk adjustments are the main components in calculating expected returns. Fiscal policy may be one component of risk adjustment that is priced within the nominal yield of government bonds. In the event of a deteriorating fiscal balance, investors demand greater returns for holding government bonds in their portfolio due to the increase in default risk. Accordingly, expectations of better fiscal management or fiscal consolidation increase their confidence about their portfolios, thus reducing the risk premium. In their survey, Eyraud, Debrun, Hodge, Lledo, and Pattillo (2018) indicate that the implementation of fiscal policy tends to decrease risk premiums through the decline in the sovereign spread. In an empirical examination, David, Guajardo, and Yepez (2019) use a novel database containing global news to argue that fiscal consolidation significantly lowers the interest rate through the decline in the sovereign spread. These results constitute a confidence effect that channels through the risk premium required by investors in assessing fiscal policy and interest rate pricing.
4.3.2 Non-linearities of fiscal policy and the interest rate

Many studies have identified the non-linearities impact of fiscal policy on the interest rate. At a level of public debt that they consider high, investors perceive a rise in government solvency risk that could impact the risk premium. An empirical study by Baldacci and Kumar (2010) found that an initial deficit and public debt-to-GDP ratio above 60% increases the impact on the interest rate by 14 and 6 basis points respectively. Ardagna et al. (2007) also find relatively similar results by using squared terms of variable and interaction terms between binary and continuous forms. However, Dell’Erba and Sola (2016) suggest contrasting results. They found unclear evidence of non-linearity due to a relatively small impact of around 0.3 basis points on public debt to interest rates.

4.4 Methodology

This section discusses the econometric model and techniques of regression for this study. The baseline linear model specification is based on the reduced form of the equation of nominal interest rate in small open economies following the study by Edwards and Khan (1985). In perfect capital mobility, the interest rate is the function of the foreign nominal interest rate, expected depreciation and a country-specific spread. On the other hand, in a closed economy, the interest rate is affected by domestic factors—inflation and money supply. The real rate, however, is determined by the rate of population growth or technological progress and saving rates, as stated in the Solow growth model. Population growth and technological progress are represented by real growth rate while the saving rate is represented by the constant and the fiscal policy (deficit or debt) (Aisen and Hauner, 2013). The reduced form of baseline model is summarised thus:
\[ i_{t,t} = \delta_0 + \delta_1 Fiscal_{t,t} + X_{t,t}\delta_2 + \epsilon_{i,t} \]  

Where \(i_{t,t}\) is the interest rate variable for the country, \(Fiscal\) is the variable that represents fiscal policy—public debt and budget deficit—and \(X\) is the matrix of control variables, containing finance and other relevant variables.

We firstly examine whether non-linearities play an important role in the dataset. As previously discussed, the non-linear impact is justified, given the default risk and liquidity premium priced in the government yields. The approach to examining the non-linearity condition differs from the previous study: we employ a non-parametric approach to explore the relationship between fiscal variables and interest rates. This non-parametric model provides a flexible form of regression curve. Furthermore, we can use Baltagi and Li’s (2002) semiparametric fixed effect regression estimator by declaring the interest variable as non-parametric and setting the controls to a parametric standard. To estimate the semiparametric regression, we use the “xtsemipar” command on Stata 13 as developed by Libois and Verardi (2013).

The empirical approach to the impact of fiscal policy on interest rates is also affected by endogeneity issues such as measurement error, reverse causality and omitted variables. To address endogeneity, many researchers have utilised VAR or instrumental variable (IV) regressions. However, there are potential shortcomings when using either. For instance, VAR tends to be sensitive in ordering and lacks the capability to model multiplicative relationships. The IV method may also suffer from weak instruments that cause unreliable instrumental estimations, hypothesis tests and confidence intervals (Aisen & Hauner, 2013).
This study, therefore, utilised a dynamic panel model using the GMM estimator of Arellano and Bover (1995) and Blundell and Bond (1998) to estimate, in a system of regression equations, the differences and levels with specific instruments. The GMM estimator is appropriate for estimating this dataset since it has advantages in addressing unobserved country-specific fixed effects and potential endogeneity issues. I follow the estimation program prepared by Roodman (2006). Standard errors are reported using the correction method from Windmeijer (2005). I refer the lag length selection to Arellano and Bond (1991) and the Hansen test. To minimise the proliferation of instruments, the collapse command is used. The baseline model for the GMM estimation is:

$$ir_{it} = \rho ir_{i,t-1} + \delta_1 Fiscal_{it} + X_{it}\beta_2 + u_i + \alpha_t + \epsilon_{it} \tag{4.2}$$

### 4.5 Data

This study employs a panel dataset of 53 developing and emerging countries based on the classification of the World Bank and IMF from 1990 to 2015. Pursuing an interest rate analysis of developing and emerging markets has been challenging due to the availability of data. I aimed for around 60 countries in this group but ended up with 53 due to data cleaning and limitation. Most data is retrieved from international financial statistics from the IMF and the World Development Index from the World Bank.

The proxy of interest rate data in the nominal term ideally uses long-term interest rate data from government bond yields. Long-term interest rates are less impacted by monetary and fiscal policy (Aisen & Hauner, 2013). However, the availability of such data is limited for a developing country—even in developed countries, long-term interest rate data for earlier periods is limited. Therefore, short-term interest rate data was
retrieved for this study. Such data has also been used in some previous studies of developed countries: for instance, Bernhardsen’s (2000) study on European countries, Driffill and Snell’s (2003) on OECD countries and Neumeyer and Perri’s (2004) on emerging economies. To maximise the sample data, I followed Aisen and Hauner (2013) in compiling short-term rates such as money market rates, saving rates and lending rates from the IMF—both World Outlook and International Financial Statistics.

Fiscal variables such as deficits and public debt are from the World Economic Outlook and the IMF Historical Public Debt Database. The budget deficit represents general government classifications from the database. However, public debt comes under the classification of central government. This is because many emerging and developing countries restrict the ability of state or local governments to raise debt. They may, however, request budget funding from the central government, which can raise debt on their behalf.

Several variables were considered for the macroeconomic controls, such as real money supply, which is the growth rate of the broad money ratio to GDP. Inflation is defined as the average value in the annual change of the consumer price index. The other variable is real GDP growth. On the financial side, two variables were included in the model. Risk spread is proxied by the spread of lending rates to a benchmark instrument, which is the US treasury bill rate. Other studies consider the credit rating level as a proxy of sovereign risk. However, the credit rating from rating agencies is less sensitive to market information and is very discreet, agencies having their own methodologies to measure

24 For instance, Aizenman, Hutchison, and Jinjarak (2013) use credit ratings such as S&P and other rating agencies. Aisen and Hauner (2013) use the ICRG rating due to its better coverage over other rating agencies’ data.
ratings. Another way to measure sovereign rating is the credit default swap (CDS), which is an insurance contract against the default condition of the debtor. Although the movement of the CDS is relatively sensitive to market information, it is also sensitive to risk premiums that make interpretation difficult (Beirne & Fratzscher, 2013). Based on this context, I prefer to measure risk by risk spread, proxied by the spread of lending rates to a benchmark instrument: the US treasury bill rate. The main reasons are that this method measures the spread value of local rates to a benchmark rate. The higher the spread, the greater the risk premium demanded from the investor. The coverage of data is also much more extensive than retrieving credit ratings or CDS.

The second financial variable is financial depth. I include financial depth represented by the liquid liability of the banking sector relative to GDP in the model because of the theoretical influence of the interest rate. This differs from Aisen and Hauner’s (2013) methodology that applies financial depth only to interactive models. Financial development is one of the factors deserving attention for inclusion in the model. Ardagna et al. (2007) point out that the degree of financial development affects interest rate sensitivity to fiscal shocks. Therefore, the interaction of fiscal variables and financial development may result in an interesting relationship. Financial development can be represented with private credit, commercial bank and central bank asset ratios, and liquid liability. Since liquid liability data is widely available from developing countries, I proxied the financial depth with liquid liability to GDP ratio in the model.

The dataset is averaged in five-year non-overlapping intervals to reduce the effect of business cycles and monetary conditions. This data process allows more focus on cross-sectional and long-term analysis. The non-overlapping average is common in growth
studies and is used other contexts as well—for example, the determination of public deficit (see Calderon, Chong, and Loayza (2002) and Chinn and Ito (2006) for a full study). Following Aisen and Hauner (2013), I conducted the study using current data, despite expected values. The arguments for this are, firstly, the limited data available for expected variables such as inflation, public debt and fiscal deficit. The most used available data, such as Consensus Economics and Bloomberg Economics, contain only a limited number of countries and mostly feature advanced economies. Secondly, the study uses a yearly horizon in the dataset and we assume that adaptive expectations apply. Garcia and Perron (1996) argued that expectation that equals current conditions occurs where agents receive information efficiently, or the variable behaves like random walks with zero drift. Table 1 displays the summary of variables used in the estimation.

Before estimating the model, we performed some data cleaning because some developing countries have experienced hyperinflation that directly impacts the interest rate. We removed several countries that had interest rates above 100%, which resulted in a drop in the number of countries from 60 to 53. Table 1 shows the descriptive analysis of the variables.

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25 In this paper, we assume that current and expected inflation are strongly correlated; however, this assumption does not hold under very high and volatile inflation (Aisen & Hauner, 2013. Therefore, the removal of outliers is necessary as this might affect parameter estimates.
Table 4.1 Variables and data for public debt and interest rate model

<table>
<thead>
<tr>
<th>Variables</th>
<th>Description</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest rate</td>
<td>Interest rate compilation of saving rate and lending rate.</td>
<td>IMF, World Economic Outlook (WEO)</td>
</tr>
<tr>
<td>Public debt</td>
<td>Public debt-to-GDP ratio. Total government liability including loans, securities from domestic and external source divided by the GDP in the respective year.</td>
<td>The World Bank and IMF fiscal indicators</td>
</tr>
<tr>
<td>Deficit</td>
<td>Budget deficit proxied by net lending and borrowing for the general government as percentage to GDP.</td>
<td>IMF fiscal indicators</td>
</tr>
<tr>
<td>Growth</td>
<td>Economic growth, change in real per capita GDP.</td>
<td>IMF, WEO</td>
</tr>
<tr>
<td>Inflation</td>
<td>Average annual change in consumer price index that indicates percentage change in cost of consumer in purchasing a basket of goods and services.</td>
<td>World Bank</td>
</tr>
<tr>
<td>Risk spread</td>
<td>Spread from local interest rate and short run interest rate data taken from treasury bills 3 months up to 1 year.</td>
<td>IMF, WEO</td>
</tr>
<tr>
<td>Financial depth</td>
<td>Liquid liabilities of the banking sector as percentage of GDP.</td>
<td>IMF, International Financial Statistics</td>
</tr>
<tr>
<td>Money supply</td>
<td>Real money supply growth. Ratio of broad money to GDP growth rate.</td>
<td>IMF, WEO</td>
</tr>
<tr>
<td>δ</td>
<td>Vectors of regression coefficients</td>
<td></td>
</tr>
<tr>
<td>ε_{it}</td>
<td>Error term</td>
<td></td>
</tr>
</tbody>
</table>

Source: Author’s estimation

Table 4.2 Descriptive statistics

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>mean</th>
<th>sd</th>
<th>min</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk spread</td>
<td>185</td>
<td>6.166</td>
<td>6.352</td>
<td>−5.766</td>
<td>47.76</td>
</tr>
<tr>
<td>Inflation</td>
<td>282</td>
<td>10.18</td>
<td>18.64</td>
<td>−2.302</td>
<td>208.4</td>
</tr>
<tr>
<td>Money supply</td>
<td>279</td>
<td>16.18</td>
<td>12.63</td>
<td>−0.451</td>
<td>105.3</td>
</tr>
<tr>
<td>GDP growth</td>
<td>280</td>
<td>3.666</td>
<td>2.661</td>
<td>−5.693</td>
<td>16.25</td>
</tr>
<tr>
<td>Public debt</td>
<td>255</td>
<td>49.23</td>
<td>33.78</td>
<td>5.435</td>
<td>188.2</td>
</tr>
<tr>
<td>Financial depth</td>
<td>276</td>
<td>50.05</td>
<td>28.10</td>
<td>7.220</td>
<td>154.2</td>
</tr>
<tr>
<td>Deficit</td>
<td>208</td>
<td>−2.450</td>
<td>2.497</td>
<td>−13.89</td>
<td>0</td>
</tr>
<tr>
<td>Nominal interest rate</td>
<td>318</td>
<td>16.21</td>
<td>10.73</td>
<td>2.902</td>
<td>88.40</td>
</tr>
<tr>
<td>Number of countries</td>
<td>53</td>
<td>53</td>
<td>53</td>
<td>53</td>
<td>53</td>
</tr>
</tbody>
</table>

Source: IMF and World Bank.

Notes: The table gives descriptive statistics for the estimation sample based on the sample of emerging and developing countries. The variables are calculated as non-overlapping five-year averages over 1990–2015.
4.6 Results

4.6.1 Semiparametric results

This subsection starts by examining the relationship between the interest rate, the budget deficit and public debt using the semiparametric panel data model with the fixed effects of Baltagi and Li (2002). The semiparametric approach is new to interest rate literature, although common in trade literature. However, a study of the Laffer curve between debt and growth has also used the semiparametric method (Megersa, 2015).

We follow Baltagi and Li’s (2002) method because it uses other control variables to provide greater flexibility in capturing the non-linearity effect and unobservable factors and to minimise the omitted variable bias. From the baseline Equation 4.2, I estimated the interest rate model with the variable of interest along with other controls. The “xtsemipar” command on Stata 13 from Libois and Verardi (2013) was used to solve the semiparametric equation.

The results of semiparametric estimations are twofold: the parametric results from the control variables and the semiparametric estimation of the fiscal variables. Table 3 displays the results in the parametric model of the relationship between deficit and the interest rate. The coefficients in this parametric fixed effect show a positive relationship to the interest rate with significantly strong statistics. The real GDP growth has a negative coefficient as expected but is not significant.

Turning to semiparametric analysis, Figure 4.5 represents the semiparametric estimation of a budget deficit relationship with the interest rate. This estimation uses a kernel-
weighted local polynomial fit based on the Epanechnikov kernel, with confidence intervals at 95% and standard error clustered by country. The partial fit graph shows that the budget deficit semiparametric estimation line runs relatively flat and close to zero. Note also that the estimation dots of fixed effects are close to linear parametric regression. These results show that the effects of the observed variables—the budget deficit—has little effect on the interest rate.

Table 4.3 Parametric estimate relationship of budget deficit to interest rate

<table>
<thead>
<tr>
<th>Variables</th>
<th>Parametric results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Money supply</td>
<td>0.185***</td>
</tr>
<tr>
<td></td>
<td>(0.067)</td>
</tr>
<tr>
<td>Risk spread</td>
<td>0.478***</td>
</tr>
<tr>
<td></td>
<td>(0.162)</td>
</tr>
<tr>
<td>Inflation</td>
<td>0.170***</td>
</tr>
<tr>
<td></td>
<td>(0.042)</td>
</tr>
<tr>
<td>Growth</td>
<td>−0.348</td>
</tr>
<tr>
<td></td>
<td>(0.265)</td>
</tr>
<tr>
<td>Financial depth</td>
<td>−0.041</td>
</tr>
<tr>
<td></td>
<td>(0.062)</td>
</tr>
<tr>
<td>Observations</td>
<td>96</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.524</td>
</tr>
</tbody>
</table>

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Figure 4.5 Non-parametric relationship between budget deficit and interest rate
Source: Author’s estimation
Note: semiparametric regression is done using the “xtsemipar” command on Stata13. The budget deficit is treated as a semi parametric variable. The variables are calculated as non-overlapping five-year averages over 1990–2015.

Next, we estimate the semiparametric relationship of public debt to the interest rate in the sample. Parametric results for the control variables are presented in Table 4.4. Most of the control variables have the expected coefficient. Economic growth in this result shows a significantly negative value, implying that an increase in economic growth is associated with a decrease in the interest rate. For the relationship of public debt to the interest rate, semiparametric estimation shows a relatively similar result. Figure 4.6 shows semiparametric results on public debt and the interest rate. Fiscal deficit was replaced with public debt-to-GDP ratio in the baseline function. The semiparametric line of public
debt is near the zero value. This shows that the relationship between public debt and the interest rate has little impact on growth.

**Table 4.4 Parametric estimate relationship of public debt to interest rate**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Parametric results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Money supply</td>
<td>0.155*** (0.053)</td>
</tr>
<tr>
<td>Risk spread</td>
<td>0.771*** (0.113)</td>
</tr>
<tr>
<td>Inflation</td>
<td>0.325*** (0.050)</td>
</tr>
<tr>
<td>Growth</td>
<td>−0.462*** (0.173)</td>
</tr>
<tr>
<td>Financial depth</td>
<td>−0.057 (0.049)</td>
</tr>
</tbody>
</table>

Observations: 128
R-squared: 0.521

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

**Figure 4.6 Non-parametric relationship between public debt and interest rate**
Source: Author’s estimation
Note: semiparametric regression is done using the “xtsemipar” command on Stata13. Public debt is treated as a semi parametric variable. Variables are calculated as non-overlapping five-year averages over 1990–2015.
4.6.2 Linear estimation results

After examining the semiparametric condition of the baseline equation, I estimated the interest rate baseline equation using the dynamic panel model. Table 4.5 shows the results of the baseline specification. All estimates are obtained through the System Generalised Method of Moments (SGMM) from Blundell and Bond (1998). The proliferation of instruments is one of the important issues in addressing the implementation of the SGMM method. If the instruments used in estimating the model are too large and overfit the endogenous variable, the model may suffer weak instrument validation (Roodman, 2009). Considering this risk, we apply the collapse and lag option to restrict the number of instruments in use.

