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GOVERNMENT EXPENDITURE AND ECONOMIC GROWTH IN MALAYSIA: AGGREGATE AND DISAGGREGATE PERSPECTIVES

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BY

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MAY 2025

DECLARATION

We hereby declare that:

(1) This undergraduate FYP is the end result of our own work and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.

(2) No portion of this FYP has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.

(3) Equal contribution has been made by each group member in completing the FYP.

(4) The word count of this research report is 16,759.

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Next, we extend our deepest gratitude to our supervisor, Dr. Tan Chai Thing, for her continuous support, professional guidance, and constructive feedback throughout this research. Her expertise in economics and her attention to detail greatly contributed to the quality and clarity of our work. Despite her numerous commitments, she consistently dedicated time to monitoring our progress, addressing our concerns, and providing directions whenever we faced challenges. Her guidance has been a source of motivation and encouragement, and we are truly grateful for her patience and dedication.

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Lastly, we would like to extend our sincere appreciation to our groupmates for their dedication, cooperation, and commitment throughout this project. Although our group comprised only two members, the spirit of teamwork and mutual support helped ensure the smooth progress of our research. Their active contribution, consistent effort, and shared responsibility were key factors in the successful completion of this study.

PREFACE

This final year project marks the completion of our undergraduate studies at Universiti Tunku Abdul Rahman (UTAR). We undertook this research not only to fulfil academic requirements, but also to further explore our growing interest in Malaysia's economic growth and the role of government development spending in shaping long-term growth.

Our decision to focus on government development expenditure and economic growth was guided by both academic curiosity and the real-world relevance of fiscal policy. As Malaysia continues to face changing economic conditions, we believe it was important to explore how different types of public investment influence the economy over time. We hoped to contribute to a better understanding of which areas of spending can generate the greatest economic returns and why certain outcomes vary across sectors.

Throughout this journey, we encountered several challenges. Working with time series data required a high level of precision and patience, especially when applying econometric methods. Interpreting the results and identifying meaningful relationships between variables tested our critical thinking and analytical skills. At times, managing the workload with only two team members also became difficult. However, these experiences taught us the value of perseverance, teamwork, and attention to detail.

This project has strengthened our academic foundation in economics, particularly in empirical research and policy analysis. It has also reinforced our commitment to evidence-based thinking and has inspired us to think about future directions in research, data analysis, or public policy. We are proud of the effort and cooperation that went into completing this study and hope it will offer useful insights for fellow students, academics, and policymakers interested in Malaysia's fiscal development.

ABSTRACT

This study investigates the relationship between government development expenditure and economic growth in Malaysia from 1990 to 2023, using both aggregate and disaggregate perspectives. A step-by-step econometric approach is adopted, beginning with the analysis of total development expenditure, followed by aggregate social sector spending, and finally the disaggregated components: education and training, health, and housing. This layered model progression allows for a more detailed understanding of how different types of government spending influence real GDP.

Time series econometric methods, including the Johansen Cointegration Test and the Vector Error Correction Model (VECM), are employed to estimate both short-run and long-run relationships. In Model 1, aggregate development expenditure is found to have a significant and positive long-run effect on economic growth, though its short-run effect is statistically insignificant. In Model 2, social sector expenditure demonstrates a negative significant long-run relationship with GDP, but short-run effects remain weak. In Model 3, which disaggregates the social sector, it found that health and housing expenditures have positive and significant long-run effects, whereas education and training shows a negative and significant impact in the long run. However, in the short run, education shows a delayed positive impact. The short-run effects of health and housing are negative effects but some lag periods showing statistical significance and others remain insignificant. These variations are possibly due to policy inefficiencies or delayed returns.

Keywords: government expenditure; economic growth; social sector expenditure; Johansen Cointegration test; VECM; Malaysia

Subject Area: HJ7461-7980 Expenditures. Government spending

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey Fuller
BNM	Bank Negara Malaysia
DE	Government Development Expenditure
DOSM	Department of Statistics Malaysia
DW	Durbin-Watson statistic
EDU	Education and Training Expenditure in Social Sector
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
HLT	Health Expenditure in Social Sector
HOU	Housing Expenditure in Social Sector
IMF	International Monetary Funds
JB	Jarque-Bera Test
JJ	Johansen Cointegration Test
K	Capital
L	Labour
MOF	Ministry of Finance Malaysia
PCA	Principal Component Analysis
PP	Phillips Perron
SOC	Social Sector Expenditure under Development Expenditure
VECM	Vector Error Correction Model
VIF	Variance Inflation Factors

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CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

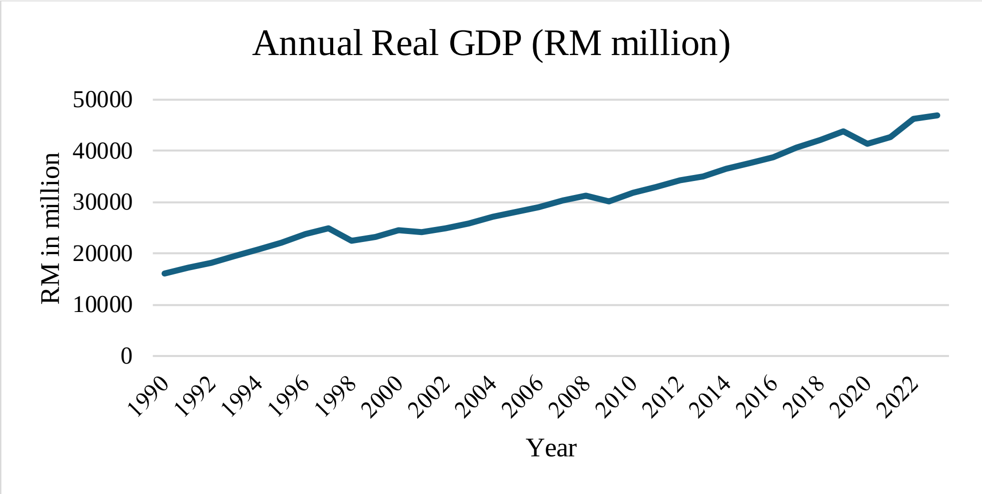
This chapter provides a brief introduction to the study, including the definition of government expenditure in the social sector and its relationship with economic growth. The focus is on Malaysia, with an emphasis on the impact of government development expenditure in education, healthcare, and housing. A problem statement on government expenditure in the social sector in Malaysia will be prepared. Additionally, the research objectives, research questions, and the significance of the study will be discussed, setting the foundation for a deeper understanding of the relationship between social sector spending and economic growth in Malaysia.

1.1 Research Background

Economic growth is vitally important for improving living standards and fostering long-term national development. Economic growth is typically measured by the rise in real Gross Domestic Product (GDP), representing a country's increasing production of goods and services (Rodrik, 2014). Sustained economic growth has led to higher income levels, more job opportunities and better public services, all of which improve people's well-being. In addition, economic growth promotes innovation, enhances global competitiveness, and increases resilience to economic downturns, making economic growth an essential element of long-term national development (Kadir and Karim, 2012).

Figure 1.1:

Annual Real GDP (in RM million) in Malaysia



Source: Government of Malaysia (2024). Annual Real GDP: 1990 to 2023

Over the past few decades, Malaysia's economy has grown significantly, making it one of the newly industrialised countries in Asia. With an average annual growth of 2.8 per cent between 1990 and 2010, Malaysia's GDP per capita was able to move up into the upper-middle income category according to the World Bank's standard classification (Cherif and Hasanov, 2015). Based on Figure 1.1, it shows that there is an upward trend in the country's economic growth, with a little drop in the most recent 2020 when the pandemic hit. The country's growth is observed to have slowed down sometimes throughout the years. The graph shows a drop in GDP during 1997 and 2008.

Based on Malaysian Investment Development Authority (2023), Malaysia's economy has gone through several unanticipated events such as the Asian Financial Crisis in 1997, the World Economic Crisis in 2008 and the Covid-19 pandemic in 2020. In response to these events, Malaysia government employed a well-managed spending strategy that help in economic recovery and long-term economic development. These measures include the way that government targeted fiscal policies, budget adjustments, and increased public expenditure aimed at restoring foreign investors' confidence (Khoo et al., 2024).

In response to the most recent Covid-19 outbreak, the government of Malaysia imposed the Movement Control Order (MCO) which had severely strained the country's economy. The GDP of Malaysia was reported to have decreased by 17.2 percent in the second quarter of 2020 and by 0.5 percent more in the first quarter of 2021. The prolonged COVID-19 epidemic has forced governments to take countercyclical measures to lessen the effects of the crisis. In this situation, the federal government stimulated the economy with a large fiscal infusion, implementing an early policy reaction (Ministry of Finance Malaysia, 2020).

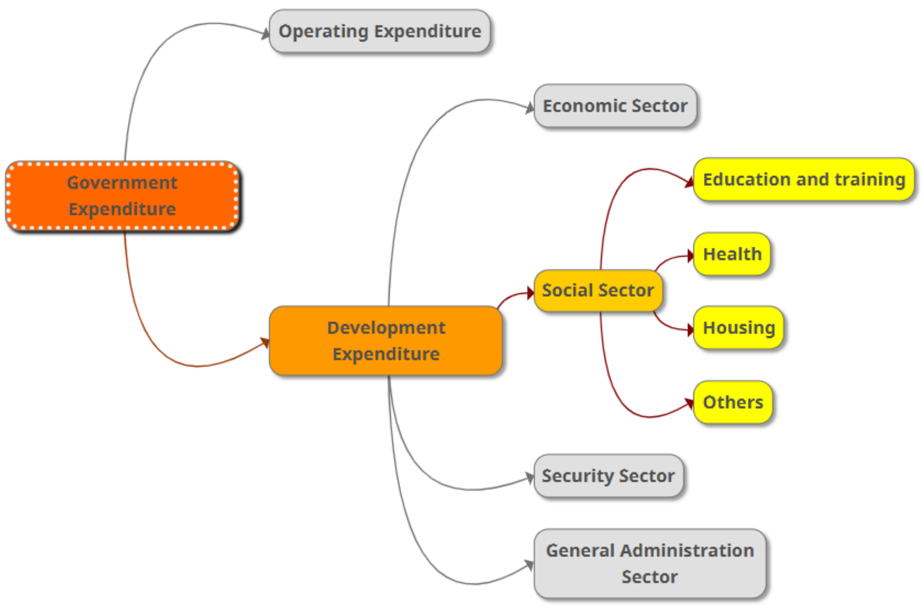
The primary response to the economic challenge that COVID-19 presented for Malaysia was the 2020 Economic Stimulus Package proclaimed on the 27th of February, which was RM20 billion in total and RM3 billion in government expenditure. This stimulus package was intended to soften the impact of business shutdowns during the pandemic by boosting struggling sectors, sustaining business operations, and preserving employment. This was the first attempt by the government to stem the economic fall amidst rising uncertainty, which set the pace for several months of unrestrained spending policy (Ministry of Finance Malaysia, 2020).

Furthermore, Covid-19 Fund was established in September 2020 with the purpose of financing the spending associated with the economic stimulus packages and recovery plans. A large part of the fund’s allocation came from the Wage Subsidy Programme (WSP) under the PRIHATIN Economic Stimulus Package. Furthermore, the PRIHATIN SME Grant received an additional RM5 billion to support easing the financial burdens on entrepreneurs (Kannan et al, 2021). At the same time, an amount of RM1 billion was allocated for social support programmes to assist vulnerable populations, including single mothers and disabled persons, through the Jaringan Prihatin Programme and Food Staples Assistance (Ministry of Finance Malaysia, 2020).

These expenditures draw attention to the larger picture of government expenditures as an instrument of economic oversight that has a significant influence on a country’s economic growth (Park and Meng, 2024). A big percentage of the GDP is made up of government expenditure, also known as public expenditures on goods and services. As government expenditure can affect aggregate demand, reallocate income, and provide public goods and services that are necessary for sustainable economic growth, it makes it an important aspect. Malaysia's economic growth has been driven by strategic government expenditure (Tang, 2009). These expenditures not only addressed short-term economic needs but also laid the foundation for long-term economic development (Zain, 2014).

To further illustrate how government expenditure plays a role in the economy, an example is provided to strengthen the idea. Since its independence in 1957, Malaysia's economy has shifted from being heavily dependent on agriculture and commodities to being more diversified and having large manufacturing and service industries. Strategic government expenditures in major industries including infrastructure, healthcare, and education have greatly aided in this transition. Besides fostering diversity in the economy, these investments have also increased the country's income level from lower to upper middle-income (World Bank, 2024).

Figure 1.2:
Structure of Government Expenditure

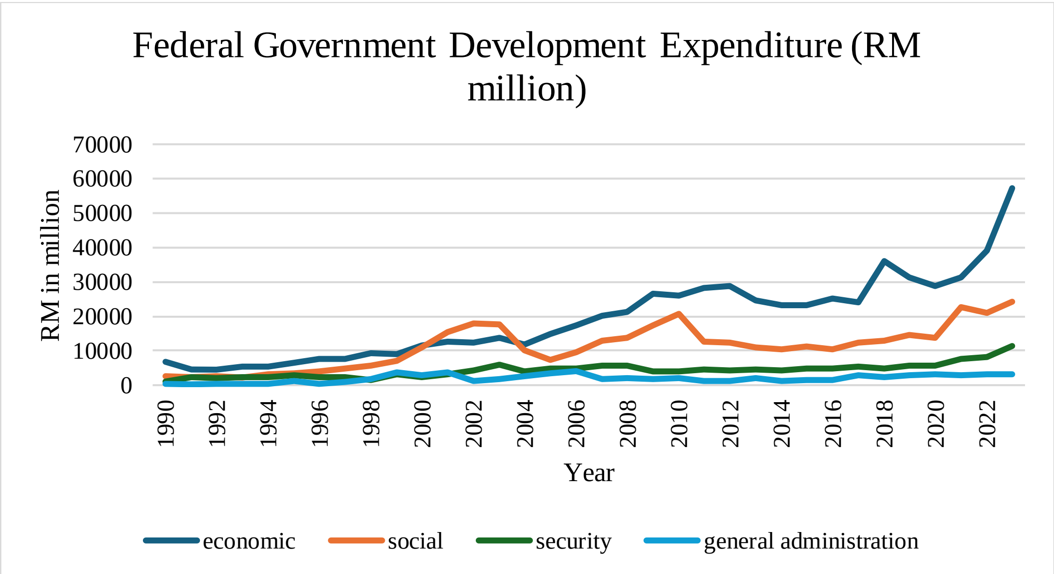


Source: Author's own creation.

Let's examine the expenditure framework of Malaysia. The federal expenditure for Malaysia consists of three sections: Operating Expenditure (OE) and Development Expenditure (DE). The Operating Expenditure includes agriculture and rural development, energy and public utilities, trade and industry, transport, communications, and environment, while DE general administration, social services, economic services, and security (International Monetary Fund, 2024). Operating Expenditure has historically consumed a large chunk of Malaysia's fiscal budget. This government spending covers current activities such as paying salaries, providing public services, and managing public administration. This type of expenditure has always remained substantial to maintain governmental functions and effectively deliver public services. Even so, it is equally important to point out that there has been a significant increase in DE in the last few years which is supposed to be good for the long-term economic growth of our country. For instance, expenditure on investments related to housing as well as healthcare and education and training are classified as DE. There was a dip in OE during the Covid-19 pandemic, while DE rose relentlessly to recover the economy. This was also due to a notable surge in the health sub-sector which is part of the social services sector under DE (Ministry of Finance Malaysia, 2024).

Figure 1.3:

Federal Government Development Expenditure (RM million) in Malaysia

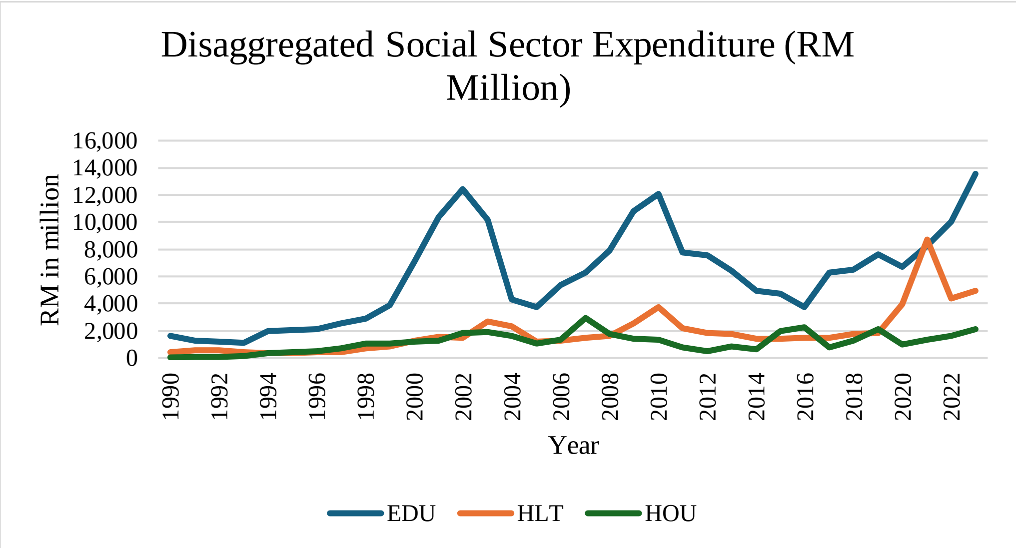


Source: Government of Malaysia (2023). Annual Federal Government Development Expenditure by Function

Based on Figure 1.3, we can see that the economic subsector consistently receives the highest allocation of development expenditure. Spending in this subsector grew from RM 6,701 million in 1990 to a projected RM 57,238 million in 2023. The social subsector expenditure has also seen steady growth, rising from RM 2,617 million in 1990 to an estimated budget of RM 24,247 million in 2023. However, its share relative to the economic subsector has remained lower. Moreover, security had a decline in the 1990s and 2000s. General administration expenditure has remained relatively low compared to the other subsectors, ranging from RM 310 million in 1990 to an expenditure of RM 3,225 million in 2023.

Figure 1.4:

Disaggregated Social Sector Expenditure (RM Million) in Malaysia



Source: Government of Malaysia (2023). Annual Federal Government Development Expenditure by Function

In this study, the focus will be on the social sector classified under DE comprised of education and training, health, and housing. Given that the economic subsector has always been recorded as the highest expenditure subsector, this has been a consistent trend and is well-documented. Therefore, this study shifts attention to the social sector to explore its role and impact on economic growth, providing insights that are often overlooked in favour of the economic subsector. The first and highest expenditure subsector of the social sector is education and training. Education includes the primary, secondary and tertiary education level. In comparison to Singapore and Thailand, Malaysia's government spent the greatest percentage of GDP on education (UNESCO, 2024). The expenditure on education is primarily on the construction of additional schools and upgrading current ones.

Besides, there is the health subsector. There is a sudden increase of expenditure between 2020 and 2022 as Covid-19 happened. The Malaysian government spends large amounts of funds on healthcare to guarantee that people have access to high-quality medical care (Wong and Yusoff, 2019). This includes programs that enhance the accessibility of necessary medications and medical personnel, as well as investments in public clinics, hospitals, and medical infrastructure (Jakovljevic et al., 2020). Various public health initiatives are also funded by the government. News from the New Straits Times (2024) said that Malaysia is expected to experience some of the fastest growth rates in Asean for medium-term health expenditures. On top of that, the health subsector has a forecasted increase in budget in 2024 for constructing and upgrading healthcare facilities and acquiring medical supplies (Ministry of Finance Malaysia, 2023).

Moreover, the housing subsector expenditure is spent on the construction of government quarters and affordable houses for people (Ministry of Finance Malaysia, 2023). To provide low-income families access to affordable housing, the government is investing significant funding in public housing initiatives like the People's Housing Program (PPR). Offering first-time homebuyers financial aid and discounted housing units, these programs seek to close the housing gap, especially in urban areas where housing demand is high (Yurnal and Saiful Adli, 2018). According to Azmi et al. (2023), there will be a total of RM 2.47 billion in government expenditure allocated to the PPR program.

