THE IMPACT OF GLOBALIZATION ON INCOME INEQUALITY: EVIDENCE FROM ASEAN COUNTRIES

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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 21,379.

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LIST OF ABBREVIATIONS

ARIMA	Autoregressive Integrated Moving Average
BLUE	Best Linear Unbiased Estimator
FBS	Fixed Broadband Subscription
FDI	Foreign Direct Investment
FEM	Fixed Effect Model
FTA	Free Trade Agreement
GDP	Gross Domestic Product
GDPpc	Gross Domestic Product per capita
GINI	Gini Coefficient
GMM	Gaussian Mixture Model
HO	Heckscher-Ohlin
ICT	Information and Communications Technology
MNC	Multinational Corporation
OLS	Ordinary Least Square
POLS	Pooled Ordinary Least Square
POP	Population
PR	Palma Ratio
REM	Random Effect Model
SE	School Enrolment
TRD	Trade
VAR	Vector Autoregression
VIF	Variance Inflation Factor

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PREFACE

Globalization has been a buzzword in the world of economics for decades, with its proponents and opponents fiercely debating its effects on different aspects of human life. One such aspect that has been of great concern is income inequality, which has risen sharply in many countries around the world over the last few decades. ASEAN countries have experienced significant economic growth due to globalization, but it is unclear whether this growth has led to a reduction or a deterioration of income inequality. This research project aims to discover on the impact of globalization on income inequality in ASEAN countries. Through a comprehensive analysis of existing literature and empirical analysis, this project will provide evidence-based insights into the relationship between globalization and income inequality in these countries. We will examine a range of economic, social, and political factors that contribute to income inequality, and assess how globalization has influenced these factors. The findings of this research project will have important implications for policymakers and other stakeholders interested in promoting inclusive and sustainable economic growth in ASEAN countries. We hope that our research will contribute to a more informed understanding of the complex relationship between globalization and income inequality and provide valuable insights into how to create a more equitable society for all.

ABSTRACT

The integration of markets, technology, and trade has created both opportunities and challenges for developing economies, particularly those in Southeast Asia. The ASEAN region is home to a diverse set of economies that have undergone rapid economic growth and structural transformation in recent years, but income inequality has remained a persistent challenge. This research project aims to contribute to the existing literature on the impact of globalization on income inequality in ASEAN countries. The study uses a panel dataset covering the period from 2001 to 2020 and employs a range of statistical techniques. The study uses a combination of fixed effects, random effects, and pooled ordinary least squares (POLS) regression methods to analyse the relationship between income inequality and various independent variables, including foreign direct investment (FDI), trade openness, ICT development, economic growth, education, and population. The results of the study suggest that FDI has a positive but insignificant effect on income inequality in ASEAN countries. On the other hand, trade openness and education resulted will widen the income gap in ASEAN countries. This result is surprising given that trade openness and education often considered as the key drivers of economic growth and development. This study also finds that economic growth, population, and trade openness have an impact on reducing income inequality in ASEAN countries.

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

This chapter will begin with an overview of the study background, including the impact of globalization on the income inequality with the evidence from ASEAN countries. It will follow by a discussion of the research problem related to the issues of globalization in affecting income inequality. A discussion of the research question and objectives will also include in this study. Likewise covered in this chapter will be the research significance.

1.1 Background of study

1.1.1 Background of ASEAN

ASEAN is a regional organization comprising of ten countries, namely Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam. Initially established as the Association of Southeast Asia (ASA) by the Philippines, Thailand, and the Federation of Malaya in 1961, it later evolved into ASEAN. ASEAN's primary goal is to enhance economic cooperation and trade amongst its member states, as well as with other nations across the world. The organization's focus also includes promoting technical and research collaboration between governments. The main goal that establishes of ASEAN is to achieve collaborative peace and shared prosperity (Moon, 2019). ASEAN is a union of countries with significant differences between them. Despite this, the ASEAN region has a population of over 600 million and a combined GDP of 3.2 trillion (Limaye et al., 2017). The 2020 World Bank statistics show that Myanmar has the lowest GDP per capita, which is around $1,400, while Singapore has the highest GDP per capita of around

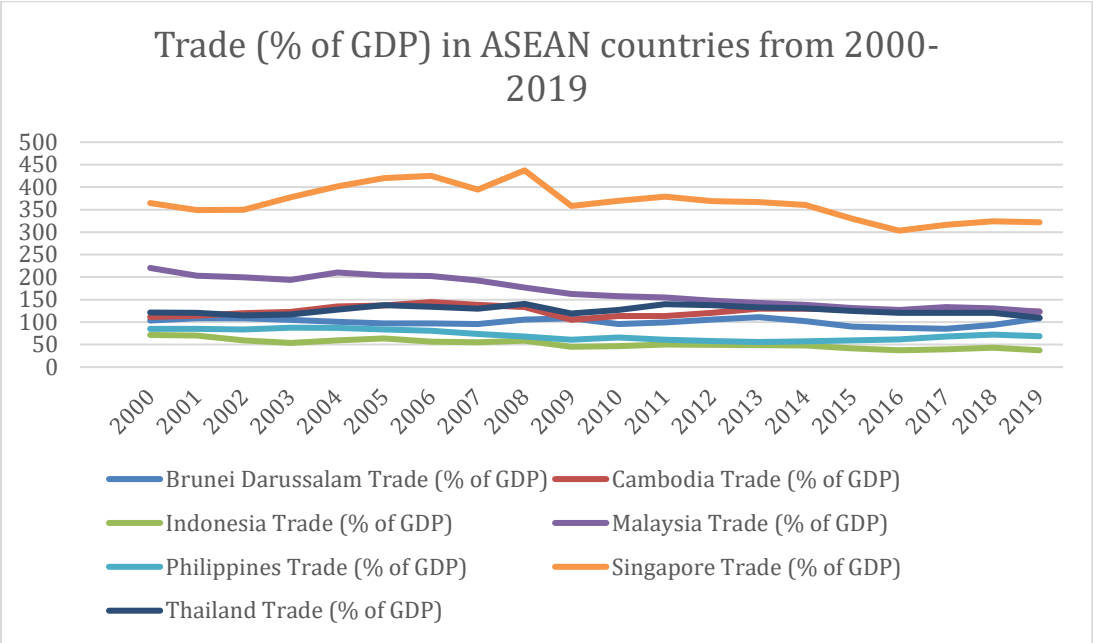
$60,000. ASEAN consists of various religious and ethnic groups, with different demographic profiles. Singapore and Vietnam have the highest religious diversity, while Cambodia, with most Buddhists, and Indonesia, with most Muslims, have almost homogeneous religious populations. ASEAN's geography is determined by archipelagos and continents with low plains and rugged mountains. Furthermore, ASEAN has six free trade agreements with nations outside the region, including India (Moon, 2022). At the end of 2015, ASEAN established the ASEAN Economic Community (AEC). The AEC is a form of economic integration whose aims include the free movement of capital, skilled labour, goods, and services. Through its involvement in negotiations to create the biggest free trade agreement in the world and the establishment of six free trade agreements with other regional economies, ASEAN has played a significant role in the economic integration of Asia. ASEAN has made strides towards economic integration and free trade by establishing the ASEAN Free Trade Area (AFTA) to create a single market, boost intra-ASEAN trade and investment, and promote international investment (Ishikawa, 2021).

1.1.2 Trade to GDP: ASEAN

These days, businesses want to be able to tap into global marketplaces, as doing so may present new prospects for growth. As a result, globalization has contributed to the growth of international trade by creating a market outside of national borders. The term “international trade” usually refers to cross-border trading in goods and services. In addition to other variables like outsourcing and globalization, multinational corporations have a significant impact on the growth of international trade. International trade makes it possible for consumers in different countries to purchase goods and services that are produced abroad. Therefore, it is important for business due to the potential for earnings to increase, the decreased reliance on established markets, as well as the expansion of existing operations (Surugiu & Surugiu, 2015). Not only that, but international trade also helps

in the stimulation of countries' economic growth. According to Andersen and Babula (2008), three variables are cited as the causes of how international trade affects growth. Firstly, access to foreign intermediate inputs and technology is provided through trade. This can be done by bringing in foreign inputs that were not made in the nation of origin but used directly in the production, or as inputs for R&D. Secondly, trade expands the market for new product variants, encouraging research and development to continuously create new goods. Lastly, trade enables the spread of information beyond national boundaries. Due to the non-rival character of knowledge, it can be shared between trading partners, resulting in knowledge spillovers that speed up R&D and innovation. As a result, businesses cannot ignore globalization because of the foreign markets offering opportunities to them and hence, many countries are involved in international trade, including the Association of Southeast Asian Nations (ASEAN) countries. The trade-to-GDP ratio is a common way to evaluate the significance of foreign trade in comparison to domestic trade. To calculate this ratio, the total trade, which includes both the import and export of goods and services, is divided by the country's GDP. A high trade-to-GDP ratio typically suggests that the economy is heavily reliant on trade. However, it is important to note that a low ratio may not necessarily indicate high barriers to foreign trade but could be due to the country's size or distance from potential trading partners. The term "openness" is sometimes used to describe this ratio, but it can be misleading as well (OECD, 2011b).

Figure 1.1 Trade in ASEAN from 2000-2019



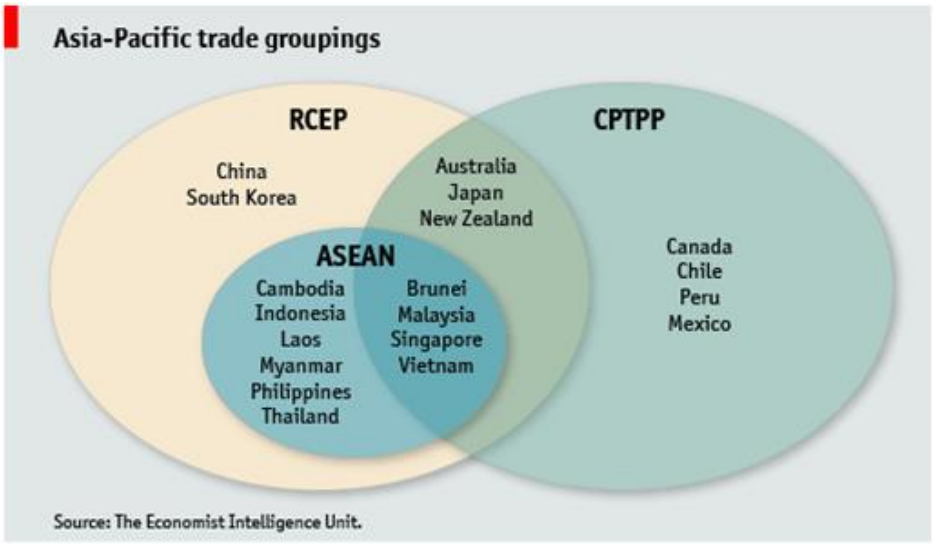
Source: World Bank (2022)

Figure 1.1 demonstrates the trade-to-GDP ratio in each ASEAN country from the year 2000 to 2019. The ratio of Singapore is one of the highest globally, meaning to say that international trade is a major part of the economy of Singapore. Based on the research, most of Singapore's revenue in the year 2022 is coming from foreign trade, which largely comprises the export of machinery and equipment (43%), petroleum (19%), chemical products (13%), as well as miscellaneous manufactured articles (8%). In addition, China, Hong Kong, Malaysia, Indonesia, the United States, and Japan are the main exporter partners of Singapore (Trading Economics, 2019). The high figure of ratio can be due to the Singaporean government, who deliberately works to increase the nation's openness to world trade. International Enterprise (IE) Singapore, a statutory board within the Ministry of Trade & Industry, is primarily responsible for achieving this. The goal of this organization is to "drive Singapore's external economy." International Enterprise (IE) Singapore negotiates free trade agreements (FTA) for Singapore and aims to "spearhead the overseas growth of Singapore-based enterprises and promote international trade" (Jun, 2012). Furthermore, although Malaysia's trade-to-GDP ratio is declining mainly due to the outbreak of the covid-19 pandemic, the

Malaysian government is working hard to strengthen Malaysia's position and competitiveness in global trade, said Prime Minister Datuk Seri Ismail Sabri Yaakob (Safri, 2021). Malaysia is a participant in both the Asia Pacific Economic Cooperation (APEC) and ASEAN. Malaysia has significantly lowered tariffs on imports from its AFTA partners under the ASEAN Free Trade Area Agreement (AFTA). Additionally, it is dedicated to lowering import taxes on almost every type of product, including automobiles. According to the World Trade Organization (WTO), the economy will be more open to trade in products and services because of the Uruguay Round agreements being put into effort, which will encourage competition and specialization (World Trade Organization, 1997).

1.1.3 ASEAN encompassed trading blocs

Figure 1.2: Asia-Pacific trading blocs



Source: The Economist Intelligence Unit (2020)

In 2012, 16 nations, including the ten members of the Association of Southeast Asian Nations (ASEAN), China, Japan, India, South Korea, Australia, and New Zealand, began RCEP discussions and negotiations. As of 17 January 2022, seven out of ten ASEAN countries are formally joined Regional Comprehensive Economic Partnership (RCEP). RCEP is an

international trading bloc that aims to establish an integrated trading market among fifteen member countries, to reduce the trade barriers and make the goods and services more easily to trade with each other (The Japan Times, 2021). This trading bloc will be the world largest Free Trade Agreement (FTA) partnership, it encompasses over 30 percent of global GDP and 27 percent of global merchandise trade despite India decided to quit from RCEP in 2019 (Cali, 2020). The ASEAN countries that joined RCEP are Cambodia, Indonesia, Laos, Myanmar, Philippines, Thailand, Brunei, Malaysia, Singapore and Vietnam as shown in figure 1.2.

As a result, RCEP will lead to a higher stage of business interaction among partnership countries, this trading bloc involved 45 percent of world population and most of them are developing countries where contain potential growth opportunities in the future. The most important feature of RCEP is the members are sharing and integrating into a same production chain. This is because the agreement aligns rules of origin for all fifteen member countries. This may help RCEP members attract a larger share of global value chains and improve their specialization (Cali, 2020). Furthermore, with lower trade barriers, investors are more likely to enter ASEAN market and therefore inflow of foreign direct investment might increase to those countries joined RCEP. Based on research published by ASEAN and East Asia (ERIA) Economic Research Institute, ASEAN will be benefited more from the RCEP. Free Trade Agreements (FTAs) can help to lower trading barriers, such as tariffs, and unify trade among member countries. This means that the trade of commodities between member nations is no longer subject to varying tariff timelines and is not affected by separate FTAs. That is, it reduces the trading cost and encouraging businesses from entering the market. Moreover, RCEP could help to stabilize economies of the member countries. Indeed, it might lead to a more dependency on the China's market, but it will heavily reducing ASEAN's economic reliance on the US economic (Spire, n.d.).