Firstly, the public debt effect on interest rates is estimated using a parsimonious equation. Secondly, all control variables are placed in the multivariate model. Next, public debt is replaced with the budget deficit and performs similar steps of estimation.

The analysis starts with the results of the relationship between public debt and interest rate. The parsimonious model shows that the coefficient is positive as expected but is not significant (Column 1). However, in Column 2, the multivariate estimation result suggests that the impact of public debt to the interest rate in emerging and developing countries is positive and significant at a 95% confidence level. It is noted that the magnitude of impact from public debt to interest rate is higher in the latest model (5 and 6) and that the confidence level is also higher. This confirms the study of Kinoshita (2006) that found a higher positive estimation in a range between four and five basis points using a sample of 19 advanced countries. The magnitude is higher than previous studies which show that a
1% increase of public debt is associated with an interest rate rise of between two and five basis points (Gale & Orszag, 2003; Gamber & Seliski, 2019; Laubach, 2009).

Table 4.5 Baseline estimation results of fiscal policy and interest rates

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public debt</td>
<td>0.005</td>
<td>0.045*</td>
<td></td>
<td>0.031**</td>
<td>0.049***</td>
<td></td>
</tr>
<tr>
<td>Money supply</td>
<td>0.090</td>
<td></td>
<td>0.030</td>
<td></td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>Risk spread</td>
<td>0.905***</td>
<td></td>
<td>0.705***</td>
<td></td>
<td>0.706***</td>
<td></td>
</tr>
<tr>
<td>Inflation</td>
<td>0.678***</td>
<td></td>
<td>0.575***</td>
<td></td>
<td>0.724***</td>
<td></td>
</tr>
<tr>
<td>Growth</td>
<td>−0.148</td>
<td></td>
<td>−0.240</td>
<td></td>
<td>0.479</td>
<td></td>
</tr>
<tr>
<td>Financial depth</td>
<td>−0.019</td>
<td></td>
<td>−0.017</td>
<td></td>
<td>−0.020</td>
<td></td>
</tr>
<tr>
<td>Lagged interest rate</td>
<td>0.678***</td>
<td>0.117</td>
<td>0.551***</td>
<td>0.266***</td>
<td>0.669***</td>
<td>0.152</td>
</tr>
<tr>
<td>Year</td>
<td>0.002**</td>
<td>0.001</td>
<td>−0.311***</td>
<td>0.002**</td>
<td>0.002***</td>
<td>−0.000</td>
</tr>
<tr>
<td>Y1</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Y2</td>
<td>3.278***</td>
<td>1.940*</td>
<td>0.000</td>
<td>2.326</td>
<td>2.895</td>
<td>5.977***</td>
</tr>
<tr>
<td>Y3</td>
<td>−1.382</td>
<td>0.000</td>
<td>−4.670***</td>
<td>0.000</td>
<td>−2.414</td>
<td>2.822**</td>
</tr>
<tr>
<td>Y4</td>
<td>−1.325*</td>
<td>−2.098***</td>
<td>−3.715***</td>
<td>−1.527**</td>
<td>−1.984</td>
<td>0.000</td>
</tr>
<tr>
<td>Y5</td>
<td>0.000</td>
<td>−1.332*</td>
<td>−1.846***</td>
<td>−1.057</td>
<td>−0.390</td>
<td>1.287*</td>
</tr>
<tr>
<td>Y6</td>
<td>0.059</td>
<td>−0.310</td>
<td>0.000</td>
<td>−0.241</td>
<td>0.000</td>
<td>2.177**</td>
</tr>
</tbody>
</table>

Observations: 214  135  130  120  167  106
Number of countries: 43  30  43  34  43  30
Number of instruments: 38  30  28  24  27  20
Arellano-Bond test (p-value): 0.091  0.574  0.898  0.879  0.395  0.718
Hansen J-stats (p-value): 0.099  0.375  0.327  0.318  0.128  0.288

Notes: Dependent variable is nominal interest rate. Models 1–6 are estimated using the SGMM method. Panel dataset is averaged in non-overlapping five-year periods. Lag restrictions and collapse command are used in the “xtabond2” command on Stata 13. Standard errors are in parentheses. ** and *** denote significance at 5% and 1% levels, respectively.
As for budget deficit, we found positive and significant relationship to interest rate on model 5 and 6. The parsimony model in Column 3 shows a positive relationship; however, the impact is not statistically significant. Inserting similar control variables provides better results. In the multivariate model (Column 4), the budget deficit in emerging and developing countries is associated with the increase in interest rate but, again, the coefficient is not statistically significant. This result confirms the Ricardian predictions which states that budget deficit has insignificant impact to the interest rate because private saving offsets 100% of budget deficit (Gale and Orzag (2003)).

Following the procedure of Beetsma, Giuliodori, and Sakalauskaite (2016), we include both fiscal variables in the right-hand side of the equation. Column 5 presents the parsimonious result of the interest rate with public debt and deficit along with lag interest rate and year dummies. Both public debt and fiscal deficit have a positive impact on the interest rate at a 95% confidence level. Model 5 shows that the increase of the budget deficit is associated with an increase in the interest rate of 64 basis points. Lastly, we include all fiscal variables and the control variables in one equation in Column 6. In this equation, the increase in the budget deficit is associated with an interest rate increase of 62 basis points. Compared to the previous study, the impact of the budget deficit in this model is higher, while Aisen and Hauner (2013) found an impact at a medium level of 44 basis points.

Overall, the above baseline model is satisfactory, based on the post-estimation tests. The Arellano-Bond tests show that the error term is not serially correlated, thus supporting the

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26 Gale and Orszag (2003) conclude that the studies found a positive significant coefficient of budget deficit to interest rate in most cases in the range of 20 to 60 basis points per 1% increase of budget deficit.
implementation of GMM estimation. Hansen tests also validate the instrument used in the estimation. Turning to other control variables, inflation and risk spread are highly significant in all multivariate models. The positive coefficients are expected and in line with existing theory and empirical literature. The high value of coefficients also suggests that the inflation and risk premium spread has a more direct influence on the interest rate in developing and emerging countries. Economic growth represented by GDP growth has a negative coefficient, as expected, but is not statistically significant in most models. Lastly, financial depth represented by liquid liabilities in the banking sector also has a negative coefficient as expected but, again, this is not significant.

4.6.3 Interaction

We now explore whether the relationship of public debt and budget deficit with the interest rate differs between various interactive conditions by splitting the existing dataset into subsamples. Firstly, the sample is split into high and low deficit conditions by generating dummy variables. The median value is the threshold in dividing subsamples. New separate variables are generated for “High” and “Low” condition and coded 1 if they are above than the mean value (High) and below the mean value(Low). Secondly, using a similar method, the sample is split into low and high financial depths. After splitting the sample, the interactive variables are generated starting from the public debt and then the budget deficit model. Due to collinearity, each interaction is estimated separately.
Table 4.6 Interaction results on public debt and interest rates

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Publicdebt*lowdeficit</td>
<td>0.038*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.022)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Publicdebt*highdeficit</td>
<td>0.044***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.011)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Publicdebt*lowdepth</td>
<td>0.050**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.022)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Publicdebt*highdepth</td>
<td></td>
<td></td>
<td></td>
<td>0.015</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.021)</td>
</tr>
<tr>
<td>Money supply (growth)</td>
<td>0.029</td>
<td>0.133</td>
<td>0.120</td>
<td>0.047</td>
</tr>
<tr>
<td></td>
<td>(0.083)</td>
<td>(0.117)</td>
<td>(0.116)</td>
<td>(0.071)</td>
</tr>
<tr>
<td>Risk spread</td>
<td>0.868***</td>
<td>0.933***</td>
<td>0.914***</td>
<td>0.842***</td>
</tr>
<tr>
<td></td>
<td>(0.058)</td>
<td>(0.102)</td>
<td>(0.073)</td>
<td>(0.089)</td>
</tr>
<tr>
<td>Inflation</td>
<td>0.670***</td>
<td>0.677***</td>
<td>0.624***</td>
<td>0.573***</td>
</tr>
<tr>
<td></td>
<td>(0.122)</td>
<td>(0.168)</td>
<td>(0.114)</td>
<td>(0.120)</td>
</tr>
<tr>
<td>GDP growth</td>
<td>−0.401</td>
<td>−0.285</td>
<td>−0.325</td>
<td>−0.184</td>
</tr>
<tr>
<td></td>
<td>(0.309)</td>
<td>(0.337)</td>
<td>(0.383)</td>
<td>(0.272)</td>
</tr>
<tr>
<td>Financial depth</td>
<td>−0.017</td>
<td>−0.040</td>
<td>0.003</td>
<td>−0.035</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(0.026)</td>
<td>(0.031)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>Lagged interest rate</td>
<td>0.166**</td>
<td>0.074</td>
<td>0.130</td>
<td>0.211**</td>
</tr>
<tr>
<td></td>
<td>(0.066)</td>
<td>(0.137)</td>
<td>(0.097)</td>
<td>(0.098)</td>
</tr>
<tr>
<td>Year</td>
<td>0.001</td>
<td>0.002</td>
<td>0.001</td>
<td>0.002*</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>Y1</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Y2</td>
<td>2.597***</td>
<td>2.398***</td>
<td>2.008</td>
<td>2.564*</td>
</tr>
<tr>
<td></td>
<td>(0.817)</td>
<td>(0.784)</td>
<td>(1.723)</td>
<td>(1.317)</td>
</tr>
<tr>
<td>Y3</td>
<td>0.602</td>
<td>0.302</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>(0.833)</td>
<td>(1.052)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Y4</td>
<td>−1.198</td>
<td>−2.173**</td>
<td>−1.795**</td>
<td>−2.073</td>
</tr>
<tr>
<td></td>
<td>(0.762)</td>
<td>(0.990)</td>
<td>(0.833)</td>
<td>(1.359)</td>
</tr>
<tr>
<td>Y5</td>
<td>0.000</td>
<td>−1.476***</td>
<td>−1.256</td>
<td>−1.375</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.540)</td>
<td>(1.116)</td>
<td>(1.367)</td>
</tr>
<tr>
<td>Y6</td>
<td>0.048</td>
<td>0.000</td>
<td>−0.277</td>
<td>−0.305</td>
</tr>
<tr>
<td></td>
<td>(0.832)</td>
<td>(0.000)</td>
<td>(1.351)</td>
<td>(1.191)</td>
</tr>
<tr>
<td>Observations</td>
<td>135</td>
<td>135</td>
<td>135</td>
<td>135</td>
</tr>
<tr>
<td>Number of countries</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Number of instruments</td>
<td>30</td>
<td>30</td>
<td>24</td>
<td>30</td>
</tr>
<tr>
<td>Arellano-Bond AR(2) test</td>
<td>0.453</td>
<td>0.628</td>
<td>0.636</td>
<td>0.970</td>
</tr>
<tr>
<td>(p-value)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hansen J-stats (p-value)</td>
<td>0.406</td>
<td>0.176</td>
<td>0.066</td>
<td>0.087</td>
</tr>
</tbody>
</table>

Notes: Dependent variable is nominal interest rate. Models 1–4 are estimated using the SGMM method. Panel dataset is averaged in non-overlapping five-year periods. Lag restrictions and collapse command are used in the “xtabond2” command on Stata 13.1. SEs are in parentheses. ** and *** denote significance at 5% and 1% levels, respectively.
Table 4.6 shows the results of the interacting variables on the public debt model. It can be concluded that public debt matters when the deficit is high with a four basis points increase in the interest rate per 1% increase in public debt-to-GDP. A low deficit condition also has a significantly positive impact on rising interest rates with a weak significant level. However, in high deficit condition, public debt shows high significance in affecting the rise of interest rate. Furthermore, it is evident that lower financial depth also increases the interest rate in developing countries. At a lower financial depth, a 1% increase in public debt adds five basis points to the interest rate. Aisen and Hauner (2013) also found a significant impact on financial depth with a mixed database between advanced and developing countries. In sum, the interaction models show that public debt matters more in affecting interest rate on high deficit condition and low financial depth.

Regarding financial depth interaction model, there are two reasons for the results. The first is that low financial depth may intensify the effect of the risk premium on the interest rate, as pointed out by Caballero and Krishnamurthy (2004). Secondly, the shallow financial sector may create competition if the government and the private sector require funds, implying a greater possibility of a crowding-out effect. This eventually increases the effect of public debt on the interest rate (Aisen & Hauner, 2013; Montiel, 2003). The result may imply the significance of the crowding out of public debt for private investment in the low financial depth condition; however, this study does not focus on examining the crowding-out effect of fiscal policy. Further study is needed to examine the effect of public debt on private investment using a more relevant variable and adjusted econometrics method.
Table 4.7 Interaction results on budget deficit and interest rates

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deficit*lowdeficit</td>
<td>−0.706</td>
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<td></td>
<td>0.534</td>
</tr>
<tr>
<td></td>
<td>(0.836)</td>
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<td>(0.392)</td>
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<tr>
<td>Deficit*highdeficit</td>
<td></td>
<td>0.582***</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>(0.188)</td>
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<td></td>
</tr>
<tr>
<td>Deficit*lowdepth</td>
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<td></td>
<td>0.085</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.456)</td>
<td></td>
</tr>
<tr>
<td>Deficit*highdepth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Money supply (growth)</td>
<td>0.093</td>
<td>−0.043</td>
<td>0.118</td>
<td>0.059</td>
</tr>
<tr>
<td></td>
<td>(0.096)</td>
<td>(0.084)</td>
<td>(0.144)</td>
<td>(0.158)</td>
</tr>
<tr>
<td>Risk spread</td>
<td>0.564***</td>
<td>0.666***</td>
<td>0.719***</td>
<td>0.731***</td>
</tr>
<tr>
<td></td>
<td>(0.109)</td>
<td>(0.103)</td>
<td>(0.176)</td>
<td>(0.160)</td>
</tr>
<tr>
<td>Inflation</td>
<td>0.402**</td>
<td>0.696***</td>
<td>0.581***</td>
<td>0.571***</td>
</tr>
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<td></td>
<td>(0.171)</td>
<td>(0.144)</td>
<td>(0.201)</td>
<td>(0.217)</td>
</tr>
<tr>
<td>GDPgrowth</td>
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<td>0.637**</td>
<td>−0.542</td>
<td>0.095</td>
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<td></td>
<td>(0.445)</td>
<td>(0.288)</td>
<td>(0.626)</td>
<td>(0.522)</td>
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<td>Financial depth</td>
<td>−0.013</td>
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<td>(0.025)</td>
<td>(0.025)</td>
<td>(0.042)</td>
<td>(0.022)</td>
</tr>
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<td>Public debt</td>
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<td>0.045*</td>
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<td>0.021</td>
</tr>
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<td>(0.022)</td>
<td>(0.023)</td>
<td>(0.056)</td>
<td>(0.017)</td>
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<td>Lag interest rate</td>
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<td>0.188*</td>
<td>0.198</td>
<td>0.241**</td>
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<tr>
<td></td>
<td>(0.089)</td>
<td>(0.102)</td>
<td>(0.153)</td>
<td>(0.103)</td>
</tr>
<tr>
<td>Year</td>
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<td>0.002</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.001)</td>
<td>(0.003)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Y1</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Y2</td>
<td>3.993**</td>
<td>6.393***</td>
<td>2.034*</td>
<td>3.139*</td>
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<td></td>
<td>(1.935)</td>
<td>(1.538)</td>
<td>(1.184)</td>
<td>(1.673)</td>
</tr>
<tr>
<td>Y3</td>
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<td>2.422**</td>
<td>0.000</td>
<td>0.000</td>
</tr>
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<td>(0.000)</td>
<td>(0.985)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Y4</td>
<td>−1.146</td>
<td>0.000</td>
<td>−1.728**</td>
<td>−1.769</td>
</tr>
<tr>
<td></td>
<td>(0.701)</td>
<td>(0.000)</td>
<td>(0.788)</td>
<td>(1.111)</td>
</tr>
<tr>
<td>Y5</td>
<td>0.002</td>
<td>1.299*</td>
<td>−0.861</td>
<td>−0.874</td>
</tr>
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<td></td>
<td>(1.260)</td>
<td>(0.710)</td>
<td>(1.104)</td>
<td>(1.334)</td>
</tr>
<tr>
<td>Y6</td>
<td>0.400</td>
<td>2.118**</td>
<td>−0.319</td>
<td>−0.265</td>
</tr>
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<td>(0.962)</td>
<td>(0.924)</td>
<td>(1.339)</td>
<td>(1.208)</td>
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<td>106</td>
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</tr>
<tr>
<td>Number of instruments</td>
<td>27</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
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<td>Arellano-Bond AR(2) test</td>
<td>0.846</td>
<td>0.707</td>
<td>0.752</td>
<td>0.949</td>
</tr>
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<td>(p-value)</td>
<td>0.401</td>
<td>0.713</td>
<td>0.059</td>
<td>0.223</td>
</tr>
</tbody>
</table>

Notes: Dependent variable is nominal interest rate. Models 1–4 are estimated using the SGMM method. Panel dataset is averaged in non-overlapping five-year periods. Lag restrictions and collapse command are used in the “xtabond2” command on Stata 13.1. SEs are in parentheses. ** and *** denote significance at 5% and 1% levels, respectively.
The interactive relationship of the budget deficit model is presented in Table 4.7. In column 2, the result displays that the impact of a budget deficit on the interest rate is strongly significant under a high deficit condition. Under a high deficit condition, the interest rate may rise around 58 basis points due to the increasing budget deficit of 1%. Further, under a low deficit condition (column 1), the impact is negative on interest rates but is not significant. Under low financial depth and high financial depth condition (column 3 and 4), the coefficients show insignificant relationship to interest rate. Interaction models may also explain the non-linearity of the fiscal effect on the interest rate. However, based on the results above, no evidence can be found to support a non-linearity effect which is in line with the semiparametric estimation in the first section of this chapter.