Thus, it begs the question of whether the government's expenditure behaviors are influencing this strong economic performance in light of the increasing growth rates noted by Bank Negara Malaysia in these years and the expenditure of funds presented in past reports. In this study, we focus on the relationship between aggregate and disaggregate government spending and economic development in Malaysia from 1990 to 2023.

1.2 Research Problems

Through fiscal policy, governments can influence aggregate demand, create jobs, and stimulate investment in key sectors such as infrastructure, education, and transportation. To achieve sustainable growth, it is essential that government expenditure is allocated effectively across various sectors. However, the effectiveness of these expenditures depends on whether the government directs the funds to the most impactful sectors. In Malaysia, government development expenditure (DE) has been increasing over the years. According to the Government of Malaysia (2023), it rose from RM11.69 billion in 1990 to RM96.10 billion in 2023. Similarly, the budget allocation for DE has also grown significantly. In 1990, the budget allocated RM9.25 billion for DE, while the 2024 Budget allocates RM90 billion (Aljeffri and Co., 1990; Noris, 2023). However, this continuous rise in spending raises important questions. Are these funds being used in sectors that have the most meaningful impact on long-term growth? Are some sectors being overlooked?

Historically, Malaysia has spent the most on the economic sector, with extensive research showing its significant impact on economic growth through investments in infrastructure, industry, and technology. However, in recent years, there has been a noticeable shift in government spending towards the social sector, which includes education and training, health, and housing (Refer to Figure 1.4). While this sector is receiving the second-highest allocation in DE, there is limited empirical research on how such spending contributes to economic growth. This presents a gap in understanding. It is unclear whether the current social sector investments are producing real economic benefits or if they are being allocated efficiently.

The social sector expenditure has great potential to drive growth. Investment in education and training enhances human capital by equipping individuals with the skills necessary for a competitive workforce, which in turn boosts productivity and innovation (Sairmaly, 2023). Moreover, health spending ensures a healthier population, reducing absenteeism and increasing labour force participation (Raghupathi and Raghupathi, 2020). Additionally, housing expenditure promotes social stability by addressing affordability issues and improving living standards (Zyed, 2014). Yet, the actual long-term and short-term effects of these investments on Malaysia's growth have not been adequately examined through empirical models.

This issue became even more important during the COVID-19 pandemic. The crisis exposed weaknesses in public health, digital education access, and housing affordability. For instance, Malaysia's public hospitals were overwhelmed at the height of the health crisis, ICU bed occupancy rate rose from 96 percent to 104 percent (Free Malaysia Today, 2021). Besides, Selvanathan et al. (2020) found that about 52 percent of students in Sabah did not have internet access. This was mainly due to poor infrastructure in the state. Regarding housing, many households struggled to afford rent and utility payments due to income loss during the pandemic. Without liquid assets, they faced difficulties meeting these basic needs (Roll and Despard, 2020). These findings show that the social sector needs more attention and support. Strengthening education, healthcare, and housing can help the country handle future crises better and reduce socioeconomic disparities. As development spending increases, it is important to look closely at how funds are used in these areas to ensure they truly help grow the economy in a stable and fair way.

In conclusion, the impact of government expenditure on economic growth depends on how effectively funds are allocated across key sectors, especially the social sector. This sector has often been overlooked, despite its importance for long-term economic resilience. The COVID-19 pandemic highlighted the need for stronger investment in education, healthcare, and housing to reduce vulnerabilities and support sustainable development. These concerns show why it is necessary to study how social sector spending contributes to Malaysia's economic growth.

1.3 Research Objectives

The main objective of this study is to investigate the relationship between aggregate and disaggregate government spending and economic growth in Malaysia.

Specific Objective:

1. To examine the impact of aggregate government development expenditure on economic growth in Malaysia.
2. To examine the impact of aggregate social sector expenditure under development expenditure on economic growth in Malaysia.
3. To examine the impact of different categories of social sector expenditure (education and training, health, and housing) on economic growth at a disaggregated level in Malaysia.
4. To examine the short-run and long-run relationship between development expenditure (both aggregate and disaggregated) and economic growth in Malaysia.

1.4 Research Questions

1. What is the relationship between aggregate government development expenditure and economic growth in Malaysia?
2. What is the relationship between aggregate social sector expenditure and economic growth in Malaysia?
3. What is the relationship between disaggregated social sector expenditure (education and training, health, and housing) and economic growth in Malaysia?
4. What is the short-run and long-run relationship between government development expenditure (both aggregate and disaggregated levels) and economic growth in Malaysia?

1.5 Significance of Study

This study aims to examine the impact of development expenditure in the social sector, specifically education and training, health, and housing on Malaysia's GDP growth. Firstly, this study is important as it provides insights for policymakers to design and implement more effective fiscal policies. By examining the relationship between government expenditure in the social sector and Malaysia’s economic growth, the study enables policymakers to make informed decisions on budget allocations. These insights will help government expenditure maximises economic benefits, which is vital for Malaysia’s goal of transitioning from an emerging market to a developed economy.

Secondly, this study analyses how government spending in the social sector affects GDP growth in both the long and short term. This will assist the government in optimising its spending strategy to promote long-term, sustainable economic growth. Additionally, the findings will support Malaysia’s aim to achieve balanced and inclusive development by making sure the benefits of growth are widely distributed across the society.

Lastly, this study contributes to the ongoing academic discussion on the role of public spending in driving economic growth. By focusing on Malaysia, it offers a clearer understanding of how government expenditure in the social sector relates to the country’s economic performance. Using data from 1990 to 2023, the study provides a comprehensive picture of how different types of social sector expenditures affect Malaysia's economic trajectory.

In conclusion, this study addresses a gap in research regarding the impact of social sector expenditures on economic growth in Malaysia. Most past studies have focused on overall public spending or infrastructure, but this study looks closely at education and training, health, and housing, areas that have not been thoroughly researched.

1.6 Conclusion

Next chapter will analyse the relationship between these expenditures and key economic indicators like labour and capital. By using time series econometric methods, the research will offer insights into how social sector expenditure contributes to economic performance. The findings will help policymakers, government and relevant stakeholders optimise expenditure strategies to promote sustainable growth.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

Increasing government expenditure particularly in social sectors has influenced fiscal policy and prompted ongoing debate among economists regarding its true impact on GDP. A review of literature shows that scholars have explored and analysed the relationship between government expenditure and economic growth.

2.1 Underlying Theories

2.1.1 Classical Growth Theory

The early economic theories of growth and development centered around the Classical Growth Theory which has highlighted labour and capital accumulation as the main factors behind economic progress. This theory which was developed early on by economists like Adam Smith, David Ricardo, and Thomas Malthus proposes that economies expand as a result of the accumulation of productive resources, namely labour and capital (Eltis, 2000).

Moreover, Malthusian idea inspired by Malthus within this framework also stated that the population increase will only lead to resource scarcity when affected by factors such as disease or poverty (Aronoff, 2016). The Malthusian approach emphasizes the importance of environmental constraints on the classical model, highlighting how the limited availability of natural resources will eventually halt economic growth in the absence of technological innovation or other external forces (Hassler et al., 2021). However, due to its limited consideration of technological progress, innovation, and policy-driven factors such as government expenditure, the Classical Growth Theory is not fully suitable for this study.

2.1.2 Neoclassical Growth Theory

Following the Classical Growth Theory and its Malthusian concerns, economic theory continues to develop to address the constraints imposed by resource scarcity and the lack of long-term growth drivers in the classical framework. As a result, Robert Solow's work contributed to developing the Neoclassical Growth Theory in the middle of the 20th century. The Neoclassical Growth Theory introduced a more structured production function, which is generally stated as $Y = f\left(L_t^{\alpha} K_t^{\beta}\right)$, where Y stands for output, K for capital, and L for labour. This shifted the focus from the traditional factors of production, which are labour, capital, and land (Das et al., 2015; Felipe and McCombie, 2024).

The incorporation of an exogenous technological element, A, in the later version of the production function, $Y = A_t f\left(L_t^{\alpha} K_t^{\beta}\right)$, is the most important development in the Neoclassical Growth Theory. The premise that capital and labour alone cannot support long-term economic growth is reflected in this adjustment. Instead, the main factor behind continuous economic growth is the advancement of technology (Rumanzi et al., 2021). Technology advancement is viewed in this model as exogenous, which means that it is not explained by the framework itself but rather is determined by variables outside of it (Şerban, 2020).

While the Neoclassical Growth Theory represents a major theoretical improvement by incorporating technology into the growth process, its treatment of technological progress as an exogenous factor limits its applicability to this study. Since this study focuses on internal drivers of growth such as aggregate government expenditure and social sector investment, it requires a model that allows such factors to influence growth from within the economic system itself.

2.1.3 Endogenous Growth Theory

Endogenous growth theory is then developed as a result of the inadequacies of Neoclassical growth theory as they overemphasized technology as an external factor and oversimplifies the process of economic growth (Smorodinskaya et al., 2019). Endogenous growth theory addresses the existence of technological advancement and other development factors as endogenous within the economic system, instead of viewing them as exogenous factors. The model can accurately capture long-term economic trends which had been a struggle back when technological progress is treated as an exogenous factor.

Building on this perspective, Romer (1994) emphasizes that the income per capita has increased since the industrial revolution, but the increase cannot be fully explained by the technological progress posits by the Neoclassical growth theory. In fact, Romer states that the decisions made by the public and private sectors greatly influence the rate of growth in different countries. Similar to neoclassical growth theory, endogenous growth centers on the overall economic behavior. The theory states that public goods, infrastructure, and human capital investments are key components of economic growth (Sardoni, 2024). On top of it, several studies state that the theoretical framework of this study is based on the Cobb-Douglas production function (Wong and Yusoff, 2019; Yushkov, 2015; Mahaboob et al., 2019).

$$Y = f\left(A_t L_t^{\alpha} K_t^{\beta}\right)$$

The model can be interpreted as where A_t represents the technology at time t, K represents the amount of capital, L represents the labour while α and β are the output elasticities of labour and capital, respectively (Wulan, 2014). In this model, output rises when workers and capital are added, whereas technology will also be influenced by these endogenous factors.

2.2 Review of Literature

2.2.1 Government Development Expenditure on Economic Growth

Research on the relationship between government DE and economic growth has received widespread attention over the years as scholars continue to debate the topic. However, scholars have not reached a consensus on the issue. Some studies, such as those by Gurdal et al. (2021), and Kirikkaleli and Ozbeser (2022), suggest that government spending positively influences economic growth. In contrast, other studies, including Phiri (2019), Onifade et al. (2020), and Hlongwane et al. (2021), argue that government spending negatively affects economic growth. Theoretically, Keynesian economics supports the idea that government spending drives economic growth, while the Classical perspective believes it harms the economy. However, Wagner proposed that higher economic activities is the causal effect of higher government expenditure. On the other hand, the Ricardian Equivalence model suggests that government expenditure has no impact on economic growth when individuals are anticipating future outcomes (Badaik and Panda, 2022).

The positive correlation between government DE and economic growth means that when the government increases spending on areas such as infrastructure, education, or healthcare, the economy tends to perform better. This is because more spending creates jobs, boosts demand for goods and services, and raises the economy’s productive capacity. Numerous studies across various contexts and periods support this view. For instance, Anwar, Ahuja, and Pandit (2020) and Hlongwane et al. (2021) found that a 1 per cent increase in government spending can raise economic growth by 0.15 per cent, with benefits for education and investment in surrounding regions. Zulkifli et al. (2022) find that from 1980 to 2020, development expenditure overall had a positive and significant impact on Malaysia’s economic growth. However, certain social sector components like education, healthcare, and gross fixed capital formation showed negative significance in some cases. This means that while development spending helps growth, the effectiveness of specific sectors depends on how efficiently resources are allocated and used. Similarly, Acikgoz and Cinar (2017), Nartea and Hernandez (2020) also identified a positive correlation between expenditure and growth across 21 developed countries and 12 provinces respectively. Additionally, research by Hyer and Kulkarni (2018) in the U.S. and Laboure and Taugourdeau (2018) across 147 countries highlights that government DE particularly in low-income nations, significantly contributes to economic growth. Besides, Mishra and Mohanty (2021), Gurdal et al. (2021) further confirmed that government spending has a favourable and statistically significant impact on growth, with causality running in both directions. Furthermore, Kirikkaleli and Ozbeser (2022) showed that even though growth leads to more spending in the long run, government expenditure becomes crucial during downturns to help the economy recover.

On the other hand, the negative relationship between government DE and economic growth suggests that when government spending increases, economic growth can slow down. This might happen if the spending leads to inefficiencies, misallocation of resources, or if it crowds out private sector investment. Several studies support this view. In South Africa, Chipaumire et al. (2014) found that a 1 per cent increase in government spending caused a sharp 6.54 per cent drop in GDP. Molefe and Choga (2017) also confirmed that higher public spending can harm economic growth. Masipa (2018) further supported this view, finding that in South Africa, a 1 per cent increase in spending reduced economic growth by 0.2 per cent. Other findings across different countries and periods support the same idea. Eid and Awad (2017) showed that in one state, government consumption expenditure might boost growth but reduce it by 0.25 percent in another. Phiri (2019) discovered that an inverted U-shaped relationship where initial military spending boosts growth but eventually leads to a decline. Furthermore, Mose (2020) reported that a 1 per cent rise in government DE negatively impacts regional growth by 0.02 per cent with no long-term causal relationship between growth and expenditure components.

2.2.2 Government Development Expenditure in Social Sector on Economic Growth

Social sector expenditures, including those on education, health, housing and others, have positive externalities that improve the living standards and well-being of both individuals and society. These expenditures contribute to the Human Development Index (HDI), which is central to measuring economic growth and development. Sustainable development goals (SDGs) aim to protect the environment, address climate change, and promote prosperity. To achieve these goals requires reforms and increased spending in the social sector (Unacademy, 2022).

Mishra et al. (2019) find a strong long-run relationship between social sector development and economic growth across Indian states. The study shows that public spending on areas like health, housing, sanitation, and social welfare positively contributes to growth. It also notes uneven spending across states, which has caused disparities in development. However, the results predict convergence over time, suggesting that balanced investment in the social sector can promote inclusive and sustained economic growth. This result is also supported by Ayuba (2014) and Khan and Bashar (2015). It used Vector Error Correction (VEC) model-based causality to analyse the impact of SOCIAL on economic growth in Nigeria from 1990 to 2009. Moreover, Sinha (2023) finds a strong link between social sector spending and economic growth in India. Most areas like education, housing, and welfare show two-way causality with GDP, while health spending impacts growth in one direction. This shows social spending plays a key role in driving development. Besides, Demiral and Alper (2016) demonstrate that government expenditures on education, health, and social protection significantly enhance economic growth in OECD countries, with education showing the strongest impact. Their findings confirm that social sector spending serves as a profitable public investment, aligning with endogenous growth theory's emphasis on human capital development. The study concludes that such expenditures not only address market failures but also foster growth through multiple channels including productivity gains, innovation, and equitable welfare distribution (Demiral and Alper, 2016). Lastly, Zawawi et al. (2024) showed that SOC has a significant short-term impact on economic growth. In the long term, investment in housing and education are driving Malaysia's economic expansion (Zawawi et al., 2024).

Several studies have shown that social sector spending does not always promote economic growth and may even have an adverse impact in some cases. For example, a study analysing social spending plans in 22 EU countries between 1990 and 2015 found that while social spending reduces poverty and inequality, there is no positive correlation between total public social spending and GDP growth and may even be negatively correlated due to cyclical factors and measurement issues (Aban and Garcia-Vigonte, 2022). Research in Greece and other countries using vector error correction models (VECM) found a significant negative effect of government expenditure on social security on economic growth in the long run (Owino, 2017). Similarly, some studies in African nations found a negative causal relationship between state spending on education and health and economic development, often attributed to corruption and inefficiencies (Eggoh et al., 2015). Besides, Cammeraat (2020) finds that total social sector spending in 22 EU countries from 1990 to 2015 reduces poverty and inequality but does not have a clear impact on GDP growth. The effect on growth varies across spending categories, suggesting that only certain types of social expenditure, like health or housing, may contribute more directly to economic performance. This highlights the need for targeted and efficient allocation of social spending to support both welfare and growth goals.

2.2.3 Education and Training Expenditure on Economic Growth

Education spending is viewed as an investment in human capital, as it builds skills, enhances employability, and creates a more capable workforce (Hasnul, 2015). Jovović (2017) have emphasized that long-term economic growth heavily relies on education and training. In developed countries, government spending on education often focuses on the quantity of education rather than the quality and broader learning environment. Several factors that may affect the returns on educational investments, including environmental and family factors and disparities in educational quality (Hanushek et al., 2008). Ignoring these factors may limit the understanding of how education helps to build human capital and support economic growth (Hanushek and Woessmann, 2011). When implemented effectively, education and human capital produce positive impacts on the economy and society. Individuals benefit through improved employment, income, and health, while society gains from stronger long-term growth, reduced poverty, greater innovation, and improved social connections (Ministry of Education, 2015).

Hence, EDU are acknowledged as key drivers of economic growth, with numerous studies highlighting their positive impact on development. Babatunde (2018), Ota and Benjamin (2021) and Suwandaru et al. (2021) emphasized that investment in education infrastructure, along with transportation and communication, contributes positively to economic development particularly during democratic periods. Research by Ibrahim (2016) in Nigeria from 1980 to 2014, Chin et al. (2021), Forson et al. (2021) and Akingba et al. (2018) in Singapore from 1980 to 2013 both found that EDU has a positive effect on GDP growth. Furthermore, Yakubu and Gunu (2022) advocated for policies that ensure all students have access to high-quality education, noting that creative skills developed through education can improve economic outcomes. Similarly, Nenbee and Danielle (2021) suggested increasing the education budget to meet UNESCO’s recommendations, believing that better-funded education systems can drive economic growth.

Research has also identified cases where EDU does not always lead to positive economic outcomes. Nayak and Palita (2021) observed that despite improvements in physical infrastructure, public schools in their study still provided poor educational quality. This suggests that investment in infrastructure alone may not improve economic performance if the quality of education is not simultaneously addressed. Similarly, Kamis et al. (2020) and Forson et al. (2021) found that in Malaysia and 25 economies in sub-Saharan Africa, respectively, education expenditure had a negative relationship with economic growth. Additionally, studies by Suwandaru et al. (2021), Abubakar and Mamman (2020), and Gifari (2016) showed that EDU had no significant impact on economic growth in Indonesia, Malaysia, and 37 OECD countries. This suggests that the link between

EDU and economic performance is not always clear. According to Zhu (2016), graduates from special education, primary schools, high schools, and junior middle schools had no significant impact on economic growth in China (2000–2010). From these studies, the positive impact of education outweighs the negative effects.

2.2.4 Health Expenditure on Economic Growth

Public health expenditure is a social welfare expenditure that benefits people's lives and well-being and invests in a country's health capital. It can improve population health, which contributes to a more effective labour force. According to previous research data, the capital and macro investment return rate in member countries of the Organization for Economic Co-operation and Development (OECD) from 2005 to 2020 had a fluctuating downward trend (Yang et al., 2022). A well-developed social security system improves citizens' health conditions, increases workforce participation, and supports faster economic and social development. Hu and Wang (2024) noted that appropriate HLT can also help to prevent excessive inflation in social consumption and maintain economic and social stability. Therefore, countries rely on investments in healthcare and other social welfare functions to improve citizens' health and work efficiency, ensure the labour market is active, and support steady economic growth. (Hu and Wang, 2024).