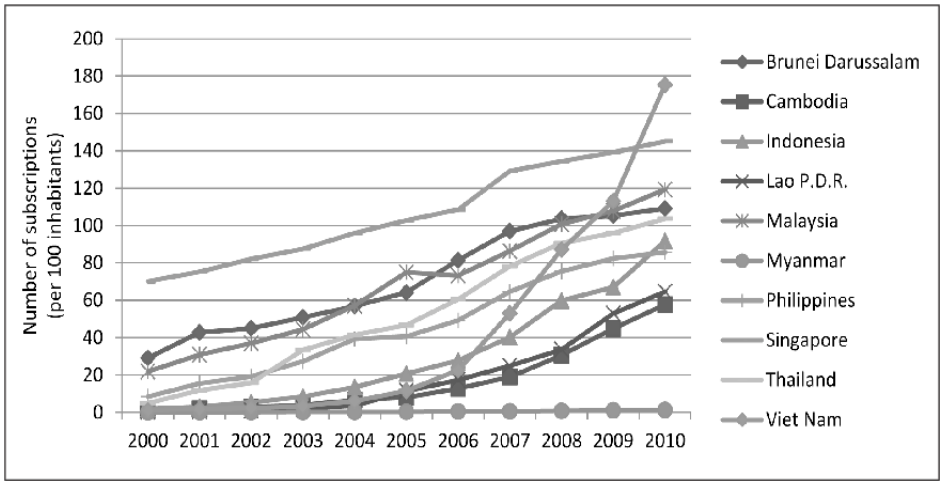
Besides RCEP, some of the ASEAN countries are joined another trading bloc named Comprehensive and Progressive Agreement for Trans-

Pacific Partnership (CPTPP). From 2018, Singapore, Vietnam, Brunei, and Malaysia entered CPTPP accordingly as shown in figure 1.2. CPTPP is like RCEP, a free trade agreement (FTA) between the member countries. The objectives of CPTPP are to create job opportunities and strengthen the economic relation among the members. Additionally, CPTPP involves technical cooperation purposed on trading among the members, including with SMEs, regulatory unity and economic growth (Government of Canada, 2022).

Nevertheless, the FTA for RCEP and CPTPP will lower down the trade barriers and therefore will intensify the trade openness and international interaction. The expected economic growth rate or GDP of ASEAN in year 2030 is forecasted to increase 0.2 percent from the participation in RCEP (Cali, 2020). The ASEAN countries joining the trading blocs stimulate their involvement into the globalization.

1.1.4 ICT infrastructure development in ASEAN

Figure 1.3: ICT development in ASEAN

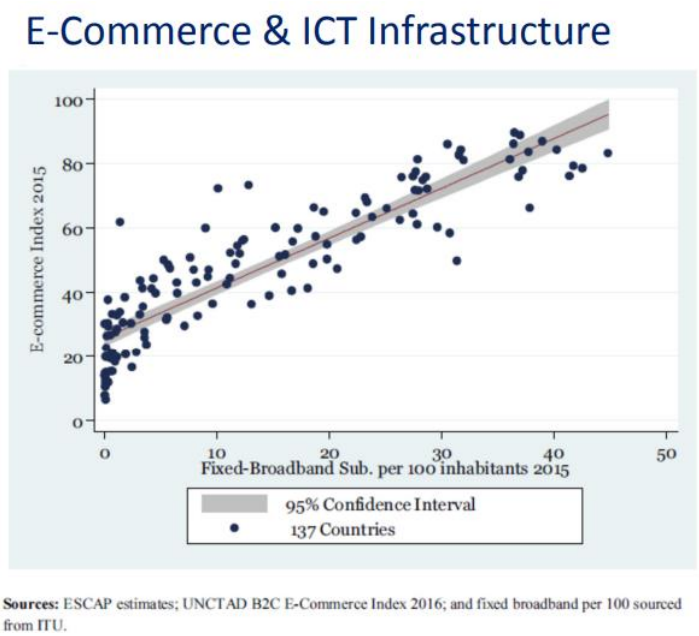


Source: Mahyideen et al. (2012)

Information and Communication Technology (ICT) can be defined as the telecommunications that provides access to information on communication technologies. The development of ICT to economic trends

carried the promise of new sources of productivity opportunities at the macroeconomic level (Czernich et al., 2011). Without ICT, globalisation would not have been possible. ICT has evolved progressively since the industrial revolution. Globalization is a result of the numerous associated technical developments in information and communication. Satellites, telephones, televisions, computers, and the internet have all contributed significantly to this process. Since it offers a cheap, dependable, and quick network, the internet has been increasingly significant in terms of globalisation over the past several decades. As a consequence, information is now accessible anywhere and in real time. ICT has connected the world's economies, and a global economy has developed as a result. As a result, global trade and e-commerce have expanded, and financial markets are now more interconnected (Erturk, 2015). Extension of ICT can be viewed as a new wave of globalization. For instance, the modern ICT trade is more on digitalization, reductions in cost of transportation, coordination and sharing information. Modern ICT trade is much better in terms of data flows, connectivity, and interoperability than conventional commerce, which centred on market access. Besides that, almost all ASEAN countries tend to develop their economy through the practices of ICT which is known as digital economy (Jing et al., 2019). Currently, the extension of ICT being concerned by the government of ASEAN nations, companies and regional organisations, this can be seen in the figure 1.3. According to the figure 1.3, the graph illustrates that the number of mobile cellular subscriptions in ASEAN countries from 2000 until 2010. From the graph it shows that there is an obvious uptrend in all ASEAN countries except Myanmar which representing the positive development of ICT infrastructure in the public.

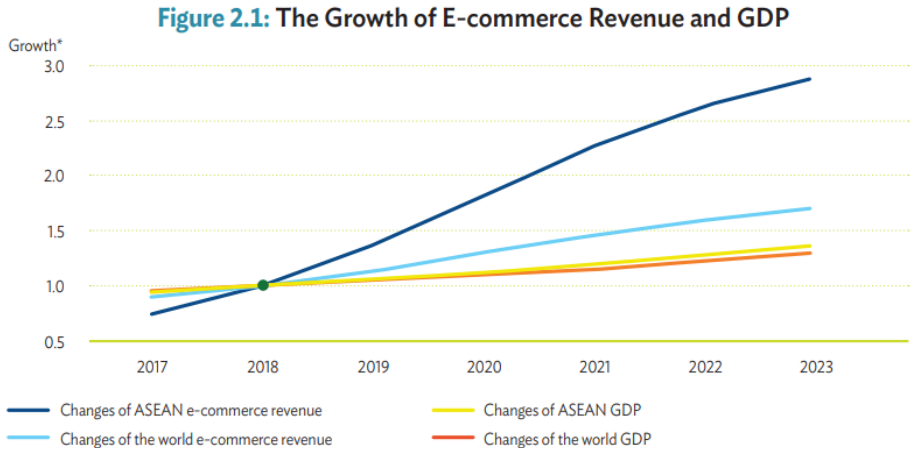
Figure 1.4: Relationship of E-commerce and ICT infrastructure



Source: Lee and Das (2018)

According to the figure 1.4, the growth of e-commerce in ASEAN is driven by the development of ICT. Anvari and Norouzi (2016) found that the E-commerce has a significant positive impact on the economic growth, simultaneously, economic growth also has a positive effect on the E-commerce. Cross-border e-commerce has been increasingly important in the globalization and the interaction among countries (European Commission, 2011). Cross-border e-commerce has slowly become the major stream to the international trade. It has lesser intermediate dependency between importers and exporters, but has large demand on services such as logistics, payments and information. Today, cross-border e-commerce is dominated by business-to-business (B2B) e-commerce. However, the business-to-customer (B2C) has growing faster than B2B especially in Asia-Pacific region (Chen, 2017).

Figure 1.5: Growth of E-commerce



Source: Statista (2022)

Adoption of ICT, such as the Internet, creating more opportunities such as less expensive and easier for businesses to expand their markets within or outside their origin country. Lower cost of information transactions, technology has decreased the market frictions and provided major momentum to the process of globalization (Totonchi & Kakamanshadi, 2011). According to figure 1.5, the ASEAN E-commerce revenue almost tripled from 2017 to 2023, which representing the growth of E-commerce is very rapid in these years. Internet is the most crucial factor in this digital era. In fact, the development of E-commerce requires a high quality of network connection. In ASEAN, the average quality of internet infrastructure appears to be better than the global average (Chen & Kimura, 2020).

It can be observed that the growing of ICT infrastructure in ASEAN will lead to the increase of E-commerce. The digitalization is slowly become an important factor that determine how well a country involve into the international trade.

1.2 Problem statement

Income inequality is always one of the biggest issues that faced by the governments. Income inequality occurs in all countries from the well-developed country to the least developed country. Even the world highest GDP country, United State is challenged by the income inequality. However, there are some researchers found that the activity of globalization is having some impact on the income inequality.

Trade reforms have found to be managed to decrease income inequality between countries, but they have also been accompanied by polarisation in the income distribution in some areas, leading to considerable rises in income inequality within countries. It is possible that the latter is what's driving the current reaction against international trade. Trade reforms implemented in developing countries since the 1990s have led to faster economic growth, which has reduced income gaps and inequality between countries. Rapid trade reforms and integration into international markets have helped countries such as Brazil, China, and India to experience faster growth than developed countries and narrow the income gap between developed and developing nations. However, while international trade has improved living standards in developing countries, it has also resulted in income polarisation within countries. Economic inequality between countries has decreased, but on average, it has increased within every country due to a sharp increase in incomes at the top of the income distribution and a stagnation in incomes at the bottom. This trend of income polarisation within countries may be driving the current opposition to international trade (United Nations, 2019).

Ravallion (2006) argues that globalization can decrease poverty if it promotes economic growth and does not increase inequality. However, if the benefits of trade only go to non-poor individuals, it can negatively affect the poor. The fact that skilled workers benefit more from recent technologies than uneducated workers support this claim. Nonetheless, in developing countries, growing demand for unskilled labour could lead to decreased inequality, despite wage gaps. Poor and unskilled individuals often lack access to critical information, exacerbating the

situation. The impact of globalization on a country's economy depends on several factors, including its growth conditions and global economic policies. During recessions, the costs and risks of globalization are greater for poorer countries, while the benefits are not distributed equitably during periods of economic growth. Recent studies suggest that the impact of globalization on the poor is due to a lack of convergence among trading partners. These studies also suggest that more openness in trade is linked to greater economic shocks and volatility, which can have a more significant impact on vulnerable and poor households. This can temporarily worsen poverty and income inequality, as seen during the Asian financial crisis (Aradhyula et al., 2007).

ICT development provided a new platform for the businesses to integrate in the international trading. ICT is a principal factor that drives the process of globalization (Erturk, 2015). However, there is an ambiguous effect between ICT development and the income inequality. Roller and Waverman (2001) stated that the development of ICT contributes a lot to the economic growth. Hence it is a trend that will help to reduce poverty where improve income gap. Spiezia (2012) have a same conclusion that ICT will improve the income inequality. This is because ICT increases the productivity of a nation and increase the individual and household incomes simultaneously. The development might break through the original wealth concentration in a country, thus income distribution might more equality (Latzer, 2009). However, according to the empirical result from Tong and Dall'erba (2008), ICT will deteriorate the income inequality in China. ICT industry in China is encountering difficulties due to the country's fast expansion within the research year range. The uneven distribution of ICT growth, particularly depending on the number of Internet users, will be a key problem. Such gaps increase the inequalities in wealth and opportunity. Iacovone and Lopez (2018) suggested that the ICT development will give opportunities to the both high-skilled worker and low-skilled workers receive higher salaries in a more ICT-progressive industries than non-ICT-progressive industry. Therefore, it will increase the income gap. In ASEAN, it has been a huge improvement in ICT development for the 21st century. Therefore, ICT development in ASEAN might has an impact on the income gap, either positive or negative.

1.2.1 Consequences of income inequality

The focus of income inequality is economics. Hence, it makes sense that it could lead to widespread economic outcomes. It has primarily been associated with decreased growth, investment, and innovation economically. According to a 2016 study conducted by economists at the International Monetary Fund (IMF), neoliberal policies, which are market-oriented reform policies (e.g., removing price controls, reducing trade barriers) have benefited society through increases in global trade and the transfer of technology. However, the accompanying rise in inequality has weakened growth, the exact thing that the neo-liberal agenda is bent on increasing (Polacko, 2021). In addition, a cross-national OECD study conducted by Cingano (2014) proposed that once income inequality reaches a particular point, growth is reduced. This can be supported by Dabla-Norris et al. (2015) who mentioned that greater income inequality hinders lower-income households' capacity to stay healthy and build up their human as well as physical capital, which will then reduce growth. For example, education is being less invested in because children who are poor end up in schools with lower quality and are less likely to further their studies at university. Consequently, there will be lower productivity than what it is supposed to be in a fairer world without the problem of an income gap. Furthermore, research conducted by Alesina and Rodrik (1996) with the purpose of identifying the relationship between income inequality and economic growth for developing countries has concluded that the Gini coefficient (indicator of income inequality) has a detrimental impact on economic growth.

On the contrary, there are some economists who argue that greater income inequality can drive growth in several ways. First, when inequality is severe, there are more incentives for innovation and business ventures. Large salary CEO roles will provide an incentive for lower paid workers to compete for desirable labor positions. To join the highest income group in a society, those poor people of a community will put in more effort, create

new firms, or develop new products. Nevertheless, people in lower income groups have less motivation to increase their income when the gap between incomes is small (Birdsong, 2015). The above statement has been proved by Cingano (2014) who stated that high levels of inequality can motivate people to work harder, invest more money, and take on greater risks to reap higher returns. For example, if highly educated individuals are more productive and earn higher returns, greater income disparities could incentivize more people to pursue education. This is because wealthy individuals tend to save more and consume less, which encourages collective savings and capital creation.

Another important economic consequence of income inequality is that it has a significant negative impact on public investment and welfare spending. Authorities have less money available to pay for education, public facilities, and other services which the poor depend heavily on because a larger portion of the income distribution is earned by the rich. Due to the higher quality of their own alternatives, the wealthy choose not to use publicly funded services, hence causing social segregation. As a result, there is an ongoing cycle of rising income inequality that will probably eventually result in private prosperity and public poverty (Polacko, 2021).

Low-income people have been reported to experience psychosocial stress more regularly and frequently than high-income people, and these concerns extend beyond the job (Jensen & van Kersbergen, 2016). According to Wilkinson and Pickett (2020), increased income disparity leads to depression, chronic stress, and low self-esteem because of status anxiety. This happens as a result of the fact that people's positions in a hierarchy with higher disparity are given more weight. They provide concrete evidence for their claim that more unequal countries have a significantly larger percentage of the population who suffer from mental illness. Moreover, numerous studies have demonstrated that severe income gaps cause the poor to experience feelings of guilt in a variety of settings. Additionally, a meta-analysis of 208 research by Dickerson and Kemeny (2004) revealed that cortisol, which is a stress hormone, was elevated more

frequently when the person thought that others were passing judgement on them. On top of that, Kawachi et al. (1997) mentioned that rising income inequality causes people to feel more frustrated, which could have negative behavioral and physiological effects. Besides that, it is believed that certain illnesses occur at disproportionately high rates among the poorer sections of society. Poor people can have limited or no access to good healthcare and nutritious meals (Birdsong, 2015). In a higher-inequality environment, there are higher rates of obesity, drug misuse, crime, mental illness, as well as total mortality. There are also lower levels of child well-being and educational performance. This is due to the reason that status anxiety, which is driven by social hierarchy, is linked to bad health (Buttrick & Oishi, 2017). Psychosocial environment theory illustrates that stress and healthy behavior are the two key mechanisms by which income inequality affects health. The study also found a link between lung cancer and the income gap (Lynch et al., 2004).