4.7 Conclusion

This chapter contributes to the literature as a fresh perspective on whether fiscal policy can affect the interest rate. While previous studies use a mixed- or advanced-countries case, I focus on emerging and developing countries that have been recently exposed to the capital market. I extend the literature by not only examining the relationship of public debt but also the budget deficit to the interest rate. Furthermore, I explore the interaction to explain the heterogeneity in the literature by applying the GMM method.

Several conclusions can be drawn from the estimation. Firstly, the public debt-to-GDP ratio has a positive relationship with interest rates. A 1% rise in this ratio is associated with a six basis points rise in the interest rate. On the other hand, the impact of budget
deficits on interest rates is statistically significant by 67 basis points. Secondly, the effects vary if the sample is split into several interactive conditions. For instance, the impact of public debt on the interest rate is significant under high deficit and low financial depth conditions. This also occurs in the budget deficit interaction model, where the impact of the budget deficit under high deficit conditions is strongly significant.

Based on previous studies, the interactions can be further explored to explain the heterogeneity condition. However, limited data for fiscal and finance in emerging and developing economies is the main challenge for further investigation. Nevertheless, important policy implications can be derived from the above results. Governments must be aware of this when managing budget deficits and public debt because increases may result in investors and the financial sector requiring risk premiums. The development of domestic financial markets is also needed because it may create financial deepening and make interest rate movement more resilient. Avenues for further research include investigating the crowding-out effect on investment that can determine the magnitude of the fiscal effect on investment that eventually influences growth.
**APPENDIX TO CHAPTER 4**

Table A4.1 List of emerging and developing countries

| 4. Bahrain | 23. Indonesia | 41. Seychelles |
| 5. Bangladesh | 24. Jamaica | 42. Solomon Islands |
| 8. Bolivia | 27. Madagascar | 45. St. Lucia |
| 10. Burundi | 29. Malaysia | |
| 11. Chile | 30. Mauritania | |
| 12. Colombia | 31. Mauritius | |
| 13. Costa Rica | 32. Mexico | |
| 14. Dominica | 33. Myanmar | |
| 15. Dominican Republic | 34. Nigeria | |
| 16. Egypt, Arab Rep. | 35. Panama | |
| 17. Fiji | 36. Papua New Guinea | |
| 18. Grenada | 37. Paraguay | |
| 19. Haiti | | |

Note: Based on grouping of middle income countries by the World Bank and emerging economies by the IMF
Source: World Bank, IMF
CHAPTER 5. PUBLIC DEBT IN DEVELOPING ASIA: A HELP OR HINDRANCE TO GROWTH?

5.1 Introduction

Since the 2008–09 Global Financial Crisis (GFC), rising public debt has contributed significantly to surging global debt. Global debt—private plus public debt—stands at a new record high of around 225% of global GDP, some 12% higher than before the GFC. Most global debt is owed by advanced economies, which had gone into the crisis with already high levels of public debt. However, emerging and developing economies in Asia have accounted for most of the post-GFC increase; China alone is responsible for 43% of the rise (IMF, 2018).

Historically, war has contributed to high levels of public debt, notably in the advanced economies during the two world wars; currently, public debt in this grouping is, on average, around 105% of GDP, a level not seen since World War II. Meanwhile, in developing and emerging economies, public debt, at almost 50% of GDP on average, is at levels associated in the past with fiscal crises in many low-income developing economies currently experiencing debt distress (IMF, 2018).

In the wake of the GFC, public debt has escalated due to higher budget deficits stemming from falling revenue and increased government spending to counter recession.27 This exacerbates already high debt levels in many economies, especially in Southern Europe

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27 See Spilimbergo, Symansky, Cottarelli, and Blanchard (2009))
and Japan. The fiscal response to the crisis, co-ordinated worldwide through the Group of Twenty economies (G20), spawned a huge empirical literature with mixed results that focus mainly on estimating various fiscal multipliers.\textsuperscript{28} There has been far less attention on the longer-term effect of high public debt on economic growth, which is critically important to the sustainability of public debt-to-GDP ratios into the future.

Asian economies have contributed strongly to post-GFC world growth, accounting for up to two thirds of global economic growth, driven by the robust performances of China, India and Indonesia.\textsuperscript{29} Unlike the advanced economies, developing Asia avoided recession during the GFC, and coped better with the post-crisis global downturn. Of the advanced economies, Japan and Western Europe in particular have persistently experienced economic growth below pre-GFC rates—see Figure 5.1.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure51.png}
\caption{Economic growth: advanced economies vs. developing Asian economies}
\end{figure}

\textbf{Source: IMF, World Economic Outlook}

\begin{flushright}
\textsuperscript{29} IMF (2018). See also Ferrarini, Ramayandi, and Jha (2015), Sangsubhan and Basri (2012).
\end{flushright}
Meanwhile, Japan, the world’s third largest economy, has by far the highest public debt at 240% of GDP, which has a significant upward bias on advanced economies’ average public debt. At the same time, developing and emerging economies in Asia—a group comprising China, India, Indonesia, Mongolia, Vietnam, Myanmar, the Philippines, Thailand, Malaysia, Brunei, Cambodia, Lao PDR, Bangladesh, Sri Lanka, Nepal, and the small Pacific island states—had relatively lower levels of public debt on average pre-GFC at under 40% in 2008, reaching an average of over 50% in 2018. China, whose public debt level almost doubled from 27% to 51% over this time, was a notable exception. Hereafter, this grouping will simply be referred to as developing Asian economies.

![Figure 5.2 Public debt-to-GDP: advanced economies vs developing Asian economies](source)

**Figure 5.2 Public debt-to-GDP: advanced economies vs developing Asian economies**

Source: IMF, *World Economic Outlook*

Figure 5.2 is based on IMF data and depicts public debt-to-GDP ratios for all advanced economies versus developing Asian economies since the turn of the century. The advanced economies category includes 40 countries; developing Asia includes 30. There are differences from previous studies in comparing the relationship between public debt
and growth between developing and advanced countries. For instance Schclarek (2004) found that non-linearity between debt and growth only exists in developed countries, whereas developing countries shows a negative linear relationship. Kourtellos et al. (2013) find that the quality of government institutions is crucial in determining the effect of public debt on growth in both developing and developed countries.

This chapter focuses on the relationship between public debt and economic growth in emerging and developing Asia. Section 5.2 canvasses theoretical linkages between public debt and economic growth and surveys the empirical literature. Section 5.3 explains the data and econometric methods, as well as the proposed model for examining the public debt-economic growth relationship using dynamic panel regression. Section 5.4 reports the estimation results and the final section makes policy recommendations.

5.2 Public debt and economic growth: previous studies

5.2.1 Theoretical linkages

There are several macroeconomic channels through which public debt can influence economic growth. Firstly, according to the classic loanable funds approach, budget deficits that generate higher public debt increase the demand for funds which, all other things being equal, pushes up domestic interest rates. This crowds out private investment which limits expansion of the economy’s capital stock, a key driver of economic growth.

High public debt fuelled by unproductive deficit spending can also harm business and household confidence and create uncertainty about how public debt will be paid down via
fiscal repair; this is inimical to private investment and durable economic growth.30 The Ricardian equivalence proposition then implies crowding out of private consumption as households save to meet future tax obligations to repay public debt.31 The intergenerational inequity argument also suggests that it is unfair for future generations to repay public debt incurred by the present generation, although this is unlikely to affect economic growth per se.32

In an open economy, budget deficits are also funded from abroad, increasing both foreign and public debt. Servicing this debt incurs a drain on national income as interest paid abroad must be subtracted from net national product to derive net national income. In addition, an interest risk premium arises as foreign lenders react negatively to the economy’s rising public debt. This raises domestic interest rates further, increases the sum of interest paid abroad, and exacerbates investment crowding-out.

Moreover, as foreign capital inflow that funds budget deficits appreciates the borrower country’s real exchange rate, there is a loss of international competitiveness and crowding out of net exports which could also stymie economic growth. On the other hand, public investment, in the form of productive infrastructure that builds human capital, augments the capital stock and positively affects growth, as does debt-funded government spending on education and health that improves workers’ human capital.

Therefore, public debt can slow economic growth if it funds unproductive spending, crowds out private investment and net exports, and harms business confidence.

32 See Modigliani (1961), Meade (1958) and Buchanan (1976).
Alternatively, government borrowing—and hence higher public debt—enhances economic growth if it funds productive infrastructure or arises from fiscal measures that improve productivity. What therefore matters is whether increased public debt—a liability—is matched by corresponding productive capital—an asset—in the hypothetical national balance sheets of economies.

These competing factors motivate subsequent empirical analysis of the public debt-economic growth nexus. By estimating the size and significance of the influence of public debt on economic growth in emerging Asian countries, it becomes possible to infer whether negative or positive effects predominate. This has obvious implications for budgetary policy and fiscal policy settings in the region.

5.2.2 Previous empirical studies

Numerous empirical studies have been published that examine the linkage between public debt and growth, yielding mixed results. Very few have focused selectively on the experience of developing Asian economies or employed the empirical approach that is subsequently applied in this paper.

5.2.3 Linear negative correlation

Previous studies have examined the link between fiscal deficits, public debt and interest rates, a rise which implies lower capital accumulation and hence lower growth. For instance, Ardagna, Caselli, and Lane (2007) found that fiscal deficits increase interest rates in OECD countries. Others have examined the direct link between public debt and economic growth. For instance, Adam and Bevan (2005) found for the Euro region that
high public debt worsens economic growth; however, at a low-level, debt-funded productive government expenditure can positively affect growth. Checherita-Westphal and Rother (2012), and Baum, Checherita-Westphal, and Rother (2013) found evidence of a non-linear relationship in Euro area countries which suggests that public debt-to-GDP ratios above 70% adversely affect growth, particularly through higher interest rates.

Several studies that encompass developing economies have found a negative relationship between public debt and economic growth—see, for instance, Eberhardt and Presbitero (2015), Égert (2015a), Presbitero (2012), Reinhart and Rogoff (2010). Conversely, other studies have found a positive relationship between public debt and economic growth in developing countries: Lopes da Veiga, Ferreira-Lopes, and Sequeira (2016), Owusu-Nantwi (2016).

More recently, Dombi and Dedák (2019) have studied the impact of public debt on economic growth using the neoclassical framework of Blanchard (1990) and the Ramsey-Cass-Koopmans (RCK) model (Ramsey 1928; Cass 1965; Koopmans 1965). The theoretical framework consists of three main economic agents: households, firms and the government. According to their findings, public debt influences the consumption of household and results in decreasing growth output of around 2% to 3%.

5.2.4 Non-linearity correlation of debt and growth

The paper by Reinhart and Rogoff (2010) has proven to be the most controversial in this field. Their research reviewed macroeconomic and government financial data for 44 countries over two centuries with the key finding that public debt thresholds were central to interpreting the impact of public debt on economic growth. In particular, the research
found a weak relationship between public debt and economic growth below a 90% public
debt-to-GDP threshold; above the 90% threshold, economic growth was reduced by
around 1.2% per annum.

These findings sparked criticism from Herndon et al. (2014), Pescatori, Sandri, and Simon
(2014), and Égert (2015b). *Inter alia*, these authors argued that Reinhart and Rogoff’s
90% threshold was not universal and could vary according to regions and the economic
conditions that gave rise to the debt. Égert (2015b) also found a negative impact in
countries that have low debt levels of around 20%–60%.

Kumar and Woo (2015) also examined non-linearities in the public debt economic growth
relationship for 38 advanced and emerging economies and found that high public debt
was significantly associated with slower subsequent growth, reflecting slower capital
accumulation. Their results showed that a 10% increase in the public debt-to-GDP ratio
reduces GDP growth by 0.2% in emerging economies, while, in advanced economies,
debt-to-GDP ratios above 90% reduced GDP growth by 0.15% per annum, consistent

In the European case study, Checherita-Westphal and Rother (2012) and Baum et al.
(2013) examined public debt and the economic growth relationship through various
econometric methods in selected European countries over 40 years. The results confirm
that the non-linearity of public debt and the economic growth relationship in European
countries exists. They also suggest that a ratio of public debt in the sample data above
80%–90% leads to a decline in GDP growth. Furthermore, there are three ways that public
debt impacts growth: a decrease in private savings, a slowdown in public investment, and
a decrease in total factor productivity. In addition, Baum et al. (2013) verified that the debt-to-GDP ratio also had a significant impact on the interest rate. The results revealed that below a 70% debt-to-GDP threshold, the relationship is negative, and above 70%, the relationship is positive.

Interestingly, Ramos-Herrera, Ramos, and Sosvilla-Rivero (2017) have used a mixed classification of data from the World Bank and the IMF to examine the pattern of public debt’s impact on economic growth. Like Reinhart and Rogoff (2010), this study also uses a large cross-section of data with a long sample period. With classifications from the World Bank, the results confirm the findings of Reinhart and Rogoff (2010). However, if the IMF classifications are adjusted, the results are mixed. There is different behaviour evident between countries in lower-middle, upper-middle and high-income countries. Therefore, they conclude that a specific debt threshold cannot be related to debt overhang conditions in the sample countries. It is necessary to examine the factors that determine the relationship between public debt and growth with an emphasis on institutional factors.

Ahlborn and Schweickert (2018) have examined the impact of public debt in European countries based on their economic system. The database is divided into three clusters of economic systems in Europe: Liberal (Anglo Saxon countries), Continental (core EU member countries) and Nordic (Scandinavian members countries). They argue that the economic systems in European countries influence the impact of public debt on economic growth through fiscal uncertainty. The results show that the Continental countries cluster has a clearly negative relationship between public debt and growth which is more significant a 75% level of debt. The Liberal countries group shows no significant relationship between public debt and growth, whereas the Nordic countries group shows
a significant non-linear relationship between public debt and growth. The growth becomes negative when public debt reaches 69% in this latter country group.

5.2.5 Empirical studies of fiscal neutrality

Some studies have found no effect of public debt at points before the effect is detrimental to economic growth. Ghosh et al. (2013) used a database of 23 advanced countries spanning 1970–2007 to find that, at a moderate level, the impact of public debt-to-growth is weak; however, there is a negative effect when the public debt-to-GDP ratio exceeds 90%. They also argue that the threshold limit may increase with the improvement of structural characteristics.

Kourtellos, Stengos, and Tan (2013) examine the relationship between public debt and economic growth using broad heterogeneous data from advanced and developing countries. They argue that, after considering various alternative theories, there is little evidence showing a long-term non-linear relationship between public debt and growth. This study mentions the importance of government institutions in channelling the non-linear relationship of public debt and growth. The results show that, when government institutions perform poorly, the detrimental effect of public debt on economic growth is higher. Interestingly, when the institution’s performance quality is higher, the effect of public debt on economic growth is neutral or not significant.

The neutrality effect of public debt on economic growth is also found in several empirical studies. Proaño, Schoder, and Semmler (2014) studied the effect of public debt on growth in OECD countries from 1981 to 2013. They reported no clear evidence to support a decline in economic growth due to a rise in public debt. The effect of public debt on
macroeconomic variables principally has a non-linear pattern due to volatility in the financial sector. The adverse impact of public debt occurs during financial stress; when conditions are normal, there is no evidence that public debt has a negative impact on growth. Panizza and Presbitero (2014) also supported the hypothesis of the minimal effect of public debt, arguing that the 90% public debt threshold of Reinhart and Rogoff was not robust and was driven by outliers.

Furthermore, Panizza and Presbitero (2014) concluded that the impact of public debt on the economy was driven, not by the stock of public debt, but from its composition and structure. Clear empirical evidence of a negative impact on growth is not easy to find. Égert (2015b) studied the nexus of OECD countries and argued that the 90% threshold of Reinhart and Rogoff (2010) is not universal: it may vary based on regions and specifications.

In a more recent study, Hendranata (2016), with a specific focus on developing countries, found that the negative impact of public debt on economic growth was statistically significant. In summary, Proaño et al. (2014) found public debt insignificant or weak and Hendranata (2016) and Presbitero (2012) also found a minimal effect of public debt, arguing that the composition and structure of public debt influenced its impact.

**Public debt and growth causality**

In addition, numerous studies investigating the relationship between public debt and economic growth have also examined the causality between public debt and growth. However, the results in this area are also inconclusive. For instance, Ferreira (2016) demonstrates a bidirectional causality relationship in 28 European countries during the
past ten years. The results are statistically significant before and after the GFC. It is also
evident that economic growth contributes to the decline of debt. Conversely, Puente-
Ajovín and Sanso-Navarro (2015) used a vector autoregression model to find that changes
in government debt did not cause real GDP growth in OECD countries between 1980 and
2009. Similarly, using an instrumental approach, Panizza and Presbitero (2014) also do
not find a causal relationship between public debt and growth.

Gómez-Puig and Sosvilla-Rivero (2015), using sample divisions, had mixed results.
When using the full sample, the results confirmed that the negative causation between
sovereign debt and growth is not significant. However, the reverse Granger causality is
detectable post-GFC, with the debt threshold ranging from 56% to 103%. Using a
database from 40 developing and developed countries, Chudik, Mohaddes, Pesaran, and
Raissi (2018) find a robustly persistent negative relationship between public debt and
growth. They argue that the causality relationship can run both ways, making it difficult
to generate a generic fiscal policy recommendation.