The relationship between healthcare spending and economic growth is broad and often shows a positive connection. Higher HLT often contributes to higher productivity by improving the health and efficiency of the workforce, which in turn drives economic growth (Piabuo and Tieguhong, 2017; Kurt 2015). Studies have shown that healthier populations are more productive, leading to higher GDP and overall economic performance. This was supported by Raghupathi and Raghupathi (2020), Kamis et al. (2020), Seo et al. (2019), and Dali (2014). In Malaysia, Kamis et al. (2020) found that from 1987 to 2016, increased health spending had a strong and positive impact on growth through gains in productivity. This aligns with Chin et al. (2021), who found similar positive effects in countries participating in the Belt and Road Initiative (BRI) from 2000 to 2015. Likewise, Uddin et al. (2020) showed that among 120 developing countries in the Organisation of Islamic Cooperation (OIC) and non-OIC nations with higher health spending experienced faster growth from 1996 to 2016. This was supported by Ahsan and Haque (2017), who found that greater healthcare investment helped boost economic performance. Moreover, healthcare spending is seen as an investment in human capital. It brings long-term benefits such as longer life expectancy, better education outcomes, and enhanced labour productivity (Anand and Sen, 2000). However, Yang (2020) pointed out that in some developing countries, HLT reduced growth by 0.07 per cent, though this negative impact can be lessened if human capital levels are high (Raghupathi and Raghupathi, 2020).

Although healthcare spending usually supports economic growth, the relationship is not always straightforward. In some cases, increased health expenditure can result in diminishing returns, especially when the spending is poorly managed or draws resources away from other important sectors (Agénor, 2008; Boucekkine et al., 2008). Additionally, high healthcare costs can also burden economies, particularly in developed nations. This is a concern in developed countries, where healthcare often makes up a large share of GDP and may contribute to slower economic growth (Piabuo and Tieguhong, 2017; Oni, 2014; Erdil and Yetkiner, 2009). The effect of HLT on growth depends on how well it is used. If the funds are not allocated efficiently, the economic gains may be limited (Andrade et al., 2018; Beckerman, 2017; Weil, 2014). For instance, Ibrahim (2016) and Gifari (2016) both found that there is no significant link between HLT and GDP, implying that other factors might influence the relationship or that its impact is context-dependent. Similarly, Aísa and Pueyo (2006), Ghosh and Gregoriou (2006) found that health spending had a negative impact on economic growth in certain countries. These outcomes suggest that inefficient or excessive spending may limit progress. Moreover, some researchers also note that the relationship between healthcare spending and growth is nonlinear. It may show threshold effects, where spending boosts growth only up to a certain point. After that, the effect may decline or even reverse (Carrion-I-Silvestre, 2005; Cha and Luo, 2015).

2.2.5 Housing Expenditure on Economic Growth

In the context of government expenditure, housing expenditure refers to the funds allocated or used by the government for housing-related subsidies, projects, or programs. The reason for such spending is to address the housing needs of the population, promote affordable housing, and resolve various issues within the housing sector. Additionally, through various initiatives, the recovery of the housing sector can stimulate the economy and contribute to overall growth (Zawawi et al., 2024).

Government spending on housing has consistently shown a positive impact on economic growth through various interconnected mechanisms. For instance, HOU contributes to economic growth by improving health, employment conditions, and the financial sector (Hasnul,2015; Poku et al.,2022; Doling et al., 2013). Besides, Kumar (2021) highlighted that housing investments, such as the subsidized housing lottery in Mumbai, significantly improved population welfare and drove economic development. During economic shocks like the Covid-19 pandemic, Molidya and Fanggidae (2020) observed that housing subsidies are essential in maintaining economic stability, highlighting the resilience created by strategic housing expenditure. Afonso and Sousa (2012) also discovered that government spending positively affects house prices over the long term, suggesting lasting benefits for economic growth. However, Kunovac and Zilic (2022) noted that while housing subsidies can bring immediate economic benefits, they may disrupt market dynamics. This means that the need for careful management of housing policies to ensure their positive impact on growth.

The relationship between HOU and economic growth is complex, with both positive and negative impacts depending on the situation. On the negative side, studies consistently found that increases in government spending can crowd out residential investment, leading to significant declines in this sector without necessarily raising interest rates (Ramey and Shapiro, 1998; Edelberg et al., 1999; Mountford and Uhlig, 2005). Similarly, Agnello and Sousa (2013) and Andres et.al. (2015) also found that positive fiscal shocks often lead to a gradual and persistent decrease in housing prices. This suggests that while government spending may stimulate certain areas of the economy, it can also depress residential investment and weaken the housing market.

On the other hand, the impact of HOU on economic growth can also be mixed or sector specific. Ismail et al. (2010) found that while operating expenditure generally correlates positively with household consumption, the effects of development expenditure, including housing, are more complex. Only certain sectors show positive impacts. Similarly, Fatás and Mihov (2001) and Wigren and Wilhelmsson (2007) pointed out that government infrastructure and housing investments often have ambiguous and sometimes weak effects on long-term growth, even though short-term benefits may still be observed. Moreover, Kunovac and Zilic (2022) argued that housing subsidies can disrupt market dynamics and contribute to inflation, which may undermine the expected economic benefits.

2.2.6 Control Variable: Labour

In this study, employment data will be used as a proxy for labour. According to classical thinking, labour is one of the key factors of production in the economy (Nadilla and Ichsan, 2023). Employment serves as a link between economic growth and poverty reduction. Economic growth leads to job creation, which in turn provides more employment opportunities. This increase in jobs helps raise the income of poorer individuals. With higher earnings, workers can invest more in education, improving their children's skills and productivity. This, in turn, creates the conditions needed for further economic growth in the future (Sudrajat, 2008).

Studies in Indonesia by Nadilla and Ichsan (2023) show that higher labour force participation rates have a positive and significant effect on GDP in the short term. However, in the long term, the L shows a positive but insignificant impact on economic growth. This means labour can support growth in the short term, but its influence weakens over time (Nadilla and Ichsan, 2023). Similar findings appear in studies by Azzaky (2022) and Dahal and Rai (2019), where short-term effects are positive, yet long-term results are insignificant. Moreover, Rozmar et al. (2017) in Jambi Province which found that long-term labour force participation does not significantly impact economic growth. In contrast, Zulu and Banda (2015) observed a steady positive link between labour and output per worker in Mauritius and South Africa, especially in sectors with high capital use. A study on Nigeria from 1990 to 2021 found that both male and female labour force participation rates had a positive and significant impact on economic growth in the short run, though their long-run effects were statistically insignificant (Romanus and Nkechi, 2024).

The relationship between government spending on L and economic growth can show negative effects. According to Haider et al. (2023) and Akcoraoglu (2010), the study suggests that in developing countries, the connection between employment and growth is weak, potentially leading to jobless growth. They suggest that policymakers should shift their focus towards employment-led growth strategies instead of growth-led employment policies (Haider et al., 2023). Furthermore, Gagnon et al. (2021) also noted that ageing populations reduce GDP growth by slowing down both employment and productivity. Research by Samans et al. (2017) suggests that while many developing countries experience significant economic growth, this growth does not necessarily lead to employment creation. In support of this, Berg et al. (2012) and An et al. (2017) both discovered that in low and lower middle-income countries, economic growth does not always lead to better employment outcomes. Berg et al. (2012) observed that slowdowns were linked to slower employment growth, but GDP upturns did not always lead to more jobs, highlighting a lack of synchronization between the two. Similarly, An et al. (2017) explained this gap through factors like poverty, skill mismatches, and the nature of growing industries, confirming a weak and often negative relationship between economic growth and employment.

2.2.7 Control Variable: Capital

The relationship between capital and economic growth involves both human and natural elements. Capital refers to financial resources and physical assets used in production. It is vital in improving productivity and encouraging innovation (Hexmoor, 2015). Human capital, especially when supported by education and skills training, helps boost productivity and supports technological progress. At the same time, natural capital, such as natural resources, may not always support growth. In some cases, countries that depend too much on natural resources experience the "resource curse," where other sectors are neglected, reducing trade and limiting foreign investment. To support long-term growth, countries must manage both types of capital wisely and strike a good balance between them (Diamond and Heller, 1989).

The relationship between K and economic growth is largely positive, as shown by many studies. Solow (1956) explained that capital flows from developed to emerging countries lead to more efficient resource allocation, facilitating growth in emerging economies. Fischer (1997) and Summers (2000) also pointed out that these capital flows increase long-term profitability for both developed and developing nations, thereby promoting economic growth. In addition, endogenous growth theories, such as Romer's (1986) model emphasis on human capital and knowledge, which are built through capital investment, play a key role in creating new technologies. These innovations are necessary for continuous economic growth. Moreover, Gross Fixed Capital Formation (GFCF) has been identified as a critical component of economic growth across various regions and periods. Meyer and Sanusi (2019) highlighted the importance of GFCF in facilitating economic growth and employment. Empirical evidence from studies like Ledhem and Mekidiche (2021) and Chin et al. (2021) demonstrated that GFCF significantly boosts economic growth in Southeast Asia (2013-2019) and in 59 Belt and Road Initiative (BRI) countries (2000-2015). Similarly, Content et al. (2014) found that GFCF, particularly private investment, has a positive and significant impact on economic growth in the Central African Economic and Monetary Community (CEMAC) subregion (1980-2010). In Pakistan, Ali (2017) found that GFCF positively supported long-term growth from 1981 to 2014, while Suwandaru et al. (2021) and Yakubu et al. (2021) confirmed the positive correlation between GFCF and economic growth in Indonesia (1986-2018) and Turkey (1970-2017), respectively, in both the short and long term.

The relationship between capital and economic growth can be complex and sometimes even negative, especially when global capital flows lead to greater macroeconomic imbalances and heighten economic vulnerabilities. For example, Calvo et al. (1996) and Gamra (2009) emphasize that large, volatile capital flows can lead to economic instability, which may hinder economic growth. In addition, Lucas (1990) argues that capital tends to flow mainly among developed countries, which may ignore emerging economies and exacerbate growth gaps. This unequal distribution of capital can cause slower growth in some countries due to insufficient capital inflows. Moreover, rapid capital outflows can trigger severe economic shocks, destabilising financial markets and severely hinder growth. This is confirmed in the studies of Stiglitz (2003) and Rodrik and Subramanian (2009), who discuss how sudden reversals of capital flows can lead to financial crises. Besides, as Billio et al. (2012) point out, the high degree of interconnectedness of the global financial system increases systemic risks, making economies more vulnerable to rapid downturns during crises. Additionally, Minoiu and Reyes (2013) observe that after a financial crisis, the economy often takes a long time to recover, reflecting the long-term negative impact of capital flow disruptions on economic growth.

2.3 Theoretical Framework

Earlier theory such as Classical Growth Theory emphasized capital and labour accumulation, whereas later theory like the Neoclassical Growth Theory introduced exogenous technological progress to explain long-term growth. However, these earlier theories often treated key growth drivers as exogenous to the economic system. In contrast, the Endogenous Growth Theory highlights the internal role of aggregate government expenditure making it especially relevant to this study.

Grounded in this perspective, the study adopts the Cobb-Douglas production function as its theoretical basis, wherein technological progress is not treated as a constant, but instead substituted with key variables. In line with previous studies, such as Owino (2017), technology (A) was substituted with other in the Cobb-Douglas production function. Hence, this study also substitutes A with government expenditures in development (DE), social sectors, and specific components like education, health, and housing. This substitution reflects the endogenous nature of these variables in influencing long-term economic growth. The function expresses the output of an economy in terms of its capital (K) and labour (L) inputs as well as technology (A). Its basic form is:

$$\text{Production function, } Y_t = f\left(A_t K_t^{\beta} L_t^{1-\beta}\right),\ 0 < \beta < 1 \tag{1}$$

To adapt this classical model to the objectives of this study aiming at determining the link between aggregate government expenditure and economic. A is reinterpreted and decomposed into government expenditure components. Accordingly, three theoretical models are proposed:

$$\text{Model 1: } Y_t = DE_t K_t^{\beta} L_t^{1-\beta} \tag{2}$$

$$\text{Model 2: } Y_t = SOC_t K_t^{\beta} L_t^{1-\beta} \tag{3}$$

$$\text{Model 3: } Y_t = EDU_t HLT_t HOU_t K_t^{\beta} L_t^{1-\beta} \tag{4}$$

Based on Model 1, DE is the proxy for A. This equation examines if development expenditure is significantly contributing to GDP. It acts as a baseline to determine if government expenditure, in its wider definition, produces a positive and statistically significant effect on the economy. If positive results, continue to justify further disaggregation.

Building on the results of Model 1, Model 2 isolates the social sector component of development expenditure. Social sector includes government expenditure on education, health, housing, and others. This model helps refine the theoretical understanding by focusing on government expenditure that directly supports societal well-being and development. If the social sector is found significant, it supports further examination of its internal components.

The final model, Model 3, breaks down the social sector into its disaggregated components which are education and training, health, and housing. This detailed structure enables a more precise evaluation of how different subsectors of social investment contribute to economic growth. It allows the model to identify which specific areas of government expenditure are most impactful. As the main focus of this study, it represents the culmination of theoretical refinement informed by the preceding equations.

Under the Endogenous Growth Theory framework, government expenditure in the social sector, specifically education, healthcare, and housing. It plays a direct role in influencing economic growth through its impact on gross fixed capital formation (K) and total employment by status (L).

2.4 Hypothesis Development

This study is to investigate the relationship between aggregate and disaggregate government expenditure and economic growth in Malaysia. Hence, there are hypotheses that were made as shown below:

H_1 = There is positive impact of government **development expenditure** on Malaysia’s economic growth.

H_2 = There is positive impact of **social sector** under government development expenditure on Malaysia’s economic growth.

H_3 = There is positive impact of **education and training** on Malaysia’s economic growth.

H_4 = There is positive impact of **health** on Malaysia’s economic growth.

H_5 = There is positive impact of **housing** on Malaysia’s economic growth.

H_6 =There is positive impact of **labour** on Malaysia’s economic growth.

H_7 = There is positive impact of **capital** on Malaysia’s economic growth.

Table 2.1

Expected relationship with GDP

Variables	Unit Measurement	Expected relationship with GDP
Development expenditure	RM/million	Positive
Social sector under DE	RM/million	Positive
Education and Training	RM/million	Positive
Health	RM/million	Positive
Housing	RM/million	Positive
Labour	RM/billion	Positive
Capital	RM/million	Positive

Source: Author's own work.

2.5 Gap of Literature

Nowadays, most research focus on economic sectors in government expenditure such as infrastructure, industry, and technology. These sectors have been traditionally viewed as the main contributors to national development due to their direct impact on production, trade, and employment. However, this focus has led to a relative neglect of the social sector, which includes areas such as education and training, health, and housing.

While the relationship between government spending and economic growth has been extensively studied in Malaysia, the recent shift in budget allocations toward social development has not been well empirically analysed. Research on the increasing emphasis on social sector expenditure remains limited, especially in understanding how such spending affects long-term economic outcomes. Among the social subsectors, housing is particularly understudied. Despite the growing importance of housing in improving quality of life and addressing urban development issues, housing spending has rarely been included in economic growth models. This creates a knowledge gap in assessing how public housing investment contributes to broader economic growth.

Besides, most existing studies also examine education and training, health, or housing separately, rather than analysing them comprehensively as part of a broader social sector framework. This fragmented approach makes it difficult to understand how different social investments interact and affect economic growth. In addition, the application of disaggregated analysis is also limited in Malaysia. Many studies focus only on total government spending, which cover the different impacts of each spending category. As a result, the policy conclusions drawn from such studies may be too general to guide effective policymaking.

Therefore, this study aims to fill these gaps by examining the impact of both aggregate and disaggregated development spending on Malaysia's economic growth. By including education and training, health, and housing under a unified analysis, this study provides a more complete understanding of the contribution of social sectors expenditure to a country's long-term development.

2.6 Conclusion

Chapter 2 reviewed the theoretical and empirical foundations that support the relationship between government expenditure and economic growth. The literature review then examined existing studies on government development expenditure in both general and social sectors, with specific attention given to education, healthcare, and housing. Additionally, labour and capital are also covered as key control variables, which influence economic performance. The theoretical framework and hypotheses were built on these foundations. Finally, several research gaps were identified.

CHAPTER 3: METHODOLOGY

3.0 Introduction

This chapter provides an overview of the data sources, the variables considered in the study, and the econometric method used for data analysis. The objective is to ensure that the findings are reliable and contribute to understanding the relationship between the aggregated and disaggregated components of social sector expenditure and economic growth in Malaysia. The dataset covers the period from 1990 to 2023, spanning over 33 years. Secondary data has been used for this analysis. The theoretical framework in Chapter 2 already provides a clear picture of relationship between both aggregate and disaggregate government expenditure and economic growth in Malaysia.

3.1 Empirical Framework

To validate the empirical frameworks, we undergo a logarithmic transformation in the context of the Cobb-Douglas production function aligns to minimise forecasting mistakes by streamlining the functional form. Hence, the Cobb-Douglas production function transform to logarithmic:

$$lnY_t = lnA_t + \beta_1 lnK_t + (1 - \beta_1) lnL_t + u_t \qquad (5)$$

3.1.1 Examine the impact of development expenditure on economic growth in Malaysia

From Model 1, the equation undergoes a logarithmic transformation:

$$lnGDP_t = \beta_0 + \beta_1 lnDE_t + \beta_2 lnK_t + (1-\beta_2)lnL_t + u_t \qquad (6)$$

Where,

GDP_t = Real Gross Domestic Product per capita, in RM million

DE_t = Annual Government Development Expenditure, in RM million

L_t = Total Employed persons by status in employment, in person

K_t = Gross Fixed Capital Formation, in RM billion

u_t = Error term

Once this model is proven significant, will proceed to the next model.

3.1.2 Examine the impact of social sector spending on economic growth in Malaysia

From Model 2, the equation undergoes a logarithmic transformation:

$$\ln GDP_t = \beta_0 + \beta_1 \ln SOC_t + \beta_2 \ln K_t + (1-\beta_2) \ln L_t + u_t \qquad (7)$$

Where,

SOC_t = Annual government development expenditure in social sector, in RM million

Once this model is proven significant, will proceed to the Model 3.

3.1.3 Examine the impact of disaggregate components of social sector spending on economic growth in Malaysia

From Model 3, the equation undergoes a logarithmic transformation:

$$lnGDP_t = \beta_0 + \beta_1 lnEDU_t + \beta_2 lnHLT_t + \beta_3 lnHOU_t + \beta_4 lnK_t + (1 - \beta_4) lnL_t + u_t \quad (8)$$

Where,

EDU_t = Annual government expenditure in education and training, in RM million

HLT_t = Annual government expenditure in health, in RM million

HOU_t = Annual government expenditure in housing, in RM million

In Model 1, 2 and 3, the traditional Cobb-Douglas production function is extended by integrating disaggregated components of the government expenditure into the model to better understand their distinct contributions to Malaysia's economic growth. While the standard Cobb-Douglas production function usually includes a technology parameter (A), this study substitutes it with government development expenditure in Model 1. Model 2 replaces it with government development expenditure in the social sector. Model 3 further disaggregates this expenditure into three key components: education and training, health, and housing. This adjustment reflects the endogenous growth theory's emphasis on policy-driven accumulation of human capital and infrastructure as engines of sustained economic development.

3.2 Research Design

Research design is the framework used to achieve objectives and address questions. Being able to clearly describe the techniques used to collect, understand, and evaluate the data helps to further establish the framework. To collect the data needed to solve the problem, the objectives of the study should also be stated (Frey, 2022). Therefore, choosing the best research design is important.

The goal of descriptive study is to offer a greater understanding of the features of a group or phenomenon. It focuses on gathering detailed information about a particular situation. (Kim et al., 2016). Besides, exploratory research focuses on defining and outlining the nature and scope of a problem. It looks forward to future research and is more focused on knowing the issue than testing hypotheses. On top of that, by determining the relationship between variables, causality research explains the relationship between cause and effect. It can predict the course of upcoming trends in development (Shorey and Ng, 2022).