More equitable countries have lower violent crime rates (Hsieh & Pugh, 1993). This is partly since more equal countries experience less poverty, which in turn results in fewer people feeling hopeless about their circumstances. It has also been demonstrated that those with lower incomes are more likely to commit crime. Based on strain theory, more unequal societies place a larger social emphasis on economic achievement while offering less resources to do so (Merton, 1938). This causes stress, which might encourage more people to turn to crime to achieve financial success. On the other hand, rich people in more equal societies are less likely to take advantage of others, engage in fraud, or engage in other anti-social activities, since they do not feel the need to use shortcuts to advance or to make money. According to studies, income inequality and crime are positively correlated. The possible explanation for the correlation is that disadvantaged individuals of society may be more prone to experience resentment and hostility due to their economic situation or competition for limited jobs or resources, which could lead to a high tendency for criminal action. Also, the temptation to commit crime has risen because of inequality. For poor people who live in an unequal society, there are fewer legitimate ways for them to

get resources. Even when the potential for punishment is considered, getting resources illegally may yield better results than doing it legally (Birdsong, 2015). Moreover, Kawachi and Kennedy (1997) argued that a wide income gap causes irritation, stress, as well as family disturbance, which could lead to an increase in the crime, violence, and homicide rates.

1.3 Research objectives

1.3.1 General objective

To determine whether the process of globalisation has a significant effect towards the level of income inequality in ASEAN.

1.3.2 Specific objectives

1. To determine whether foreign direct investment has a significant effect towards the level of income inequality in ASEAN countries.

2. To determine whether trade openness has a significant effect towards the level of income inequality in ASEAN countries.

3. To determine whether ICT development has a significant effect towards the level of income inequality in ASEAN countries.

4. To determine whether economic growth has a significant effect towards the level of income inequality in ASEAN countries.

5. To determine whether education has a significant effect towards the level of income inequality in ASEAN countries.

6. To determine whether population has a significant effect towards the level of income inequality in ASEAN countries.

1.4 Research questions

1. Does foreign direct investment have a significant effect towards the level of income inequality in ASEAN countries?

2. Does trade openness have a significant effect towards the level of income inequality in ASEAN countries?

3. Does ICT development have a significant effect towards the level of income inequality in ASEAN countries?

4. Does economic growth have a significant effect towards the level of income inequality in ASEAN countries?

5. Does education have a significant effect towards the level of income inequality in ASEAN countries?

6. Does population have a significant effect towards the level of income inequality in ASEAN countries?

1.5 Significance of study

This research aims to examine the connection between income inequality and globalization in ASEAN countries. Through this study, the objective is to raise awareness about the problems associated with income inequality and its relationship to globalization. The impact of globalization on income inequality has been widely debated in academic circles. While globalization has been credited with boosting economic growth and social development globally, it has also been blamed for causing rising income inequality and environmental damage, resulting in social deterioration and increased competitiveness challenges. This research may also help people to know that the global production sharing can affect the income inequality through its influence on the income gap between the skilled and unskilled employees, and through their differential impact on worker wages across industries, occupations, and firms. Inequality has risen in most rich countries. Since low-

skilled workers in these countries are now more competitive with workers in developing countries, it is of course plausible that global economic integration has put pressure on higher inequality in rich countries, and often the opposite effect in poor countries (Dollar, 2005). In this research is mainly to figure out if the increasing market integration in international trade and finance affects income inequality.

Conducting this study will contribute to many sectors and organizations. The government will be the party that demanding the most on such macroeconomic research especially income inequality is the main issue in a country. By conducting this research, government will be able to know which policy can improve the income inequality based on the test results. For example, if one variable is significantly reducing the income gap, the government can launch relevant policy to magnify the effect of the variable. Income inequality can have significant implications for political stability as well. When income inequality is high, there is often a greater risk of social and political instability, which can threaten the government and country. By understanding the effects of globalization on income inequality, governments can take steps to address this risk and to avoid the social instability.

Moreover, this study will help banks to have better understanding to the impact of globalization on the income inequality. When bank is realized that the globalization affects the income inequality, they can create different financial plans to personalize people at different stages so that the income inequality problem will be solved. A personal financial plan, including the income, liabilities, assets, and investments is documented analysis of customer personal finances. Its goal is to assist customer in determining the viability of their personal goals and the financial steps that the customer must take to realize them. This will help the customer understand deeper how to assign their income. Also, globalization has led to increased cross-border trade and investment, which has facilitated the growth of the banking industry. Banks have played a key role in financing international trade and investment and have benefited from the increased opportunities created by globalization. If better understanding the effects of globalization on income

inequality, banks can better anticipate the risks and opportunities associated with changes in global economic conditions.

1.6 Structure of study

There are five chapters to be discussed in this study. Chapter 1 provides the background and the trend of the ASEAN. Also, the problem statement which stated the consequences of income inequality. The research objectives and questions will be provided in this chapter as well. Chapter 2 will be discussed in the theory applied for this research and discuss the literature review of the variables used in this study. In chapter 3 will explain the sources data used, the empirical model, and the diagnosis checking. Chapter 4 will be presented all the results. While last chapter, chapter 5 will discuss what are the major outcome from this study and some recommendation for the similar future research.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

This chapter will be discussing on the relevant theories related to the impact of globalization to the income gap as well as the literature review compare with the past data. The findings related to income inequality and independent variables namely, Foreign direct investment, Trade openness, ICT development, Economic growth, Education and Population. Other than that, this chapter also discussed on the hypothesis and the relationship between the predicted variable and explanatory variables from the literature review.

2.1 Relevant theories

2.1.1 Stopler-Samuelson theorem

This theory was derived from the framework of the Heckscher-Ohlin model by Wolfgang Stolper and Paul Samuelson in 1941. They argue that globalization will cause an increase in income inequality in developed countries but will lead to a decrease in income inequality in emerging countries. The Heckscher-Ohlin theory is a model of international trade that suggests a country will specialize in and export goods that they have an abundance of, due to their relatively well-endowed resources. According to the Stolper-Samuelson theorem, trade openness can increase the price of export goods that are abundant in a country. For developing countries, foreign direct investment primarily results in an inflow of capital from developed countries. This can lead to increased productivity and efficiency of labor, which in turn can increase the income distribution of labor and ultimately decrease income inequality in these countries (Uddin, 2020).

One way to explain the relationship between income inequality, trade openness, and foreign direct investment (FDI) is by considering the differences between skilled and unskilled labor. As production moves from developed to developing countries, low-skilled workers in developing countries may see an increase in wages due to the Stolper-Samuelson theorem. This theorem suggests that when the return to education (known as the skill premium) decreases, the wages of low-skilled workers rise. In this scenario, high-skilled workers would not receive as much income benefit from their education, resulting in a decrease in the skill premium and a decrease in income inequality in developing countries (Tica et al., 2022).

In developed countries, the increase in globalization can lead to higher income inequality, as high-skilled workers benefit from higher skill premiums while unskilled workers producing traded goods may be worse off. This is because unskilled labor is less abundant in developed countries compared to capital. Research shows that income inequality in developed countries may increase when trading with low-income and developing countries (Roser & Cuaresma, 2014). The Stolper-Samuelson theorem exists in many empirical studies and is used to explain the association between FDI, trade openness, and income inequality (Baek & Shi, 2016; Giri et al., 2021; Munir & Bukhari, 2019; Reuveny & Li, 2003; Sánchez López et al., 2019; Tica et al., 2022; Uddin, 2020).

2.1.2 Kuznets Curve

Kuznets, also known as Kuznets Curve, is a concept used to hypothesize that industrializing countries experience a rise and subsequent decline in income inequality. This concept was established by Simon Kuznets in 1970. The characteristic of the Kuznets Curve is the shape of inverted-U. It generates an idea for explaining the relationship between economic growth and income inequality. Simon Kuznets argues that income inequality will increase as rural labor migrates to cities, after that the income

inequality will tend to reduce once its welfare state has taken hold at a certain period. In the early stage, growth in labor sources from rural areas to urban areas in a country would lead to a decline in labor wages due to the competitiveness of employment in a city. This situation will cause income inequality to increase with the economic growth.

The second stage is when the increase of income inequality reaches a peak and terminates at a certain level of economic growth due to social mobility increasing sufficiently. In the third stage, income inequality starts to decrease as the economic growth grows to a sufficient and maximum level til the welfare of the labor takes hold. This circumstance will result in the rise of wages of workers who migrate from rural to cities (Halton, 2021). Kuznets Curve theory was used in seven studies to explain the inverted-U shaped relationship between economic growth and income inequality (Anyanwu, 2016; Munir & Bukhari, 2019; Kang-Kook, 2014; Reuveny & Li, 2003; Oguzhan & Burak, 2012; Seneviratne & Sun, 2013; Claus et al., 2012). For example, England's Gini coefficient increased by 0.227 points from 1871 to 1823. During the industrializing period, the Gini coefficient dropped by 0.184 points in 1901 (Halton, 2021).

Besides, Kuznets curve also proposes that population growth can exacerbate income inequality in the early stage of economic development. Due to migration labor from rural to urban areas, population growth will increase. Increased population will lead to a surplus of labor forces that exceed job opportunities. So, large number of labor will competing for limited number of low-skilled jobs. This will lead to depress of wages as well as increase income inequality (Halton, 2021).

However, this effect will turn to be positive once a country reaches a certain level of economic development. In this stage of economic development, population growth can decrease income inequality as the labor shifts towards higher-skilled jobs and welfare state takes hold (Halton, 2021). Hence, increase in population will rise the demand of goods and services, as well as more employment opportunity and investment.

Additionally, larger population can lead to lower production costs and higher productivity, which can contribute to higher economic growth and lower income inequality.

2.1.3 Composition and Compression effect

The composition effect and Compression effect are the theory established by Knight and Sabot (Knight & Sabot, 1983). It argues that a rising in education in the average year will affect the income distribution and income inquality in two ways which are the composition effect and the compression effect. The composition and compression effect is both used to explain the impact of a change in the educational composition of the labor force toward income inequality. A study by Knight and Sabot (1983) also suggests that the countries' income inequality would raise as reaching higher educational attainment. A study by Seefeldt (2018) showed the composition effect presented is due to more education which rewarded with higher income will rise the income inequality. If educational inequality increases, the distribution of wages widens for high-educated people, so they will gradually begin to earn higher and higher incomes, then the income inequality will rise (Seefeldt, 2018). In contrast, if education inequality decreases, the return to education for high-educated people is relatively small, and the income inequality will be narrow later in the expansion process. At the same, income for less educated individuals will have high chances of getting similar income with high-educated people, and the income inequality will decrease.

However, the wage compression effect means an increase in the supply of educated labor relative to demand. The compression effect showed a decline in the distribution of wages among workers since the supply of educated workers increased. As the rise in the supply of educated workers surpasses the demand for educated workers, the return to education will reduce, thus leading to diminishing income inequality (Seefeldt, 2018). One

study theorized the relationship between education and income inequality using composition and compression effects (Anyanwu, 2016).

2.2 Review of literatures

2.2.1 FDI and income inequality

One of the major components in globalisation is the global capital flows such as foreign direct investment (FDI). FDI usually flows to the high-skilled sector in a country which the foreign investors expect that their investments will have a more secured return (Asteriou et al., 2014). FDI is often linked to multinational corporations (MNC) and there are several past studies stated that FDI is widening the income gap. If a MNC is massive enough, it can exert pressure on the local government to reduce the social spending which will damage the middle and lower classes (Salvatore, 1998). Moreover, Jenkins (1996) stated that MNCs are earning the profits from the least developed countries back to their home country, this will leave the least developed countries remaining underdeveloped and suffering in poverty.

According to Acharyya (2011), skill-biassed FDI could lead to income inequality in both developed and developing countries. This is because the FDI inwards to a developing country that is considered a high-skilled sector but in some developed countries perspective, the outflows of the FDI could be to a low-skilled sector. Hence, the asymmetric view from different type of countries could lead to increase in demand for skilled employees in both nations. Moreover, the effect of FDI on the income inequality can also be affected by other factors. Empirical result from Wu and Hsu (2012) concluded that, with a lower level of absorptive capacity host countries, the FDI is more likely to increase the income gap. They performed panel data set with 54 countries and found that FDI is positively significant to affect income inequality. Harrison and Rodríguez-Clare (2010) suggested that FDI will positively increase the income inequality and

concluded that it is because from the labour market. The foreign firms pay higher salaries to local workers since the labour markets in developing countries are not perfectly competitive and usually multinational corporations are more productive. The large gap of salaries between MNC and local company created an environment that is more salary inequality in developing countries. Dreher et al. (2008) have the same idea where they suggested that lower trade barriers in developing countries, increased the globalisation and attracted more inward FDI. This will create jobs for skilled labours. The advanced technology from foreign countries increased the demand for skilled labours. Consequently, this will lead to inequality in salaries between skilled and unskilled labours in emerging countries. However, empirical result from Roodman (2007) suggests that the FDI is statistically insignificant to the income inequality in developing countries.

The result from Asteriou et al. (2014) showed that the FDI has a robustly positive effect on the income inequality in the EU-27 countries. They concluded that globalization would deteriorate the income inequality and the effect is mainly from FDI. The research performed by Sturm and De Haan (2015) showed that the FDI stock has a positive significant effect on income inequality. Moreover, Reuveny and Li (2003) also found that FDI is going to increase the income gap by studying the impacts of democracy and openness on the income gap of 69 nations from 1960 to 1996. Munir and Bukhari (2019) conducted research in Asian developing countries and concluded that FDI is positively significant affecting income inequality. They summarized that this is due to the FDI advantageous to the high-skilled intensive sector and deteriorating income inequality. That is, high-skilled labors will receive higher salaries since there is more support from the FDI inflows. Sánchez López et al. (2019) conducted a study in 29 European countries by using the data from 2005 to 2015 and resulted in FDI outflows having a negative impact while FDI inflows had a positive impact on the Gini index. Furthermore, Uddin (2020) studied the impact of globalization on income inequality in Bangladesh and concluded that FDI has a positive significant effect towards the income gap. Choi (2006) concluded that FDI outflows will worsen the income gap rather than FDI inflows. Even though

many studies found that there is a positive relationship between FDI and income gap, according to Tsai (1995), he believes the existence of a positive coefficient for FDI is due to the studies not distinguishing the effects of regional.