More robust methods than Reinhart and Rogoff (2010) are used below to empirically
examine public debt and economic growth in the emerging Asian region, based on growth
accounting that includes public debt as a possible determinant, along with selected control
variables.
5.3 Data and model specification

5.3.1 Data and descriptive analysis

This study uses annual macroeconomic data observations from 1960 to 2015 for select Asian economies which span crucial crisis events such as the Asian Financial Crisis (AFC) and GFC that were integral to public debt dynamics over the period (Doraisami, 2013; Hill & Shiraishi, 2007; Reinhart & Rogoff, 2013). Data was collected from numerous international sources, notably the World Bank (World Development Index), IMF (World Economic Outlook, International Financial Statistics, Fiscal Monitor) and the Penn World Tables (Feenstra, Inklaar, & Timmer, 2015).

The 25 developing Asian economies in the panel were Bangladesh, Brunei Darussalam, Cambodia, China, Fiji, India, Indonesia, Kiribati, Lao PDR, Malaysia, Maldives, Mongolia, Myanmar, Nauru, Nepal, Palau, Papua New Guinea, Philippines, Samoa, Solomon Islands, Sri Lanka, Thailand, Tuvalu, Vanuatu and Vietnam. Due to missing values, this panel will occasionally shrink when our models require repeated sequences of observations (e.g. when estimating dynamic models). As is standard in the empirical macroeconomic literature, the observations for these counties are divided into sub-periods of five yearly non-overlapping intervals to smooth out short-term business cycle variation (e.g. Kumar and Woo (2015)). Accordingly, with the five-year intervals starting from 1960, the database for regression comprises 11 waves (1960–1964, 1965–1969 … 2011–2015).

The key indicator analysed is the growth rate of real per capita GDP which reflects improvement in individual living standards over time. This distinguishes our work from
others that measure growth in nominal terms (Checherita-Westphal & Rother, 2012; Kumar & Woo, 2015) or that do not adjust for population growth (Ghosh et al., 2013).

The following exogenous factors were included as possible drivers of the dependent variable, consistent with Barro and Sala I. Martin (1992):\(^{33}\)

- The initial real GDP to capture potential dependence on output growth as a function of its level.
- Public debt-to-GDP ratio of country. Total central government liability including loans, securities from domestic and external source divided by the GDP in the respective year.
- Inflation measured by change in the consumer price index (CPI).
- Trade openness proxied by the sum of exports and imports, as a percentage of GDP.
- Population growth per year as a proxy for labour input (Antonakakis, 2014; Checherita-Westphal & Rother, 2012; Presbitero, 2012).
- Workers’ share of population (aged 15–64).
- Secondary school education as a human capital indicator, as suggested by Kumar and Woo (2015), and Barro (1996).
- Foreign direct investment relative to GDP as a capital inflow measure.
- Domestic investment proxied by gross fixed capital formation to GDP ratio (Taylor, 1995).

\(^{33}\) Detail definition of variables are available in Appendix to Table A5.1.
• Dummies indicating crisis conditions denoting both the 1997 AFC and 2008 GFC.

• Annual dummies also capture the period fixed effects.

Table 1 summarises the descriptive statistics for these variables. Real per capita growth in developing Asia averaged close to 3% per annum, although it was highly volatile, with values ranging from −8.6% to 17.2% and a standard deviation of 3.2%, indicating frequent episodes of both rapid development and sharp contraction. Average public debt-to-GDP was close to 50% while average population growth was 2% per annum; almost half of the population (46%) had some secondary education.

Table 5.1 - Descriptive statistics – estimation sample

<table>
<thead>
<tr>
<th>Variable</th>
<th># Obs</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real growth per capita</td>
<td>213</td>
<td>2.878</td>
<td>3.161</td>
<td>−8.658</td>
<td>17.22</td>
</tr>
<tr>
<td>Average public debt (% GDP)</td>
<td>190</td>
<td>47.60</td>
<td>33.45</td>
<td>0.729</td>
<td>202.0</td>
</tr>
<tr>
<td>Trade openness</td>
<td>220</td>
<td>70.70</td>
<td>46.10</td>
<td>0.670</td>
<td>310.6</td>
</tr>
<tr>
<td>Population growth</td>
<td>275</td>
<td>2.001</td>
<td>1.012</td>
<td>−2.394</td>
<td>6.254</td>
</tr>
<tr>
<td>School enrolment</td>
<td>198</td>
<td>46.81</td>
<td>26.74</td>
<td>1.920</td>
<td>109.8</td>
</tr>
<tr>
<td>Foreign investment</td>
<td>173</td>
<td>2.191</td>
<td>2.518</td>
<td>−3.061</td>
<td>12.53</td>
</tr>
<tr>
<td>Inflation</td>
<td>196</td>
<td>9.854</td>
<td>25.45</td>
<td>−23.82</td>
<td>338.7</td>
</tr>
<tr>
<td>Working-age population (%)</td>
<td>275</td>
<td>56.87</td>
<td>5.349</td>
<td>46.28</td>
<td>73.95</td>
</tr>
<tr>
<td>Domestic investment ratio</td>
<td>201</td>
<td>23.69</td>
<td>10.01</td>
<td>5.36</td>
<td>65.24</td>
</tr>
<tr>
<td>Crisis dummy</td>
<td>275</td>
<td>0.182</td>
<td>0.386</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Initial GDP (log)</td>
<td>208</td>
<td>6.857</td>
<td>1.143</td>
<td>4.578</td>
<td>10.57</td>
</tr>
<tr>
<td>Waves (five-yearly)</td>
<td>275</td>
<td>6.000</td>
<td>3.168</td>
<td>1</td>
<td>11</td>
</tr>
</tbody>
</table>

Notes: The table gives descriptive statistics for the estimation sample based on the sample of developing Asian countries. Each observation is a five-year average from 1960 to 2015.

Average inflation was high over this period (around 9%), influenced by the AFC, which saw rapid but short-lived price growth in South-East Asian economies, most notably in Indonesia and Thailand. Foreign direct investment was around 2% of GDP and average
real income level was around US$1827.\textsuperscript{34} Taylor (1995) mentions that domestic investment is an important channel of growth as an endogenous factor. In this study, we include domestic investment using gross capital formation that expects to have a positive impact on growth through capital deepening and the implementation of new technology.\textsuperscript{35}

The dynamics of growth and public debt are illustrated below in Figures 3 and 4.

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\textbf{Figure 5.2 Average growth rates in Asian countries over time}

Notes: The figure shows the link between real per capita economic growth and time in our sample of developing Asian countries. Growth is given on the vertical axis and the year is presented on the horizontal axis. Each data point represents a five-year average. A non-parametric trend is fitted in red and a 95\% confidence interval is shown in grey.

Figure 5.2 shows growth rates based upon our five-year averages (with each data point depicting one county for a given window) with a local polynomial trend (a zero-order estimate using Epanechnikov kernels) shown in red. A 95\% confidence interval around

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\textsuperscript{34} Estimated via lognormal correction \( \exp(6.857 + 0.5 \times 1.143^2) \) in 2010 dollars.

\textsuperscript{35} Thanks to an anonymous reviewer for the insightful comments and for pointing out the gross capital formation as an essential channel of growth; this improved this chapter substantially.
the estimate is shown in grey. Economic growth in the region was lower in the 1980s and 1990s (around 2.5%) but accelerated significantly after 2000, reaching an average value of nearly 4%. Furthermore, there is evidence of slightly declining volatility over time, with periods of negative growth being relatively common from 1980–2000, becoming less prevalent subsequently.

Figure 5.3 Debt-to-GDP ratios in Asian countries over time

Notes: The figure shows the link between the debt-to-GDP ratio and time in our sample of developing Asian countries. The debt ratio (as a percentage) is given on the vertical axis and the year is presented on the horizontal axis. Each data point represents a five-year average. A non-parametric trend is fitted in red and a 95% confidence interval is shown in grey.

Trends in public debt are depicted above. The average debt ratio in our basket of countries started around 30% in the 1960s and was fairly stable until around 1980. The average ratio then approximately doubled over the next two decades and peaked at almost 65% during the AFC in 1997. After this point, increased growth, repayments and, in some
instances, debt forgiveness brought the average indebtedness down to less than 50% of GDP by the mid-2010s (Bua, 2014).

As in the growth dynamics depicted in Figure 5.2, there is also evidence of reduced cross-national variation in this measure in our latter time-periods. There are multiple outliers (i.e. countries with very high debt, such as Vietnam and Myanmar) in the years around the 1997 AFC but there was, notably, no corresponding increase in volatility around the 2008 GFC, highlighting the relative ease with which Asian economies negotiated this adverse economic event.

### 5.3.2 Model specification.

Three alternative econometric models are employed to examine the empirical link between public debt accumulation and economic growth. Let $y_{it}$ denote the real per capita growth rate of country $i$ in period $t$ and $DGDP_{it}$ represent the corresponding debt-to-GDP ratio. Here, a $1 \times k$ vector of other assumedly exogenous controls is given by $X_{it}$ with $\varepsilon_{it}$ as an error term. Parameters $\alpha_i, \beta, \lambda_t, \rho$ and $\gamma$ are to be estimated.

The models are:

$$y_{it} = X_{it}'\beta + \lambda_t + \gamma DGDP_{it} + u_i + \varepsilon_{it}$$ (5.1)

$$y_{it} = \alpha_i + \lambda_t + X_{it}'\beta + \gamma DGDP_{it} + \varepsilon_{it}$$ (5.2)

$$y_{it} = \alpha_i + \lambda_t + \rho y_{it-1} + X_{it}'\beta + \gamma DGDP_{it} + \varepsilon_{it}$$ (5.3)

The first (Equation 5.1) is a random-effects model (here $u_i$ is a random effect, in contrast with fixed effect $\alpha_i$) that can be estimated by generalised least squares. This model captures the link between debt accumulation and economic growth via the parameter $\gamma$, which will be negative if public debt slows growth. The second equation (Equation 5.2)
is a fixed-effect model and is interpreted similarly, yet it allows for correlation between the individual specific effects $\alpha_i$ and $X_{it}$.

This specification controls for time-invariant heterogeneity and is superior to the random-effects model in Equation (5.1) as it is possible that unobservable invariant factors related to culture or institutions may determine $y_{it}$ and also be related to $DGDPIt$. This model is estimated using least squares but uses within-transformed data to remove country-specific effects with degree-of-freedom adjustments made to obtain correct standard errors.

The third model is a dynamic panel that controls for potential hysteresis in growth dynamics. Since economic growth in a particular period may be determined by momentum carried over from a previous period (rather than via $X_{it}$), this model accounts for possible mis-specification. We use difference GMM (Arellano & Bond, 1991) to estimate parameters, which is an instrumental variable approach that corrects for endogeneity bias in the calculation of $\rho$ when the panel is short.

5.4 Empirical results

The key results of our chapter are presented in Table 5.2, which shows regression results for the models in Equations (5.1–5.3). In each case, the models are estimated twice: firstly with the covariate vector included in $X_{it}$, and secondly without this vector (annual dummies are employed in both instances). Models (1) and (2) are random-effects specifications and Models (3) and (4) are estimated with fixed effects. Models (5) and (6) are dynamic panels estimated via the Arellano and Bond (1991) procedure.
Table 5.2 - Effects of public debt on economic growth

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Debt to GDP</td>
<td>-0.002</td>
<td>-0.014</td>
<td>-0.020**</td>
<td>-0.021</td>
<td>-0.04***</td>
<td>-0.030</td>
</tr>
<tr>
<td>Trade Openness</td>
<td>0.002</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School Enrolments</td>
<td>-0.007</td>
<td>-0.015</td>
<td>-0.025</td>
<td>-0.008</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population Growth</td>
<td>-0.346</td>
<td>-0.857</td>
<td>-0.778*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foreign Investment Ratio</td>
<td>0.069</td>
<td>0.028</td>
<td>0.106</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic Investment Ratio</td>
<td>0.137***</td>
<td>0.103**</td>
<td>0.116***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inflation</td>
<td></td>
<td>-0.015</td>
<td></td>
<td>-0.017</td>
<td>-0.023</td>
<td></td>
</tr>
<tr>
<td>Working population</td>
<td></td>
<td></td>
<td></td>
<td>0.195***</td>
<td>-0.023</td>
<td>-0.047</td>
</tr>
<tr>
<td>Crisis dummy</td>
<td>-0.157</td>
<td>-0.613</td>
<td></td>
<td>0.008</td>
<td></td>
<td></td>
</tr>
<tr>
<td>InitialGDP (log)</td>
<td>-1.090*</td>
<td>0.452</td>
<td>0.248</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dum 60-64</td>
<td>-0.520</td>
<td>0.380</td>
<td>0.095</td>
<td>0.231***</td>
<td>0.158</td>
<td>0.123</td>
</tr>
<tr>
<td>Dum 65-69</td>
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<td></td>
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<tr>
<td>Dum 70-74</td>
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<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Dum 74-79</td>
<td>-3.041</td>
<td>2.152</td>
<td>0.591</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dum 80-84</td>
<td>-2.858</td>
<td>1.306</td>
<td>-0.124</td>
<td>0.130</td>
<td>-0.081</td>
<td>-0.879</td>
</tr>
<tr>
<td>Dum 84-89</td>
<td>-3.360</td>
<td>0.653</td>
<td>-0.566</td>
<td>-0.308</td>
<td>-0.747</td>
<td>-1.368</td>
</tr>
<tr>
<td>Dum 90-94</td>
<td>-2.392</td>
<td>0.324</td>
<td>-0.217</td>
<td>-0.396</td>
<td>-0.064</td>
<td>-1.005</td>
</tr>
<tr>
<td>Dum 94-99</td>
<td>-0.729</td>
<td>1.496</td>
<td>1.287</td>
<td>1.007*</td>
<td>1.560**</td>
<td>0.742</td>
</tr>
<tr>
<td>Dum 00-04</td>
<td>-1.702*</td>
<td>0.215</td>
<td></td>
<td>-0.157</td>
<td></td>
<td>-0.512</td>
</tr>
<tr>
<td>Dum 05-09</td>
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<td></td>
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<tr>
<td>Dum 10-15</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Lagged Growth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>1.800</td>
<td>0.296</td>
<td>2.989</td>
<td>2.329**</td>
<td>5.371</td>
<td>3.820***</td>
</tr>
<tr>
<td>( nT )</td>
<td>116</td>
<td>176</td>
<td>116</td>
<td>176</td>
<td>90</td>
<td>138</td>
</tr>
</tbody>
</table>

Notes: Models (1) and (2) are random-effects specifications and Models (3) and (4) are estimated with fixed effects. Models (5) and (6) are dynamic panels estimated via the Arellano and Bond (1991) procedure. Standard errors are clustered by country and *, ** and *** denote significance at 10%, 5% and 1% respectively.

Using the data described in Table 5.2, we use two specifications for each model, producing six models in total. In all cases, cluster-robust standard errors are used, where the clustering is performed at the country level. The key estimates of the impact of public debt on economic growth are presented in the first row. The first two columns give results from the random-effects estimations (Equation (5.1)) where the coefficients of interest are negative in both cases, implying an inverse relationship between growth and debt, although they are not significant at standard levels. The fixed effects’ estimates in the
central two columns are more likely to represent causal effects given the weaker exogeneity assumptions.

Again, the coefficients are negative across both models and insignificant at standard levels. The dynamic models presented in the final two columns explicitly allow for potential hysteresis in economic growth rates (such that growth spills over period to period). This plausibly implies that economic growth in any given period is not just set by covariates $X_{it}$, but by other previous factors (including unobservables).

In this fully specified model (i.e. containing all controls), we again obtain a negative and highly significant effect of public debt on economic growth. In the fixed effect Model (3), the result shows a significant negative impact of public debt on economic growth $0.020$ at a 95% confidence level. Moving to the dynamic panel Model (5), the weakening impact of public debt to growth is much greater with a stronger significance level. The value is $-0.040$ and implies that a 10% increase in debt accumulation is predicted to lower economic growth by around 0.4%. Thus, a country growing at the sample average of 2.9% would be expected to fall to around 2.5% if their debt ratio increased—for example, from 50% to 60%.

On the face of it, this may not appear macroeconomically significant; however, due to compounding, this implies a sizeable national income loss over the medium to longer terms. For instance, if the 5% per annum average economic growth rate of developing Asia could be higher by 0.4% over the next decade, the volume of its output would be 5% higher than otherwise in ten years. Thus, across the spectrum of models we see negative, although seemingly small, coefficients in all cases.
Diagnostics

The six panel data models presented above vary in their assumptions about how rising public debt can influence economic growth. In the static random-effects models, we rely on the error component $u_i$ being unrelated to our regressors (including public debt) for the identification of parameters. These country-specific values may well reflect factors such as culture, institutions and the political environment which are plausibly correlated with various facets of macroeconomic performance.

In such an instance, the estimates in these models will be biased relative to those obtained from the fixed effects specifications. To investigate this issue, we employ the now standard Hausman-Wu specification tests based upon the coefficients in Columns 1–4 in Table 5.3. The results are presented in Table 5.3.

The dynamic models also rely upon some assumptions about the structure of the error term $\epsilon_{it}$ and also on the roles played by our lagged dependent and independent variables as instruments. Consistent estimation of our dynamic models requires that $\epsilon_{it}$ contain first order serial correlation but also that there is no meaningful second-order correlation. Since we are employing large numbers of instruments in our estimates of parameter $\rho$, the possibility that some of these instruments are not exogenous, and hence may produce results that are inconsistent with other instruments, arises. Thus Table 5.3 also reports Sargan test statistics for over-identification.
Table 5.3 - Diagnostic Checks – panel data models

<table>
<thead>
<tr>
<th>Test</th>
<th>Model (1)</th>
<th>Model (3)</th>
<th>Model (5)</th>
<th>Model (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hausman-Wu</td>
<td>0.9830</td>
<td>0.7681</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AR(1)</td>
<td>0.0058</td>
<td>0.0182</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AR(2)</td>
<td>0.3738</td>
<td>0.6713</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sargan OverID</td>
<td>0.0505</td>
<td>0.1014</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: The table presents p-values for (i) Hausman-Wu specification tests for differences in parameters for Models (1) and (3) as compared to their counterparts Models (2) and (4). Also presented are p-values for autocorrelation tests for dynamic Models (5) and (6) and over-identification tests on the same models.