Therefore, causal research was chosen as the research type for this study since the goal of the investigation is to determine the relationship between the dependent and independent variables. As a result, such research provides information for the relationships of causality between variables and offers a solid basis for forecasts in the future.

3.3 Sampling Design

This study analyses the impact of aggregate government development expenditure and disaggregated government expenditure in the social sector, specifically education and training, healthcare, and housing on Malaysia's economic growth from 1990 to 2023.

3.4 Data Collection Method

This study relies exclusively on secondary data to conduct a time series analysis. Secondary data encompasses research information that has been previously collected, documented, and distributed by other scholars through various sources, including academic journals, literature, and official government reports. Researchers can’t collect data through surveys or interviews as the variables studied in this study are tied to economic considerations.

This research study focuses on Malaysia. The dataset in this research is classified as a time series which is characterised by a sequence of data points recorded at various intervals. Time series data is typically organised into different time frames such as annually, semiannually, quarterly, or monthly intervals. For this research, the data has been collected annually, covering from 1990 to 2023, resulting in 34 observations. The collected data will be analysed using EViews 12 software to ensure thorough data testing. To maintain accuracy and reliability, the data has been sourced from reputable institutions including the Department of Statistics Malaysia (DOSM), World Bank Group, Data Government of Malaysia and the Ministry of Finance Malaysia (MOF).

3.4.1 Source of Data and Definitions

Table 3.1:

Source of Data and Definitions

Acronym	**Variables**	**Proxy Used**	**Source of Data**
GDP	Economic Growth	Annual Real Gross Domestic Product per capita in Malaysia	Data.Gov.My ***
DE	Development Expenditure	Annual Federal Government Development Expenditure by Function	Data.Gov.My ***
EDU	Education and Training	Government Expenditure in Education and Training in Malaysia	MOF **
HLT	Health	Government Expenditure in Health in Malaysia	MOF **

HOU	Housing	Government Expenditure in Housing in Malaysia	MOF **
L	Labour	Total Employed persons by status in employment, Malaysia	DOSM * and MOF**
K	Capital	Gross Fixed Capital Formation (GFCF) in Malaysia (Constant LCU)	World Bank Data

*Notes. * Department of Statistics Malaysia*

*** Ministry of Finance Malaysia*

****Data Government of Malaysia*

Source: Author's own work.

3.5 Proposed Data Analysis Tool

3.5.1 Unit Root Test

One common econometric method for assessing a time series' stationarity is the unit root test. To evaluate this property, the test results are compared with the original data. Under the null hypothesis, a time series is considered to have a unit root which suggests that the series is non-stationary. Conversely, the alternative hypothesis claims that the time series may be classified as stationary. If a time series' mean, variance, and covariance don't change over time, it's considered stationary.

Results from regression models with non-stationary time series variables are frequently deliver unreliable results. Usually, these models have a significantly low Durbin-Watson statistic ($R^2 > DW$) together with an unnaturally high R-squared value which is close to 1. Furthermore, even though there is no meaningful theoretical or practical relationship between the two variables, this situation may wrongly imply a great statistical significance of the independent variable in influencing the dependent variable (leading to the rejection of H_0 in a t-test at a 0.01 significance level).

3.5.1.1 Augmented Dickey-Fuller (ADF)

When analysing the relationship between variables in a time series, it is essential to assess the stationarity of the underlying variables. Thus, the Augmented Dickey-Fuller (ADF) test can be used to assess if the time series is stationary or non-stationary. This assessment is critical for reducing the risk of spurious regression results, which can occur when non-stationary data is used in regression models.

The ADF model is shown in the equation with intercept and trend:

$$\Delta Y_t = \beta_1 + \beta_{2t} + \gamma Y_{t-1} + \alpha_i \sum_{i=2}^{p} \Delta y_{t=i} + u_t \qquad (9)$$

We account for both an intercept and a trend in the equation. Here, Y_t represents the variable, which could be level of technology, labour, capital, or the types of tax. The term u_t symbolises the white noise residual, which has a constant variance and zero mean. The symbol t refers to the time trend, and Δ represents the differencing operator. The parameters $\{\beta_1, \beta_2, \gamma, \alpha \ldots \alpha_i\}$ form the set of coefficients within the model.

Testing for hypothesis using ADF

$H_0 : \gamma = 0$ (Y_t is non-stationary/ unit root)

$H_1 : \gamma < 0$ (Y_t is stationary)

According to Dickey and Fuller (1979) and Mushtaq (2011), if the test statistic is smaller than the critical value at a particular significance level (1%, 5%, or 10%), the null hypothesis should be rejected and the variables should be regarded as stationary. Conversely, if the null hypothesis, where $\gamma = 0$, is not rejected, it indicates that the unit root is present and the variables are non-stationary.

3.5.1.2 Phillips-Perron (PP)

The Phillips-Perron (PP) test is frequently used in place of the Augmented Dickey-Fuller (ADF) test to determine whether a time series is stationary. It relies on lagged difference terms to control serial correlation in the error term, the PP test employs a non-parametric approach. This research has the expectation that the results will yield conclusions consistent with the ADF test.

Testing for hypothesis using PP

$H_0 : \gamma = 0$ (Y_t is non-stationary/ unit root)

$H_1 : \gamma < 0$ (Y_t is stationary)

3.5.2 Cointegration Test

3.5.2.1 Johansen Cointegration Test

The Johansen cointegration test is applied to evaluate long-term correlations between several time series. The Johansen test is better suited for identifying multiple cointegrating relationships inside a dataset than the Engle-Granger (EG) cointegration test, which only detects a single cointegrating link. Two key statistics are used in this test to determine whether cointegration exists between the variables.

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{g} \ln(1 - \widehat{\lambda_t})$$

$$\lambda_{max}(r, r+1) = -T \sum_{i=r+1}^{g} \ln(1 - \widehat{\lambda_{r+1}})$$

T is the sample size; λ_i represents the estimated eigenvalues from the model; g is the total number of variables in the system.

The number of cointegrating vectors under the null hypothesis is represented by r, and λ_i reflects the estimated ordered eigenvalue of the matrix.

Testing for the hypothesis uses the Johansen cointegration test

$H_0 : r = 0$ (no cointegrating vectors)

$H_1 : 0 < r \leq g$ (contains cointegrating vectors)

If the test statistic is greater than the critical value, the null hypothesis should be rejected, indicating the presence of cointegration, vice cersa. After indicating a cointegrating relationship, further analysis is necessary until a scenario is reached where the null hypothesis cannot be rejected.

Next step:

$H_0 : r = 2$ (no cointegrating vectors)

$H_1 : 2 < r \leq g$ (contains cointegrating vectors)

If continuously reject the null hypothesis, perform the next steps:

$H_0 : r = g - 1$ (no cointegrating vectors)

$H_1 : r = g$ (contains cointegrating vectors)

Nonetheless, the testing procedure will end if we are able determine that there are no cointegrating vectors.

3.5.2.2 Vector Error Correction Model (VECM)

When a non-stationary data series shows cointegration or long-term equilibrium relationship, the Vector Error Correction Model (VECM) is employed. It enables researchers to assess equilibrium relationships over the long run as well as short-term shifts at the same time.

$$\Delta Y_t = \pi Y_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \, \Delta Y_{t-i} + u_t$$

Testing for the hypothesis use the Vector Error Correction Model (VECM)

$H_0 : \beta = 0$ (there is no long-term relationship/ no cointegration present)

$H_1 : \beta \neq 0$ (there is a long-term relationship/ cointegration is present)

3.6 Diagnosis Testing

3.6.1. LM Test for Autocorrelation

Autocorrelation in a regression model can lead to inefficient estimations and biased standard errors. The LM test is a commonly used method to detect the presence of autocorrelation in residuals. The LM test can identify higher-order autocorrelation, in contrast to the Durbin-Watson test, which is able to only identify first-order autocorrelation.

Regressing the original model's residuals on the independent variables and lag residuals up to a predetermined order p is part of the LM test. The test equation is provided as follows:

$$u_t = \alpha_0 + \alpha_1 X_t + \alpha_2 X_t^2 + \rho_1 u_{t-1} + \rho_2 u_{2-1} + \cdots + \rho_p u_{t-p} + \varepsilon_t$$

Testing for the hypothesis use the LM test

$H_0 : p_1 = p_2 = \cdots = p_p = 0$ (There is no autocorrelation)

$H_1 : p_1, p_2, \cdots, p_p \neq 0$ (There is autocorrelation)

p represents the number of lags considered in the test. The LM statistic follows a chi-square (X^2) distribution with p degrees of freedom. If the p-value of the test is less than the 0.05 significance level, we reject H_0 and conclude that there is significant autocorrelation in the residuals at some order up to p.

3.6.2. Jarque-Bera for Normality

The Jarque-Bera test is commonly applied to large data sets. If the distribution of the data is normal or nearly normal, it shows that the information is reliable and able to express the actual circumstance.

$$JB = [\frac{S^2}{6} + \frac{(K-3)^2}{24}]$$

Testing for the hypothesis use the Jarque-Bera test

H_0: The data is normal distributed.

H_1: The data is not normal distributed.

We reject H_0 if the p-value is less than the significance level (0.05) and conclude the equation's residuals are not normally distributed.

3.6.3. White Test for Heteroscedasticity

Heteroscedasticity leads to inefficient parameter estimates and unreliable statistical inferences, affecting hypothesis testing and confidence intervals. The White test is used for detecting heteroscedasticity without requiring any specific functional form of error variance. Unlike the Breusch-Pagan-Godfrey test that assumes the variance depends linearly on the explanatory variables, the White test allows for more general forms of heteroscedasticity by including both the regressors and their squared terms (Khan et al., 2025).

$$u_t^2 = \delta_0 + \delta_1 X_{t1} + \delta_2 X_{t2} + \cdots + \delta_k X_{tk} + v_t$$

Testing for the hypothesis use the White test

H_0: $\delta_1 = \delta_2 = \cdots = \delta_k = 0$ (There is no heteroscedasticity)

$H_1 : \delta_1, \delta_2, \cdots, \delta_k \neq 0$ (There is heteroscedasticity)

The test statistic follows a chi-square (X^2) distribution. We reject H_0 if the F-statistic's p-value is less than 0.05 and determine that the model possesses heteroskedasticity.

3.6.4. Variance Inflation Factor for Multicollinearity

A Variance Inflation Factor (VIF) value exceeding 10 is commonly interpreted as a sign of serious multicollinearity, which can weaken the reliability of regression results. A VIF value between 5 to 10 is considered moderate multicollinearity that may warrant closer scrutiny, still safe. It would be best if the value is below 5.

Although labour (lnL) and capital (lnK) are necessary inputs in production and significant for explaining economic growth. However, they are also highly related in macroeconomic analysis. This might raise the possibility of multicollinearity between them. Hence, instead of removing either variable which would compromise the economic meaning of the model, we applied Principal Component Analysis (PCA) to merge both into a single index lablled CVs.

While eliminating redundancy, these linked elements capture the greatest amount of volatility in the original data (Jaadi, 2024). By applying PCA to lnL and lnK, we retained their joint economic contribution within a single variable, which can help to resolve the multicollinearity issue without undermining the model's conceptual foundation. It is important to note that PCA was applied exclusively to these control variables, while the government expenditure variables remained untouched to preserve their direct interpretability for policy analysis.

3.7 Conclusion

This chapter outlines the analytical methods used to ensure valid and reliable findings. The analysis begins with a unit root test to check data stationarity. Then, the Johansen cointegration test is applied to examine long-run relationships between variables. The VECM model helps to separate short-run and long-run effects, though the focus is mainly on the long-run. Diagnostic tests are also included to check for any issues and strengthen the overall results.

CHAPTER 4: DATA ANALYSIS

4.0 Introduction

Chapter 4 presents the results of the data analysis based on the selected methods. It examines the relationships between variables and economic growth in Malaysia. The chapter includes unit root tests, cointegration analysis, and the VECM model to identify both short-run and long-run effects. Each test is explained with its findings to support the research objectives.

4.1 Descriptive Analysis

Table 4.1 displays the descriptive statistics for the main variables in the model. This analysis offers valuable insights into the characteristics of the variables by showing their mean, median, minimum, and maximum values. It also evaluates the distribution pattern of the data through the use of Kurtosis and Skewness statistics, which help in understanding the shape and symmetry of the data.

Table 4.1:

Descriptive Statistics

	$lnGDP$	$lnDE$	$lnSOC$	$lnEDU$	$lnHLT$	$lnHOU$	lnL	lnK
Mean	10.2813	24.1610	22.9460	22.3109	21.0483	20.5533	16.1859	25.9755
Median	10.2965	24.3977	23.1318	22.5620	21.1257	20.8513	16.1579	25.9541
Min.	9.6860	22.9814	21.5208	20.8339	19.6848	17.5767	15.7154	25.0851
Max.	10.7567	25.2886	23.9116	23.3302	22.8888	21.8041	16.5764	26.5392
Std. Dev	0.2971	0.6328	0.7003	0.7163	0.7957	1.0137	0.2677	0.4047
Skewness	-0.1525	-0.5905	-0.7281	-0.6009	0.0527	-1.514	-0.0962	-0.2252
Kurtosis	2.0730	2.2723	2.3575	2.2914	2.5338	4.6956	1.7408	2.0495
Obs	34	34	34	34	34	34	34	34

Source: E-view's computation, 2025.

Table 4.1 shows that both the **mean and median** values fall within the range of the maximum and minimum values, suggesting that the data are accurate and reliable. Additionally, **standard deviation** measures how much data points deviate from the mean. Overall, the variables are relatively stable with some variability, but not excessive fluctuation. Variables with lower standard deviations such as lnL (0.2677) show more consistency. On the other hand, variables with higher standard deviations, such as $lnHOU$ (1.0137), reflect greater variation.

A symmetric distribution has a **skewness** value of zero. When the distribution is skewed to the right, it indicates positive skewness, which means that the distribution has a longer tail on the right side and most values are concentrated on the lower end. On the other hand, a negative skewness suggests a longer tail on the left side and more values concentrated towards the higher end of the distribution (Bankole and Adesanya, 2024). In Table 4.1, **most variables** display **negative skewness,** excluding $lnHLT$. This means that most of their values are above the mean, with only a few observations pulling the average down. This pattern suggests that the Malaysian economy and government social sector expenditures remained relatively strong throughout the observed period, with occasional weaker years. These few lower values might reflect specific economic shocks or downturns that temporarily affected GDP or spending levels. However, $lnHLT$ shows a slightly **positive skewness** (0.0527), indicating that most values were lower, but a few exceptionally high values increased the average. This is likely due to specific years of high health spending, possibly during health emergencies like the COVID-19 pandemic.

Kurtosis measures the flatness of a distribution. A normal distribution has a kurtosis of three. If the kurtosis is less than three, the distribution is considered flat (platykurtic) compared to the normal distribution. If the kurtosis exceeds three, the distribution is more peaked (leptokurtic) than normal (Bankole and Adesanya, 2024). In table 4.1, the results show that most of the variables have kurtosis values below three. These are platykurtic, meaning their distributions are flatter than the normal curve and have lighter tails, which implies fewer extreme values. However, $\boldsymbol{lnHLT}$ is an exception. Its kurtosis value exceeds three (4.6956), which indicates a leptokurtic distribution. This pattern suggests that health expenditure tends to have more extreme values, possibly due to irregular spending during critical periods such as health emergencies or policy shifts.

4.2 Unit Root Test

To avoid the spurious regression problem we performed the proposed unit root tests using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests for all chosen variables, including Real Gross Domestic Product (GDP), Capital (K), Labour (L), Education (EDU), Health (HLT), and Housing (HOU), to solve the problem and guarantee the validity of our model.

Table 4.2:

Results of Unit Root Test

Variables	**ADF**		**PP**	
	Level	**1st difference**	**Level**	**1st difference**
$\boldsymbol{ln\,GDP}$	-1.2877(2)	-4.8600(1)***	-1.5783(2)	-5.5662(2)***
$\boldsymbol{ln\,DE}$	-0.4338(0)	-4.2673(0)***	-0.4337(0)	-4.2673(0)***
$\boldsymbol{ln\,SOC}$	-1.7423(1)	-4.7010(0)***	-1.4170(2)	-4.7089(2)***
$\boldsymbol{ln\,K}$	-1.3191(0)	-5.9097(0)***	-1.3679(3)	-5.8984(3)***
$\boldsymbol{ln\,L}$	-1.1231(3)	-3.3744(2)**	-1.9432(1)	-4.7811(6)***
$\boldsymbol{ln\,EDU}$	-2.0679(1)	-4.1748(0)***	-1.4362(3)	-4.0619(4)***
$\boldsymbol{ln\,HLT}$	-1.1278(0)	-3.5531(3)**	-1.1957(1)	-5.1833(0)***
$\boldsymbol{ln\,HOU}$	-2.8794(0)	-5.0209(1)***	-2.8793(0)	-5.9924(3)***

*Note: ***, **, * indicate the rejection of the null hypothesis at 1%, 5%, and 10% significance levels. All variables are in natural log.*

Source: E-view's computation, 2025.

The unit root tests presented in Table 4.2 confirm that all variables are integrated of order one $I(1)$. This finding is based on the ADF and PP tests, both of which indicate non-stationarity at levels but stationarity at first differencing at the 5%

significance level. This satisfies the condition for using the Johansen cointegration test, which requires all variables to be $I(1)$. As a result, all variables were included as endogenous in the VECM to examine both long-run and short-run relationships.

After performing the unit root test, we proceed to perform the test for three different equations, using the first two as a foundation to determine the importance of the third equation, which is the primary focus of our research. The models tested are below:

Model 1: $y = (K, L, DE)$
Model 2: $y = (K, L, SOC)$
Model 3: $y = (K, L, EDU, HLT, HOU)$

4.3 Model 1: $\boldsymbol{y = (K, L, DE)}$

4.3.1. Johansen Cointegration Test

To examine the current cointegration relationship between the variables, we apply the Johansen test. The Johansen methodology enables many cointegrating relationships between the variables, but the Engle-Granger test can only identify one. This is a significant difference between the two methods.

Table 4.3:

Results of Johansen Cointegration Test for Equation 3.1.1

Hypothesized no. of CF(s)	Trace Statistic	5% CV Trace	Max-Eigen Statistic	5% CV Max Eigenvalue
0	**98.5326**	**47.8561**	**49.8134**	**27.5843**
≤1	**48.7192**	**29.7971**	**31.3169**	**21.13162**
≤2	**17.4022**	**15.4947**	**14.3081**	**14.2646**
≤3	3.0942	3.8415	3.0942	3.8415

Note: Bolded figures indicate the rejection of the null hypothesis (H_0).
Source: E-view's computation, 2025.

The Johansen cointegration test helps identify whether a long-run relationship exists among the variables. As shown in Table 4.3, both the trace statistic and max-eigen statistic are greater than their respective 5% critical values at ranks r = 0, r ≤ 1, and r ≤ 2. For example, at r = 0, the trace statistic (98.5326 > 47.8561) and the max-eigen statistic (49.8134 > 27.5843) both exceed the critical values. The same pattern is seen at r ≤ 1 and r ≤ 2, where the test statistics continue to surpass the threshold values.

H_0: There is no long-run relationship between the variables.
H_1: There is a long-run relationship between the variables.

Since the test statistics are higher than the 5% critical values up to r ≤ 2, we reject the null hypothesis. This confirms the presence of **three cointegrating vectors**, suggesting that the variables are cointegrated. In conclusion, real GDP, gross fixed capital formation (K), total employment by status (L), and development expenditure share a long-run equilibrium relationship and influence each other over time.