However, there are also few studies suggesting that FDI will improve income inequality. According to the empirical result from Giri et al. (2021), they found that FDI is actually having a negative significant impact towards the income inequality in India. Also, Mohanty (2017) has the same result where FDI has a negative relationship with the income gap in India. Georgantopoulos and Tsamis (2011) suggested that FDI will reduce income gap since the FDI inflows will create more job opportunities as well as improve the economic growth indirectly. FDI also will increase the government revenues such as taxes and therefore be able to launch more poverty alleviation plans. They also conducted empirical analysis and concluded that FDI is negatively significant to the Gini coefficient. The study from Hussain et al. (2007) concluded that FDI is negatively significant on the income gap and suggested that FDI should reduce poverty and equalise the wealth in developing countries. Choi (2006) found a negative relationship between bilateral FDI and the Gini index. Celik and Baldes (2010) conducted research based on developing and developed countries and found that FDI improved the income inequality in both regions. However, East-Asian nations are having the opposite effects where FDI will deteriorate the Gini index. Adams (2008) investigated 62 developing countries from 1985 to 2011 and found that there is insufficient evidence to conclude that FDI has a relationship with income distribution.

There are few research mainly studying the determinants of income inequality in ASEAN countries and included the FDI as a variable. Based on the empirical results from Farhan et al. (2014), they studied AESAN-5 countries from 1970 to 2012 and found that FDI inflows in Malaysia, Philippines, and Thailand reduced income inequality, however, Singapore and Thailand widened the income gap. They concluded that each nation has various FDI policies and economic conditions tend to have different effects

from FDI inflows. Merican et al. (2008) have a consistent result with Farhan et al. (2014) where they found that FDI has a negative relationship with Gini coefficient in Malaysia and Indonesia, while a opposite effect in Thailand, FDI in Philippines is found to be insignificant. However, Mukaramah et al. (2014) have a different result from Farhan et al. (2014), they found that FDI inflows actually widen the income gap in Malaysia. This is because MNC increases salaries to the high-skilled labours in Malaysia. Cho and Ramirez (2016) performed research with seven ASEAN countries from 1990 to 2013 and found that FDI inflow has a significant positive relationship with the Gini index. That is, the FDI will worsen the income inequality in the selected seven ASEAN countries. Moreover, Arshad and Islam (2020) investigated the FDI impact on income gap in ASEAN eight countries excluded Singapore by using the data from 1990 to 2015 and found that FDI is significantly worsen the income gap, despite it has positive effect on economic development. However, they also claimed that this deterioration effect from FDI will be offset by the economic growth in the future. Hence, in the long term, the income gap will have the least effect from FDI. Ningsih and Choi (2018) found that FDI has a positive significant effect towards the income gap. This study studied the eight ASEAN members from the period of 1995 to 2014.

In short, despite the Stopler-Samuelson theorem suggesting that globalisation will improve the income gap, there are some past studies challenging this theorem. FDI is one of the major components in globalisation and to be found that it has an ambiguous effect on the income distribution. There are many studies suggesting that FDI will improve the income gap but there are also numerous research results that support that FDI is worsening the income gap.

2.2.2 Trade openness and income inequality

The term "trade openness" often refers to the removal of trade restrictions that prevent the free flow of products and services across international borders, resulting in the unification of national markets. For many years, economists have been debating and worrying about the impact of trade openness on income inequality. Many nations opened their economies to trade in the recent decades (Mahesh, 2011). Based on the data extracted from World Bank, the contribution of global trade to global output rose from 33% in 1975 to 59% in 2013. In terms of GDP figure, the world output has reached to 96.53 trillion in 2021, which is the highest amount, exceeding the previous year (World Bank, 2021).

One theory used to describe how trade openness will affect income inequality is Heckscher-Ohlin (HO) model. According to HO theorem, a country with an abundance of capital will export the good that requires the most capital (capital-intensive good), whereas a country with an abundance of labor will export the good that requires the most labor (labor-intensive good) (Dorn et al., 2021). It is important to note that income inequality is a result of an increasing wage difference between skilled and unskilled labor. According to Polpibulaya (2015), developed countries have lower opportunity costs of trade than developing countries when it comes to exporting expensive or labor-intensive goods. Hence, these countries tend to produce items that require a lot of skilled work, whereas developing countries will produce items that requires the most labor. As a result, high-skilled labor's relative wage will rise in developed nations due to increased demand brought on by international competitiveness (Galiani & Sanguinetti, 2003). In this case, skilled labor in developed countries will benefit from that and causes the widening of wage gap in the countries, which then give rise to income inequality. Looking from the perspective of developing (or underdeveloped) countries, they will demand more unskilled labor which will raises the wage for unskilled labor. Therefore, the income gap in that countries should be narrower. This can be supported by Bourguignon and

Morrison (1990) who stated that developing countries with abundant labor will lead to an increase in real wages, which then lowers down the income inequality.

Dynamic panel data technique used by Calderon and Chong (2001) in their investigation of the link between trade openness and income inequality. For the years 1960 to 1995, they use data from 102 developed and developing nations. For models based on dynamic panel data, they employ GMM estimation. They discover that changes in income distribution are related to trade volume rather than trade terms. Research conducted by Polpibulaya (2015) has proved that trade openness has a positive impact on income inequality, meaning to say when the trade to GDP ratio (indicator of trade openness) increases, income inequality (measured by GINI) will increase as well. This can be supported by Aradhyula et al. (2007) who found that an increase in trade openness is associated with an increase in income inequality at significant level of 1%. Furthermore, Roser and Cuaresma (2014) used panel models and data from 32 developed countries between the years of 1963 and 2002. Based on their findings, trade openness is positively correlated with income inequality, which is consistent with the Stolper-Samuelson theory. According to their research, imports from developing countries has positive relationship with income inequality in the developed world. Other developed nations do not find this conclusion to be statistically significant because it appears to be driven by the group of liberal market economies. Not only that, Hanson and Harrison (1999) who focuses on the research on Mexico has discovered that when there is heavy trade liberalization, the wage gap will be widened. In a sample of 65 developing nations, Meschi and Vivarelli's (2009) findings indicate that trade is positively correlated with income inequality, which is the opposite of what the HO model predicts. Also, research conducted by Zakaria and Fida (2016) that using panel data to evaluate China and the SAARC countries from the period of 1973 to 2012 has proved that the coefficient on openness is positive and significant. The coefficient figure of 0.6 indicated that the income inequality will increases by 0.06% when the trade liberalization increases by 1%.

However, there are some studies found that there is negative relationship between trade openness and income inequality. Giri et al. (2021) has studied the relationship between trade openness and income inequality using the cointegration test (cointegration of ARDL model). They have conducted the test for long run as well as short run. At a 5% significance level, they find that trade globalization reduces income inequality over the long run. The Stolper-Samuelson theorem predicts that trade will increase the income of low-skilled abundant factor of production is supported by this particular relationship. In addition, they have discovered similar outcomes in the short run to those reported in the long run research. This proved that trade globalization has a detrimental effect on income equality. Furthermore, Cerdeiro and Komaromi (2017) proposed that if a country has high trade openness, it tends to have higher standards of living and lower income inequality. In addition, a study conducted by Agusalim and Pohan (2018) has found out that trade openness and income inequality have negative relationship in Indonesia in the long run, but the effect is not significant. On the other hand, trade openness has a significant negative effect on the income inequality in Indonesia in the short run. Based on the research conducted by Nissanke and Thorbecke (2006), liberalisation is frequently accompanied by increased economic volatility and shocks that, at the very least temporarily, worsen poverty and income inequality by having a greater negative impact on vulnerable and low-income households.

To sum up, it is believed that the relationship between income inequality and trade openness could be either positive or negative. To be noted that, the effect of trade openness might be more ambiguous than other factors.

2.2.3 ICT development and income inequality

Information and Communication Technology (ICT) can be defined as the telecommunications that give everyone the opportunity to access information mainly on communication technology. ICT included the effect of modern communication technologies to society such as the Internet and wireless network. To gain the competitive advantage of a country, ICT is one of the most important factors (Seki, 2008). However, the development of ICT might change the initial wealth concentration in a country. That is, ICT has inconclusive evidence of income inequality (Latzer, 2009). Roller and Waverman (2001) suggested that ICT development will improve economic growth and therefore it could reduce poverty and income inequality. OECD (2011a) suggested that the reason for the widened income gap is because of the disturbance of salaries between workers with ICT skills and unskilled workers. This phenomenon has risen since the 1980s because of the high demand with the relevant skilled workers in high-tech industries. As a result, the income for those with relevant knowledge and professional education to work in high-tech ICT industries will be higher.

According to the empirical result from Tong and Dall'erba (2008), ICT development has a robustly positive relationship with income inequality in China. The ICT industry in China is facing some obstacles within the rapid growth of developing at the study year range. The primary issue is the inequality income distribution of ICT development. This is because of the difference in the number of Internet users in rural and urban areas, such gaps rise up the inequalities in income distribution as well as opportunities. Iacovone and Lopez (2018) also have the same empirical result that ICT will widen the income gap in Mexico. They concluded that the positive effect might be due to the labourers working in the ICT industry receiving higher salaries compared to the workers working in a non-ICT industry. In some cases, a highly skilled employee working in a non-ICT industry will have relatively lesser wages to the low skilled worker who worked in the ICT industry. Thus, the differences of wages between ICT

and non-ICT industries will widen the income inequality in a country. Kudasheva et al. (2015) found that the penetration of ICT in Kazakhstan is positively related to income inequality. They concluded since the higher income group will have higher chances to access the Internet compared to the low-income group. In this scenario, the initially high-income group will have higher wages and thus increase the income gap. This is because the accessibility of ICT for the high-income group will have better opportunities than the low-income group. For example, information efficiency benefits from ICT will lead to better education standards for high-income groups and therefore wider income inequality as the consequences.

However, some studies found that ICT development can reduce the income gap. According to Aker and Mbiti (2010), ICT including fintech is significant to reduce income inequality especially in the developing world. It creates new employment opportunities for the low-income group. Fintech can help to improve the tax collection method and therefore lower down the degree of corruption. Asongu and Le Roux (2017) revealed that internet and mobile penetration is negatively related to income inequality. They performed this research using the data in 49 Sub-Saharan nations from 2000 to 2012. Besides that, Asongu (2015) found that the penetration of ICT is negatively related to income inequality by using the data of 52 Africa nations. A similar result from Asongu and Odhiambo (2019), a significant negative relationship of ICT development towards the inequality in 48 African countries. Other similar results based on the data in developing countries have revealed that ICT actually can reduce poverty (Abor et al., 2018; Beuermann et al., 2012; Aker & Mbiti, 2010).

Some studies in ASEAN found homogeneous results. Jing et al. (2019) studied ASEAN-5 countries from 2003 to 2018 using the GMM model and found that ICT development is negatively related to income inequality. The study used mobile-cellular telephone subscription (lMCT), fixed telephone line subscription (lFT) and fixed broadband subscription (lFB) as proxies and all resulted in statistically significant results. Moreover, Ningsih and Choi (2018) found that technological development is

negatively significant towards the income gap. This study studies the data within eight ASEAN countries from 1995 until 2014.

Overall, despite some studies suggesting that the ICT will deteriorate the income gap, however, most studies concluded that it is helpful to reduce poverty especially in the developing countries. Two studies Jing et al. (2019) and Ningsih and Choi (2018) both concluded that ICT development will reduce the income gap in ASEAN.

2.2.4 Economic growth and income inequality

Economic growth is considered one of the factors that have a significant relationship with income inequality. Many previous empirical studies found that there is a significant relationship between economic growth and income inequality. According to Baek and Shi (2016), found that economic growth will significant affect negatively on income inequality for 26 developed countries and 52 developing countries using year 1990 to 2011. Also, a study found a significantly negative relationship between economic growth and income inequality on 117 countries from year 1970 to 2018 (Khan et al., 2021). Moreover, Antonelli and Gehringer (2013) showed a negative relationship between economic growth and income inequality. Beck et al. (2007) suggested that attraction on foreign investment encourages consumption and investment the rather than production and saving in countries. Thus, it will develop the economic growth and poor's income, which will lead to decline of income inequality. Next, Greenwood and Jovanovic (1990) mentioned that the level of economic development might contribute to financial openness and cause reducing on income inequality as it enables household access financial markets more easily. Mohanty (2017) stated that the economic growth has negative relationship with income inequality for 115 economies in the period between 1993 and 2012. In addition, higher productivity and output on agriculture will reduce

the income inequality in developing countries as the income of those works in agriculture sector will rise.

A study from Anyanwu (2016), showed a Kuznets curve and inverted U-shaped in explaining the relationship between economic growth and income inequality in Southern Africa. This relationship will be resulting in a positive sign on GDP per capita and a negative sign on the square term of GDP per capita. The Kuznets curve and inverted U-shaped means that the economic growth will have a positively significant on income inequality first, after attaining a maximum level, the relationship will tend to be negatively significant. Similarly, Munir and Bukhari (2019) emphasized that economic growth was significant and positive associates with income inequality in 11 Asian emerging economies for the period of 1980 to 2014. Also, the study noticed the existence of Kuznets inverted-U hypothesis in developing countries. This means that the economic growth first has a positive impact on income inequality, after reaching a certain level, it will turn into negative affect on income inequality. Kang-Kook (2014) showed a significant positive association between economic growth and income inequality before a threshold level, then the relationship will turn to significant negative after the threshold level. This result is obtained by using panel data of 1990 to 2004. A study also emphasized that a well-functioning financial system would contribute to the financial market and credit market; hence it will prompt economic growth and income distribution. Consequently, the study concluded that income inequality would not decrease unless the market is sound (Banerjee & Newman,1993). Reuveny and Li (2003) stated that the share of agriculture in GDP was highly correlated with economic growth and will significantly influence income inequality. Furthermore, the study's findings revealed a Kuznets curve link between economic development and income disparity in less developed nations. This predicts that income disparity will rise in tandem with economic development, but will thereafter fall (Reuveny & Li, 2003). Moreover, Alderson et al. (2002) stated that for OECD nations, there is a Kuznets curve link between economic growth and income disparity. Oguzhan and Burak (2012) established the existence of a Kuznets curve in

the link between economic growth and income inequality in the United States. Additionally, Seneviratne and Sun (2013) proposed an inverted U-shaped association between economic development and income disparity for ASEAN-5 nations. Research corroborated by Claus et al. (2012) also revealed that there is a U-shaped association between economic development and wealth disparity in Asian nations. Yet, according to Giri et al. (2021), economic growth will have a beneficial long-term and short-term impact on income disparity in India. Likewise, SenGupta (2021) found that economic development had a substantial positive relationship with income disparity in emerging nations.

In short, most of the previous studies suggest that there is an inverted U-shaped relationship between economic growth and income inequality, which proves the existence of the Kuznets curve. Kuznets curve indicates that countries' income inequality will rise until mobility become sufficient, and it will drop when the welfare of labor being concerned. However, some past studies conclude that economic growth inversely affects income inequality. Additionally, economic growth is always associated with trade openness and foreign direct investment.