Table 5.3 presents p-values for the hypothesis tests described above. In terms of the specification tests that differentiate between the fixed effects and random-effects specifications, in both cases we were unable to reject the null of systematic differences in the parameters between the two models and, hence, are happy to interpret the random-effects estimates alongside those obtained from fixed effects.

The serial correlation tests for the dynamic models in Columns (5–6) are both in line with our assumptions requiring the presence of AR(1) errors but not AR(2). Thus, this aspect of the modelling is satisfied. The over-identification checks provided by the Sargan statistics indicate no significant signs of incoherent instrumentation at 5% for the fully specified model (Column (5)), and none at any standard level for the parsimonious specification in Model (6).

The dynamic model that found that a significant link between public debt and economic growth may be criticised for being over-identified. However, if run again, replacing the
annual dummies with a trend, the Sargan statistic from this regression is not rejected (with
a p-value of 0.184) and the estimate of γ is −0.035, which is significant at standard levels.

5.5 Conclusion

Economic theory is ambiguous about whether public debt enhances or detracts from
economic growth. Ultimately, whether debt positively or negatively affects long-term
growth depends on the public debt incurred. If it funds unproductive government
spending, it is likely to lessen growth due to higher than otherwise interest rates and
exchange rates that cause private investment and net export crowding out, as well as
negative confidence and heightened uncertainty effects. Alternatively, if public debt
reflects funding of productive public investment in infrastructure and human capital, it
can enhance economic growth.

Developing Asia has been the main engine of global economic growth since the turn of
the century. This paper has examined the impact of public debt, which increased
significantly in the region post-GFC—especially in China—on that growth. Using a range
of econometric techniques, we have shown that public debt has had a small yet significant
negative impact on economic growth in the developing Asian region.

The dynamic panel regression suggests that a 10% increase in public debt is associated
with a decrease in economic growth of 0.4%. These results are broadly consistent with
those of Fincke and Greiner (2015), Hendranata (2016) and Afonso and Jalles (2013).
This negative effect may seem relatively small on a year-to-year basis. Nevertheless,
assuming an average economic growth rate of 5% per annum for developing Asia over
the next decade, this implies that the volume of Asian output would be around 5% less
than otherwise ten years hence due to compounding, a significant national income loss over that time.

The inclusion of control variables in the models of both fixed effect and GMM has shown slightly larger results than the simple regressions. The fixed effect model resulted in a significantly negative impact of public debt on economic growth in developing Asian countries. However, the dynamic model produces better estimation results than the fixed effect model with stronger statistical significance and coefficient direction of existing variables. The inclusion of a crisis did not yield a significant result and only resulted in a marginally higher coefficient in the negative influence of public debt.

The corollary of these results is that public debt reduction could slightly strengthen future economic growth in emerging Asia, although by how much would depend on the means by which fiscal deficits are reduced. Public debt-to-GDP ratios in emerging Asian economies are lower than in advanced economies, although financing budget deficits through international capital markets has been growing rapidly. This makes servicing public debt more susceptible to rises in world interest rates.

Moreover, reducing public debt in Asia is also advisable for minimising rollover risk, which rises whenever global financial conditions tighten or foreign lender sentiment shifts. Unexpected fiscal shocks that raise public debt-to-GDP ratios—such as the realisation of contingent liabilities or increased quasi-fiscal spending—would deepen this risk. Foreign lending to developing Asian economies will continue to grow as Asia-Pacific financial markets become more integrated, with Indonesia, the Philippines,
Thailand and Vietnam being particularly major issuers of government bonds that appeal to global investors.

Prudent debt management is required to ensure the negative effect of public debt on economic growth in the region does not worsen. Governments in developing Asian economies will particularly need to borrow more selectively to ensure extra public debt is matched by high quality public spending. Meanwhile, scope exists for strengthening budgetary institutions and practices to minimise fiscal risk.
# APPENDIX TO CHAPTER 5

Table A5. 1 Variables in government public debt and economic growth

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public debt-to-GDP</td>
<td>Public debt-to-GDP ratio of country. Total central government liability including loans, securities from domestic and external source divided by the GDP in the respective year.</td>
<td>The World Bank and IMF Fiscal Indicator</td>
</tr>
<tr>
<td>Trade openness</td>
<td>Total trade in the economy derived from the sum of exports and imports relative to GDP.</td>
<td>World Development Indicators, World Bank</td>
</tr>
<tr>
<td>School enrolments</td>
<td>Secondary school enrolment as a human capital indicator. Total student enrolment in secondary level (who have already completed basic education) as ratio to total population.</td>
<td>Penn World Table, World Bank</td>
</tr>
<tr>
<td>Population growth</td>
<td>The percentage of population growth. The increase of a population of a country over a one-year period.</td>
<td>World Development Indicators, World Bank</td>
</tr>
<tr>
<td>Foreign investment</td>
<td>Foreign direct investment relative to GDP. It is the net inflow of investment into an enterprise operating in the economy (10% or more of voting stock).</td>
<td>World Development Indicators, World Bank, International Monetary Fund</td>
</tr>
<tr>
<td>Domestic investment</td>
<td>The change to domestic investment in the economy. It is proxied by the change in gross capital formation, which is the addition of fixed assets plus net changes in the level of inventories.</td>
<td>World Development Indicators, World Bank</td>
</tr>
<tr>
<td>Inflation</td>
<td>Inflation, change in consumer price index.</td>
<td>World Development Indicators, World Bank</td>
</tr>
<tr>
<td>Working population</td>
<td>Workers’ share of population. It is the sum of population aged 15–64 relative to the total population.</td>
<td>World Development Indicators, World Bank</td>
</tr>
<tr>
<td>Initial GDP</td>
<td>Initial level of real GDP, it is an endogenous repressor to control for conditional convergence.</td>
<td>World Development Indicators, World Bank</td>
</tr>
</tbody>
</table>

Source: World Bank, IMF, Penn World Table
CHAPTER 6. FISCAL SUSTAINABILITY AND AGEING IN ASEAN COUNTRIES

6.1 Introduction

According to the IMF Fiscal Monitor, global public debt in 2018 reached an average of 82%, with the greatest levels in advanced economies. Japan, for instance, has a public debt level of 239% of GDP; in Italy and the United States, it reached 133.6% and 106.7% respectively. Furthermore, the increasing path of public debt accumulation is also seen in emerging and developing countries, despite their strong growth. Historically, government debt has been rising since 1900 in both developing and developed countries (Checherita-Westphal & Rother, 2012).

Moreover, Tanzi and Schuknecht (1997) report that government debt increased approximately 66% on average in the 20th century compared to the prior century. The latest data shows that, in 2018, public debt in advanced countries was 104% of their GDP and at an average of 51% in developing economies. The growth of public debt in South-East Asian countries, especially in ASEAN (Association of South-East Asian Nations), has occurred in a context of high public debt over the last 70 years (IMF, 2019).

ASEAN is a regional organisation that focuses on promoting governmental and economic cooperation along with regional stability. There are ten member countries of ASEAN: Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam. Economic growth in ASEAN has been robustly positive in the period 2000–2017. Following the Asian Financial Crisis (AFC) of 1998–1999, economic
growth in ASEAN countries rebounded to 6% in 2000 and continued to grow steadily around 5.3% until 2017 (ASEAN Secretariat, 2018). The combined GDP in ASEAN was valued around US$2.8 trillion in 2017 as the fifth largest economy globally and the third largest in Asia.

ASEAN countries have experienced strong economic growth in recent years. These relatively healthy growth factors are the result of global trade activity and resilient domestic consumption. Indonesia, Malaysia, the Philippines and Thailand are expected to have average growth of 3.6% to 6.4% in the period 2018–2022. Brunei and Singapore expected economic growth of around 0.5% and 2.3% respectively in 2018–2022. Growth in Brunei relies on the strength of demand for oil and gas and Singapore’s growth factors come from investment in infrastructure and technology. The most significant growth in the region will come from Cambodia, Lao PDR and Myanmar, which are expected to increase 7.2%, 7.1% and 7.4% respectively on the back of export recovery and growth in the tourism sector (IMF, 2019; OECD, 2018)).

The resilience of growth in ASEAN countries has been tested by several economic shocks in the last three decades. Figure 3.1 displays the historical nominal GDP per capita in ASEAN countries and in emerging and developing countries. The movement of nominal GDP shows that the crisis periods resulted in a drop in GDP; however, the rebound was relatively swift. Sound fundamental economic policies and a rapid response to fiscal policy are the main reasons for fast recovery from the global shock (Budina & Tuladhar, 2010). However, the speedy recovery has its own cost, specifically in the ASEAN fiscal stance. Following the GFC, advanced economies are experiencing larger fiscal deficits
that are likely to be long-lasting. The ASEAN region has mirrored this condition, although its level of fiscal deficit is not as severe as in advanced countries.

![Figure 6.1 Gross domestic product in ASEAN and developing countries](image)

**Figure 6.1 Gross domestic product in ASEAN and developing countries**
Source: IMF, World Economic Outlook, 2019
Notes: GDP per capita is valued at nominal current prices. The ASEAN-5 consists of Indonesia, Thailand, Malaysia, the Philippines and Vietnam.

A long-term fiscal risk that ASEAN member countries need to anticipate is population ageing, a global phenomenon that will create challenges for the economy and public finance in the coming decades. Increasingly aged populations put pressure on public finance since the elderly are primarily recipients of public services, while the working population, as net payers, is in decline (Lassila, Valkonen, & Alho, 2014). In ASEAN since 2000, the decline in the population share of young people is in line with the increase in the prime working-age population that indicates the shift from a non-productive young population to employment age. The population share of young people in ASEAN is expected to decline from 27% to around 25% of the total population over 2000–2030. In the same period, the population share of the prime age group will rise from around 27% to about 35% (Henning, 2019). Overall, Asian countries have entered the next stage of
demographic change with a rising elderly population, most noticeably in East Asia (Lee, Kim, & Park, 2017).

While still a recognised source of global growth, many countries in Asia are currently experiencing a shift in demographic structure due to ageing populations (Lee et al., 2017). In their recent study, Lee et al. (2017) explore the impact of an ageing population on fiscal sustainability from spending, revenue and growth projections in Asia. They found that the ageing population adversely impacts fiscal sustainability through revenue and tax systems that warrant further analysis of fiscal health in Asia.

Based on this background, apart from the robust economic growth in ASEAN countries, there are two research questions that warrant investigation. The first is whether the fiscal policy is sustainable in ASEAN countries. Using intertemporal budget constraint (IBC) formulae, this chapter attempts to examine fiscal sustainability by computing the requirement of primary balance to stabilise public debt as a condition of fiscal sustainability. The study also compares the required and actual primary balance from the latest available data to calculate whether a country requires fiscal consolidation to achieve fiscal sustainability. The second research question is whether population ageing affects fiscal sustainability condition in ASEAN countries. The impact of an ageing population on fiscal sustainability is measured using the IBC formulae with projected real GDP growth from the United Nations (UN) database.

The chapter is structured as follows. Section 6.2 briefly reviews fiscal policy activity in ASEAN countries post-GFC 2009. Section 6.3 discusses methodology and data. Section 6.4 records the results of the debt stabilisation formulae. Section 6.5 presents the formulae
calibrating in reducing public debt and simulation results. Section 6.6 presents an overview of population ageing in ASEAN. Section 6.7 investigates the impact of population ageing using the debt stabilisation formulae. Lastly, Section 6.8 draws conclusions and presents policy implications.

6.2 Overview of economic and fiscal policy in ASEAN countries

6.2.1 Economically diverse countries of ASEAN

Economic growth in ASEAN has been robustly positive over the last 50 years; however, at present there is much diversity between ASEAN countries, both in economic performance and fiscal capacity. For instance, growth in ASEAN is concentrated in three countries: Indonesia, Thailand and the Philippines. These countries accounted for around 60% of the region’s GDP in 2018. Furthermore, the disparity in GDP contrasts with Singapore and Brunei Darussalam, which equate to approximately 13 times the GDP of other ASEAN countries, or seven times the regional GDP averages. In contrast, Cambodia, Lao PDR, Myanmar and Vietnam (CLMV) have the lowest GDP levels in the region but have the highest GDP growth.

Accordingly, fiscal activity within ASEAN varies depending on the size of the economy. According to IMF income classifications, Singapore and Brunei are classified as advanced countries with the highest GDP per capita in the region. Indonesia, Malaysia, the Philippines and Thailand (the ASEAN-4) are as classified as emerging and developing economies and are currently rated as investment grade. In contrast, Cambodia, Lao PDR, Myanmar and Vietnam (CLMV) are included in low developing economies. The diversity in the economic and fiscal activity in ASEAN countries leads to the different fiscal stance
related to the fiscal sustainability condition that will be discussed further. Figure 6.2 shows income disparity in ASEAN member countries. The ASEAN-6 contribute around 90% of nominal GDP in the region, mostly from Indonesia, Thailand and Singapore.

![Figure 6.2: Gross domestic product in ASEAN, at current prices (nominal) in US dollars](image)

**Figure 6.2 Gross domestic product in ASEAN, at current prices (nominal) in US dollars**

Source: Based on ASEAN secretariat database, IMF-WEO Database

Note: ASEAN-6 are Brunei Darussalam, Indonesia, Malaysia, Singapore, Thailand and the Philippines. CLMV stands for Cambodia, Lao PDR, Myanmar and Vietnam

### 6.2.2 Fiscal policy dynamics in ASEAN member countries

Active fiscal policy also supports the growth of ASEAN countries, especially in times of financial turbulence. Governments in the ASEAN region reacted promptly to the GFC by implementing fiscal stimulus policy as well as monetary policy. With high levels of government intervention, ASEAN countries had ample room to move the policy rate downward to ease monetary conditions and support domestic consumption (Chirathivat, Sabhasri, & Chongvilaivan, 2015). On the fiscal side, ASEAN governments launched discretionary fiscal stimulus packages which were predominantly spending-based; for instance, in Malaysia the stimulus was 100% spending-based, whereas in Singapore and
the Philippines it was 80%. Only in Indonesia was the fiscal stimulus mainly revenue based (Budina & Tuladhar, 2010). However, compared to its North Asian regional counterparts, the ASEAN fiscal stimulus packages were less significant. China for instance, launched stimulus packages of around 13% of its GDP, while Japan and Korea introduced fiscal stimulus equating to 2.4% and 2.8% of their GDP. With a significantly integrated market within the Asian region, the sizeable fiscal stimulus from other countries may create a second-round effect to improve import demands in each other’s countries (Sangsubhan & Basri, 2012).

Table 6.1 General government overall fiscal balances (% of GDP)

<table>
<thead>
<tr>
<th></th>
<th>Average 00-09</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASEAN</td>
<td>−1.6</td>
<td>−2.0</td>
<td>−0.8</td>
<td>−0.9</td>
<td>−1.7</td>
<td>−1.4</td>
<td>−1.6</td>
<td>−1.5</td>
<td>−1.6</td>
<td>−1.8</td>
</tr>
<tr>
<td>Advanced economies</td>
<td>−3.1</td>
<td>−7.6</td>
<td>−6.2</td>
<td>−5.4</td>
<td>−3.6</td>
<td>−3.0</td>
<td>−2.5</td>
<td>−2.5</td>
<td>−2.1</td>
<td>−2.1</td>
</tr>
<tr>
<td>Emerging economies</td>
<td>−1.2</td>
<td>−2.1</td>
<td>−0.9</td>
<td>−0.9</td>
<td>−1.4</td>
<td>−2.4</td>
<td>−4.4</td>
<td>−4.8</td>
<td>−4.3</td>
<td>−4.0</td>
</tr>
<tr>
<td>Low-income countries</td>
<td>−0.8</td>
<td>−2.9</td>
<td>−1.3</td>
<td>−2.0</td>
<td>−3.5</td>
<td>−3.3</td>
<td>−3.9</td>
<td>−3.9</td>
<td>−4.2</td>
<td>−4.0</td>
</tr>
</tbody>
</table>

Source: IMF, World Economic Outlook, 2019
Notes: The averages are weighted by GDP at purchasing power parity adjusted exchange rate. The data for Brunei Darussalam is not available and is thus excluded from the averages for ASEAN.

Table 6.1 shows the historical level of overall balance in ASEAN countries compared to other country groups. The overall fiscal balance in the ASEAN countries deteriorated prior to the GFC at around −1.6% and −2.0% in 2010. These figures are well below the deterioration of overall fiscal balance in advanced economies at −3.1% on average after the GFC and −7.6% in 2010. Having learnt from the AFC, the ASEAN countries have a relatively strong fiscal stance even with ongoing fiscal expansion. In 2010, Indonesia had achieved a deficit of −1.2% of fiscal balance, whereas Singapore had a surplus condition of 6.0%. However, there has been considerable variation among countries in more recent
years. In 2018, Singapore still had a surplus of 4% of GDP and Thailand has a near balance position. Malaysia, Vietnam and Lao PDR have relatively large deficits at −3.6%, −4.6% and −4.7% respectively (IMF, 2019).

![Overall budget balance in ASEAN](chart.png)

**Figure 6.3 Overall budget balance in ASEAN**
Source: World Economic Outlook, IMF
Note: ASEAN-4 consists of Indonesia, Thailand, Malaysia and the Philippines. CLMV stands for Cambodia, Lao PDR, Malaysia and Vietnam.