4.3.2. Vector Error Correction Model (VECM)

When a non-stationary data series shows cointegration or long-term equilibrium relationship, the VECM is employed. The inclusion of an error correction term (ECT) reflects how quickly deviations from the long-run path are corrected over time.
After proceeding with VECM test, the final version for equation 3.1.1 (Model 1) in the **long run** is determined, and the predicted coefficient is interpreted as:

$$lnGDP_{t-1} = ECT_{t-1} + 11.8312 lnDE_{t-1} + 17.1988 lnK_{t-1} - 43.8750 lnL_{t-1} -$$

(-5.4351) (-3.6002) (4.0736)

$$12.6453$$

Note: Figures in parenthesis is t-statistics.

DE ($lnDE_{t-1}$) has a positive coefficient of 11.8312, meaning that a 1% increase in government development expenditure leads to a 11.83% increase in GDP. This underscores the importance of public investment in stimulating economic growth, as supported by Gurdal et al. (2021), and Kirikkaleli and Ozbeser (2022).

Capital (lnK_{t-1}) positively affects economic growth, with a coefficient of 17.1988, which is consistent with previous findings of Ledhem and Mekidiche (2021) and Chin et al. (2021) demonstrated that GFCF significantly boosts economic growth in Southeast Asia (2013-2019) and in 59 Belt and Road Initiative (BRI) countries (2000-2015). This suggests that a 1% increase in capital leads to an approximately 17.2% increase in GDP.

Meanwhile, labour (lnL_{t-1}) has a negative coefficient of -43.8750, indicating that a 1% increase in labour results in a 43.88% decrease in GDP. This unexpected negative relationship may align with Haider et al. (2023) who found that in developing countries, job growth often does not lead to economic growth, especially when employment is concentrated in low-productivity sectors. An et al. (2017) further explained that factors such as poverty, skill mismatches, and the structure of expanding industries often weaken the employment-growth link. In Malaysia's case, the increase in employment could be occurring in sectors with limited value-added output. The constant term (-12.6453) captures the overall structural effects in the model.

Model 1 in **short run** is determined as follows:

$$lnGDP_t = \underset{(2.3165)}{0.0096ECT_{t-1}} - \underset{(1.3344)}{0.5482lnGDP_{t-1}} - \underset{(2.1415)}{0.8435lnGDP_{t-2}}$$

$$- \underset{(1.5327)}{0.6453lnGDP_{t-3}} + \underset{(1.6427)}{0.1045lnDE_{t-1}} - \underset{(0.3209)}{0.0206lnDE_{t-2}} -$$

$$\underset{(0.2174)}{0.0139lnDE_{t-3}} - \underset{(0.2060)}{0.0700lnL_{t-1}} - \underset{(1.9770)}{0.6665lnL_{t-2}} - \underset{(0.3501)}{0.1207lnL_{t-3}} +$$

$$0.1837lnK_{t-1} + 0.2608lnK_{t-2} + 0.1970lnK_{t-3} + 0.0853$$

(1.6372) (2.2258) (0.1161) (3.3451)

The coefficient of the error correction term (ECT), 0.0096, is positive, suggesting that deviations from the long-run equilibrium are corrected at a relatively slow rate. Only about 0.96% of the disequilibrium is adjusted each year. The short-run dynamics of past changes in GDP show a negative relationship with current GDP growth. The coefficients for lagged values of $\Delta \ln GDP$ are -0.5482, -0.8435, and -0.6453. This shows that previous economic shocks or fluctuations tend to slow down current growth, possibly due to economic instability or weak structural foundations.

DE ($\Delta lnDE$) mixed effects. The coefficient in the current period is 0.0853 and is statistically significant, showing that immediate increases in development spending can support growth. However, the earlier lags show negative or insignificant effects, which suggests that if the spending is delayed, inefficient, or not well-targeted, it may not help or could even hurt short-term performance.

Labour (ΔlnL) does not show a strong or clear influence. The third lag shows a small positive coefficient (0.1207), but its low t-statistic indicates it is not statistically significant. This suggests that in the short run, changes in labour force do not have a meaningful or consistent impact on growth. For capital (ΔlnK) the coefficients are positive across the lags, with the second lag (0.2608) being the most significant. This means capital investment supports short-term growth, though the effects vary over time.

4.3.3. Diagnosis Checking for VECM

Once the VECM is established, diagnostic tests are conducted to ensure the model's validity and reliability. Diagnosis tests include checking for autocorrelation, normality, heteroscedasticity and multicollinearity.

Table 4.4:

Results of Diagnosis Checking for Equation 3.1.1

Diagnostic Checking		**Probability Value**
LM Test	Lag 1	0.6474
	Lag 2	0.9139
	Lag 3	0.5929
	Lag 4	0.9945
Jarque-Bera		0.0082
White Heteroskedasticity		0.1843
		Centered VIF
Variance Inflation Factors	CVs	3.6935
	DE	3.6935

Source: E-view's computation, 2025.

Note: CVs refer to Control Variables.

The diagnostic checking confirms mixed results for the VECM model. The LM test shows no serial correlation in residuals for all four lags, as the p-values are well above 0.05. The Jarque-Bera test has a p-value of 0.0082, which indicates that the residuals are not normally distributed. However, Anderson et al. (2002) in a Federal Reserve Bank of St. Louis working paper highlight that macroeconomic time series data frequently experience persistent shocks, making strict normality uncommon. Nevertheless, the VECM can still produce reliable estimates and forecast outcomes effectively, if the model satisfies stability conditions and other key diagnostic assumptions (Anderson et al., 2002). Moreover, the White test p-value of 0.1843 suggests there is no significant heteroskedasticity problem. Lastly, the VIF values for the control variables (CVs) and DE are 3.6935, which are below the critical level of 10. This means multicollinearity is not a major issue.

4.4 Model 2: $y = (K, L, SOC)$

4.4.1. Johansen Cointegration Test

To examine the current cointegration relationship between the variables, we apply the Johansen test.

Table 4.5:

Results of Johansen Cointegration Test for Equation 3.1.2

Hypothesized no. of CF(s)	**Trace Statistic**	**5% CV Trace**	**Max-Eigen Statistic**	**5% CV Max Eigenvalue**
0	**88.3292**	**47.8561**	**40.2797**	**27.5843**
≤1	**48.0495**	**29.7971**	**26.9659**	**21.1316**
≤2	**21.0836**	**15.4947**	**18.5810**	**14.2646**
≤3	2.5026	3.8415	2.5026	3.8415

Source: E-view's computation, 2025.

To determine whether a long-run relationship exists among the variables. Based on the results, the trace statistic (21.0836 > 15.4947) and the eigenvalue statistic (18.5810 > 14.2646) are both higher than the critical values when $r \leq 2$. Similarly, at $r = 0$ and $r \leq 1$, both statistics also exceed their respective 5% critical values.

H_0: There is no long-run relationship between the variables.
H_1: There is a long-run relationship between the variables.

Since the trace test and eigenvalue statistic are greater than the 5% critical values at $r = 0$, $r \leq 1$, and $r \leq 2$, we reject the null hypothesis. This indicates that there are **three cointegrating relationships**. Therefore, GDP, social sector expenditure (SOC), total employment by status (L), and capital (K) have a long-run relationship with one another.

4.4.2. Vector Error Correction Model (VECM)

After proceeding with VECM test, the final version for equation 3.1.2 (Model 2) in the **long run** is determined, and the predicted coefficient is interpreted as:

$$lnGDP_{t-1} = ECT_{t-1} - 0.946lnSOC_{t-1} - 2.3596lnK_{t-1} + 5.8087lnL_{t-1} - 0.6540$$

(5.8893) (4.3117) (5.6054)

In the long run, the coefficient for $\ln SOC_{t-1}$ is -0.946 and the t-statistic is 5.8893. This means that a 1% increase in social sector expenditure leads to a 0.95% decrease in GDP. The high t-statistic shows that this result is statistically significant. This negative sign suggests that social spending may be inefficient, poorly targeted, or mismanaged, possibly due to administrative waste, corruption, or spending focused on consumption rather than investment. This finding aligns with Owino (2017), who found that social security spending in Greece and other countries negatively impacted long-term economic growth, and with Eggoh et al. (2015), who reported that in several African countries, government spending on health and education hindered economic development due to inefficiencies and corruption.

Capital (lnK_{t-1}) has a negative coefficient of -2.3596, with a strong t-statistic of 4.3117. This result is unusual because capital investment is normally expected to boost growth. The negative sign might indicate over-investment, inefficient use of capital, or that returns to capital in Malaysia have been declining due to structural issues like low innovation or weak productivity. This outcome is supported by Gamra (2009), who found that unstable capital flows can harm growth in developing economies. Minoiu and Reyes (2013) also noted that disruptions in capital flows, especially after financial crises, can lead to long-term negative effects on growth.

Meanwhile, Labour (lnL_{t-1}) has a positive coefficient of 5.8087 and a high t-statistic of 5.6054, showing a strong and statistically significant positive relationship. This means that, in the long run, a 1% increase in labour contributes to a 5.81% rise in GDP. This suggests that labour plays a critical role in driving long-term economic growth in Malaysia, possibly because of a large working population or labour-intensive industries. This finding is consistent with Zulu and Banda (2015), who observed a steady positive effect of labour on output per worker in countries like Mauritius and South Africa, particularly in sectors with high capital use. Similarly, a study by Azeez et al. (2022) on selected Asian countries highlighted that labour force growth positively influenced economic performance when paired with adequate capital investment and technological adaptation. These results imply that Malaysia's labour force, when efficiently employed, has the potential to enhance long-run economic growth significantly.

Model 2 in **short run** is determined as follows:

$$\Delta lnGDP_t = -0.0714ECT_{t-1} - 0.4028\Delta lnGDP_{t-1} - 0.8442\Delta lnGDP_{t-2} -$$
(2.2272) (1.0483) (2.0632)

$$0.3351\Delta lnGDP_{t-3} + 0.0145\Delta lnSOC_{t-1} + 0.0144\Delta lnSOC_{t-2} +$$
(0.6966) (0.3788) (0.4444)

$$0.0128\Delta lnSOC_{t-3} - 0.1744\Delta lnL_{t-1} - 0.7087\Delta lnL_{t-2} -$$
(0.0330) (0.4954) (2.1274)

$$0.1448\Delta lnL_{t-3} + 0.1703\Delta lnK_{t-1} + 0.2567\Delta lnK_{t-2} +$$
(0.3900) (1.5890) (2.1314)

$$0.1224\Delta lnK_{t-3} + 0.0814$$
(0.9782)

The error correction term (ECT_{t-1}) carries a negative and statistically significant coefficient of -0.0714, with a t-statistic of 2.2272. This result confirms that the model adjusts back to long-run equilibrium when there is a deviation. However, the correction speed is slow, as only 7.14% of the disequilibrium from the previous period is corrected in the current period. This slow adjustment could reflect structural rigidities or policy delays in Malaysia’s economy.

In the short term, lagged changes in GDP show a mix of effects. $\Delta lnGDP_{t-1}$ and $\Delta lnGDP_{t-3}$ have negative and positive signs respectively, but both are statistically insignificant. In contrast, $\Delta lnGDP_{t-2}$ has a significant and negative coefficient of

-0.8442 (t-stat = 2.0632). It suggests that past negative shocks to GDP continue to weigh down economic growth two periods later. This might imply that the effects of recent downturns linger in the economy and dampen output performance in the short run.

Besides, social sector expenditure ($\Delta lnSOC_t$) at three lags consistently shows positive coefficients (0.0145, 0.0144, and 0.0128). However, all these estimates are statistically insignificant, with t-statistics below 1. This result indicates that while social spending may support economic activity, its short-run effects are weak or delayed. This may reflect issues such as bureaucratic inefficiencies, delays in project execution, or the fact that social investment outcomes, such as improved health or education take time to influence GDP directly.

Labour dynamics ΔlnL_{t-1} and ΔlnL_{t-2} show negative effects, with the second lag being statistically significant (-0.7087, t-stat = 2.1274). This suggests that a recent rise in labour supply might have a depressing effect on growth, possibly due to job creation in sectors with low productivity or wage pressure that does not translate into higher output. The third lag of labour (ΔlnL_{t-3}) turns positive but remains statistically insignificant, implying a potential delayed benefit, though weak in magnitude.

Additionally, capital (ΔlnK_{t-2}) is statistically significant (0.2567, t-stat = 2.1314), indicating that capital investments begin to show positive effects on economic growth after two periods. ΔlnK_{t-1} *and* ΔlnK_{t-3} also have positive coefficients but are not significant, suggesting that the influence of capital is delayed rather than immediate. These results imply that capital accumulation, such as infrastructure or machinery investment, takes time to stimulate output growth, reflecting typical gestation periods in development projects.

Overall, the short-term model reflects a slow and complex adjustment process. There are some negative short-term effects on labour and GDP, possibly due to productivity lags and recent economic shocks. In contrast, the contribution of capital investment to short-term growth is more stable and positive, albeit with a time lag. Social sector expenditures, while theoretically supportive of growth, appear to be less effective in the short run, possibly due to implementation inefficiencies.

4.4.3. Diagnosis Checking for VECM

This section reports the diagnostic tests performed on the VECM to verify the validity of the model and ensure it meets the basic econometric assumptions.

Table 4.6:

Results of Diagnosis Checking for Equation 3.1.2

Diagnostic Checking		**Probability Value**
LM Test	Lag 1	0.2219
	Lag 2	0.0817
	Lag 3	0.6884
	Lag 4	0.8304
Jarque-Bera		0.9026
White Heteroskedasticity Test		0.3151
		Centered VIF
Variance Inflation Factors	SOC	2.1173
	CVs	2.1173

Source: E-view's computation, 2025.

Note: CVs refer to Control Variables.

The diagnostic checking confirms mixed results for the VECM model. The LM test shows no serial correlation in residuals for all four lags, as the p-values are larger than the 0.05 threshold. The Jarque-Bera test has a p-value of 0.9026, which indicates that the residuals are normally distributed. Furthermore, the White heteroskedasticity test p-value of 0.1843 suggests there is no significant heteroskedasticity problem. Lastly, the VIF values for the control variables (CVs) and SOC are 2.1173, which are below the critical level of 10. This confirms that multicollinearity is not a serious concern in the model.

4.5 Model 3: $y = (K, L, EDU, HLT, HOU)$

4.5.1. Johansen Cointegration Test

To examine the current cointegration relationship between the variables, we apply the Johansen test.

Table 4.7:

Results of Johansen Cointegration Test for Equation 3.1.3

Hypothesized no. of CF(s)	Trace Statistic	5% CV Trace	Max-Eigen Statistic	5% CV Max Eigenvalue
0	**183.6434**	**95.7537**	**70.4972**	**40.0776**
≤1	**113.1462**	**69.8189**	**45.7554**	**33.8769**
≤2	**67.3908**	**47.8561**	**37.2316**	**27.5843**
≤3	**30.1592**	**15.4947**	**25.5078**	**21.1316**
≤4	4.6513	3.8415	4.6214	14.2646
≤5	0.0299	3.8415	0.0299	3.8415

Source: E-view's computation, 2025.

Using the trace test and the Eigenvalue statistic at a 5% significance level, we determine the number of cointegrating vectors to assess whether a long-run relationship exists between the variables. Based on Table 4.7, the trace statistics and max-eigenvalue statistics are consistently higher than their corresponding 5% critical values at $r = 0$, $r \leq 1$, $r \leq 2$, and $r \leq 3$. This pattern continues up to $r \leq 3$. The trace statistic (30.1592 > 15.4947) and the eigenvalue statistic (25.5078 > 21.1316) are both greater than the critical values.

H_0: There is no long-run relationship between the variables.

H_1: There is a long-run relationship between the variables.

Since both the trace and eigenvalue statistics exceed the 5% critical values from r = 0 up to $r \leq 3$, we reject the null hypothesis. This means there are **four cointegrating relationships**. Therefore, the variables in Equation 3.1.3 share a long-run relationship and move together over time.

4.5.2. Vector Error Correction Model (VECM)

After proceeding with VECM test, the final version for equation 3.1.3 (Model 3) in the **long run** is determined, and the predicted coefficient is interpreted as:

$$lnGDP_{t-1} = ECT_{t-1} - \underset{(10.7046)}{0.1892} lnEDU_{t-1} + \underset{(9.3100)}{0.1524} lnHLT_{t-1} + \underset{(8.4436)}{0.0688}\, lnHOU_{t-1}$$

$$+ \underset{(6.5352)}{0.2445} lnK_{t-1} + \underset{(6.8585)}{0.5164} lnL_{t-1} - \underset{(4.9385)}{4.8286}$$

The long-run estimation for Model 3 shows how different components of social sector expenditure and key production factors influence economic growth in Malaysia over time.

The coefficient for education expenditure ($lnEDU_{t-1}$) is -0.1892, with a strong t-statistic of 10.7046. This negative sign is unexpected because education is typically seen as a positive contributor to growth. This finding is consistent with previous studies by Kamis et al. (2020) and Forson et al. (2021), which also reported a negative relationship between education expenditure and economic growth in Malaysia. Kamis et al. (2020) specifically explained that this negative link may be due to the way education spending in Malaysia is often treated as consumption rather than investment. Instead of directing funds toward improving education quality or enhancing workforce skills, a significant portion of the expenditure may go to administrative costs or ineffective programmes that do not contribute to productivity. Furthermore, since the benefits of education take time to realised. The impact on economic growth may not be immediate, especially when the education system does not align with labour market demands. These findings suggest that the issue is not merely the amount spent on education, but rather how effectively and efficiently the funds are used. Without strong policy direction, efficient management, and a clear focus on long-term outcomes, education spending may fail to support human capital development and thus contribute little to economic growth.

Health expenditure ($lnHLT_{t-1}$) has a positive coefficient of 0.1524, which is statistically significant (t-stat = 9.3100). This result suggests that long-term investment in health has a positive contribution to economic growth. A healthier labour force tends to be more productive and efficient, which reduces the number of days lost to illness and improves overall economic performance. In the case of Malaysia, this may reflect the benefits of expanding public health coverage and investing in health infrastructure. This finding is consistent with studies by Raghupathi and Raghupathi (2020), Kamis et al. (2020), and Seo et al. (2019), which have shown that healthier populations tend to be more productive, contributing to higher GDP and better economic performance.

Housing expenditure ($lnHOU_{t-1}$) also shows a positive effect on GDP, with a coefficient of 0.0688 and a t-statistic of 8.4436. Although the size of the impact is modest, it indicates that long-term investment in housing supports economic activity. The result is aligned with Poku et al. (2022) and Afonso and Sousa (2012). Poku et al. (2022) found that government housing spending boosts economic growth through improvements in health, employment, and the financial sector, supporting the positive effect observed in this study. Afonso and Sousa (2012) also showed that government housing expenditure positively impacts house prices in the long term, reinforcing the lasting benefits for economic growth seen in this analysis.

Capital (lnK_{t-1}) contributes positively as well, with a coefficient of 0.2445 and a t-statistic of 6.5352. This confirms that capital formation, including infrastructure and equipment, supports long-term growth. Investment in capital enhances production capacity and technological adoption, which are essential for sustained development.

lnL_{t-1} has the largest positive coefficient in this model at 0.5164 (t-stat = 6.8585), confirming that labour remains a key driver of Malaysia's long-run growth. This may reflect the advantages of a young and growing workforce, or the dominance of labour-intensive sectors such as manufacturing and services that contribute heavily to GDP.

The constant term (-4.8286) and error correction term (ECT_{t-1}) both confirm the model's ability to return to equilibrium over time. In summary, the long-run results from Model 3 highlight the importance of health, housing, capital, and labour in driving Malaysia's growth, while education and training spending requires deeper policy review due to its unexpected negative effect.