2.2.5 Education and income inequality

The relationship between education and income inequality remains to be a contentious topic at the centre of economic discussions. Enrolling in primary and secondary schools can reduce income inequality, while enrolling in universities can increase it. Some argue that investing in human capital is the most effective way to address income inequality, but opponents of this theory suggest that education at different levels can have different impacts on income distribution. To improve income distribution, investment in vocational education and training is seen as a potential solution. This approach aims to develop more balanced structures and improve the distribution of skills and earnings. On the other hand, Mincer (1970) states

that using the income function, investment in education affects each person's income in addition to their basic income, which is unrelated to their level of education. Personal income grows together with the rate at which education is invested in and its success rate (Shahabadi et al., 2018).

Inherent talent and parental support for early schooling are found to be significant factors in explaining economic inequality and intergenerational income mobility. A major factor contributing to the increase in income inequality is the disparity in investment in early education between poor and rich families. Poor families tend to invest less in their children's education, leading to lower-quality schools and a lower likelihood of pursuing higher education. Through policy testing, the study found that providing direct subsidies to low-income parents is the most effective way to ease the financial burden on these families and encourage investment in their children's early education (Yang & Qiu, 2016). Income levels are frequently passed down from one generation to the next through inheritance, cultural background, and, more broadly, communal traits. For instance, Cooper (1998) has found that higher income families tend to display a higher level of intergenerational economic stability than lower or moderate-income households (Rodríguez & Tselios, 2009). In order to address the growing income inequality over the medium term, it is frequently believed that expanding education is a crucial policy tool. Expansion of education is thought to be important for fostering economic growth, but it can also work to reduce inequality of opportunity and intergenerational transmission of poverty, which in turn lowers future income inequality. Expanding education would decrease income inequality and the need for fiscal redistribution through unfavourable fiscal measures like progressive income taxation or means-tested transfers (Coady & Dizioli, 2018).

De Gregorio (2002) conducted a panel data analysis on numerous countries from 1960 to 1990 and found that education and income distribution are correlated. The study revealed that having a higher education level and a fairer income distribution are important factors in

achieving more equality in income distribution. The researchers examining long-term time series data from many countries to demonstrate that a more even distribution of educational opportunities over extended periods has a negatively significant impact on distribution of income. Krueger and Lindahl (2001) conducted a study and found that each extra year of education results in approximately a 10% increase in earnings in the USA. The research also showed that the return on investment in education differs over time and varies between countries. While Belzil and Hansen (2003) utilized a structural dynamic model to show that family background, particularly the educational level of parents, accounts for up to 68% of a child's educational achievement, whereas the child's own abilities have the least significant impact among the identified factors. On the other hand, individual variations in salaries are mainly attributed to specific skills, which contribute up to 73%. Shavit et al. (2007) suggested that the quality of services provided in the higher education sector is increasingly stratified, with affluent individuals favouring prestigious programs in the private sector. This hierarchical differentiation allows privileged groups to maintain their position by creating exclusive institutions or programs.

However, Seefeldt (2018) demonstrated that the composition effect, where higher education can lead to higher income and wider wage distribution, is a major contributor to rising income inequality. As educational inequality grows, highly educated individuals earn increasingly higher incomes, which ultimately leads to an increase in income inequality. According to Saez and Zucman (2016), wealth inequality in the US has significantly increased since 1913, with the top 1% of households holding a greater share of total wealth. They suggest that this trend is largely attributed to the accumulation of human capital, which includes education. They further argue that the high returns on education contribute to the accumulation of wealth and the widening income inequality gap. Goldin and Katz (2010) explored that the historical relationship between education and technology, and positively affecting the income inequality over time. They argue that technological advancements have increased the demand for

skilled workers, which has driven up wages for those with advanced degrees, leading to greater income inequality.

2.2.6 Population and income inequality

One of the major components in globalization that affects income inequality is population. The population density and educational access are among the demographic factors since they are frequently cited as important predictors of income inequality. The benefits of increased income and overall GDP growth associated with globalization are not shared equally among all population groups. Rising income inequality can indicate a lack of economic opportunity, which in turn can hinder economic growth by preventing some individuals and businesses from fully benefiting from the opportunities presented by globalization. Furthermore, income inequality can hinder the effective matching of capital and labor, which can also limit economic growth potential (Jaumotte et al., 2008).

Additionally, as different types of shocks to economies periodically restrict growth in the near term, higher inequality increases the population's vulnerability to poverty. Moreover, the regression coefficients on education indicate that a rise in the population's average years of education reduces inequality. This is probably because more people can take advantage of the opportunities provided by technological advancement and foreign direct investment. However, a greater dispersion as indicated by the percentage of the population with secondary or higher education tends to increase inequality at a given average level of education. Imports from developing nations are linked to lower inequality for wealthy nations. The effective income of poorer portions of the population is enhanced, allowing them to consume more than before, to the extent that noncompeting imports are more readily and affordably available (Jaumotte et al., 2008).

Other economic and demographic factors that are likely to have an impact on localized patterns of income disparity are present in rural counties

that are undergoing population expansion or decline, in addition to the direct relationship between population change and income inequality. Rural economies may be more reliant on access to large and socioeconomically diversified workforces and customer bases for non-durable industries (such as food processing and textiles) and some services (such as healthcare and education). Given salary differences within and between sectors, these instances imply a correlation between changes in population size and industrial mix that has strong consequences for local income inequality (Butler et al., 2020).

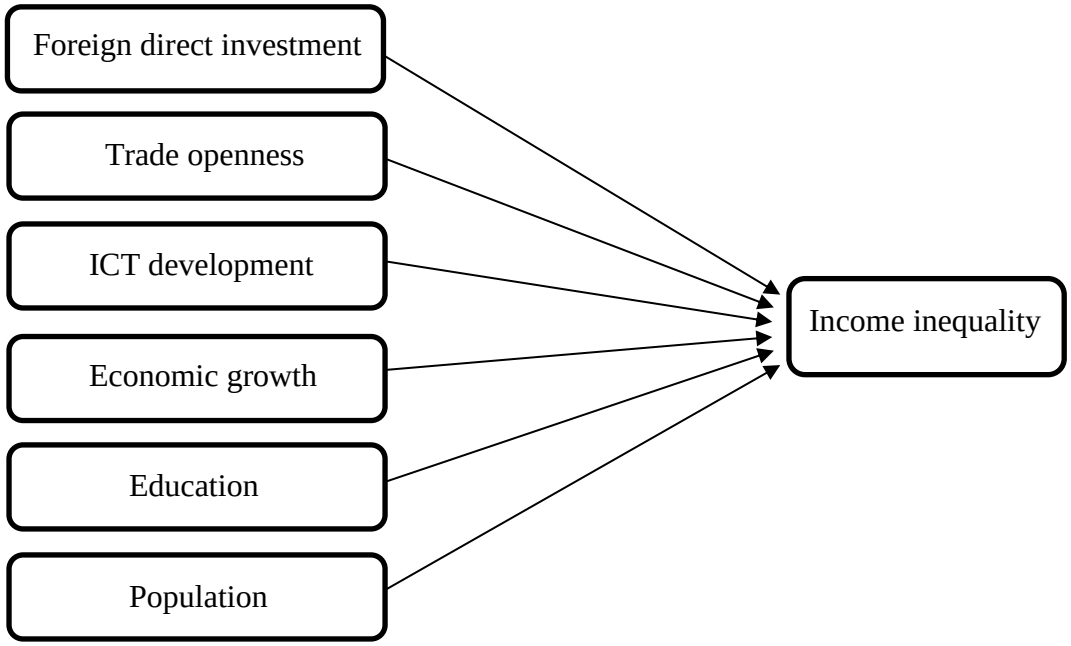
In addition, patterns of population growth and decrease are related to trends in socio-demographic makeup, such as the distribution of ages and educational levels. Several rural counties see population increase fueled by the inflow of retirees, which exacerbates the ageing of the local population. Given the inequalities in income levels throughout the age distribution, such changes in age structure will lead to changes in the income distribution as well. Also, there is more disparity as compared to both the longer-term residents and the service workers lured to these developing rural towns since in-migrants are typically favourably picked based on their level of education, wealth, and other socioeconomic qualities (Butler et al., 2020).

According to Lee et al. (2007), the population growth impact lends credence to the claim that the influx of a sizable group of young people raises income inequality by boosting the labour supply and inflating the bottom tail of the income distribution. Suppose that per capita income increases at an equal rate in all countries, but population growth is faster in both the richest and poorest countries. In this case, it is possible to examine how population growth affects between-country income inequality independent of income growth. As a result of population growth, the tails of the income distribution become wider, leading to an increase in inequality. Similarly, if countries in the middle of the income distribution experience the fastest population growth, inequality would decrease (Firebaugh & Goesling, 2004).

Therefore, an observed change in income ratios may partially reflect the impact of shifting population shares. A change in population shares can affect the world average income, which in turn affects income ratios (Firebaugh & Goesling, 2004). According to Chen et al. (2021), due to the spatial concentration of economic activities, both the overall population and urban populations typically result in greater income inequality. In addition, if the share of labor income in national income is fixed, the increase in population may hinder the income growth of the poor (Koudalo & Wu, 2022). According to Sitthiyot and Holasut (2022), there is obviously no income inequality in a country with a single population, therefore the Gini coefficient would be zero. However, it is challenging to identify a common set of variables that have similar impacts for all countries due to the degree of variation in social, economic, and political aspects that could lead to varying income disparity between countries. It is difficult to suggest that Singapore, with a population of 5.53 million, should experience wealth inequality caused by the same social, economic, and political forces as China, with a population of 1.37 billion (Sitthiyot & Holasut, 2022).

The advantages of the rising earnings and output growth have not been distributed fairly among all parts of the population, despite advances in technology, liberal market-oriented reforms, and country integration (Asteriou et al., 2014). Higher access to education would be anticipated to lessen income disparity for a given level of technology as a greater proportion of the population may engage in high-skill activities. Moving from agriculture to industry in emerging nations is anticipated to improve income distribution by raising the income of low-income groups (Asteriou et al., 2014). According to Ahmad et al. (2012), imply that while trade liberalization has a negative relationship with poverty while income disparity and population growth have positive relationships with it. For example, Pakistan must manage population growth and the gap in income distribution if it intends to eliminate poverty.

2.3 Conceptual framework



2.4 Hypothesis

Foreign direct investment

H_{01}: There is no relationship between FDI and income inequality

H_{A1}: There is a significant relationship between FDI and income inequality

Trade openness

H_{02}: There is no relationship between trade openness and income inequality

H_{A2}: There is a significant relationship between trade openness and income inequality

ICT development

H_{03}: There is no relationship between ICT development and income inequality

H_{A3}: There is a significant relationship between ICT development and income inequality

Economic growth

H_{04}: There is no relationship between economic growth and income inequality

H_{A4}: There is a significant relationship between economic growth and income inequality

Education

H_{05}: There is no relationship between level of education and income inequality

H_{A5}: There is a significant relationship between level of education and income inequality

Population

H_{06}: There is no relationship between the population size and income inequality

H_{A6}: There is a significant relationship between the population size and income inequality

2.5 Summary

This chapter included the previous studies of direct investment, trade openness, ICT development, economic growth, education, and population. Also, this chapter has developed the conceptual framework and hypothesis for the variables.

CHAPTER 3: METHODOLOGY

3.0 Introduction

In this chapter, it will be about the research methodology followed by research design, method of data collected, sources of data, data analysis, model specification and diagnosis checking. The proper method to be used in the study is important because it will lead to misleading if the method is not appropriate. However, to determine the accuracy of the outcomes, the models are tested by various type of diagnostic test. The next chapter will make further use of the methodologies from this chapter.

3.1 Research design

The study examines the relationship between globalization effects and income inequality in countries. The chosen independent variables in this research are Foreign Direct Investment (FDI), trade openness, economic growth, education, and population, whereas the dependent variable is income inequality. Income inequality always been the issues in developing countries which can lead to middle income trap. ASEAN is an emerging market which started to increase the globalization exponentially. There are many studies have conducted similar research; however, this study has included the ICT development which is one of the major components to determine the globalization. These independent variables will explain the effect of globalization on the dependent variable, which could formulate a regression model. For cross-sectional data, this study chooses seven ASEAN countries to conduct the research study. The criteria of selecting the countries are based on the income per capita accordingly. They are Singapore, Malaysia, Indonesia, Philippines, Vietnam, Thailand, and Brunei. For the time series data, the ICT development for ASEAN countries is mostly after the millennium. Thus, this study will carry up the research method by using the annual data with the period

from 2001 until 2020. The study will use a quantitative approach as the basis for this research study. It is an appropriate mechanism for explaining the relationship between these variables. The quantitative approach is one of the research concepts in which the study collects mathematical-based data resulting in a series of numbers such as panel data.

3.2 Data collection method

The data collection method of this study is through the secondary data. The secondary data can be obtained from other researchers' contribution, or the data published in the databases such as World Bank development indicator. Secondary data is used to identify the association among the variables. Again, the results from previous studies seem essential in interpreting the relationship between globalization effects and income inequality. The secondary data, especially macroeconomic data, may be easily to get from various validated sources. This collection method can make the research conducted in more efficient way compared to primary data. The panel data is a source of data consisting of cross-sectional and time-series elements which enable the implementation of testing and analysing in this study. This will obtain the panel data from the World Bank database and World Inequality database which is more authentication and valid data.

3.3 Sources of data

To make a research analysis, this research collect the data from the World Bank development indicators and World Inequality database. In this research, income inequality will be the dependent variable. Whereas foreign direct investment, trade openness, and ICT development are the independent variables to determine the globalization. For economic growth, education, and population are the independent variables that make the model more complete in the consideration.

In this research, the proxy for income inequality is Palma ratio. Palma ratio is a ratio that compares the income share of the top 10% of earners to that of the bottom 40% of earners (Floyd, 2022). The higher Palma ratio, the wider the income inequality and vice versa. There are a lot of studies using the Gini index as the income inequality proxy. However, Gini index is a summary measure of the entire income distribution. In many developing countries, the distribution of income is skewed, with a small proportion of individuals or households holding a large share of the national income. Therefore, using Palma ratio to identify the income inequality will be more appropriate for ASEAN. While other proxies are common proxies to identify the independent variables which could be found in many past studies.