Figure 6.3 shows the historical overall budget balance over an extended period in the ASEAN region, which is divided into three country groups based on Table 6.1. The budget balance for each group is calculated as an unweighted average within each year. Historically, most ASEAN countries were better off before the AFC when they had a general budget surplus. However, since the AFC, their budget balance performance is mixed; for example, Singapore seems in a relatively different or better condition than its neighbours. After the AFC and GFC, Singapore achieved a budget surplus in some periods, mainly due to improvements in its manufacturing sector and revenue from corporate taxes (OECD, 2018).
In contrast, the ASEAN-4 countries remain in a deficit condition following the AFC, while the CLMV countries have, on average, been in a deficit budget since before that. The persistent deficit level in CLMV countries is related to high levels of growth: the consequence is rising public debt-to-GDP that risks fiscal sustainability.

Table 6.2 General government gross debt (as percent of GDP)

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>ASEAN</td>
<td>54.9</td>
<td>44.5</td>
<td>43.7</td>
<td>45.4</td>
<td>45.4</td>
<td>44.6</td>
<td>45.3</td>
<td>45.7</td>
<td>45.9</td>
<td>46.6</td>
</tr>
<tr>
<td>Cambodia</td>
<td>34.6</td>
<td>28.7</td>
<td>29.7</td>
<td>31.5</td>
<td>31.7</td>
<td>31.9</td>
<td>31.2</td>
<td>29.1</td>
<td>30</td>
<td>29.4</td>
</tr>
<tr>
<td>Indonesia</td>
<td>49.8</td>
<td>24.5</td>
<td>23.1</td>
<td>23</td>
<td>24.8</td>
<td>24.7</td>
<td>27.5</td>
<td>28.3</td>
<td>28.9</td>
<td>29.2</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>73.1</td>
<td>53.5</td>
<td>49</td>
<td>53.6</td>
<td>54.3</td>
<td>56.5</td>
<td>56</td>
<td>56.4</td>
<td>60.3</td>
<td>63</td>
</tr>
<tr>
<td>Malaysia</td>
<td>40.9</td>
<td>51.9</td>
<td>52.6</td>
<td>54.6</td>
<td>56.4</td>
<td>56.2</td>
<td>57.9</td>
<td>56.6</td>
<td>55.2</td>
<td>56.2</td>
</tr>
<tr>
<td>Myanmar</td>
<td>114.6</td>
<td>50.2</td>
<td>47.7</td>
<td>46.5</td>
<td>43.4</td>
<td>37.6</td>
<td>37.1</td>
<td>39.8</td>
<td>35.2</td>
<td>38.2</td>
</tr>
<tr>
<td>Philippines</td>
<td>62.2</td>
<td>49.7</td>
<td>47.5</td>
<td>47.9</td>
<td>45.7</td>
<td>42.1</td>
<td>41.5</td>
<td>39</td>
<td>39.9</td>
<td>39.6</td>
</tr>
<tr>
<td>Singapore</td>
<td>91.7</td>
<td>97</td>
<td>100.4</td>
<td>104.8</td>
<td>101.2</td>
<td>96.1</td>
<td>99.4</td>
<td>103.7</td>
<td>106.9</td>
<td>108.3</td>
</tr>
<tr>
<td>Thailand</td>
<td>46.2</td>
<td>39.8</td>
<td>39.1</td>
<td>41.9</td>
<td>42.2</td>
<td>43.3</td>
<td>42.6</td>
<td>41.8</td>
<td>41.9</td>
<td>42.1</td>
</tr>
<tr>
<td>Vietnam</td>
<td>37.5</td>
<td>48.1</td>
<td>45.6</td>
<td>48.1</td>
<td>51.7</td>
<td>54.7</td>
<td>57.1</td>
<td>59.7</td>
<td>58.2</td>
<td>57.5</td>
</tr>
<tr>
<td>Advanced economies</td>
<td>75.4</td>
<td>97.4</td>
<td>101.5</td>
<td>105.6</td>
<td>104.2</td>
<td>103.6</td>
<td>103.1</td>
<td>105.6</td>
<td>103.6</td>
<td>102.6</td>
</tr>
<tr>
<td>Emerging economies</td>
<td>43.4</td>
<td>37.9</td>
<td>37.2</td>
<td>37.2</td>
<td>38.5</td>
<td>40.4</td>
<td>43.8</td>
<td>46.8</td>
<td>48.5</td>
<td>50.6</td>
</tr>
</tbody>
</table>

Note: Averages are weighted by GDP at purchasing power parity adjusted exchange rate. Data for Brunei Darussalam is not available and is thus excluded in the average for ASEAN.

The post-crisis ASEAN public debt accumulation is also better than the advanced economies. With an average of 46.6% public debt-to-GDP ratio, ASEAN countries’ debt stocks are slightly lower than the average for emerging economies at 50.6%. Singapore has significantly higher debt-to-GDP ratio at 108.3% in 2018, even higher than the average of advanced economies (102.6%). Indonesia has been relatively resilient in its public debt level, which declined from 49% post-crisis to 29% in 2018. A similar declining path is also seen in the Philippines, which went from 62.2% post-crisis to 39.6% in 2018. In contrast, Vietnam’s public debt is rising from 37.5% post-crisis to 57.5% in 2018.
Fiscal policy in ASEAN countries has been expansionary in the past years. The increase in government spending on infrastructure projects in some countries requires substantial budget funding. Therefore, budget funding has resulted in a widening budget deficit which is becoming a concern in some countries, notably for Lao PDR and Vietnam.

Overall, the level of public debt and budget deficits in ASEAN countries are lower compared to emerging market economies. The low public debt-to-GDP ratio may provide some space in anticipating growth risks in the future. High debt levels that occur in developed economies decrease the capacity of governments to provide fiscal stimuli in the event of economic turbulence. However, there are some risks in the ASEAN fiscal stance, specifically in facing global uncertainty. Firstly, there is a budgetary rule that may limit the potency of fiscal policy. For example, Indonesia has a 3% of GDP deficit policy that may limit the use of fiscal policy as a stabilising tool. Secondly, the depth of the domestic financial market in emerging ASEAN countries is prone to global shock and thus needs improvement. The limited number of domestic players resulted in the high volatility of yield and exchange rates during the financial turbulence. Thirdly, revenue-based consolidation remains underdeveloped with a lower tax base that results in low tax collection (Budina & Tuladhar, 2010). Lastly, although most ASEAN countries currently still benefit from the dividends of a young population, the demographic change due to ageing is a long-term challenge that needs to be anticipated.
6.3 Methodology and data

As discussed in the theoretical framework chapter (Chapter 2), numerous authors have studied the interrelationship dynamics between the budget balance and public debt\(^36\). However, the following section focuses on the sustainability dimension in ASEAN countries. It firstly outlines the debt stabilisation formulae into the reduced form which constructs the baseline equation. The section then discusses the implications of the results.

6.3.1 Methodology

A sustainable fiscal stance requires the debt to income ratio to have stabilised without increasing in the long run. Therefore, examining fiscal sustainability requires exploring whether the ratio will be stable, increasing or declining in the forthcoming period. Primary balance (overall budget balance net of interest payments on consolidated general government liabilities) plays a central role in sustainability analysis. Primary balance determines the rate of new debt accumulation or repayment of old debt. Furthermore, the government has direct control of the primary balance by imposing discretionary fiscal policy on public spending or revenue.

The straightforward calculation in analysing public debt sustainability is the intertemporal budget constraint formula. Following Makin (2010), intertemporal budget constraint stipulates that the stock of public debt in the current period is equal to the existing debt minus the primary budget surplus (or budget deficit) plus accrued interest on the existing debt. With the intertemporal budget constraint formula, we can derive the primary balance target to stabilise the current debt. The intertemporal budget constraint formula assumes

\(^36\) For more discussion on fiscal sustainability analysis see, for instance, Blanchard (1990), Bohn (1998), Buitert and Patel (1992); Fischer (1993) and Hakkio and Rush (1991).
no seigniorage condition, meaning that the central bank does not fund the public debt by printing money.\(^{37}\)

The base of the intertemporal budget constraint formula is:

\[
P_D_t = P_{D_{t-1}} + rP_{D_{t-1}} - PB_t
\]

(6.1)

Where \(P_D\) is public debt in year \(t\), \(r\) is the assumed real interest rate, and \(PB\) is the primary budget balance in year \(t\). Dividing by nominal GDP \((Y_t)\) ensures all variables are in real terms:

\[
\frac{P_D}{Y_t} = (1 + r) \frac{P_{D_{t-1}}}{Y_{t-1}} - \frac{PB}{Y_t}
\]

(6.2)

Since \(Y_t = (1 + g)Y_{t-1}\) where \(g\) is the growth of GDP from year:

\[
\frac{P_D}{Y_t} = \frac{1 + r}{1 + g} \frac{P_{D_{t-1}}}{Y_{t-1}} + \frac{PB}{Y_t}
\]

(6.3)

Next, subtracting \(P_{D_{t-1}}/Y_{t-1}\) from both sides:

\[
\frac{P_D}{Y_t} - \frac{P_{D_{t-1}}}{Y_{t-1}} = \frac{(1 + r)}{(1 + g)} \frac{P_{D_{t-1}}}{Y_{t-1}} - \frac{P_{D_{t-1}}}{Y_{t-1}} + \frac{PB}{Y}
\]

(6.4)

After imposing the debt stabilisation condition:

\[
\frac{P_D}{Y_t} - \frac{P_{D_{t-1}}}{Y_{t-1}} = 0
\]

(6.5)

The required primary balance to stabilise the public debt-to-GDP ratio becomes,

\[
\frac{PB}{Y_t} = \left[\frac{(r - g)}{(1 + g)}\right] \frac{P_{D_{t-1}}}{Y_{t-1}}
\]

(6.6)

Assuming \(g\) is relatively small, and expressing lower case \(pb\) and \(pd\) as ratios to GDP, we can restate (6.6) as:

\[
pb_t = (r - g) pd_{t-1}
\]

(6.7)

\(^{37}\) See Makin (2010); Makin and Arora (2012); Makin and Pearce (2016) for discussions of sustainability formulae.
According to Equation (6.7), if the real interest rate is higher than the economic growth rate, a primary budget surplus is required to stabilise the ratio of public debt-to-GDP.

### 6.3.2 Data

The data and variables used in this study are retrieved principally from the World Bank, IMF Fiscal Monitor and the UN Population Division, particularly for labour productivity growth calculations.

**Table 6.3 List of variables and data sources**

<table>
<thead>
<tr>
<th>No</th>
<th>Variable</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Public debt to GDP, pd</td>
<td>General government debt-to-GDP ratio. The current value at 2018 is used for the calculation.</td>
<td>World Development Index, World Bank</td>
</tr>
<tr>
<td>2</td>
<td>Primary balance ,pb</td>
<td>Primary balance to GDP ratio. Current primary balance is used for comparison with the required primary balance from IBC formulae.</td>
<td>Fiscal Monitor Database, IMF</td>
</tr>
<tr>
<td>3</td>
<td>Real interest rate, r</td>
<td>Lending interest rate adjusted by the inflation rate.</td>
<td>World Development Index, World Bank. IMF country-specific report</td>
</tr>
<tr>
<td>4</td>
<td>l</td>
<td>Five year average of the rate of employment growth.</td>
<td>UN</td>
</tr>
<tr>
<td>5</td>
<td>γ</td>
<td>Labour productivity growth rate, change in output per hour worked. In this study, we use an average of ten years’ values to represent medium-term analysis.</td>
<td>Calculated from World Development Index</td>
</tr>
</tbody>
</table>

Source: Author compilation

### 6.4 Public debt sustainability in ASEAN countries

With the underlying formulae (Equation (6.7)), the assessment of the fiscal sustainability of a fiscal position can be calculated. Using the latest actual data available (2018), we
combine the growth rate, interest rate and public debt into income ratio and insert the data into the debt stabilisation formula.

Table 6.4 Public debt stabilisation and primary balances in ASEAN 2014–2018

<table>
<thead>
<tr>
<th>Country</th>
<th>Real interest rate, r</th>
<th>Growth rate, g</th>
<th>PD to GDP, pd</th>
<th>r-g</th>
<th>Required pb</th>
<th>Actual pb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>7.47</td>
<td>5.04</td>
<td>27.72</td>
<td>2.43</td>
<td>0.67</td>
<td>−0.01</td>
</tr>
<tr>
<td>Malaysia</td>
<td>2.87</td>
<td>5.18</td>
<td>56.42</td>
<td>−2.31</td>
<td>−1.30</td>
<td>−2.05</td>
</tr>
<tr>
<td>Myanmar</td>
<td>7.36</td>
<td>6.78</td>
<td>37.58</td>
<td>0.58</td>
<td>0.22</td>
<td>−0.80</td>
</tr>
<tr>
<td>Philippines</td>
<td>3.57</td>
<td>6.40</td>
<td>40.42</td>
<td>−2.83</td>
<td>−1.14</td>
<td>−0.97</td>
</tr>
<tr>
<td>Singapore</td>
<td>3.65</td>
<td>3.30</td>
<td>102.88</td>
<td>0.35</td>
<td>0.36</td>
<td>−1.10</td>
</tr>
<tr>
<td>Thailand</td>
<td>2.88</td>
<td>3.12</td>
<td>42.34</td>
<td>−0.24</td>
<td>−0.10</td>
<td>0.32</td>
</tr>
<tr>
<td>Vietnam</td>
<td>4.96</td>
<td>6.56</td>
<td>57.44</td>
<td>−1.60</td>
<td>−0.92</td>
<td>−1.32</td>
</tr>
</tbody>
</table>

Source: Author estimation, based on debt stabilisation formulae
Note: All variable values are as a percentage of each country’s GDP. Brunei Darussalam, Lao PDR and Cambodia are absent from the table due to data unavailability for interest rates.
Source: Based on the databases from the World Bank, IMF and Singapore Public Data (data.org.sg)

Table 6.4 depicts the required primary balance to satisfy debt stabilisation. The variables in the first column are the average of the latest five-year data from each country except pb, which is the current value (2018). The required primary balance is the hypothetical value as a result of the debt stabilisation formulae. Actual primary balance serves as a comparison to required hypothetical primary balance. If the amount of actual primary balance is higher than the required balance, the public debt ratio to income must be declining. In contrast, if the actual primary balance is less than the required primary balance, the public debt must be increasing.

Public debt levels in ASEAN countries range quite widely. Singapore, as an advanced country, has the highest average public debt-to-GDP ratio, around 103%, on par with other advanced country groups. Indonesia has the lowest public debt-to-GDP with an average of 28% over the last five years. Interestingly, Vietnam, with a smaller economy
compared to the ASEAN powerhouse, has a 57% public debt-to-GDP ratio. However, Vietnam has grown strongly at around 7% over the last five years. Myanmar and the Philippines have also recorded high economic growth of around 7% and 6%, whereas Indonesia and Malaysia have income growth of around 5% and Thailand has 3%.

The stabilising primary balance in ASEAN illustrates that most of the countries in the region tend to have increased public debt. Only the Philippines and Thailand have an actual primary balance level higher than the required primary balance. Almost ten years after the GFC, governments are still relying on debt to boost the economy. These results contrast with Makin (2010), who assessed the fiscal sustainability of ASEAN countries over 2003–2004.

6.5 Reducing public debt in ASEAN economies

The IBC formulae are also useful in the scenario of a government intending to reduce public debt to a certain level. Calibrating Equations (6.7), we can exercise the option if the government has a policy of reducing public debt to a target level. However, the target level in this section is merely arbitrary because not all ASEAN governments have a predetermined policy target level or fiscal rule. Indonesia, for instance, applies public debt restrictions up to 60% of GDP, and consolidated national and local government deficit is limited to 3% of GDP in any given year. This policy replicates the Maastricht Treaty that prescribed a 60% debt level for EU countries.

An empirical study by Daniel, Callen, Terrones, Debrun, and Allard (2003) reports that, for emerging economies, the sustainable public debt level is around 25% of GDP. This level is considered conservative since fiscal solvency issues will occur if the public debt
level is above 50%. Furthermore, Reinhart and Rogoff’s (2010) controversial study proposed a 60% threshold for developing countries.

More recently, Tran (2018), using capital market indicators, has suggested a 35% debt threshold for emerging and developing countries because, above this level, debt will burden the economy. In contrast, the IMF (2003) proposes a 25% public debt ceiling, based on analysis of financial crises in European transition economies such as Bulgaria, the Czech Republic, Russia and Ukraine. In this study, the level of public debt in ASEAN is mostly under 59%—except for Singapore—so we follow the more conservative level of 25% as the target level, following the IMF study.

Using all variables from a debt stabilisation model such as real GDP growth, interest rate and debt to income ratio, we can exercise the impact of reducing public debt targets on the primary balances in ASEAN countries.