Model 3 in short run is determined as follow:

$$\begin{aligned}\Delta lnGDP_t = & -\underset{(3.5551)}{0.6371}ECT_{t-1} + \underset{(0.0461)}{0.0189}\Delta lnGDP_{t-1} - \underset{(2.6586)}{0.9389}\Delta lnGDP_{t-2} + \\ & \underset{(1.3023)}{0.0372}\Delta lnEDU_{t-1} + \underset{(2.6911)}{0.0842}\Delta lnEDU_{t-2} - \underset{(0.0278)}{0.0694}\Delta lnHLT_{t-1} - \\ & \underset{(2.4281)}{0.0585}\Delta lnHLT_{t-2} - \underset{(2.2174)}{0.0402}\Delta lnHOU_{t-1} - \underset{(1.6475)}{0.0244}\Delta lnHOU_{t-2} - \\ & \underset{(0.0085)}{0.0009}\Delta lnK_{t-1} + \underset{(2.0216)}{0.1755}\Delta lnK_{t-2} - \underset{(0.9939)}{0.2886}\Delta lnL_{t-1} - \underset{(2.1182)}{0.6061}\Delta lnL_{t-2} \\ & + 0.0856\end{aligned}$$

In the short-run estimation of Model 3, ECT_{t-1} is negative and statistically significant, with a coefficient of -0.6371. This confirms the existence of a stable long-run relationship among the variables and indicates that approximately 63.71% of the deviation from long-run equilibrium is corrected within one year. This confirms the presence of a valid short-run adjustment mechanism.

In terms of short-run dynamics, the second lag of GDP ($\Delta lnGDP_{t-2}$) has a negative and statistically significant coefficient of -0.9389 (t-stat = 2.6586), indicating that negative shocks to GDP have a lingering adverse effect on short-term economic performance. By contrast, $\Delta lnGDP_{t-1}$ shows a small and statistically insignificant positive coefficient (0.0189), suggesting weak immediate momentum in GDP changes.

Among the explanatory variables, education expenditure at lag two $\Delta lnEDU_{t-2}$ is positive and significant effect on GDP (0.0842, t-stat = 2.6911), suggesting that the benefits of educational investment materialize with some delay. This reflects the time it takes for educational improvements to translate into productive labour force participation and economic returns. The first lag of education expenditure is smaller and not statistically significant (0.0372, t-stat = 1.3023), further supporting the notion of a delayed impact.

Health expenditure shows mixed short-run effects. The first lag ($\Delta lnHLT_{t-1}$) is negative and significant (-0.0694, t-stat = 2.4281), suggesting that immediate increases in health spending might initially shift resources or reflect reactive spending in crisis periods. However, the second lag ($\Delta lnHLT_{t-2}$) turns positive and significant (0.0585, t-stat = 2.2174), implying that health investments begin to generate economic benefits after a short delay, likely through improved worker productivity and reduced absenteeism.

In addition, housing expenditure at both lags shows negative coefficients. The first lag ($\Delta lnHOU_{t-1}$) is -0.0402 (t-stat = 2.2174) and the second lag (($\Delta lnHOU_{t-2}$) is -0.0244 (t-stat = 1.6475). These results suggest that housing expenditures have a negative short-run impact on GDP, which may be due to delayed returns on construction projects, inefficiencies in housing delivery, or misallocation of resources.

In terms of capital, (ΔlnK_{t-2}) has a positive and statistically significant impact (0.1755, t-stat = 2.0216), suggesting that capital investment contributes meaningfully to growth, even though its impact is not immediate. The first lag ((ΔlnK_{t-1}) has a small and insignificant effect (0.0009), which is typical since the full impact of capital investments often takes time to be realised.

Labour dynamics show a negative short-term effect, with $\Delta lnL_{t-1} and\ \Delta lnL_{t-2}$ showing a significant coefficient of -0.6061 (t-stat = 2.1182), while ΔlnL_{t-1} is also negative, but not significant (-0.2886 , t-stat = 0.9939). This implies that an increase in labour supply may dampen economic growth in the short run, which may be due to underemployment, low-productivity sectors, or a mismatch between labour supply and market demand.

Overall, the short-run findings of Model 3 suggest that while capital and education expenditures have a delayed positive impact on economic growth, labour, housing, and early healthcare expenditures may be a drag on the economy in the short run. These dynamics highlight the importance of effective policy design, targeting, and timing of public expenditures to ensure that short-term growth outcomes are consistent with long-term development goals.

4.5.3. Diagnosis Checking for VECM

This section reports the diagnostic tests performed on the VECM to verify the validity of the model and ensure it meets the basic econometric assumptions.

Table 4.8:

Results of Diagnosis Checking for Equation 3.1.3

Diagnostic Checking		**Probability Value**
LM Test	Lag 1	0.2384
	Lag 2	0.3308
	Lag 3	0.1528
Jarque-Bera		0.7566
White Heteroskedasticity Test		0.3236
		Centered VIF
Variance Inflation Factors	EDU	5.3466
	HLT	4.3023

	HOU	2.8854
	CVs	2.2262

Source: E-view's computation, 2025.

Note: CVs refer to Control Variables.

The diagnostic checking confirms mixed results for the VECM model. The LM test shows no serial correlation in residuals for all three lags, as the p-values are larger than the 0.05 threshold. The Jarque-Bera test has a p-value of 0.7566, which indicates that the residuals are normally distributed. Furthermore, the White heteroskedasticity test p-value of 0.3236 suggests there is no heteroskedasticity problem. Lastly, the VIF values for all variables are below the commonly accepted threshold of 10, which suggests that there is no multicollinearity issue.

4.6 Conclusion and Discussion of Results

This research employs a three-equation approach to examine the relationship between development expenditure (DE) and economic growth, progressively refining the analysis to better understand the role of the social sector.

Model 1 (Equation 3.1.1) explores the overall impact of DE on GDP. The Johansen cointegration test confirms a long-run relationship between DE and economic growth, though short-run effects are minimal and statistically insignificant. The lack of short-term significance highlights the delayed impact of DE but supports its long-term relevance, justifying a more focused investigation in Model 2.

Model 2 (Equation 3.1.2) narrows the analysis to total social sector expenditure within DE, encompassing areas such as education, health, and housing. This model also shows a strong long-run relationship among the variables, despite short-run coefficients being small and statistically insignificant. The results emphasize the importance of sustained investment in the social sector and provide a rationale for further disaggregation in the next model.

Model 3 (Equation 3.1.3) is the core of the research, analysing the individual effects of education, health, and housing on economic growth. The Johansen test identifies four cointegrating vectors, indicating a stable long-run relationship among all variables, including capital and labour. While the error correction term (ECT) suggests weak short-run adjustment, the long-run results show that health and housing expenditures have positive effects on GDP, with health being the most impactful. In contrast, education expenditure shows a negative coefficient, potentially due to inefficiencies or delayed returns. Capital and labour also contribute significantly to growth, reaffirming their critical role in economic performance.

Overall, the stepwise approach from general DE to specific social sector components reinforces the research's analytical depth. It demonstrates that disaggregating social expenditure provides clearer insights, particularly highlighting health and labour as central drivers of Malaysia's long-term economic growth.

CHAPTER 5: DISCUSSION, CONCLUSION AND IMPLICATIONS

5.1 Discussions of Major Findings

This research confirms a significant long-run relationship between government development expenditure (DE) and economic growth in Malaysia. Model 1, through the Johansen cointegration test, verifies that DE and GDP move together over time, supporting Hypothesis 1 (H1). Although DE's short-run effects are statistically insignificant, their early positive lags indicate a delayed yet positive impact on GDP.

Model 2 highlights the role of social sector spending (SOC) in economic growth, revealing a stable long-term equilibrium with GDP, despite statistically insignificant short-run effects. This supports Hypothesis 2 (H2) and suggests that investments in the social sector, while slow to yield visible short-term returns, contribute meaningfully to long-run development.

When disaggregated in Model 3, the three social components show varying effects. Health expenditure (HLT) has the strongest positive and significant long-run effect on GDP, confirming Hypothesis 4 (H4) and emphasizing its role in improving workforce productivity. Housing expenditure (HOU) also has a positive but smaller long-run impact, validating Hypothesis 5 (H5). However, education expenditure (EDU) shows a negative and significant relationship with GDP, which contradicts Hypothesis 3 (H3). This unexpected outcome may reflect inefficient resource use, labour market mismatches, or delayed returns on human capital investments.

The study also examines labour (L) and capital (K) as control variables. Capital, proxied by gross fixed capital formation, has a positive long-run effect in Models 1 and 3, but a negative one in Model 2. Labour is negatively significant in Model 1 but becomes positively significant in Models 2 and 3. These mixed results suggest that the effects of L and K vary depending on the type of development expenditure, though they remain critical to Malaysia's long-term growth, supporting Hypotheses 6 (H6) and 7 (H7).

In summary, the findings stress that effective and targeted public investment—particularly in health and housing—and optimized use of labour and capital are key to sustaining economic growth. However, the negative results for education spending suggest a need for policy reassessment to improve alignment with growth objectives.

Table 5.1:

Variable-Level Significance Analysis

Variables	Long-Run	Short-Run	Key Findings
K	**M1 andM3:** Positive Sig **M2:** Negative Sig	Mixed	LR: K ↑, EG ↑or ↓ SR: No consistent trend and effects are uncertain.
L	**M1:** Negative Sig **M2 andM3:** Positive Sig	Negative Mixed	LR: L ↑, EG ↑or ↓ SR: Downward trend and effects are uncertain.
DE	Positive Significant	Mixed Insignificant	LR: DE ↑, EG ↑ SR: Mixed results and unclear short-term benefit.
SOC	Negative Significant	Positive Insignificant	LR: SOC ↑, EG ↓ SR: Upward trend and unclear short-term benefit.
HLT	Positive Significant	Negative Significant	LR: HLT ↑, EG ↑ SR: HLT ↑, EG ↓
EDU	Negative Significant	Positive Mixed (1 model sig, 1insig)	LR: EDU ↑, EG ↓ SR: Upward trend and effects are uncertain.
HOU	Positive Significant	Negative Mixed (1 model sig, 1insig)	LR: HOU ↑, EG ↑ SR: Downward trend and effects are uncertain.

Source: Author's own compilation (2025)

Note: LR refers to long run; SR refers to short run. Sig refers to significant; Insig refers to insignificant.

5.2 Implications of the Study

5.2.1. Prioritising Government Expenditure in Development Expenditure, Healthcare and Housing

This research investigates the relationship between government expenditure and economic growth in Malaysia through a disaggregate analysis, using endogenous growth theory as its theoretical framework. By obtaining data from 1990 to 2023, we explore the relationship between various components of government expenditure and economic performance. Our empirical findings from Table 5.1 indicate that different categories of government spending exhibit varying effects on economic growth. Expenditures on key sectors, particularly development expenditure, health, and housing, have a positive impact on long-run economic growth.

Hence, these areas should be prioritised in future government expenditure as they have proven to be effective in stimulating economic growth. This implies that the current investment plans are generating significant economic returns and suggests that continuing and potentially increasing budget allocations to these industries has strategic significance. By focusing on industries that demonstrate significant development impact, policymakers can ensure that limited financial resources flow towards areas that can create the greatest value.

In conclusion, identifying and priotising effective investment plans in key sectors help to drive economic growth. By focusing on these sectors, policymakers can stimulate growth and contribute to sustainable economic development in Malaysia.

5.2.2 Strategic Allocation of Government Expenditure in Social Sector and Education

While priotising government expenditure supports economic growth by reinforcing sectors that have been proven effective, ensuring effective allocation of ineffective sectors are also equally important. From Table 5.1, the social sector and education sector have both shown negative impact on economic growth in the long term. Hence, it means the initial investment plan was not quite effective, that leads to reallocation of resources. While investment is necessary, ensuring funds are channeled to areas with the highest returns.

Similar conclusions have been reached in previous empirical studies, such as those by Aban and Garcia-Vigonte (2022), Owino (2017) and Eggoh et al., (2015) highlighted that government expenditure in social sectors have a negative impact when facing cyclical factors, measurement issues, corruption and inefficiencies. To address this, policy makers should integrate programs to reduce overlap and align with long-term human capital goals.

Studies by Nayak and Palita (2021), Kamis et al. (2020) and Forson et al. (2021) state that the expenditure in the education sector tend to focus on expanding access rather than improving quality or employability of students. A mismatch between educational output and labour market needs will lead to an oversupply of graduates in non-technical fields. This causes unemployment and low productivity. Hence, the resources should be prioritised toward improving learning quality, expanding access to technical and vocational training (TVET), and aligning curricula with labour market needs.

By optimizing resource allocation in social sector and education, Malaysia can strengthen fiscal policies, ensuring that public funds are directed toward initiatives that yield the highest social and economic benefits.

5.3 Limitations of Study

This research acknowledges several limitations. First, this study focuses on the impact of social sector expenditure on economic growth, specifically examining education and training, health, and housing. However, the "others" category within social sector spending is excluded due to the lack of clear and disaggregated information in official data sources. The official sources did not specify what the “others” category includes, making it difficult to interpret its impact accurately. Including it without knowing its exact components could lead to misinterpretation or bias in the results.

Secondly, the sample period is limited to 1990–2023, covering only 33 years. While most economic studies recommend using 30 to 50 years of data for more reliable long-run analysis, this research only covers 33 years. Although this falls within the suggested range, it may still be insufficient for capturing long-term trends fully. Since one economic cycle usually lasts about five years, our data spans around six cycles. A longer timeframe could provide more consistent and dependable results. Although data from 1980 to 2023 was available, the earlier years produced poor estimates and had to be excluded. This reduced the number of usable observations, which may weaken the precision and statistical strength of the results.

5.4 Recommendations for Future Research

Based on the limitations identified in this study, future research can expand the analysis and improve the methods to better understand how government spending affects economic growth. This will help provide a more comprehensive understanding of their relationship.

Firstly, future studies could broaden the analysis of government expenditure by including the "others" category of social sector expenditure, provided that more detailed and disaggregated data becomes available. A more detailed breakdown of the “others” category, such as welfare, public safety, and related services would offer a clearer understanding of how different areas of social spending contribute to economic growth. Moreover, future research should explore the impact of development expenditure in sectors beyond the social sector, such as the economic, security, and general administration sectors. Although these areas were not examined in this study, they may play an important role in driving GDP growth. Including these components in future analyses would provide a more comprehensive picture of the overall impact of government expenditure on the country’s economic performance.

Secondly, it is also recommended that future research extend the sample period under study. Using a longer dataset that covers at least 40 to 50 years would enhance the reliability of long-run estimations and improve the robustness of the findings. If earlier data can be cleaned, verified, or reconstructed using alternative sources, this would help increase the number of observations. A larger sample size could provide more stable estimates, reduce statistical errors, and capture more economic cycles, giving a better picture of long-term relationships.

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Appendices

Appendix 4.1: Descriptive Statistics

Date: 05/05/25 Time: 17:08
Sample: 1990 2023

	LN_DE_NET_	LN_EDU	LN_GDP	LN_GFCF	LN_HLT	LN_HOU	LN_L	LN_SOC
Mean	24.16095	22.31091	10.28133	25.97553	21.04831	20.55325	16.18586	22.94600
Median	24.39774	22.56198	10.29654	25.95405	21.12573	20.85133	16.15789	23.13182
Maximum	25.28856	23.33017	10.75668	26.53916	22.88877	21.80405	16.57637	23.91156
Minimum	22.98138	20.83391	9.685977	25.08507	19.68481	17.57671	15.71538	21.52077
Std. Dev.	0.632840	0.716316	0.297139	0.404743	0.795665	1.013727	0.267738	0.700257
Skewness	-0.590503	-0.600912	-0.152485	-0.225174	0.052676	-1.514482	-0.096193	-0.728098
Kurtosis	2.272312	2.291424	2.073009	2.049501	2.533805	4.695566	1.740791	2.357549
Jarque-Bera	2.726097	2.757485	1.349119	1.567204	0.323618	17.07023	2.298710	3.588769
Probability	0.255880	0.251895	0.509381	0.456758	0.850603	0.000196	0.316841	0.166230
Sum	821.4723	758.5710	349.5652	883.1681	715.6425	698.8105	550.3192	780.1639
Sum Sq. Dev.	13.21605	16.93257	2.913630	5.405966	20.89176	33.91219	2.365564	16.18189
Observations	34	34	34	34	34	34	34	34

Appendix 4.3.1: JJ test of Equation 3.1.1

Date: 04/26/25 Time: 17:17
Sample (adjusted): 1995 2023
Included observations: 29 after adjustments
Trend assumption: Linear deterministic trend
Series: LN_GDP LN_DE_NET_ LN_GFCF LN_L
Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.820522	98.53256	47.85613	0.0000
At most 1 *	0.660369	48.71916	29.79707	0.0001
At most 2 *	0.389442	17.40222	15.49471	0.0255
At most 3	0.101200	3.094156	3.841465	0.0786

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.820522	49.81340	27.58434	0.0000
At most 1 *	0.660369	31.31694	21.13162	0.0013
At most 2 *	0.389442	14.30807	14.26460	0.0492
At most 3	0.101200	3.094156	3.841465	0.0786

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LN_GDP	LN_DE_NET_	LN_GFCF	LN_L
26.60617	-15.97022	-26.57298	36.59989
-2.467976	-1.739566	-23.73115	47.24498
-69.60890	4.406756	12.67227	47.44067
30.54352	-10.67103	-15.85228	15.18013

Unrestricted Adjustment Coefficients (alpha):

D(LN_GDP)	0.017355	-0.007903	0.005358	-0.004617
D(LN_DE_NE	0.032840	-0.034571	-0.026400	0.014416
D(LN_GFCF)	0.073539	-0.006562	-0.008127	-0.018122
D(LN_L)	0.000277	-0.007291	-0.002864	-0.002941

1 Cointegrating Equation(s): Log likelihood 252.6512

Normalized cointegrating coefficients (standard error in parentheses)

LN_GDP	LN_DE_NET	LN_GFCF	LN_L
1.000000	-0.600245	-0.998753	1.375617
	(0.07870)	(0.17223)	(0.39120)

Adjustment coefficients (standard error in parentheses)

D(LN_GDP)	0.461742
	(0.16918)
D(LN_DE_NE	0.873743

	(0.61560)			
D(LN_GFCF)	1.956583			
	(0.54779)			
D(LN_L)	0.007377			
	(0.10971)			
2 Cointegrating Equation(s):		Log likelihood	268.3097	
Normalized cointegrating coefficients (standard error in parentheses)				
LN_GDP	LN_DE_NET_	LN_GFCF	LN_L	
1.000000	0.000000	3.883042	-8.061451	
		(0.86234)	(1.52819)	
0.000000	1.000000	8.133003	-15.72203	
		(1.43566)	(2.54419)	
Adjustment coefficients (standard error in parentheses)				
D(LN_GDP)	0.481248	-0.263410		
	(0.15753)	(0.09471)		
D(LN_DE_NE	0.959063	-0.464322		
	(0.55196)	(0.33184)		
D(LN_GFCF)	1.972779	-1.163014		
	(0.54759)	(0.32922)		
D(LN_L)	0.025371	0.008255		
	(0.09322)	(0.05605)		
3 Cointegrating Equation(s):		Log likelihood	275.4637	
Normalized cointegrating coefficients (standard error in parentheses)				
LN_GDP	LN_DE_NET_	LN_GFCF	LN_L	
1.000000	0.000000	0.000000	-1.078301	
			(0.03951)	
0.000000	1.000000	0.000000	-1.095868	
			(0.14941)	
0.000000	0.000000	1.000000	-1.798371	
			(0.06762)	
Adjustment coefficients (standard error in parentheses)				
D(LN_GDP)	0.108301	-0.239799	-0.205713	
	(0.42274)	(0.09445)	(0.21439)	
D(LN_DE_NE	2.796765	-0.580662	-0.386799	
	(1.42125)	(0.31753)	(0.72078)	
D(LN_GFCF)	2.538510	-1.198829	-1.901406	
	(1.51705)	(0.33893)	(0.76937)	
D(LN_L)	0.224705	-0.004364	0.129363	
	(0.25204)	(0.05631)	(0.12782)	