Table 3.1: Source of data

Variable	Proxy	Abbreviation	Source	Unit
Income inequality	Palma ratio	PR	World Inequality Database	-
Foreign Direct Investment	Foreign direct investment, inflow	FDI	World Bank development indicators	(BoP, current US$)
Trade openness	Trade	TRD	World Bank development indicators	(% of GDP)
ICT development	Fixed broadband subscriptions	FBS	World Bank development indicators	-

Economic growth	GDP per capita	GDPpc	World Bank development indicators	(Current US$)
Education	School enrolment, tertiary	SE	World Bank development indicators	(% gross)
Population	Population, total	POP	World Bank development indicators	-

3.4 Panel data analysis

Panel data analysis is gaining popularity in the social and behavioral sciences. It involves studying longitudinal data sets that have repeated observations of the same individuals, households, businesses, countries, or other entities over time. This approach enables researchers to examine changes and trends over time by collecting multiple observations of various cross-sections. The use of both time series and cross-sections can enhance the quality and quantity of data beyond what could be achieved with just one dimension. By adding a temporal and spatial dimension to regression analysis, panel data analysis can provide a more comprehensive understanding of the data (Yaffee, 2003). Panel data offers more diverse and informative data with less collinearity among variables and greater degrees of freedom. This leads to increased efficiency in data analysis. As a result, panel data is a more advantageous approach compared to other methods (Hiestand, 2011). Researchers measure one or more variables, or parameters, for each unit while constructing a panel data set, and record their values in a tabular format. It is important to note that while some variables may vary over time, while others may not (Timeseriesreasoning.com, n.d.). When analyzing panel data, a balanced panel refers to a dataset in which each participant has the same total number of time units.

In contrast, an unbalanced panel has varying numbers of time units. Panel analytic models can take on various forms, including constant coefficients, fixed effects, and random effects models. Some examples of panel analytic models include robust models, covariance structure models, and dynamic panels (Zulfikar & STp, 2019).

3.4.1 Functional model:

$$PR = f(FDI, TRD, FBS, GDPpc, SE, POP)$$

3.4.2 Empirical model:

$$PR_{it} = \beta_0 + \beta_1 FDI_{it} + \beta_2 TRD_{it} + \beta_3 FBS_{it} + \beta_4 GDPpc_{it} + \beta_5 SE_{it} + \beta_6 POP_{it} + \mu_{it}$$

Where,

PR_{it} = Palma ratio

FDI_{it} = Foreign direct investment, inflows (BoP, current US$)

TRD_{it} = Trade (% of GDP)

FBS_{it} = Fixed broadband subscriptions

$GDPpc_{it}$ = GDP per capita (Current US$)

SE_{it} = School enrollment, tertiary (% gross)

POP_{it} = Population, total

μ_{it} = Error term

This study decided to convert FDI, SE, and POP into percentage form by using logarithm. FDI and POP are to be observed that the standard deviation is too large which contain a lot of the extreme value, by logged those variables, it can make the data more normally distributed which improve the accuracy (Kyaw, 2020). While for SE, the country Singapore contains a lot of the missing data on it, therefore, it might create the observations heavily skewed. Hence, by logging the SE can solve the issue as well.

Therefore, the modified model will be:

$$Log(PR_{it}) = \beta_0 + \beta_1 Log(FDI_{it}) + \beta_2 TRD_{it} + \beta_3 FBS_{it} + \beta_4 GDPpc_{it} + \beta_5 Log(SE_{it}) + \beta_6 Log(POP_{it}) + \mu_{it}$$

3.4.3 POLS

The pooled ordinary least squares (OLS) method is used to analyze panel data, where the model has constant coefficients for both intercepts and slopes. Researchers can apply OLS regression to the combined data in this type of model (Hiestand, 2011). Models must be estimated using approaches that address the problems that surround them. Ordinary least squares estimation can be used to estimate a constant coefficients model with residual homogeneity and normality (OLS). OLS can also be used to estimate fixed effects models if the dependant variable doesn't encounter any groupwise or other heteroskedastic effects. The errors must be homoscedasticity and independent for OLS to be applied correctly. It is frequently unrealistic to assume that OLS will be sufficient for such models because those situations are so uncommon. Beck and Katz (1995) suggested that if the sample size is small or fixed, it is essential to have more temporal observations than panel units. Additionally, they argued that the ordinary least squares (OLS) method with panel corrected errors is more dependable than the feasible generalized least squares (FGLS) approach.

The POLS can be constructed as:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \varepsilon_{it}\,, i = 1, 2, 3 \ldots, n; t = 1,2,3 \ldots, n$$

The pooled model does not incorporate a model to account for heterogeneity among either groups or individuals. Therefore, heterogeneity bias may be a result from pooled regression. The model uses differences in the means of the explanatory variables to explain variations in the dependent

variable's mean for the set of observations related to a specific group or individual. This estimator includes the within-individual or time-series information that is represented in changes within individuals across time (Suárez Serrato, 2015). When using standard OLS, the assumptions would include homoskedasticity and a lack of correlation between unit i's observations made throughout time. In fact, the Pooled OLSR model is frequently used as the benchmark or reference model in many panel data sets to analyse how other models perform in comparison (Timeseriesreasoning.com, n.d.). Usually, the Ordinary Least Squares (OLS) method is employed to estimate the parameters in regression analysis using cross-sectional data. On the other hand, the Panel Data Regression method will produce the best linear unbiased estimate (BLUE) because of the estimation.

3.4.4 FEM

FEM is one of the popular statistical models for meta-analysis. It assumes that the variables are constant across individuals. For example, variables such as gender, age, or ethnicity remained unchanged or change at a constant rate as time passed (Borenstein et al., 2010). Next, this model assumes that the intercept for the cross-sectional unit is correlated with the independent variable. This condition will give rise to endogeneity problem when correlation exists between the error term and the regressor. Moreover, dummy variables may be inserted with various intercepts for each individual. However, including too many of the dummy variables into the model may exaggerate multicollinearity problem among the independent variables. The method may not be capable of determining the influence of variables that do not change over time, such as gender, race, and religion (Baltagi, 2010).

FEM can be constructed as:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \varepsilon_{it}\,, i = 1, 2, 3 \dots, n; t = 1,2,3 \dots, n$$

Collischon and Eberl (2020) proposed that the primary advantage of fixed effects model is the potential to eliminate significant sources of bias. FE models restrict the sources of bias to time-varying factors that have a long-term correlation with both the treatment and the result.

3.4.5 REM

REM model also known as error component model, which assumes no fixed effect and is employed in the analysis of panel data. The model assumes that the baseline of each individual unit is chosen randomly from a significantly larger population with a consistent average value. The model is appropriate in a circumstance where the intercept of each cross-sectional unit is uncorrelated with the independent variables. Given its low standard error and unbiased estimate of coefficient, REM is a good model out of all other models.

REM can be constructed as:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \varepsilon_{it} + \mu_{it}$$
$$Y_{it} = \beta_0 + \beta_1 X_{it} + w_{it}$$

Other than that, Gujarati (2004) claims that REM outperforms the FEM is the random effects hypotheses are true. However, when there is a correlation between the individual-specific error term and the regressors, meaning to say it fails to hold the assumption of REM, this will lead to endogeneity problem. As a result, REM is seen as inconsistent.

3.5 Diagnostic checking

3.5.1 Jarque-Bera test

Normality test is important in research to determine whether the observations are normally distributed. Testing for normality is crucial when dealing with continuous data as it helps determine appropriate measures of central tendency and statistical techniques for data analysis. If the data is normally distributed, parametric tests are used to compare groups, but nonparametric methods are utilized for non-normally distributed data. Therefore, normality testing plays a vital role in deciding the appropriate statistical methods for data analysis based on the distribution of the data (Mishra et al., 2019). One of the famous normality tests will be Jarque-Bera normality test. This test was first introduced by (Jarque & Bera, 1980). The Jarque-Bera test is used to assess the degree to which the skewness and kurtosis of a sample data set match those of a normal distribution, serving as a measure of how well the data fits the normal distribution. The Jarque-Bera test statistic is invariably positive, and a significant departure from zero suggests that the sample data significantly differ from a normal distribution.

Test statistic for Jarque-Bera test:

$$JB = \frac{n}{6}\left(S^2 + \frac{(K-3)^2}{4}\right.$$

Hypothesis testing:

H_0: Normally distributed

H_1: Non-normally distributed

3.5.2 VIF test

VIF test is mainly to find out if the model consists of multicollinearity. Multicollinearity issues arise when all independent variables are highly correlated with one another in the model. In addition, if there is multicollinearity, the regression model will be unable to determine which independent variables are affecting the dependent variable. Below is perfect multicollinearity (Hayes, 2022a). The Variance Inflation Factor (VIF) is used to find correlations between the established coefficients in this study (Hayes, 2022a).

Construction for VIF:

$$VIF = 1 / (1 - R^2)$$

Decision making:

$$VIF = 1, \text{No multicollinearity}$$

$$1 \leq VIF \leq 10, \text{Low multicollinearity}$$

$$10 \leq VIF, \text{High multicollinearity}$$

3.5.3 Levin, Lin & Chu test

Levin-Lin-Chu test is a unit root test to test if the data is in stationary. It is important to clarify if the time-series observations are in stationary form. Stationarity of a time-series can significantly influence the behaviour and properties itself. Moreover, unit root exists, or trend will lead to spurious regressions. Levin et al. (2002) introduced this test to determine the unit root of a series of data. The LLC test has been shown to have higher power than other panel unit root tests, particularly when the time series dimension of the panel is small relative to the cross-sectional dimension. The test is widely used in empirical research, particularly in the fields of

macroeconomics and finance, to test for the presence of a unit root in panel data (Estima, 2006).

Test statistic for LLC test:

$$\Delta y_t = \alpha_i + \beta_{it} + y_i y_{t-1} + \varepsilon_{it}$$

Hypothesis testing:

H_0: Unit root exist (non-stationary)

H_1: Unit root does not exist (stationary)

3.5.4 Pedroni residual cointegration test

Pedroni (1999, 2004) developed seven test statistics to assess whether there is cointegration in nonstationary panel data. These tests are to test if there is cointegration in nonstationary heterogeneous panels. These tests allow for heterogeneity in both short-run dynamics and long-run slope and intercept coefficients across the panel. That is, there is a long-term relationship within the non-stationary time series, despite they may have short-term fluctuation that are not related. Unlike traditional time-series analysis, these tests do not require normalization or a precise number of cointegrating relationships, but rather aim to determine the degree of evidence for cointegration among two or more variables in the panel. The seven test statistics are classified into two types which is group-mean statistics and panel statistics. Group-mean statistics is used to calculate the average of the individual country test statistics while Panel statistics is used to combine the statistics along the within-dimension of the panel (Neal, 2014). When there are more than half of the seven test statistics or at least four test statistics are significant, the null hypothesis will be rejected.

Test statistic for seven panels:

Panel υ:

$$T^2 N^{\frac{3}{2}} \left(\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1}$$

Panel ρ:

$$T\sqrt{N} \left(\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \left(\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i \right)$$

Panel t:

$$\left(\tilde{\sigma}_{N,T}^2 \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-\frac{1}{2}} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \left(\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i \right)$$

Panel ADF:

$$\left(\tilde{s}_{N,T}^{*2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{*2} \right)^{-\frac{1}{2}} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{*} \Delta \hat{e}_{i,t}^{*}$$

Group ρ:

$$T \frac{1}{\sqrt{N}} \sum_{i=1}^{N} \left(\sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1} \sum_{t=1}^{T} \left(\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i \right)$$

Group t:

$$\frac{1}{\sqrt{N}} \sum_{i=1}^{N} \left(\hat{\sigma}_i^2 \sum_{t=1}^{T} \hat{e}_{i,t-1}^2 \right)^{-\frac{1}{2}} \sum_{t=1}^{T} \left(\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i \right)$$

Group ADF:

$$\frac{1}{\sqrt{N}} \sum_{i=1}^{N} \left(\sum_{t=1}^{T} \hat{s}_i^{*2} \hat{e}_{i,t-1}^{*2} \right)^{-\frac{1}{2}} \sum_{t=1}^{T} \hat{e}_{i,t-1} \Delta \hat{e}_{i,t}$$

Hypothesis testing:

H_0: No cointegration in nonstationary heterogeneous panels

H_1: Cointegration in nonstationary heterogeneous panels

3.6 Approach to select the most appropriate model

3.6.1 Poolability F-test

Poolability F-test is an econometrics technique to determine whether the POLS or the FEM is preferable, the poolability test (POLS) is used to determine whether individual effects are present. By examining individual and time impacts, the pooling of data broadens the database and enhances the accuracy of the estimated parameter. The poolability test suggests that the FEM approach is preferred as an alternative hypothesis, whereas the POLS method is preferred for the null hypothesis.

Test statistic for Poolability test:

$$F = \frac{(R^2_{FEM} + R^2_{POLS})/(K_{FEM} + K_{POLS})}{(1 - R^2_{FEM})/(n - (K_{FEM} + 1))}$$

Hypothesis testing:

H_0: $\mu_i = 0$ (POLS is preferable)

H_1: $\mu_i \neq 0$ (FEM is preferable)

3.6.2 Hausman test (1978)

The Hausman tests, introduced by Hausman (1978), are used to identify errors in econometric models. These tests involve comparing two different estimators of the model parameters to detect any misspecification in the model. The decision between FEM and REM can be based on

Hausman test (Egger, 2002). The null hypothesis is REM, while FEM will be the alternative hypothesis.

Test statistic for Hausman test:

$$H = (\beta_{FE} - \beta_{RE})[Var(\beta_{FE}) - Var(\beta_{RE})]^{-1}(\beta_{FE} - \beta_{RE})$$

Hypothesis testing:

H_0: $Cov\ (\mu_{it}/X_{it}) = 0$ (REM is preferable)

H_1: $Cov\ (\mu_{it}/X_{it}) \neq 0$ (FEM is preferable)

3.6.3 Breusch-Pagan Lagrange Multiplier Test

Breusch-Pagan Lagrange multiplier (BPLM) is used to varify for heteroskedasticity in a linear regression model. In addition, it can also be used to select the appropriate model between POLS and REM. In short, the selection between POLS and REM is based on Breusch-Pagan Lagrange multiplier test (Lee, 2020).

Test statistic for BPLM test:

$$LM = \left(\frac{\delta\xi}{\delta\theta}\right)^{T}\left(-E\left[\frac{\delta^2\xi}{\delta\theta\delta\theta^t}\right]\right)^{-1}\left(\frac{\delta\xi}{\delta\theta}\right)$$

Hypothesis testing:

H_0: $\sigma_\mu^2 = 0$ (POLS is preferable)

H_1: $\sigma_\mu^2 \neq 0$ (REM is preferable)

3.7 Summary

This chapter included a general explanation of the models such as POLS, FEM and REM that will be used to analyze the data used in the study which is collected from World Bank and World Inequality Indicator. There are some different assumptions in different tests. The next chapter will be shown all the results that the methodologies based on this chapter.

CHAPTER 4: DATA ANALYSIS

4.0 Introduction

Previously, the chapter had carried out the methodologies in the chosen data. Thus, this chapter will be explaining the significance of how the chosen variables affecting income inequality. This chapter included discussion of empirical findings and the data analysis by using the tests which had mentioned in chapter three. Tables are used in this chapter.