The debt reduction formulae are derived from Makin (2010). The solvency formula stipulates that present public debt $p_{d_t}$ at $r$ interest rate can be repaid in the future at $p_{d_{t+n}} = 0$. The current value of budget surpluses in the future must equal the public debt stock at $t$ period. The formula to represent this condition is:

$$p_{d_t} = \frac{p_{b_{t+1}}}{(1 - r)} + \frac{p_{b_{t+2}}}{(1 - r)^2} + \frac{p_{b_{t+3}}}{(1 - r)^3} + \frac{p_{b_{t+n}}}{(1 - r)^n}$$

or

$$p_{d_t} = \frac{\sum_{j=1}^{n}(1 - r)^{n-j}p_{b_{n+j}}}{(1 - r)^n}$$

For constant primary balance $\bar{p_b}$, we can achieve solvency:
\[ \bar{p}_b = \frac{pd_t(1 - r)^n}{\sum_{j=1}^{n}(1 - r)^{n-j}} \]  \hspace{1cm} (6.10)

Since the stock of public debt at some period depends on the existing public debt subtracted by the discounted sum of primary balance surpluses, the equation will be:

\[ pd_{t+n} = pd_t(1 - r)^n - \sum_{j=1}^{n}(1 - r)^{n-j}p_b_{n+j} \]  \hspace{1cm} (6.11)

Since \( Y \) is nominal income, we divide equation 6.11 by \( Y_{t+n} \) and \( Y_{t+n} = Y_t(1 + g)^n \) results in:

\[ \frac{pd_{t+n}}{Y_{t+n}} = \frac{pd_t(1 - r)^n - \sum_{j=1}^{n}(1 - r)^{n-j}p_b_{n+j}}{Y_t(1 + g)^n} \]  \hspace{1cm} (6.12)

Now, if the target public debt ratio is \( \theta \), that needs to be achieved between \( t \) and \( t+n \) or:

\[ \frac{pd_{t+n}}{Y_{t+n}} = \theta \left( \frac{pd_t}{Y_t} \right) \text{ where } 0 \leq \rho \leq 1 \]  \hspace{1cm} (6.13)

Substituting Equation (6.12):

\[ \theta \left( \frac{pd_t}{Y_t} \right) = \frac{pd_t(1 - r)^n - \sum_{j=1}^{n}(1 - r)^{n-j}p_b_{n+j}}{Y_t(1 + g)^n} \]  \hspace{1cm} (6.14)

Solving for \( pd_t \) and divide by \( Y_t \).

\[ \frac{pd_t}{Y_t} = \frac{-\sum_{j=1}^{n}(1 - r)^{n-j}p_b_{n+j}}{[\theta(1 + g)^n - (1 - r)^n]Y_t} \]  \hspace{1cm} (6.15)

Solving Equation 6.15 for constant primary balance \( \bar{p}_b \) as a proportion of national income that satisfies Equation 6.13:

\[ \frac{\bar{p}_b}{Y_t} = \frac{pd_t}{Y_t} \frac{[\theta(1 + g)^n - (1 - r)^n]}{\sum_{j=1}^{n}(1 - r)^{n-j}p_b_{n+j}} \]  \hspace{1cm} (6.16)

or

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\[ pb = \rho \frac{(1 + r)^n - (1 + g)^n \theta}{\sum_{j=1}^{n} (1 + r)^{n-j}} \]  

(6.17)

Where \( pb \) is the primary balance, \( g \) is GDP growth rate and \( \rho \) is the current public debt to income ratio. We can simulate the requirement of primary balance at designated periods to achieve the targeted primary balance \( (\theta) \) with Equation (6.17) by inserting baseline values of the interest rate, current debt ratio and growth.

![Figure 6.4 Required primary balance to meet the targeted debt level (25%)](image)

Notes: Brunei Darussalam, Lao PDR and Cambodia are absent from the table due to data unavailability for interest rates.

Source: Based on database from the World Bank and IMF.

Equation (6.17) is solved using a spreadsheet that calculates each year’s required primary balance to stabilise a target of 25% debt-to-GDP ratio for every ASEAN country except Brunei Darussalam and Lao PDR. In general, the longer the time horizon, the lower the annual surplus needed to satisfy debt stabilisation. Figure 6.4 illustrates the required primary balance for debt stabilisation in three, five and ten-year horizons given the current
state of macroeconomic indicators. It is clear that the higher the initial public debt level, the more effort must be expended to stabilise debt.

To reduce the current level of public debt to 25%, Malaysia and Vietnam must make a substantial effort to build primary surpluses compared to neighbouring countries. Malaysia and Vietnam must pursue around a 3–4% primary surplus to reduce debt in ten years, whereas Thailand and Myanmar can reduce their debt to 25% from their current position within ten years, so long as their governments can achieve around a 2% primary surplus from their GDPs. On the other hand, Indonesia’s and the Philippines’ requirements are relatively low, being in the range of a 1% primary surplus.

On the other hand, as depicted in Figure 6.2, Singapore is distant from other neighbouring ASEAN countries. As developed nation with much higher level of public debt, the effort to stabilise debt for Singapore is far more substantial. Singapore needs around 28% of primary surplus if it wants to stabilise debt in 3 years and around 10% of primary surplus in 10 years.

It should be noted that the initial debt in the calculation is primarily central government debt and does not include provincial and local governments. The scenario also excludes the influence of political and external factors that may alter the dynamics of primary budget decision making.

### 6.6 The ageing population in ASEAN

Despite robust growth in South-East Asia, ASEAN economies have the same upcoming demographic challenge as developed countries. In ASEAN, the proportion of the aged
population will double in two decades from 7.73% in 2015 to 15.49% in 2035. Singapore and Thailand have the highest ageing population ratio\(^{38}\) with 31.74% and 23.39% respectively, whereas the lowest proportions of ageing population are in Lao PDR with 8.38% and the Philippines with 8.72% (UN, 2017). An ageing population also affects the dependency ratio\(^{39}\). In the ASEAN region, the average dependency ratio is expected to increase from 0.5 to 0.6 in 2035, with the highest ratio in Singapore at 0.83 in 2035.

Ageing populations influence demographic patterns within the country that may have a wider economic impact. For instance, ageing populations reduce labour supply and decrease the support ratio, implying a decline in output per capita. Although the demographic situation is not the focus of government policy in ASEAN, action is soon needed to address the challenges related to rapidly ageing populations.

The ASEAN countries are at quite different stages in their demographic transition. The demographic change associated with economic development imposes costs but can also provide dividends in terms of living standards sustained over several decades (Kirk, 1996; Lee, Mason, & Miller, 2000; Mason & Lee, 2006). The timing of these costs and dividends tends to differ across decades. Declining fertility rates initially lower the child dependency ratio, which implies rising employment to population ratios. This is known as the first demographic dividend. However, once the smaller birth cohorts reach working age, the employment share of the population tends to fall, the population ages and the dividend is reversed. We see this pattern in the data, discussed in detail below, for

\(^{38}\) To proxy ageing population ratios, we use the support ratio of labour supply \((L)\) divided by the total population \((N)\), or \(L/N\).

\(^{39}\) Dependency ratio is a ratio of the dependent age group—0–14 and over 65—compared to the working-age population (The World Bank, 2017).
Singapore and the other ASEAN countries; however, it has quite different timing resulting in different paths for their respective demographic changes.

Figure 6.5 Support ratio. Population 15–65 as share of total population. Singapore and average ASEAN countries
Source: UN Population Division, 2015
Note: ASEAN (ex Singapore) is Vietnam, Thailand, the Philippines, Myanmar, Malaysia, Lao PDR, Indonesia, Cambodia and Brunei. The unweighted average is applied for the ASEAN countries’ figures.

Figure 6.5 illustrates the average support ratio for Singapore and other ASEAN countries. The support ratio in Singapore has been declining rapidly since 2010, representing a decline of around 10–20 years before other ASEAN countries experience similar conditions. Conversely, the old-age dependency ratio is on the rise. Figure 6.6 shows the path of old-age dependency ratios in Singapore and other ASEAN countries. It is apparent that population ageing started earlier in Singapore than in other ASEAN countries, around 2010—similar to Japan. Thailand’s aged population is projected to rise rapidly by 2040, while other ASEAN countries indicate a more subdued increase in their old-age population.
Although the impact is not imminent in most countries, the ageing population is the biggest long-term challenge for ASEAN countries (Budina & Tuladhar, 2010; Chirathivat et al., 2015). The change in demographic structure not only increases age-related spending, such as pensions and health care, but also affects economic growth. The IMF (2018) predicts that government spending on health and pensions will increase to around 7% of GDP between 2010 and 2050 due to the rise in the ageing population.

Lee and Mason (2015) reported increased health care spending in the long term for the ageing population in developing countries, although with different magnitudes across countries, depending on their fiscal capacity. The authors also noted that, with ageing populations, public spending on education declined due to a lower fertility rate. Furthermore, in terms of productivity, an ageing population may negatively impact growth. Ageing populations depress employment growth as well as productivity,
ultimately resulting in declining economic growth. The transmission and impact of ageing population trends will be explored further in the next section.

### 6.7 Population ageing and fiscal sustainability

An ageing population puts pressure on public finances and fiscal sustainability through pressures on government spending, taxation revenue and economic growth. For example, Clements (2015) studied the fiscal burden on ageing-related government spending in both developed and developing countries using UN demographic data. This study reveals that an ageing population increases healthcare and pension spending to 9% of GDP in developed countries and 11% in developing countries. Furthermore, Lee et al. (2017) have explored the impact of an ageing population on fiscal sustainability through spending, revenue and growth projections in developing Asia, including all of ASEAN. Using the National Transfer Accounts data set, UN population projections (medium fertility) and other data sources for long-term real GDP projections, they estimate that the change in fiscal balance as a share of GDP from 2010 to 2050, due to the change in the population age structure, for ASEAN countries ranges from 1.3% for Singapore (meaning ageing pushes the budget further into deficit by 1.3% of GDP) to 2.6% for Indonesia (a positive effect on its fiscal balance).

The analysis here focuses on the impact of demographic projections for the primary fiscal balance required to stabilise public debt-to-GDP in various future years. The key mechanism that we isolate is the impact of future labour force growth on GDP growth which, in turn, affects the target primary fiscal balance according to the debt sustainability condition given below. Therefore, we leave aside any implications of demographic change for government spending and revenue. Our results show that demographic
projections have non-trivial effects on the fiscal contractions required for debt sustainability, for any given level of government spending and taxation as a share of GDP.

6.7.1 Channelling population ageing to debt sustainability analysis

For a better understanding of how the channels of population ageing influence growth, we decompose income per worker equal to income per capita divided by the number of workers per capita:\(^{40}\)

\[
\frac{Y}{N} = \frac{Y}{L} \cdot \frac{L}{N}
\]

(6.18)

In Equation (6.18), \(Y\) denotes GDP, \(L\) is number of workers, \(N\) is population and \(L/N\) is the labour force population ratio. Assuming unemployment is zero or remains constant, logarithmic transformation of income per capita can be expressed as:

\[
\ln \left( \frac{Y}{N} \right) = \ln \left( \frac{Y}{L} \right) + \ln \left( \frac{L}{N} \right)
\]

(6.19)

Let \(g = \frac{Y}{N}; \ p = \frac{Y}{L}; \ \ l = \frac{L}{N}\). The growth of income per capita can be derived by

\[
g \hat{=} \hat{p} + \hat{l}
\]

(6.20)

Equation (6.20) implies that income per capita growth \((\hat{y})\) is equal to growth income per worker (labour productivity= \(\hat{p}\)) plus growth in the support ratio \((\hat{l})\).

Assuming no change in labour participation and unemployment over time, labour force growth equates with employment growth. The final step used the preceding analysis is to project values of \(\hat{g}\) based on labour force growth implied by demographic projections and assume no change in labour productivity growth. In this way, we can identify the impact of ageing on the sustainability of public debt.

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\(^{40}\) See Bloom, Canning, and Fink (2010) for further discussion of growth accounting from a labour productivity perspective.
### 6.7.2 Population ageing public debt sustainability analysis

The dataset from previous debt stabilisation formulae is applied with the newly added variable of productivity growth and labour growth to calculate the growth value.

Table 6.5 provides the data for all variables assumed constant in applying Equations (6.7) and (6.20).

#### Table 6.5 Data for debt stability condition, percentages

<table>
<thead>
<tr>
<th></th>
<th>Indonesia</th>
<th>Malaysia</th>
<th>Myanmar</th>
<th>Philippines</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Vietnam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real interest rate, $r$</td>
<td>7.47</td>
<td>2.87</td>
<td>7.36</td>
<td>3.57</td>
<td>3.65</td>
<td>2.88</td>
<td>4.96</td>
</tr>
<tr>
<td>Productivity growth, $\hat{p}$</td>
<td>4.04</td>
<td>1.61</td>
<td>7.02</td>
<td>3.23</td>
<td>1.45</td>
<td>2.90</td>
<td>4.32</td>
</tr>
<tr>
<td>PD to GDP, $pd$</td>
<td>27.72</td>
<td>56.42</td>
<td>37.58</td>
<td>40.42</td>
<td>102.88</td>
<td>42.34</td>
<td>57.44</td>
</tr>
<tr>
<td>PB to GDP, $pb$</td>
<td>-0.01</td>
<td>-2.05</td>
<td>-0.80</td>
<td>0.97</td>
<td>-1.10</td>
<td>0.32</td>
<td>-1.32</td>
</tr>
</tbody>
</table>

Source: Author estimation, based on debt stabilisation formulae
Note: All variable values are a percentage. Brunei Darussalam, Lao PDR and Cambodia are absent from the table due to data unavailability for interest rates.

Table 6.6 provides the average projected labour force growth, $l$, for the ten-year periods indicated in the table. These values combined with values for labour productivity growth, $\hat{p}$, from Table 6.5, imply changing growth rates of real GDP over time for each country.

#### Table 6.6 Projected labour force growth, $l$, percentages

<table>
<thead>
<tr>
<th></th>
<th>Singapore</th>
<th>Vietnam</th>
<th>Thailand</th>
<th>Philippines</th>
<th>Myanmar</th>
<th>Malaysia</th>
<th>Lao PDR</th>
<th>Indonesia</th>
<th>Cambodia</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015–2020</td>
<td>0.80</td>
<td>0.67</td>
<td>0.03</td>
<td>1.73</td>
<td>1.36</td>
<td>1.43</td>
<td>1.97</td>
<td>1.31</td>
<td>1.48</td>
</tr>
<tr>
<td>2020–2030</td>
<td>-0.42</td>
<td>0.73</td>
<td>-0.78</td>
<td>2.27</td>
<td>1.26</td>
<td>1.50</td>
<td>2.59</td>
<td>1.38</td>
<td>2.26</td>
</tr>
<tr>
<td>2030–2040</td>
<td>-0.67</td>
<td>0.61</td>
<td>-1.25</td>
<td>2.07</td>
<td>0.82</td>
<td>1.34</td>
<td>2.18</td>
<td>1.09</td>
<td>1.99</td>
</tr>
<tr>
<td>2040–2050</td>
<td>-0.78</td>
<td>0.37</td>
<td>-1.62</td>
<td>1.85</td>
<td>0.55</td>
<td>1.22</td>
<td>1.75</td>
<td>0.70</td>
<td>1.75</td>
</tr>
<tr>
<td>2050–2060</td>
<td>-0.91</td>
<td>0.05</td>
<td>-1.64</td>
<td>1.65</td>
<td>0.35</td>
<td>0.96</td>
<td>1.28</td>
<td>0.42</td>
<td>1.55</td>
</tr>
<tr>
<td>2060–2070</td>
<td>-0.82</td>
<td>-0.38</td>
<td>-1.42</td>
<td>1.42</td>
<td>0.18</td>
<td>0.48</td>
<td>0.81</td>
<td>0.22</td>
<td>1.01</td>
</tr>
<tr>
<td>2070–2080</td>
<td>-0.72</td>
<td>-0.77</td>
<td>-1.16</td>
<td>1.19</td>
<td>0.00</td>
<td>-0.19</td>
<td>0.31</td>
<td>0.07</td>
<td>0.05</td>
</tr>
<tr>
<td>2080–2090</td>
<td>-0.80</td>
<td>-0.94</td>
<td>-1.22</td>
<td>0.90</td>
<td>-0.21</td>
<td>-0.63</td>
<td>-0.14</td>
<td>0.01</td>
<td>0.37</td>
</tr>
<tr>
<td>2090–2100</td>
<td>-1.06</td>
<td>-0.66</td>
<td>-1.54</td>
<td>0.63</td>
<td>-0.48</td>
<td>-0.67</td>
<td>-0.45</td>
<td>-0.11</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Source: Author calculation based on UN population data
Table 6.7 Target primary balances in each year for debt stability from 2020 to the given period

<table>
<thead>
<tr>
<th>Period</th>
<th>Singapore</th>
<th>Vietnam</th>
<th>Thailand</th>
<th>Philippines</th>
<th>Myanmar</th>
<th>Malaysia</th>
<th>Indonesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020-2030</td>
<td>2.70</td>
<td>-0.05</td>
<td>0.32</td>
<td>-0.78</td>
<td>-0.35</td>
<td>-0.14</td>
<td>0.57</td>
</tr>
<tr>
<td>2030-2040</td>
<td>2.95</td>
<td>0.02</td>
<td>0.52</td>
<td>-0.70</td>
<td>-0.18</td>
<td>-0.05</td>
<td>0.65</td>
</tr>
<tr>
<td>2040-2050</td>
<td>3.07</td>
<td>0.16</td>
<td>0.67</td>
<td>-0.61</td>
<td>-0.08</td>
<td>0.02</td>
<td>0.76</td>
</tr>
<tr>
<td>2050-2060</td>
<td>3.20</td>
<td>0.34</td>
<td>0.69</td>
<td>-0.53</td>
<td>-0.01</td>
<td>0.17</td>
<td>0.83</td>
</tr>
<tr>
<td>2060-2070</td>
<td>3.11</td>
<td>0.59</td>
<td>0.59</td>
<td>-0.43</td>
<td>0.06</td>
<td>0.44</td>
<td>0.89</td>
</tr>
<tr>
<td>2070-2080</td>
<td>3.01</td>
<td>0.81</td>
<td>0.48</td>
<td>-0.34</td>
<td>0.12</td>
<td>0.82</td>
<td>0.93</td>
</tr>
<tr>
<td>2080-2090</td>
<td>3.09</td>
<td>0.91</td>
<td>0.51</td>
<td>-0.22</td>
<td>0.20</td>
<td>1.07</td>
<td>0.95</td>
</tr>
<tr>
<td>2090-2100</td>
<td>3.35</td>
<td>0.75</td>
<td>0.64</td>
<td>-0.12</td>
<td>0.31</td>
<td>1.09</td>
<td>0.98</td>
</tr>
</tbody>
</table>

Source: Author calculation based on debt stabilisation formulae.
Note: Brunei Darussalam, Lao PDR and Cambodia are absent from the table due to data unavailability for interest rates.