Appendix 4.3.2: VECM for Equation 3.1.1

Vector Error Correction Estimates
Date: 04/26/25 Time: 17:18
Sample (adjusted): 1994 2023
Included observations: 30 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LN_GDP(-1)	1.000000
LN_DE_NET_(-1)	-11.83123
	(2.17681)
	[-5.43511]
LN_GFCF(-1)	-17.19878
	(4.77716)
	[-3.60021]
LN_L(-1)	43.87496
	(10.7706)
	[4.07359]
C	12.64531

Error Correction:	D(LN_GDP)	D(LN_DE_N	D(LN_GFCF)	D(LN_L)
CointEq1	0.009609	0.022574	0.032706	-0.003547
	(0.00415)	(0.01706)	(0.01611)	(0.00245)
	[2.31646]	[1.32293]	[2.03020]	[-1.44525]
D(LN_GDP(-1))	-0.548194	0.335504	-2.281272	-0.462434
	(0.41083)	(1.68998)	(1.59548)	(0.24309)
	[-1.33435]	[0.19853]	[-1.42983]	[-1.90229]
D(LN_GDP(-2))	-0.843459	1.434179	-2.056242	0.027327
	(0.39386)	(1.62017)	(1.52958)	(0.23305)
	[-2.14151]	[0.88520]	[-1.34432]	[0.11726]
D(LN_GDP(-3))	-0.645279	0.984607	-2.865168	-0.334986
	(0.42102)	(1.73188)	(1.63504)	(0.24912)
	[-1.53266]	[0.56852]	[-1.75236]	[-1.34468]
D(LN_DE_NET_(-1))	0.104480	0.196451	0.162494	0.043752
	(0.06360)	(0.26163)	(0.24700)	(0.03763)
	[1.64271]	[0.75087]	[0.65787]	[1.16257]
D(LN_DE_NET_(-2))	-0.020557	0.212641	0.130697	0.029884
	(0.06405)	(0.26349)	(0.24876)	(0.03790)
	[-0.32093]	[0.80702]	[0.52540]	[0.78846]
D(LN_DE_NET_(-3))	-0.013867	-0.030216	-0.098675	-0.038240
	(0.06379)	(0.26240)	(0.24773)	(0.03774)
	[-0.21739]	[-0.11515]	[-0.39832]	[-1.01312]
D(LN_GFCF(-1))	0.183663	-0.027624	0.872202	0.125354
	(0.11218)	(0.46145)	(0.43565)	(0.06638)
	[1.63723]	[-0.05986]	[2.00207]	[1.88851]
D(LN_GFCF(-2))	0.260845	-0.281847	0.547039	-0.067496
	(0.11719)	(0.48208)	(0.45513)	(0.06934)
	[2.22575]	[-0.58464]	[1.20195]	[-0.97333]
D(LN_GFCF(-3))	0.196982	-0.222618	0.699749	0.114300
	(0.11608)	(0.47748)	(0.45078)	(0.06868)
	[1.69702]	[-0.46623]	[1.55230]	[1.66417]
D(LN_L(-1))	-0.070027	-1.475647	0.097552	-0.000830
	(0.33990)	(1.39820)	(1.32002)	(0.20112)
	[-0.20602]	[-1.05539]	[0.07390]	[-0.00413]
D(LN_L(-2))	-0.666460	-0.150718	-2.499192	-0.082743
	(0.33710)	(1.38668)	(1.30914)	(0.19946)
	[-1.97704]	[-0.10869]	[-1.90904]	[-0.41482]
D(LN_L(-3))	-0.120658	-0.906890	0.230109	0.468833
	(0.34463)	(1.41767)	(1.33840)	(0.20392)
	[-0.35010]	[-0.63970]	[0.17193]	[2.29907]
C	0.085331	0.052073	0.215778	0.029467
	(0.02551)	(0.10493)	(0.09907)	(0.01509)
	[3.34508]	[0.49624]	[2.17810]	[1.95221]
R-squared	0.576816	0.400775	0.518502	0.584208
Adj. R-squared	0.232978	-0.086095	0.127285	0.246377
Sum sq. resids	0.017118	0.289664	0.258175	0.005993
S.E. equation	0.032709	0.134551	0.127027	0.019354
F-statistic	1.677583	0.823166	1.325357	1.729290
Log likelihood	69.46389	27.03530	28.76154	85.20613
Akaike AIC	-3.697593	-0.869020	-0.984103	-4.747075
Schwarz SC	-3.043700	-0.215128	-0.330211	-4.093183
Mean dependent	0.029319	0.075013	0.030643	0.025387
S.D. dependent	0.037348	0.129108	0.135976	0.022295

Determinant resid covariance (dof adj.)	1.92E-11
Determinant resid covariance	1.56E-12
Log likelihood	237.5506
Akaike information criterion	-11.83671
Schwarz criterion	-9.034314
Number of coefficients	60

Appendix 4.3.3: VECM Diagnosis test for Equation 3.1.1

Autocorrelation test

VEC Residual Serial Correlation LM Tests
Date: 04/26/25 Time: 18:55
Sample: 1990 2023
Included observations: 30

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	13.54865	16	0.6323	0.827380	(16, 28.1)	0.6474
2	9.104875	16	0.9090	0.520169	(16, 28.1)	0.9139
3	14.29691	16	0.5766	0.883041	(16, 28.1)	0.5929
4	5.288872	16	0.9941	0.285656	(16, 28.1)	0.9945

Null hypothesis: No serial correlation at lags 1 to h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	13.54865	16	0.6323	0.827380	(16, 28.1)	0.6474
2	23.21637	32	0.8714	0.588492	(32, 20.0)	0.9120
3	61.79425	48	0.0872	0.919210	(48, 5.9)	0.6172
4	1302.846	64	0.0000	NA	(64, NA)	NA

*Edgeworth expansion corrected likelihood ratio statistic.

Normality test

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: Residuals are multivariate normal
Date: 04/26/25 Time: 18:57
Sample: 1990 2023
Included observations: 30

Component	Skewness	Chi-sq	df	Prob.*
1	0.128475	0.082529	1	0.7739
2	-1.361343	9.266278	1	0.0023
3	0.605322	1.832076	1	0.1759
4	-0.474965	1.127961	1	0.2882
Joint		12.30884	4	0.0152

Component	Kurtosis	Chi-sq	df	Prob.
1	2.723290	0.095710	1	0.7570
2	5.399659	7.197953	1	0.0073
3	3.841819	0.885824	1	0.3466
4	3.342163	0.146345	1	0.7021
Joint		8.325832	4	0.0803

Component	Jarque-B...	df	Prob.
1	0.178239	2	0.9147
2	16.46423	2	0.0003
3	2.717899	2	0.2569
4	1.274306	2	0.5288
Joint	20.63467	8	0.0082

*Approximate p-values do not account for coefficient estimation

Heteroscedasticity test

VEC Residual Heteroskedasticity Tests (Levels and Squares)
Date: 04/26/25 Time: 18:59
Sample: 1990 2023
Included observations: 30

Joint test:

Chi-sq	df	Prob.
280.3446	260	0.1843

Individual components:

Dependent	R-squared	F(26,3)	Prob.	Chi-sq(26)	Prob.
res1*res1	0.995611	26.17288	0.0102	29.86832	0.2731
res2*res2	0.898004	1.015883	0.5846	26.94012	0.4125
res3*res3	0.975777	4.648139	0.1150	29.27332	0.2988
res4*res4	0.967231	3.405725	0.1704	29.01692	0.3103
res2*res1	0.931198	1.561668	0.4041	27.93594	0.3616
res3*res1	0.972744	4.118036	0.1344	29.18233	0.3029
res3*res2	0.825232	0.544831	0.8345	24.75696	0.5328
res4*res1	0.986307	8.311195	0.0527	29.58921	0.2850
res4*res2	0.918315	1.297177	0.4792	27.54946	0.3810
res4*res3	0.954540	2.422785	0.2548	28.63621	0.3279

Multicollinearity test

Variance Inflation Factors
Date: 05/05/25 Time: 16:45
Sample: 1990 2023
Included observations: 34

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
PC1	7.22E-05	3.696456	3.696456
LN_DE_NET_	0.000356	5554.947	3.696456
C	0.207632	5552.250	NA

Appendix 4.4.1: Johansen Cointegration Test for Equation 3.1.2

Date: 04/26/25 Time: 19:02
Sample (adjusted): 1994 2023
Included observations: 30 after adjustments
Trend assumption: Linear deterministic trend
Series: LN_GDP LN_GFCF LN_SOC LN_L
Lags interval (in first differences): 1 to 3

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.738849	88.32916	47.85613	0.0000
At most 1 *	0.592968	48.04948	29.79707	0.0002
At most 2 *	0.461715	21.08358	15.49471	0.0065
At most 3	0.080035	2.502590	3.841465	0.1137

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.738849	40.27967	27.58434	0.0007
At most 1 *	0.592968	26.96590	21.13162	0.0067
At most 2 *	0.461715	18.58099	14.26460	0.0098
At most 3	0.080035	2.502590	3.841465	0.1137

Max-eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LN_GDP	LN_GFCF	LN_SOC	LN_L
5.152530	12.15813	4.874559	-29.92928
5.360232	11.77856	-1.023525	-26.07989
-45.72404	13.69105	3.767186	22.14074
1.668333	1.204630	-1.812536	3.420573

Unrestricted Adjustment Coefficients (alpha):

D(LN_GDP)	-0.013860	0.013152	0.004520	-0.004155
D(LN_GFCF)	-0.062062	0.020592	-0.015884	-0.018030
D(LN_SOC)	-0.077481	0.043197	-0.073476	0.025832
D(LN_L)	0.004685	0.008700	-0.004903	-0.001967

1 Cointegrating Equation(s): Log likelihood 221.8013

Normalized cointegrating coefficients (standard error in parentheses)

LN_GDP	LN_GFCF	LN_SOC	LN_L
1.000000	2.359643	0.946051	-5.808656
	(0.54726)	(0.16064)	(1.03627)

Adjustment coefficients (standard error in parentheses)

D(LN_GDP)	-0.071413
	(0.03206)
D(LN_GFCF)	-0.319774
	(0.10532)
D(LN_SOC)	-0.399221
	(0.20489)
D(LN_L)	0.024141
	(0.01978)

2 Cointegrating Equation(s): Log likelihood 235.2843

Normalized cointegrating coefficients (standard error in parentheses)

LN_GDP	LN_GFCF	LN_SOC	LN_L
1.000000	0.000000	-15.59006	7.909133
		(3.12436)	(5.32074)
0.000000	1.000000	7.007888	-5.813503
		(1.35671)	(2.31046)

Adjustment coefficients (standard error in parentheses)

D(LN_GDP)	-0.000913	-0.013592
	(0.03928)	(0.08943)
D(LN_GFCF)	-0.209398	-0.512012
	(0.14707)	(0.33485)
D(LN_SOC)	-0.167675	-0.433220
	(0.28454)	(0.64783)
D(LN_L)	0.070776	0.159440
	(0.02352)	(0.05355)

3 Cointegrating Equation(s): Log likelihood 244.5748

Normalized cointegrating coefficients (standard error in parentheses)

LN_GDP	LN_GFCF	LN_SOC	LN_L
1.000000	0.000000	0.000000	-1.064553
			(0.03327)
0.000000	1.000000	0.000000	-1.779741
			(0.08008)
0.000000	0.000000	1.000000	-0.575603
			(0.24858)

Adjustment coefficients (standard error in parentheses)

D(LN_GDP)	-0.207606	0.048297	-0.063993
	(0.23908)	(0.11236)	(0.03223)
D(LN_GFCF)	0.516865	-0.729475	-0.383435
	(0.89769)	(0.42189)	(0.12102)
D(LN_SOC)	3.191948	-1.439184	-0.698695
	(1.55527)	(0.73094)	(0.20967)
D(LN_L)	0.294951	0.092316	-0.004536
	(0.13510)	(0.06350)	(0.01821)

Appendix 4.4.2: Vector Error Correction Model for Equation 3.1.2

Vector Error Correction Estimates
Date: 04/26/25 Time: 19:03
Sample (adjusted): 1994 2023
Included observations: 30 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LN_GDP(-1)	1.000000
LN_GFCF(-1)	2.359643 (0.54726) [4.31170]
LN SOC(-1)	0.946051 (0.16064) [5.88930]
LN L(-1)	-5.808656 (1.03627) [-5.60537]
C	0.654028

Error Correction:	D(LN_GDP)	D(LN_GFCF)	D(LN_SOC)	D(LN_L)
CointEq1	-0.071413 (0.03206) [-2.22724]	-0.319774 (0.10532) [-3.03630]	-0.399221 (0.20489) [-1.94849]	0.024141 (0.01978) [1.22039]
D(LN_GDP(-1))	-0.402823 (0.38425) [-1.04834]	-1.436618 (1.26212) [-1.13826]	-2.448413 (2.45537) [-0.99717]	-0.481785 (0.23706) [-2.03236]
D(LN_GDP(-2))	-0.844204 (0.40917) [-2.06321]	-2.559926 (1.34398) [-1.90473]	6.712003 (2.61463) [2.56709]	0.008764 (0.25243) [0.03472]
D(LN_GDP(-3))	-0.335050 (0.48096) [-0.69663]	-1.700818 (1.57977) [-1.07662]	1.845410 (3.07335) [0.60046]	-0.063668 (0.29672) [-0.21457]
D(LN_GFCF(-1))	0.170330 (0.10719) [1.58904]	0.794320 (0.35208) [2.25606]	0.921917 (0.68495) [1.34595]	0.149493 (0.06613) [2.26059]
D(LN_GFCF(-2))	0.256677 (0.12043) [2.13141]	0.780302 (0.39556) [1.97267]	-1.486191 (0.76953) [-1.93129]	-0.075936 (0.07430) [-1.02208]
D(LN GFCF(-3))	0.122430 (0.12516) [0.97816]	0.429405 (0.41112) [1.04448]	0.049094 (0.79980) [0.06138]	0.046454 (0.07722) [0.60159]
D(LN SOC(-1))	0.014525 (0.03835) [0.37879]	0.035629 (0.12595) [0.28287]	0.352651 (0.24504) [1.43917]	-0.021459 (0.02366) [-0.90705]
D(LN_SOC(-2))	0.014429 (0.03247) [0.44438]	0.062441 (0.10665) [0.58546]	0.336037 (0.20749) [1.61955]	0.025556 (0.02003) [1.27576]
D(LN_SOC(-3))	0.012878 (0.03296) [0.39067]	0.126821 (0.10828) [1.17127]	-0.024289 (0.21065) [-0.11531]	-0.013202 (0.02034) [-0.64917]
D(LN_L(-1))	-0.174405 (0.35208) [-0.49536]	-0.152980 (1.15646) [-0.13228]	-0.565283 (2.24982) [-0.25126]	0.067834 (0.21721) [0.31229]
D(LN_L(-2))	-0.708672 (0.33312) [-2.12735]	-2.477167 (1.09420) [-2.26392]	-1.247584 (2.12869) [-0.58608]	-0.225404 (0.20552) [-1.09676]
D(LN_L(-3))	-0.144838 (0.37140) [-0.38998]	-0.493410 (1.21991) [-0.40446]	-0.748090 (2.37325) [-0.31522]	0.468786 (0.22913) [2.04594]
C	0.081398 (0.02671) [3.04778]	0.199101 (0.08772) [2.26963]	-0.068265 (0.17066) [-0.40000]	0.029383 (0.01648) [1.78330]
R-squared	0.540499	0.625996	0.546604	0.509201
Adj. R-squared	0.167155	0.322118	0.178219	0.110427
Sum sq. resids	0.018587	0.200538	0.758981	0.007075
S.E. equation	0.034084	0.111954	0.217799	0.021028
F-statistic	1.447724	2.060026	1.483786	1.276918
Log likelihood	68.22891	32.55109	12.58648	82.71840
Akaike AIC	-3.615260	-1.236739	0.094234	-4.581227
Schwarz SC	-2.961368	-0.582847	0.748126	-3.927335
Mean dependent	0.029319	0.030643	0.079693	0.025387
S.D. dependent	0.037348	0.135976	0.240258	0.022295

Determinant resid covariance (dof adj.)	5.50E-11
Determinant resid covariance	4.45E-12
Log likelihood	221.8013
Akaike information criterion	-10.78676
Schwarz criterion	-7.984361
Number of coefficients	60

Appendix 4.4.3: VECM Diagnosis Checking for Equation 3.1.2

Autocorrelation test

VEC Residual Serial Correlation LM Tests
Date: 04/26/25 Time: 19:04
Sample: 1990 2023
Included observations: 30

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	20.33123	16	0.2057	1.378000	(16, 28.1)	0.2219
2	24.87820	16	0.0720	1.811343	(16, 28.1)	0.0817
3	12.97587	16	0.6745	0.785567	(16, 28.1)	0.6884
4	10.80074	16	0.8216	0.632848	(16, 28.1)	0.8304

Null hypothesis: No serial correlation at lags 1 to h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	20.33123	16	0.2057	1.378000	(16, 28.1)	0.2219
2	45.52502	32	0.0572	1.669889	(32, 20.0)	0.1153
3	96.33067	48	0.0000	3.320790	(48, 5.9)	0.0689
4	1169.483	64	0.0000	NA	(64, NA)	NA

*Edgeworth expansion corrected likelihood ratio statistic.