4.1 Descriptive statistic

Table 4.1: Descriptive statistic

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
PR	112	0.4462	0.0555	0.3542	0.5658
FDI	112	7.01E+09	1.71E+10	-1.16E+10	1.11E+11
TRD	112	2.06E+09	56.88738	37.42134	324.3204
FBS	112	2359422	2852633	1076	14802380
GDPpc	112	10968.99	15009.37	434.8103	66859.34
SE	112	32.91782	14.99461	9.79335	91.08899
POP	112	81768651	78886508	340748	340748

Table 4.1 shows the descriptive statistic for the variable Palma ratio, FDI, Trade, Fixed broadband subscription, GDP per capita, Education enrolment and Population. There is total 112 observations for all variables which collected from 7 ASEAN countries in the period of 2001 to 2020. The mean value for the variable is 0.4462, 7.01E+09, 2.06E+09, 2359422, 10968.99, 32.91782, and 81768651 respectively. FDI has the highest standard deviation which indicates that the data is quite fluctuate during the period. Other than that, Fixed broadband subscription,

GDP per capita, and Population also having quite large standard deviation. While for Palma ratio, trade, and Education enrolment are having low standard deviation which having comparatively low fluctuation for the observations.

4.2 Diagnostic checking

4.2.1 Jarque-Bera test

Table 4.2: Jarque-Bera test result

Jarque-Bera test statistic	**P-value**
11.85496	0.002665 ***

***, **, and * are used to denote the significance level of 1%, 5%, and 10%, respectively.

According to table 4.2, the p-value for the Jarque-Bera test is 0.002 which is significant at 1% which reject the null hypothesis that the data is normally distributed. That is, this concludes there is sufficient evidence that the data is not normally distributed. According to Buthmann (2021), the non-normal distribution of dataset was caused by some of the observations being close to zero, which created a skew towards either the right or left side. In addition, the dataset for some proxies contained some missing values that may contribute to the non-normal distribution of the model.

4.2.2 Multicollinearity

4.2.2.1 Correlation matrix

Table 4.3: Correlation matrix

Variable	LPR	LFDI	TRD	FBS	GDPpc	LSE	LPOP
LPAL	1.0000						
LFDI	-0.1315	1.0000					
TRD	0.0206	0.2703	1.0000				
FBS	-0.0374	0.2444	-0.1129	1.0000			
GDPpc	-0.1306	0.5409	0.7165	-0.0745	1.0000		
LSE	0.2907	0.5962	0.4821	0.1908	0.6603	1.0000	
LPOP	0.1725	-0.1849	-0.7370	0.2205	-0.6917	-0.5189	1.0000

Based on the table 4.3, there is potential multicollinearity between some independent variables. In general, pairwise correlation more than 0.7 for an economic model would be considered as existence of multicollinearity problem. In this case, there are two pairs of variables are having pairwise correlation that exceeded 0.7. Log population and trade are having the highest degree of correlation which is -0.737 while GDP per capita and trade correlation is 0.7165. This indicates that the two pairs of independent variables are quite correlated and may lead to multicollinearity problem. However, correlation matrix only tests on the pairwise correlation between 2 variables and does not consider the whole model. Additionally, the correlation matrix does not provide information on the impact of multicollinearity on the regression coefficients or standard errors. Therefore, the VIF test will further identify the multicollinearity problem.

4.2.2.2 VIF test

Table 4.4: VIF test result

	LFDI	TRD	FBS	GDPpc	LSE	LPOP
Centered VIF	2.0640	2.3445	2.4530	2.7902	2.1842	4.5332

According to the table 4.4, the VIF value less than 10 will be considered as existence of low multicollinearity. In the VIF test generated by using 140 observations, the test result conclude that no variable is existed high multicollinearity. In details, the logged FDI, trade, fixed broadband subscription, GDP per capita, logged school enrolment, and logged population show 2.064, 2.3445, 2.4530, 2.7902, 2.1842, 4.5332 VIF value accordingly. Among the variable, the logged population is having the highest VIF value but still far behind the benchmark of VIF = 10. Therefore, the model is not suffer from multicollinearity issues given the test result.

4.2.3 Levin, Lin & Chu test

Table 4.5: Levin-Lin-Chu test result

	Level form	First difference	Second difference
LPR	0.19242	-2.21726	-5.21769
	(0.5763)	(0.0133) **	(0.0000) ***
LFDI	-2.72275	-4.34845	-9.07758
	(0.0032) ***	(0.0000) ***	(0.0000) ***
TRD	-0.07476	-5.44721	-8.94009
	(0.4702)	(0.0000) ***	(0.0000) ***
FBS	4.19046	1.84023	-2.33857
	(1.0000)	(0.9671)	(0.0097) ***
GDPpc	-1.47860	-2.79449	-3.75930
	(0.0696) *	(0.0026) ***	(0.0001) ***
LSE	-1.16352	-4.59677	-8.01415
	(0.1223)	(0.0000) ***	(0.0000) ***
LPOP	-1.49717	-0.59002	-5.63513
	(0.0672) *	(0.2776)	(0.0000) ***

***, **, and * are used to denote the significance level of 1%, 5%, and 10%, respectively.

Table 4.5 shows that the Levin-Lin-Chu unit root result for the seven variables, which is Palma ratio, FDI, trade, fixed broadband subscription, GDP per capita, school enrolment, and population. On the level form I(0), there are only three variables are stationary which is FDI, GDP per capita, and population. However, Palma ratio, trade, fixed broadband subscription, and school enrolment seems exist of unit root in the level form. While taking the first difference of the data I(1), there are five variables are significant in this unit root test which suggest absent of unit root. The variables absent of unit root in first difference are Palma ratio, FDI, trade, GDP per capita, and school enrolment. While fixed broadband subscription and population are insignificant. To be noted that the population is stationary in level form but when it comes to first difference, it become insignificant. For the second

difference form result I(2), all of the variables are significant at 10%, 5%, and 1%. This indicates that all of the variables are stationary when taking the second differentiation.

4.2.4 Pedroni residual cointegration test

Table 4.6: Pedroni residual cointegration test result

Panel	Test statistic (p-value)
Panel v-statistic	-0.12192
	(0.5485)
Panel rho-statistic	2.45722
	(0.9930)
Panel PP-statistic	-5.73036
	(0.0000) ***
Panel ADF-statistic	-2.82567
	(0.0024) ***
Group rho-statistic	3.19769
	(0.9993)
Group PP-statistic	-7.82651
	(0.0000) ***
Group ADF-statistic	-3.82116
	(0.0001) ***

***, **, and * are used to denote the significance level of 1%, 5%, and 10%, respectively.

Table 4.6 shows that there are 4 panel are significant at 1% out of 7 panels. The significant panel is panel PP-statistic, panel ADF-statistic, group PP-statistic, and group ADF-statistic respectively. As there is a simple majority of significant, hence there is sufficient to conclude that the data exist of cointegration in nonstationary heterogeneous panels. This suggests despite the data is nonstationary at the level form, but there is an existence of long run relationship.

4.3 Model selection

Table 4.7: Model selection test results

	POLS	FEM	REM
Poolability F-Test		46.0188	
		(0.0000) ***	
Hausman Test		276.1127	
		(0.0000) ***	
BP-LM Test			94.3938
			(0.0000) ***

***, **, and * are used to denote the significance level of 1%, 5%, and 10%, respectively.

4.3.1 Poolability F-Test

This test is conducted to choose either Pooled OLS or FEM to be the best model to estimate in this study. The H_0 is rejected since the test statistic (46.0188) falls outsides of the upper critical value (2.25) and lower critical value (-2.25). Hence, Poolability F-Test recommends that FEM is the more appropriate model to be used to estimate the regression compared to POLS.

4.3.2 Hausman Test (1978)

This test is adopted to investigate whether REM and FEM is a better model for model estimation. The H_0 is rejected since the P-Value is smaller than α (0.05). Therefore, Hausman test recommends that FEM is preferable to be used to estimate the regression compared to REM.

4.3.3 BP-LM Test

This test is employed to select either Pooled OLS or REM to be used in this study. The H_0 is rejected since the P-Value is smaller than α (0.05).

Thus, BP-LM test tested that REM is more suitable to be the estimation model instead of Pooled OLS.

Overall, the three tests suggested that the FEM will be the most adequate model since all the three tests are significant in 1%, 5%, and 10%.

4.4 POLS, FEM, and REM estimated results

Table 4.8: Empirical results

	Pooled OLS	**Fixed Effect**	**Random Effect**
Constant	-2.330572	3.209057	-2.330572
	(0.0000) ***	(0.0475) **	(0.0000) ***
LFDI	-0.026671	0.004054	-0.026671
	(0.0000) ***	(0.3510)	(0.0000) ***
TRD	0.000646	0.000627	0.000646
	(0.0005) ***	(0.0268) **	(0.0000) ***
FBS	-8.47E-09	-5.32E-09	-8.47E-09
	(0.0016) ***	(0.0067) ***	(0.0000) ***
GDPpc	-2.88E-06	-5.39E-06	-2.88E-06
	(0.0053) ***	(0.0534) *	(0.0000) ***
LSE	0.263893	0.105624	0.263893
	(0.0000) ***	(0.0002) ***	(0.0000) ***
LPOP	0.065847	-0.247765	0.065847
	(0.0000) ***	(0.0074) ***	(0.0000) ***
F-statistic (p-value)	(0.0000) ***	(0.0000) ***	(0.0000) ***
R-squared	0.563724	0.906809	0.563724
Adjusted R-squared	0.531408	0.891898	0.531408

***, **, and * are used to denote the significance level of 1%, 5%, and 10%, respectively.

The estimated models derived by using Pooled Ordinary Least Square, fixed effect, and random effects are illustrated in table 4.8. Looking at the column of Pooled OLS, it is obvious that the FDI, Fixed broadband subscriptions, and GDP

per capita are negatively correlated to Palma Ratio at the significant levels of 1%, 5%, and 10%. On the other hand, trade, school enrollment and population are positively correlated to the Palma Ratio at 1% as well as 10% significant level. As a result, LFDI increases by 1%, on average, the Palma ratio will decrease by 0.026671%, holding other variables constant. Next, for the fixed broadband subscriptions (FBS), it can be interpreted whereby when the number of fixed broadband subscriptions increases by 1 unit, on average, the Palma ratio will decrease by 0.000000847%, ceteris paribus. The third variable is GDP per capita, and the interpretation is when the GDP per capita increases by 1, on average, the Palma ratio will decrease by 0.00000288, holding other variables constant. The fourth variable will be school enrolment (LSE). When school enrollment increases by 1%, on average, the Palma ratio increases by 0.263893%, holding other variables constant. Lastly, the interpretation of the population is when the population increases by 1%, on average, the Palma ratio increases by 0.065847%, holding other variables constant.

Based on the Random Effect Model, FDI, Fixed Broadband Subscriptions, and GDP per capita have a negative relationship with Palma ratio at 1%, 5% and 10% significant levels. Meanwhile, trade, school enrollment, and population have a positive relationship with Palma ratio. By looking at the p-value, all the variables have a significant relationship with the dependent variable, which is Palma ratio because all the p-values are less than the significant levels, at 1%, 5%, and 10%. Hence, the null hypothesis will be rejected and there is sufficient evidence to conclude that the variables are important to justify the dependent variable. Furthermore, it is noted that the coefficient of each independent variable in REM is same to the POLS.

Based on the three tests to select the most relevant model, FEM is being selected. Therefore, the result within FEM will be most reliable. In the Fixed Effect Model, the variables, only FDI, fixed broadband subscriptions, and population have no significant relationship with Palma ratio due to the reason that their p-value derived using the fixed effect method is more than 0.1. Other variables such as trade, GDP per capita, school enrollment, and population have a significant relationship with Palma ratio at a 10% significant level. At the same time, fixed broadband

subscriptions, school enrollment, together with population are significant at 1%, 5% and 10% significant level. While for trade is significant at 5% and the GDP per capita is significant at 10%.

FDI is found to be no relationship with Palma ratio but has a positive sign, this rejected many past studies where majority of the past studies are having the significant result. This indicate that when the FDI increases by 1%, on average, the Palma ratio will increase by 0.004054%, holding other variables constant. Next, trade is positively significant affecting the Palma ratio. That is, it will widen the income gap. When the number of trade increase by 1, on average, the Palma ratio will increase by 0.0627%, ceteris paribus. Furthermore, fixed broadband subscription has a significant and negative coefficient where it will help to reduce the income gap. It can be interpreted whereby when the number of fixed broadband subscription increases by 1 unit, on average, the Palma ratio will decrease by 0.000000532%, holding other variables constant. Comes to the GDP per capita, this variable shows a negative coefficient whereby it will reduce income gap as well. The interpretation is when the GDP per capita increases by 1, on average, the Palma ratio will decrease by 0.000539%, holding other variables constant. Next, school enrollment has a positive relationship with the Palma ratio. This is interesting that this result is not in line with many past studies as well. The coefficient can be interpreted as when school enrollment increases by 1%, on average, the Palma ratio increases by 0.105624%, ceteris paribus. Lastly, the population has a negative coefficient whereby it helps to improve income distribution. The interpretation of the population is when the population increases by 1%, on average, the Palma ratio decrease by 0.247765, holding other variables constant.

To test the overall significance of the FEM model, it will be based on the F-test. Thus, under the p-value approach, it is obvious that the FEM model is significant to explain the Palma ratio at the significant levels of 1%, 5%, and 10% due to the reason that the p-value derived using the FEM method is less than 0.01. Moreover, the coefficient of determination, R square is a summary measure of goodness of fit in both simple and multiple regressions. To define, R square measures the proportion or percentage of the total variation in the dependent variable explained by the regression model. Based on table 4.8, the value of R

square is 0.906809 which can be interpreted as there are 90.68% of the variation in predicted Palma ratio is explained by the variation in FDI, trade, fixed broadband subscriptions, GDP per capita, school enrollment, and population. As for the adjusted coefficient of determination, adjusted R square with a value of 0.891898, the interpretation is there are 89.19% of the variation in the predicted Palma ratio is explained by the variation in FDI, trade, fixed broadband subscriptions, GDP per capita, school enrollment, and population, after considering the degree of freedom.

4.5 Conclusion

The chapter 4 summarized all the results from the diagnosis testing, and the estimated model. The observations tend to have not normal distributed. Also, despite the data are not stationary in the level form in the short run, but the cointegration test stated that it still exists of long run relationship in the non-stationary data. FEM will be the most appropriate model among the three models. And the result in the FEM is quite interesting whereby the FDI, school enrolment, and population show a different outcome which not in line with the majority studies based on the literature review in chapter 2. This will be further investigated in the chapter 5.

CHAPTER 5: DISCUSSION, CONCLUSION, AND IMPLICATIONS

5.0 Introduction

In chapter 5, the findings of previous studied are fully outlined and discussed. This chapter will discuss about the key findings, implications for policy, the limitations, as well as recommendations for additional study. The conclusion and a summary of the relationship between the dependent and independent variables will be also provided along the chapter.

5.1 Discussion of major finding

Based on the estimated result, there are some variables that present the same result with the past studies. However, there are also certain variables are not supported by the past studies. The result of FEM is quite interesting. The FDI, school enrolment, and population not in line with many studies based on the literature review in chapter 2. Here is the summary table that summarized that all the result of the variables and if the result is supported by the major past studies.