Table 6.7 shows the target primary fiscal balances required to achieve public debt stability from one ten-year period to the next. Singapore, for example, requires a primary surplus of 2.70% for debt stability from 2020 to 2030 where debt is maintained at the level in Table 6.5. For the following decade, 2030–2040, the primary surplus jumps to 2.95% to achieve the same debt level as the previous decade, rising to 3.07% for 2040–2050, and so on. For a given country, the differences for each year reflect only the differences in labour force growth rates impacting on real GDP growth, $g$, in Equations (6.7) and (6.20).

Figure 6.7 illustrates the pattern of primary surpluses required for debt stability.
The magnitude of the effect of projected labour force growth on the required primary surplus is significant. For Singapore, the primary surpluses vary from a low of 2.70% to a high of 3.20%. For the other countries in Table 6.7, the magnitudes are similar and, in some cases, larger. For example, the primary surplus for Malaysia varies by nearly 1.5 percentage points of GDP. The key conclusion from this analysis is that the fiscal changes required for debt sustainability depend in a non-trivial way on projected labour force growth reflecting expected demographic change.

6.8 Conclusion and policy options

This chapter investigates the condition of fiscal sustainability in ASEAN countries using the debt sustainability formulae from the latest data available. It also examines the impact of population ageing on fiscal sustainability through economic growth from productivity. Economic growth in ASEAN countries shows a relatively strong performance over the
past decade due to resilience against economic crises. Governments have actively deployed fiscal policies to support long-term growth. However, consequences arise from these fiscal policies, such as a deterioration of budget balances and increasing public debt. Although the debt level in ASEAN is relatively low compared to advanced countries (with the exception of Singapore) the sustainability of fiscal policy is still debatable.

Results of the debt stabilisation formulae from the IBC show that most developing ASEAN countries require substantial effort to stabilise debt. Compared to the current actual primary balance, the fiscal consolidation needed to stabilise debt varies from 0.40% to 1.5% over GDP. Due to its lower debt-to-GDP ratio, Indonesia has the ability to reduce its debt level to 25%—as long as the primary surplus remains around 1%—whereas Vietnam and Malaysia need a more substantial surplus of around 3%–4% to reduce debt in a ten-year period. Singapore has a different economy from other ASEAN countries, having a large initial debt-to-GDP ratio; it would take a massive 9.54% primary surplus to reduce public debt there to 25% within ten years.

Singapore, as an advanced ASEAN country, leads change in its demographic structure, with a larger older population than other countries in the region. The impact of an ageing population is a reduction in employment growth rate that may lower the growth rate in the long term. However, fiscal sustainability analysis shows that Singapore may still have room to expand in spite of its rapidly ageing population. The neighbouring countries in the region are in a different situation from Singapore. With increasing public debt and slower growth, countries such as Indonesia, Cambodia and Myanmar require more stringent fiscal consolidation to achieve long-term fiscal sustainability.
Currently, ASEAN countries still have a demographic dividend due to an increased working-age population to support their economies. However, ASEAN’s ageing population is a challenge for the long term. Using one aspect of the fiscal pressure from ageing—the effect of slower labour force growth on future real GDP growth—our results suggest that significantly larger primary budget balances will be required as a condition for ensuring future public debt sustainability. For instance, in Singapore, slower labour force growth impacts the primary surplus by around 1% of GDP, and for other ASEAN countries the figure is nearly that.

Furthermore, the increase of the old-age dependency ratio in emerging economies is faster than in high-income economies. It took an average of 11 years to increase the dependency ratio from 15% to 20% in Asia, compared to an average of 25 years in economically advanced countries (IMF, 2018). To prepare for a worsening of this condition, policies need to focus on maximising the current demographic dividend in ASEAN to increase productivity and create more job opportunities. Enhancing revenues would also create more fiscal opportunities in the long run—for example, by broadening the tax base and administrative reform.

The government could create a primary surplus either through expenditure limitations or revenue-based increments. Considering losses in taxation, priorities should focus on the effectiveness of public expenditure. Allocation of spending between consumption and investment should be carefully implemented to ensure that all expenditure has a positive impact on long-term growth. Furthermore, the private sector could also be involved in high capital projects such as infrastructure to address the infrastructure gap in ASEAN countries. Private-public partnerships may alleviate the pressure on government budgets.
and increase revenue through assignment of property rights and privatisation (Makin, 2010).

While ASEAN countries are still benefiting from a younger population, policies need to focus on maximising the current demographic dividend to increase productivity and create more job opportunities. The private sector can also be involved in reducing the financial burden from an ageing population by developing financial funds for policies such as superannuation, health and age care (Guest, 2008).
CHAPTER 7. CONCLUSION

7.1 Introduction

This chapter concludes the thesis and is structured as follows. The first section presents summary results using empirical data from each main chapter. The second section discusses the contribution of the thesis. The third section proposes the policy implications of the four main chapters. The last section discusses limitations, and avenues for further study.

7.2 Summary of the empirical studies

This thesis presents four distinct empirical studies on the theme of fiscal policy. Before introducing these studies, Chapter 2 surveys the basic theoretical background and also discusses the theoretical aspects of subsequent empirical studies. These studies commence in Chapter 3 by investigating the impact of government spending on economic growth in developing countries. Chapter 4 considers the impact of fiscal policy by empirically examining the effect of budget deficits and public debt on interest rates in developing countries. The two subsequent chapters analyse public debt: Chapter 5 examines the impact of public debt on economic growth in developing Asia countries, while Chapter 6 investigates public debt sustainability and the indirect effect of population ageing on public debt sustainability in ASEAN countries.

The first empirical study (Chapter 3) corresponds to the first research question “Do government spending components in developing countries influence growth?”. The chapter examines the impact of government expenditure on economic growth. It uses data from 52 developing and emerging countries from 1970 to 2015. Since the definition of productive and non-productive spending is contestable, this chapter independently
assesses the effect of spending in both the economic and sectoral categories on long-term growth. The findings show that capital expenditure is beneficial for economic growth and that current spending has a negative association with growth. Interestingly, each component of current expenditure has a different impact on economic growth in developing countries. For instance, expenditure on goods and services, along with wages spending, correspond with increasing growth, whereas spending on interest rates is associated with slower growth and expenditure on subsidy and has no significant impact on economic growth. The results are consistent with previous studies, especially in the case of developing countries.

On the sectoral side, spending on the defence sector has insignificant effect on growth while spending on the health sector is positively influence growth. Expenditure on the education sector, however, is associated with a negative coefficient on long-term growth. This contrasts with relevant growth theory, which holds that education is a growth-enhancing sector. Inefficient spending in this sector is the potential reason for the negative result. According to Landau (1986), inefficient spending occurs when an increase in expenditure on the education sector does not affect educational development targets, such as increasing school enrolments or the level of literacy, or when the allocation of spending to this sector is already relatively high; any increase (by sacrificing other spending) thus impairs growth (Devarajan, et.al, 1996).

Chapter 5 responds the research question “Does fiscal policy affect interest rates in developing countries?” It examines the impact of public debt and fiscal deficit on the interest rate. As in the first main chapter, this empirical study also uses databases from 1990 to 2015 for emerging and developing countries. On the relationship between fiscal
policy and interest rates, the study investigated both linear and non-linear relationships between public debt and budget policy, and interest rates. Semiparametric regression with fixed effect was used to study the non-linearity condition. However, the results show that all semiparametric estimates demonstrate little relationship between fiscal policy (public debt and budget deficit) and interest rates which cannot conclude the non-linear association.

Furthermore, the study also investigates the linear relationship between fiscal policy (public debt and budget deficit) and interest rates using dynamic panel modelling, with the system GMM estimator. The dynamic panel model found that both the public debt and fiscal deficit have a positive effect on interest rates in developing and emerging countries. An increase in public debt of 1% leads to a rise in the interest rate of three to five basis points, whereas a 1% increase in the budget deficit has a more substantial impact on the interest rate, from 62 to 64 basis points.

The effect also varies if applied to a split sub-sample. For example, the impact of rising public debt on interest rates is higher under a high deficit condition and low financial depth environment. Overall, the baseline model results are plausible from a theoretical point of view and are in line with previous studies. The results suggest that the impact of fiscal policy on interest rates in developing countries is larger from the flow variable—budget deficit to GDP ratio—whereas the stock variable of public debt-to-GDP ratio has a minimal impact on the interest rate.

The third empirical study examines the relationship between public debt and economic growth in developing Asian countries. This chapter answers the research question “Has
public debt in developing Asia helped or hindered economic growth?”. There are 28 developing Asian countries in the dataset spanning 1970–2015. This study applies the dynamic panel data model along with the fixed effect and random effect model as robustness checks. After highlighting the theoretical background and findings of previous studies, the study reveals that public debt has hindered economic growth in the region. According to the results from the dynamic panel model, a 10% increase in public debt is associated with a 0.04% decrease in growth. Although the magnitude seems small, the compounding effect of the reduction in growth will be significant in the future.

The last main chapter in this thesis responds to the research question “How sustainable is the public debt in developing Asian countries, specifically in ASEAN?”. The chapter focuses on the most recently available data and is estimated using fiscal sustainability formulae. Using these formulae, the study can also simulate a debt reducing scenario with current macro-data. Furthermore, the ageing population factor is incorporated into the equations to examine its impact on fiscal sustainability. Because of the diverse economic conditions in ASEAN countries, the analysis is best conducted independently for each country.

The results show that most ASEAN countries require substantial effort to achieve sustainability in the current fiscal situation. The fiscal consolidation varies from 0.4% to 1.5% of GDP. Although most ASEAN countries—excepting Singapore—have public debt-to-GDP ratios of around 30%, the reduction scenario to 25% still needs significant effort, ranging from a 1% to 4% surplus within a ten-year period. On the other hand, the ageing population in ASEAN is an increasing trend. However, the impact of ageing on fiscal sustainability is still minimal since most ASEAN countries are still benefiting from
a population dividend. Unlike other ASEAN members, Singapore has comparably slower labour growth which will lower its economic growth and lead to a worsening fiscal stance in the future.

7.3 Contribution of the study and policy implications

This thesis makes a significant contribution to the academic field and practical policy formulation in the area of government fiscal policy. The research contributions are explained as follows.

7.3.1 Academic contribution

This study makes an essential contribution to the literature on government spending and economic growth regarding the composition of government spending. Previous studies regarding spending composition and growth primarily draw their conclusions from the advanced countries’ panel data or extensive panel data consisting of a mixture of low- and high-income economies. There is still limited evidence on how the composition of government spending shapes economic growth in emerging and developing countries.

There are significant differences in the priorities of public spending allocation in developing economies compared to advanced countries, as well as differences in the impact of spending on output from both economic groups (Bose et al., 2007). Therefore, the study focuses mainly on a group of developing countries. Moreover, it examines the composition of government spending independently without having to classify the expenditure into productive and non-productive sectors. This reveals the direct impact of each component on growth in the developing countries’ group.
In the chapter devoted to the impact of fiscal policy on the interest rate, the focus is again on developing and emerging economies. This chapter introduces a new approach to investigating a non-linearity condition using semiparametric regression with fixed effect. Although the semiparametric approach is often used when investigating foreign trade, studies have utilised this approach to search the non-linearity of the Laffer curve (Megersa, 2015). Moreover, the application of a dynamic panel model (Arellano and Bond (1991), Blundell and Bond (1998) and Bond et al. (2001)) in this study sets it apart from existing studies that mostly use VAR or panel VAR, or the VECM approach. This study also provides a comprehensive estimation of public debt and budget deficit to the interest rate with the interaction model. These approaches yield detailed insights into how stock (public debt) and flow fiscal variables (budget deficit) influence the interest rate in developing countries.

The last two empirical chapters are dedicated to investigating public debt and its effect on economic growth and fiscal sustainability. These chapters contribute to the literature with their greater focus on country datasets and various methods of studying fiscal sustainability. Chapter 5 discusses the impact of public debt on economic growth: the dataset is more focused on developing Asia, which has been experiencing robust economic growth. Using several econometric techniques, the study found that public debt hinders growth in Asian development.

On the other hand, Chapter 6 applies more simple but effective techniques to assess the fiscal sustainability of ASEAN countries. Furthermore, it assesses the impact of an ageing population on fiscal sustainability. Using the simple sustainability formula, the study
shows that population ageing can influence economic growth through productivity and ultimately influence fiscal sustainability within ASEAN.

7.3.2 Major policy implications

Two key policy implications derive from this thesis: the priority of government spending and the management of public debt and budget deficit. This thesis finds that current government spending has a negative impact on economic growth in developing countries. However, the decomposition of current spending shows that some spending components have a growth-enhancing effect such as spending on goods and services and transfer while others have a negative effect. Therefore, the government may choose which spending allocation could have a more significant impact on economic growth and allocate funding accordingly. However, the parametric estimates based on the results need to be treated cautiously. A government focus on only one or some particular sectors may create redundancy and inefficiency that may, in the long run, impede economic growth (Devarajan et al., 1996).

The policy implication of the second empirical study is clear. Fiscal policy, the budget deficit and public debt, raise the interest rate; this finding highlights the urgency of fiscal policy management in developing countries. Elevated fiscal activism in this region increases the public debt level on finance, widening the fiscal deficit and eventually pushing the interest rate upward. The increasing interest rate can crowd out investment and will have social implications. With the reduction of domestic investment through capital formation, job generation and social welfare can be negatively affected.
Moreover, consumers and other sectors, such as housing, can also be affected. The domestic financial market in developing countries needs further deepening through increased market participation and financial products. An improved domestic market may create resilience during market volatility, resulting in a more stable interest rate and exchange rate movement.

The next chapter (Chapter 5) also provides empirical evidence that public debt has hindered economic growth in Asia. Although the impact is relatively small—around four basis points per 1% rise of public debt—the compounding impact is significant. This also indicates the urgency for public debt management in developing countries, especially in Asia. Improving debt management is related to better control of cost and risk associated with debt, restructuring expensive debt and improving debt management institutions. For developing countries that have limited capacity in managing debt due to limited access to capital markets, the goal is to improve the quality of spending. With improved quality of expenditure, these countries may promote development programs and restructure debt by undertaking a debt-for-development swap. This action applies to bilateral debt agreements.

The last chapter concludes the empirical study with a fiscal sustainability analysis of public debt in ASEAN countries. Using fiscal sustainability formulae, the results show that ASEAN countries need substantial effort if their governments wish to reduce current public debt to, for instance, a 25% level. There are several policy options for improving sustainability according to the sustainability formulae. Examples of this are improving economic growth to a higher rate than the interest rate and balancing the government
budget by applying fiscal consolidation, such as reduction in expenditure and/or raising government revenue.

However, fiscal consolidation is rare for governments in developing ASEAN countries because the non-discretionary element of public spending still dominates the budget. Moreover, governments need to be cautious about cutting public expenditure, particularly capital spending that has a growth-enhancing effect. Another option is to set a fiscal rule for ASEAN countries to achieve a reduced debt target within the medium term. Upper limits of sustainable debt levels can be decided, as apply in the European Union (Makin, 2005).

7.4 Avenues for further research

The thesis has contributed to the scholarly body of knowledge and produced important findings and recommendations for fiscal policy. There is, however, scope for further analysis in the area. For example, due the lack of data availability, the study does not incorporate the financing of expenditure. Therefore, further research, specifically in case studies, may include this financing component to gain a more precise analysis regarding government expenditure and economic growth. Data for functional spending under GFSM for developing countries is minimal, hence the difficulty in grouping the productive and non-productive sectors. To overcome this limited availability of panel data, further research can incorporate country-specific cases. In country specific case, it is possible to search and collect data into several functional categories for each government’s budget more thoroughly.
Further research regarding the second empirical study investigating the impact of fiscal policy on interest rates could focus on the long-term interest rate for government bond issuance since many developing countries have access to capital markets. According to the literature, the long-term interest rate is a suitable dependent variable due to its neutrality from monetary policy (Afonso & Jalles, 2014). Therefore, it would be of interest to see the impact of fiscal policy on the long-term interest rate in developing compared to advanced economies. In addition, the channels of fiscal policy (public debt and budget deficit) in affecting interest rate can also be explored further.

Furthermore, investigating the crowding-out effect of public debt on investment, particularly private investment, is also an option for further research. The next natural methodological step is to use more elaborate econometric methods. Employing an autoregressive panel model, for instance, may allow examination of the cumulative interest rate’s effect on fiscal policy over time as well as interdependencies between variables.

The last two chapters concerning the relationship between public debt and economic growth also warrant further study. The public debt variable in Chapter 5 mainly consists of general government debt and central government debt. The classification of debt, such as official bilateral debt and the issuance of government bonds, as well as debt based on currency composition, are not included in the database. The structure of debt could well influence macroeconomic effects. However, the sample size of countries for this debt classification would need to be considerably reduced.
There is, lastly, considerable scope for further research on public debt sustainability. For instance, the exchange rate has an influence on the value of foreign currency denominated public debt and the non-linearity relationship between public debt and growth. In regard to the effect of ageing population to fiscal sustainability, applying time-series methods following Bohn (1998) approach with ageing variable and incorporating other related variables using different estimation techniques could prove fruitful.
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