Normality test

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: Residuals are multivariate normal
Date: 04/26/25 Time: 19:04
Sample: 1990 2023
Included observations: 30

Component	Skewness	Chi-sq	df	Prob.*
1	-0.294627	0.434024	1	0.5100
2	0.172258	0.148365	1	0.7001
3	-0.683429	2.335378	1	0.1265
4	-0.211875	0.224455	1	0.6357
Joint		3.142223	4	0.5343

Component	Kurtosis	Chi-sq	df	Prob.
1	3.444266	0.246715	1	0.6194
2	3.103596	0.013415	1	0.9078
3	3.206791	0.053453	1	0.8172
4	3.004181	2.18E-05	1	0.9963
Joint		0.313605	4	0.9889

Component	Jarque-B...	df	Prob.
1	0.680739	2	0.7115
2	0.161780	2	0.9223
3	2.388832	2	0.3029
4	0.224477	2	0.8938
Joint	3.455828	8	0.9026

*Approximate p-values do not account for coefficient estimation

Heteroscedasticity test

VEC Residual Heteroskedasticity Tests (Levels and Squares)
Date: 04/26/25 Time: 19:06
Sample: 1990 2023
Included observations: 30

Joint test:

Chi-sq	df	Prob.
270.4520	260	0.3151

Individual components:

Dependent	R-squared	F(26,3)	Prob.	Chi-sq(26)	Prob.
res1*res1	0.872855	0.792118	0.6922	26.18564	0.4529
res2*res2	0.996729	35.15915	0.0066	29.90187	0.2717
res3*res3	0.920579	1.337446	0.4665	27.61738	0.3775
res4*res4	0.973237	4.195939	0.1312	29.19711	0.3022
res2*res1	0.988057	9.545708	0.0434	29.64170	0.2827
res3*res1	0.987198	8.897972	0.0479	29.61595	0.2838
res3*res2	0.892519	0.958146	0.6102	26.77556	0.4212
res4*res1	0.978111	5.155848	0.1004	29.34332	0.2957
res4*res2	0.980070	5.674014	0.0885	29.40209	0.2931
res4*res3	0.888173	0.916425	0.6296	26.64518	0.4281

Multicollinearity test

Variance Inflation Factors
Date: 05/05/25 Time: 16:59
Sample: 1990 2023
Included observations: 34

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
LN_SOC	0.000229	2344.442	2.117305
PC1	5.68E-05	2.117305	2.117305
C	0.120431	2343.325	NA

Appendix 4.5.1: Johansen Cointegration Test for Equation 3.1.3

Date: 04/26/25 Time: 16:57
Sample (adjusted): 1993 2023
Included observations: 31 after adjustments
Trend assumption: Linear deterministic trend
Series: LN_GDP LN_EDU LN_GFCF LN_HLT LN_HOU LN_L
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.897111	183.6434	95.75366	0.0000
At most 1 *	0.771446	113.1462	69.81889	0.0000
At most 2 *	0.699113	67.39078	47.85613	0.0003
At most 3 *	0.560814	30.15916	29.79707	0.0454
At most 4	0.138499	4.651346	15.49471	0.8447
At most 5	0.000964	0.029910	3.841465	0.8626

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.897111	70.49720	40.07757	0.0000
At most 1 *	0.771446	45.75543	33.87687	0.0012
At most 2 *	0.699113	37.23162	27.58434	0.0021
At most 3 *	0.560814	25.50782	21.13162	0.0113
At most 4	0.138499	4.621436	14.26460	0.7886
At most 5	0.000964	0.029910	3.841465	0.8626

Max-eigenvalue test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LN_GDP	LN_EDU	LN_GFCF	LN_HLT	LN_HOU	LN_L
-33.47295	-6.332846	8.182493	5.102895	2.302093	17.28454
-18.42539	-4.093725	-5.775656	2.172136	2.172825	27.59212
-22.81650	2.288839	6.835710	2.593998	-1.579925	7.259049
-47.58426	-1.307953	21.02390	5.871091	2.251727	8.001861
-20.60144	0.815551	1.150351	-2.175030	-0.338241	25.80390
-0.725901	1.935898	-5.350160	-4.651689	0.620206	10.46569

Unrestricted Adjustment Coefficients (alpha):

D(LN_GDP)	0.019034	0.002292	0.010364	-0.005304	0.001622	-0.000457
D(LN_EDU)	0.120860	-0.019816	-0.110539	-0.081885	0.001477	0.001665
D(LN_GFCF)	0.036407	0.027017	0.039563	-0.044421	-0.001099	-0.001779
D(LN_HLT)	-0.153870	-0.097283	-0.039019	-0.009670	0.027856	0.000248
D(LN_HOU)	0.146807	-0.105537	0.145617	-0.101969	0.056762	0.006409
D(LN_L)	0.006656	-0.009974	0.004320	-0.001755	-0.003771	-0.000142

1 Cointegrating Equation(s): Log likelihood 234.0137

Normalized cointegrating coefficients (standard error in parentheses)

LN GDP	LN EDU	LN GFCF	LN HLT	LN HOU	LN L
1.000000	0.189193	-0.244451	-0.152448	-0.068775	-0.516373
	(0.01761)	(0.03741)	(0.01637)	(0.00815)	(0.07529)

Adjustment coefficients (standard error in parentheses)

D(LN GDP)	-0.637121
	(0.17921)
D(LN_EDU)	-4.045549
	(1.50810)
D(LN_GFCF)	-1.218647
	(0.81773)
D(LN_HLT)	5.150473
	(1.23106)
D(LN_HOU)	-4.914070
	(2.94555)
D(LN_L)	-0.222782
	(0.13821)

2 Cointegrating Equation(s): Log likelihood 256.8914

Normalized cointegrating coefficients (standard error in parentheses)

LN_GDP	LN_EDU	LN_GFCF	LN_HLT	LN_HOU	LN_L
1.000000	0.000000	-3.444434	-0.350673	0.213137	5.111042
		(0.64772)	(0.25665)	(0.09455)	(1.33030)
0.000000	1.000000	16.91386	1.047737	-1.490074	-29.74431
		(3.35745)	(1.33036)	(0.49011)	(6.89557)

Adjustment coefficients (standard error in parentheses)

D(LN GDP)	-0.679353	-0.129922
	(0.20346)	(0.04015)
D(LN EDU)	-3.680436	-0.684269
	(1.71166)	(0.33781)
D(LN GFCF)	-1.716438	-0.341158
	(0.89923)	(0.17747)
D(LN HLT)	6.942952	1.372684
	(1.07794)	(0.21274)
D(LN HOU)	-2.969516	-0.497669
	(3.21693)	(0.63488)
D(LN L)	-0.039015	-0.001320
	(0.12786)	(0.02523)

3 Cointegrating Equation(s): Log likelihood 275.5072

Normalized cointegrating coefficients (standard error in parentheses)

LN_GDP	LN_EDU	LN_GFCF	LN_HLT	LN_HOU	LN_L
1.000000	0.000000	0.000000	-0.107301	0.004425	-0.874227
			(0.02404)	(0.01316)	(0.04760)
0.000000	1.000000	0.000000	-0.147336	-0.465197	-0.353711
			(0.10208)	(0.05587)	(0.20213)
0.000000	0.000000	1.000000	0.070656	-0.060594	-1.737664
			(0.05438)	(0.02976)	(0.10767)

Adjustment coefficients (standard error in parentheses)

D(LN_GDP)	-0.915830	-0.106200	0.213354
	(0.20891)	(0.03699)	(0.05692)
D(LN_EDU)	-1.158327	-0.937275	0.347776
	(1.59718)	(0.28283)	(0.43519)
D(LN_GFCF)	-2.619134	-0.250604	0.412304
	(0.95635)	(0.16935)	(0.26058)
D(LN_HLT)	7.833222	1.283376	-0.963884
	(1.18277)	(0.20944)	(0.32227)
D(LN_HOU)	-6.291992	-0.164375	2.806190

	(3.40125)	(0.60229)	(0.92675)		
D(LN L)	-0.137591	0.008569	0.141596		
	(0.14143)	(0.02504)	(0.03853)		

4 Cointegrating Equation(s): Log likelihood 288.2611

Normalized cointegrating coefficients (standard error in parentheses)

LN_GDP	LN_EDU	LN_GFCF	LN_HLT	LN_HOU	LN_L
1.000000	0.000000	0.000000	0.000000	-0.363189	-1.164797
				(0.06678)	(0.20140)
0.000000	1.000000	0.000000	0.000000	-0.969970	-0.752694
				(0.12207)	(0.36819)
0.000000	0.000000	1.000000	0.000000	0.181475	-1.546328
				(0.04338)	(0.13085)
0.000000	0.000000	0.000000	1.000000	-3.425997	-2.707980
				(0.63829)	(1.92517)

Adjustment coefficients (standard error in parentheses)

D(LN GDP)	-0.663425	-0.099262	0.101835	0.097849
	(0.29414)	(0.03606)	(0.10957)	(0.03830)
D(LN EDU)	2.738100	-0.830173	-1.373762	-0.193796
	(1.94762)	(0.23880)	(0.72552)	(0.25358)
D(LN GFCF)	-0.505400	-0.192504	-0.521595	0.086293
	(1.21141)	(0.14853)	(0.45127)	(0.15772)
D(LN HLT)	8.293374	1.296024	-1.167191	-1.154482
	(1.72480)	(0.21148)	(0.64252)	(0.22457)
D(LN_HOU)	-1.439859	-0.031004	0.662398	0.298962
	(4.71149)	(0.57768)	(1.75511)	(0.61343)
D(LN_L)	-0.054085	0.010864	0.104701	0.013203
	(0.20518)	(0.02516)	(0.07643)	(0.02671)

5 Cointegrating Equation(s): Log likelihood 290.5718

Normalized cointegrating coefficients (standard error in parentheses)

LN_GDP	LN_EDU	LN_GFCF	LN_HLT	LN_HOU	LN_L
1.000000	0.000000	0.000000	0.000000	0.000000	-1.123017
					(0.07253)
0.000000	1.000000	0.000000	0.000000	0.000000	-0.641113
					(0.29305)
0.000000	0.000000	1.000000	0.000000	0.000000	-1.567204
					(0.07701)
0.000000	0.000000	0.000000	1.000000	0.000000	-2.313867
					(0.68722)
0.000000	0.000000	0.000000	0.000000	1.000000	0.115036
					(0.50357)

Adjustment coefficients (standard error in parentheses)

D(LN GDP)	-0.696838	-0.097939	0.103701	0.094321	0.019931
	(0.30732)	(0.03611)	(0.10928)	(0.03938)	(0.01892)
D(LN_EDU)	2.707681	-0.828969	-1.372064	-0.197007	0.224937
	(2.04252)	(0.24002)	(0.72628)	(0.26176)	(0.12576)
D(LN_GFCF)	-0.482759	-0.193400	-0.522860	0.088683	-0.019644
	(1.27040)	(0.14929)	(0.45173)	(0.16281)	(0.07822)
D(LN_HLT)	7.719497	1.318742	-1.135146	-1.215070	-0.535152
	(1.74908)	(0.20554)	(0.62194)	(0.22415)	(0.10769)
D(LN_HOU)	-2.609240	0.015289	0.727695	0.175503	-0.370220
	(4.85105)	(0.57006)	(1.72494)	(0.62169)	(0.29869)
D(LN_L)	0.023597	0.007789	0.100364	0.021404	-0.015851
	(0.20592)	(0.02420)	(0.07322)	(0.02639)	(0.01268)

Appendix 4.5.2: Vector Error Correction Model for Equation 3.1.3

Vector Error Correction Estimates
Date: 04/26/25 Time: 17:00
Sample (adjusted): 1993 2023
Included observations: 31 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LN_GDP(-1)	1.000000
LN_EDU(-1)	0.189193
	(0.01761)
	[10.7406]
LN_GFCF(-1)	-0.244451
	(0.03741)
	[-6.53524]
LN_HLT(-1)	-0.152448
	(0.01637)
	[-9.30997]
LN_HOU(-1)	-0.068775
	(0.00815)
	[-8.44357]
LN_L(-1)	-0.516373
	(0.07529)
	[-6.85848]
C	4.828624

Error Correction:	D(LN_GDP)	D(LN_EDU)	D(LN_GFCF)	D(LN_HLT)	D(LN_HOU)	D(LN_L)
CointEq1	-0.637121	-4.045549	-1.218647	5.150473	-4.914070	-0.222782
	(0.17921)	(1.50810)	(0.81773)	(1.23106)	(2.94555)	(0.13821)
	[-3.55511]	[-2.68255]	[-1.49028]	[4.18376]	[-1.66830]	[-1.61192]
D(LN_GDP(-1))	0.018918	-3.788518	-1.146415	-4.007198	10.54461	-0.240898
	(0.41016)	(3.45159)	(1.87154)	(2.81753)	(6.74147)	(0.31632)
	[0.04612]	[-1.09762]	[-0.61255]	[-1.42224]	[1.56414]	[-0.76157]
D(LN_GDP(-2))	-0.938886	4.905685	-2.519450	6.903302	-0.344487	-0.351849
	(0.35315)	(2.97185)	(1.61141)	(2.42592)	(5.80446)	(0.27235)
	[-2.65857]	[1.65072]	[-1.56351]	[2.84565]	[-0.05935]	[-1.29189]
D(LN_EDU(-1))	0.037242	0.753301	0.047127	-0.173244	0.989947	0.018575
	(0.02860)	(0.24064)	(0.13048)	(0.19644)	(0.47001)	(0.02205)
	[1.30233]	[3.13037]	[0.36117]	[-0.88193]	[2.10622]	[0.84228]
D(LN_EDU(-2))	0.084169	0.460732	0.176045	-0.250940	0.532607	0.056041
	(0.03128)	(0.26320)	(0.14271)	(0.21485)	(0.51407)	(0.02412)
	[2.69109]	[1.75050]	[1.23355]	[-1.16798]	[1.03606]	[2.32333]
D(LN_GFCF(-1))	-0.000856	0.360864	0.357290	0.448104	-2.310493	0.070336
	(0.10029)	(0.84393)	(0.45760)	(0.68890)	(1.64833)	(0.07734)
	[-0.00854]	[0.42760]	[0.78079]	[0.65046]	[-1.40172]	[0.90942]
D(LN_GFCF(-2))	0.175545	-1.620483	0.330484	-2.006787	0.445049	0.040152
	(0.08684)	(0.73073)	(0.39622)	(0.59650)	(1.42723)	(0.06697)
	[2.02159]	[-2.21762]	[0.83409]	[-3.36429]	[0.31183]	[0.59957]
D(LN_HLT(-1))	-0.069372	-0.780112	-0.245823	0.245322	-0.448727	-0.042038
	(0.02780)	(0.23390)	(0.12683)	(0.19093)	(0.45684)	(0.02144)
	[-2.49582]	[-3.33522]	[-1.93826]	[1.28485]	[-0.98223]	[-1.96113]
D(LN_HLT(-2))	-0.058465	0.055750	-0.129820	-0.026019	-0.698044	-0.027513
	(0.02408)	(0.20262)	(0.10987)	(0.16540)	(0.39575)	(0.01857)
	[-2.42811]	[0.27514]	[-1.18160]	[-0.15731]	[-1.76383]	[-1.48167]
D(LN_HOU(-1))	-0.040207	-0.224627	-0.090104	0.266579	-0.614351	-0.024853
	(0.01813)	(0.15259)	(0.08274)	(0.12456)	(0.29803)	(0.01398)
	[-2.21737]	[-1.47210]	[-1.08904]	[2.14019]	[-2.06137]	[-1.77722]
D(LN_HOU(-2))	-0.024413	-0.033578	-0.006538	0.357024	-0.553703	-0.010415
	(0.01482)	(0.12470)	(0.06761)	(0.10179)	(0.24355)	(0.01143)
	[-1.64752]	[-0.26928]	[-0.09670]	[3.50747]	[-2.27346]	[-0.91135]
D(LN_L(-1))	-0.288559	-0.800410	0.222794	-0.330171	-5.699828	-0.143326
	(0.29033)	(2.44319)	(1.32476)	(1.99438)	(4.77192)	(0.22390)
	[-0.99389]	[-0.32761]	[0.16818]	[-0.16555]	[-1.19445]	[-0.64012]
D(LN_L(-2))	-0.606136	-3.707303	-2.493817	-1.106895	2.236442	-0.142457
	(0.28616)	(2.40805)	(1.30570)	(1.96569)	(4.70328)	(0.22068)
	[-2.11820]	[-1.53955]	[-1.90994]	[-0.56311]	[0.47551]	[-0.64553]
C	0.085633	0.214449	0.210290	0.024988	0.053811	0.052938
	(0.01734)	(0.14592)	(0.07912)	(0.11911)	(0.28500)	(0.01337)
	[4.93849]	[1.46965]	[2.65785]	[0.20978]	[0.18881]	[3.95873]
R-squared	0.638607	0.618560	0.431620	0.811735	0.395372	0.394849
Adj. R-squared	0.362248	0.326870	-0.003024	0.667768	-0.066991	-0.067913
Sum sq. resids	0.015106	1.069753	0.314516	0.712825	4.080892	0.008984
S.E. equation	0.029810	0.250852	0.136018	0.204770	0.489952	0.022989
F-statistic	2.310786	2.120609	0.993044	5.638336	0.855111	0.853245
Log likelihood	74.22560	8.194577	27.16890	14.48676	-12.55819	82.27971
Akaike AIC	-3.885523	0.374543	-0.849606	-0.031404	1.713431	-4.405143
Schwarz SC	-3.237916	1.022151	-0.201999	0.616203	2.361038	-3.757536
Mean dependent	0.030523	0.078078	0.034938	0.067742	0.100421	0.026069
S.D. dependent	0.037328	0.305751	0.135813	0.355260	0.474321	0.022246

Determinant resid covariance (dof adj.)	4.11E-13
Determinant resid covariance	1.12E-14
Log likelihood	234.0137
Akaike information criterion	-9.291206
Schwarz criterion	-5.128017
Number of coefficients	90

Appendix 4.5.3: VECM Diagnosis Checking for Equation 3.1.3

Autocorrelation test

VEC Residual Serial Correlation LM Tests
Date: 04/26/25 Time: 16:46
Sample: 1990 2023
Included observations: 31

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	44.09128	36	0.1666	1.295266	(36, 29.1)	0.2384
2	41.35643	36	0.2482	1.174109	(36, 29.1)	0.3308
3	47.36967	36	0.0973	1.450298	(36, 29.1)	0.1528

Null hypothesis: No serial correlation at lags 1 to h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	44.09128	36	0.1666	1.295266	(36, 29.1)	0.2384
2	NA	72	NA	NA	(72, NA)	NA
3	NA	108	NA	NA	(108, NA)	NA

*Edgeworth expansion corrected likelihood ratio statistic.

Normality test

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: Residuals are multivariate normal
Date: 04/26/25 Time: 16:50
Sample: 1990 2023
Included observations: 31

Component	Skewness	Chi-sq	df	Prob.*
1	-0.159280	0.131078	1	0.7173
2	-0.395248	0.807140	1	0.3690
3	0.396352	0.811659	1	0.3676
4	0.084580	0.036961	1	0.8475
5	0.448084	1.037361	1	0.3084
6	0.676996	2.368004	1	0.1238
Joint		5.192203	6	0.5194

Component	Kurtosis	Chi-sq	df	Prob.
1	4.020944	1.346339	1	0.2459
2	2.894341	0.014420	1	0.9044
3	2.682217	0.130440	1	0.7180
4	2.978528	0.000596	1	0.9805
5	4.110122	1.591812	1	0.2071
6	3.252471	0.082333	1	0.7742
Joint		3.165940	6	0.7878

Component	Jarque-B...	df	Prob.
1	1.477417	2	0.4777
2	0.821560	2	0.6631
3	0.942099	2	0.6243
4	0.037557	2	0.9814
5	2.629173	2	0.2686
6	2.450337	2	0.2937
Joint	8.358143	12	0.7566

*Approximate p-values do not account for coefficient estimation

Heteroscedasticity test

VEC Residual Heteroskedasticity Tests (Levels and Squares)
Date: 04/26/25 Time: 16:53
Sample: 1990 2023
Included observations: 31

Joint test:

Chi-sq	df	Prob.
560.5862	546	0.3236

Individual components:

Dependent	R-squared	F(26,4)	Prob.	Chi-sq(26)	Prob.
res1*res1	0.903234	1.436034	0.3987	28.00026	0.3584
res2*res2	0.837289	0.791672	0.6903	25.95596	0.4655
res3*res3	0.939699	2.397451	0.2053	29.13066	0.3052
res4*res4	0.809269	0.652768	0.7778	25.08735	0.5140
res5*res5	0.708690	0.374273	0.9455	21.96941	0.6904
res6*res6	0.832163	0.762795	0.7080	25.79706	0.4743
res2*res1	0.817505	0.689169	0.7543	25.34265	0.4997
res3*res1	0.938091	2.331203	0.2136	29.08083	0.3074
res3*res2	0.949624	2.900093	0.1548	29.43833	0.2915
res4*res1	0.891168	1.259763	0.4600	27.62620	0.3771
res4*res2	0.955782	3.325427	0.1252	29.62925	0.2833
res4*res3	0.852116	0.886471	0.6350	26.41560	0.4405
res5*res1	0.974039	5.772102	0.0499	30.19520	0.2596
res5*res2	0.769397	0.513302	0.8676	23.85131	0.5845
res5*res3	0.912726	1.608939	0.3488	28.29449	0.3441
res5*res4	0.770106	0.515358	0.8663	23.87328	0.5832
res6*res1	0.762652	0.494342	0.8794	23.64221	0.5964
res6*res2	0.915771	1.672679	0.3326	28.38891	0.3396
res6*res3	0.814471	0.675386	0.7632	25.24862	0.5049
res6*res4	0.851459	0.881869	0.6376	26.39523	0.4416
res6*res5	0.511661	0.161193	0.9988	15.86148	0.9395

Multicollinearity test

Variance Inflation Factors
Date: 05/05/25 Time: 17:01
Sample: 1990 2023
Included observations: 34

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
LN_EDU	0.000401	5349.327	5.346557
LN_HLT	0.000262	3106.311	4.302340
LN_HOU	0.000108	1224.918	2.885352
PC1	4.34E-05	2.226151	2.226151
C	0.067720	1813.207	NA