Table 5.1: Summarized conformity of past studies

Hypothesis	**Empirical result**	**Conformity**
H1: There is a significant relationship between FDI and income inequality	Positive Insignificant	Not supported
H2: There is a significant relationship between Trade Openness and income inequality	Positive Significant	Supported

H3: There is a significant relationship between ICT development and income inequality	Negative Significant	Supported
H4: There is a significant relationship between economic growth and income inequality	Negative Significant	Supported
H5: There is a significant relationship between education and income inequality	Positive Significant	Supported
H6: There is a significant relationship between population and income inequality	Negative Significant	Supported

5.1.1 FDI and income inequality

The globalization indicators other than ICT development such as trade and FDI are shown different results. Based on the empirical results, the FDI variable is insignificant in all three levels, 10%, 5%, and 1%. This result has a same result with Roodman (2007); Goldberg et al. (2005); Milanovic (2002). However, not in line with the several past studies in ASEAN such as Farhan et al. (2014); Merican et al. (2008); Mukaramah et al. (2014); Cho and Ramirez (2016); Arshad and Islam (2020). These studies all concluded that the FDI is significantly affecting the income inequality in ASEAN, either positively or negatively. The FEM result from this study is not in line with the existing studies. There may be several reasons to address this outcome. The time-series period is different from the past studies. For example, Farhan et al. (2014) studied the cases from 1970 to 2012; Cho and Ramirez (2016) started the research data from 1990 to 2013. For this research is aimed to examine the relationship of variables and income inequality between 2001 to 2020. Therefore, it is worth to conduct further research on it. Moreover, FDI often targets industries that are not labour-intensive. That is, FDI tends to flow into sectors that require high levels of

capital investment and technology. These industries may not be very labour-intensive and may not have a significant impact on employment levels or wage rates in the broader economy (Keller, 2004).

Despite the result is insignificance, but coefficient is positive. This might indicate that increase in FDI might lead to deteriorate income inequality, even the effect is not very significant. Munir and Bukhari (2019) stated that high-skilled labourers will receive higher salaries since there is more support from the FDI inflows. Keller (2004) suggested that FDI often flow to high levels of capital investment and technology which mainly in the technology sector. In detail, employee in this sector would get the highest paid since there are very few people having such skills and knowledges for the specialized (Priya, 2022). The higher paid with such workers will lead to an increase of income inequality. However, the sector is not very labour-intensive whereby only a small number of employees are compensated such high salaries. Therefore, under the assumption, FDI will lead to wider income inequality, but the effect seems insignificant.

5.1.2 Trade openness and income inequality

According to the result, there is a significant positive relationship between trade openness and income inequality in ASEAN countries. This means that greater trade openness will lead to wider income inequality. This result is in line with the results from several past empirical studies such as Dorn et al. (2021); Mohanty (2017); Roser & Cuaresma (2014); Polpibulaya (2015); and Meschi and Vivarelli's (2009). This outcome occurred because local businesses were unable to compete against multinational corporations (Hossain et al., 2022). Therefore, the local business will tend to have lesser market share compared to the imported products. This will widen the income gap by the limited ability of the local companies paying out a considerable wage to the domestic workers. Indeed, some MNC might be outstanding in this situation, especially when they have manufacturing plant

in local. In the phenomenon, they will be able to hire employee with higher salary. Therefore, the income gap wider. To tackle this problem, policymakers and governments in Asian economies should create strategies that aid local businesses in staying competitive and benefiting from multinational corporations.

Another reason encountered by Dorn et al. (2021), stated that the impact of trade openness on income inequality is anticipated to vary based on a country's level of development. This would be associated with the Stolper-Samuelson theorem, which suggests that increased trade openness leads to an increase in income inequality (Dorn et al., 2021). In addition, the implementation of market-based reforms stimulated the inflow of foreign direct investment and the integration of nations in the worldwide market, and those countries that experienced transition may have failed to consider for impact of trade openness on income inequality. The fundamental change and reorganization of the economy and governance have probably affected the pace of globalization and the increase of income inequality (Dorn et al., 2021). Based on this perspective, ASEAN countries may undergo a transition moving toward the global market and confront challenges in competing with multinational corporations.

5.1.3 ICT development and income inequality

According to the result, the ICT development is negative significantly affecting the income gap in ASEAN countries. This contributes that the ICT development such as improvement on ICT infrastructure in rural area has improved the living quality of the poor and thus reduced income gap. This has a same outcome with Aker and Mbiti (2010); Asongu (2015); Asongu and Le Roux (2017); Asongu and Odhiambo (2019); Roller and Waverman (2001); Abor et al. (2018); Beuermann et al. (2012); Jing et al. (2019); Ningsih and Choi (2018). This finding can be indicated that the development of technology is increasing the living standards of people, as

in the new stage of globalization. Aker and Mbiti (2010) claims that the advancement of information and communication technology (ICT) can lead to the creation of job opportunities for those in low-income groups. In addition, financial technology has the potential to enhance tax collection methods, which could decrease levels of corruption also. In short, ICT development able to reduce income inequality by creating new employment opportunities, improving access to services, and enabling individuals to participate more fully into the global economy.

5.1.4 Economic growth and income inequality

This research found that there is a significant negative relationship between economic growth and income inequality in the ASEAN countries. There are several past empirical studies shown in line with the result, such as Khan et al. (2021); Mohanty (2017); Baek and Shi (2016); and Antonelli and Gehringer (2013). According to the findings of Beck et al. (2007), the consequences of foreign investment promote consumption and investment over production and savings in countries. This, in turn, spurs economic growth and increases the income of those living in poverty, and causes a reduction in income inequality. Greenwood and Jovanovic (1990) suggested that economic advancement could lead to greater financial openness, thereby facilitating household access to financial markets and potentially reducing income inequality. Wahiba and Mahmoudi (2023) proved that the relationship between economic growth and income inequality is highly attributed to Kuznets' hypothesis, which suggests a transition of relationship from positive to negative, ultimately resulting from short run to long run. Furthermore, Hossain et al. (2022) expressed that the Asian region also experiences the Kuznets curve, which means the economic growth can eventually lead to reduced income inequality. Therefore, it is important for governments to take action to ensure that economic growth benefits people from all social classes (Hossain et al., 2022).

5.1.5 Education and income inequality

The findings of this study indicate a significant positive correlation between education levels and income inequality in ASEAN countries. Several outcomes form past studies were in line with Seefeldt (2018); Saez and Zucman (2016); Goldin and Katz (2010). If a country has a high level of income inequality, it is possible that the gap in earnings between less educated parents and more educated parents could persist for many centuries. This is because the parents with lower levels of education find it more difficult to invest in their children's education due to lower earnings and limited financial resources. Consequently, lead to a widening gap in human capital between different socioeconomic groups, potentially exacerbating income inequality in the long term (Lasisi et al., 2023). That is, the wealthy family will have more opportunities to study at a higher level of education while the poor will have some restrictions on pursuing higher quality of education and only can study in an average college. This phenomenon indicates that, even though the tertiary school enrolment increased, the students from wealthy families would have higher quality education such as higher-ranking private University. This phenomenon is in line with the composition effect, in which the rise of income inequality was due to higher educational inequality initially between the children from wealthy families and poor families (Seefeldt, 2018). Consequently, wealthy students who graduated from better college might earn a more superior income than the students who graduated from an average school.

Moreover, this study results that an increase in education will lead to increase in income inequality. The reason behind was the inability of low educated parent to invest their children's education due to lack of financial resources and earning ability. Even the school enrolment has risen, but income inequality has also increased. Therefore, a phenomenon reflects a composition effect arises from higher educational inequality among citizens. This expresses the fact that most of the enrolled students come from affluent and educated families. Certainly, making investments toward the

development of intellectual capital can result in objective career success for individuals as well as decrease income inequality (Lasisi et. al., 2023). Besides, even the school enrolment increases and lead to more graduates, but there might be insufficient employment opportunities and industry to absorb these graduates. It also means the high-educated graduates does not match the current talent market demand. This indicates that graduates would suffer under-employment, which means the graduates fail to do their graduate level jobs, which will have high paid salaries for them. Instead, it shifts most of the graduates moving into a normal level of employment, that do not match with their education level. Hence, the employers can only pay the salaries based on normal level jobs. It forces the graduates to compete for the limited employment opportunity. In short, there is limited and insufficient higher paying jobs to absorb the excessive graduates. Thus, even higher education but still cannot improve the income inequality.

5.1.6 Population and income inequality

Based on the result from this study the population has a significant negative relationship with the income inequality. This is in line with Firebaugh and Goesling (2004), and this study further suggest that inequality decreases if countries with the middle of the income distribution see their populations expand the fastest. There are a lot of research conclude that the population can lead to higher income inequality. However, in ASEAN, this might be due to the middle-income trap. The middle-income trap is a situation where a country experiences fast economic growth, leading to the attainment of middle-income status, but then struggles to move beyond that point and catch up with developed nations (Glawe & Wagner, 2016). That is, the middle-income population is keep on increasing in ASEAN majority countries and therefore lead to the decrease of income inequality. Moreover, in some developing countries, a growing population can lead to greater economic growth, which can create new job opportunities and reduce poverty. However, this depends on the country's economic

policies and the degree to which the benefits of growth are shared across the population (World Bank, 2018).

5.2 Implications

5.2.1 Theoretical implication

The Stolper-Samuelson theorem is a fundamental theorem in the Heckscher-Ohlin trade theory that explains the connection between the relative prices of output and the relative rewards for different factors of production, such as real wages and real returns to capital. The theorem suggests that free trade across borders will benefit the factor of production that is abundant in a country while hurting the one that is scarce. This leads to the problem of income inequality as some factors of production gain more than others. Thus, based on the Stolper-Samuelson theorem, there exists a correlation between income inequality and foreign direct investment (FDI).

However, based on the finding in this study, FDI does not result a relationship with the income inequality where it is statistically insignificant. This is in contrast with the Stolper-Samuelson theorem. Despite there are many factors such as research period that might affecting the FDI become insignificant to the income inequality, but it is worth to conduct further academic research on it. Moreover, the statistically insignificant does not necessary mean it is economic insignificant. Thus, the Stolper-Samuelson theorem may still hold on to the relationship between FDI and income inequality practically.

Moreover, there are many studies supported that education will more likely improve the income gap. However, the result from this study further justified by the theory of composition and compression effect which stated in chapter 2. This theory stated that if the education inequality present, the increase of education in total will widen income inequality (Seefeldt, 2018).

5.2.2 Practical implication

The finding shows that globalization has a notable influence on income inequality. After analyzing, five out of six variables are significant on income inequality in ASEAN countries. The government possesses the ultimate power to oversee and regulate the macroeconomy within their countries. Therefore, it is the duty of the governments to deal with the problem of income inequality by implementing effective policies and regulations.

Most of the blame for income inequality was placed on foreign and trade agents during the political elections, technology advancements may have a more significant effect. Governments can make investments in ICT infrastructure, including broadband networks, digital technologies, and high-speed internet. Through this investment, people who could have never had access to ICT tools and resources before may be capable of reducing the digital gap. To increase access to new prospects, digital infrastructure needs to be enhanced. To boost digital access, there must be greater governmental investment as well as incentives to promote more private investment. The success in many countries in utilizing mobile telephone to connect substantial populations to the mainstream economy, especially financial markets, serves as an example of the new opportunities for development that allow for a leapfrog (Qureshi, 2021).

The ICT development in ASEAN is growing rapidly since 2000, especially in Malaysia. Malaysia is quickly becoming one of the most advanced fintech landscapes in Southeast Asia, surpassing other countries in ASEAN (YCPSolidiance, 2022). This is due to the government policy in Malaysia is so aggressive in the development of ICT infrastructure. The government imposed Jalinan Digital Negara, which is also known as JENDELA, is a plan to improve the digital infrastructure in Malaysia in response to the increased demand for better fixed and mobile broadband coverage caused by the COVID-19 pandemic and Movement Control Order.

Tengku Zafrul, the Finance Minister of Malaysia, stated that the JENDELA phase two will require a total investment of RM8 billion, with contributions from various industry players. The objective is to enhance internet accessibility by achieving complete population coverage, as well as increasing fiber broadband access to 9 million fiber-connected premises by 2025. Additionally, the program will receive RM700 million to enhance digital connectivity in 47 industrial areas and nearly 3,700 schools throughout the nation (Wong, 2022). Perhaps, other governments in ASEAN can propose similar plan that can boost the ICT development to reduce the income gap.

Other than the infrastructure development, the knowledges on how to utilize the ICT is significant. Governments is responsible to launch programs that can help people develop the necessary skills and knowledge to use ICT tools effectively. These programs can provide free or affordable training for digital skills such as coding, data processing, and digital marketing, which can enable individuals to create their own businesses, find freelance work, or access new job opportunities and increase their income. To ensure that disadvantaged communities can also benefit from these opportunities, these programs can be targeted specifically to them. It is important for education and training programs to prioritize skills that are relevant to new technologies, which requires collaboration between public and private sectors to finance, deliver, and develop the content of these programs. The accessibility and quality of lifelong education should be improved to meet the rapidly changing skill demands and the need for upskilling. This can involve greater involvement of universities and apprenticeship programs, as well as partnerships with employers. The use of Lifelong Learning Accounts can be a way to improve access to retraining for workers, which has already been implemented in countries like Singapore and France. Government scholarship initiatives can also be made more flexible to support older adults returning to education or first-time college students (Qureshi, 2021).

As the increase in trade openness that will lead to higher income inequality because of the weak competitiveness of local firm, the government can try to improve the local businesses by implement some policies. Referring to the China's government policy. China has a fair sharing system, and the proper behavior of local governments can build a favorable export environment for companies. To achieve this, it is crucial to further improve the incentives in taxation, to create institutional advantages that support Chinese firms' export competitiveness. Tax incentives or government subsidies can be tailored to the characteristics of different types of processing trade firms, given that their competitive crowding-out effects may vary depending on their output elasticity of intermediate products. This approach can enhance firms' capacity to promote Domestic Value-Added Ratio (DVAR), compete more effectively in export markets, and establish an export competitive advantage (Mah, 2007). Furthermore, the duty drawback systems can reduce the cost of imported materials, which in turn is likely to enhance the competitiveness of exporting companies. This system able to enhance the competitiveness of local businesses especially to the intermediate goods. Many countries have implemented this system to reduce tax on export, including China (Mah, 2007). Therefore, government in ASEAN could try to implement a similar policy.

Besides, the finding revealed that increase in education will lead to increase in income inequality. The reason behind was the inability of low educated parent to invest their children's education due to lack of financial resources and earning ability. Therefore, a phenomenon reflects a composition effect arises from higher educational inequality among citizens. This expresses the fact that most of the enrolled students come from affluent and educated families. Certainly, making investments toward the development of intellectual capital can result in objective career success for individuals as well as decrease income inequality (Lasisi et al., 2023). Hence it is essential to equalizing access to education by government. The government can increase the accessibility for all individuals to have quality education regardless of their socioeconomic status or background. For example, Anwar's Revised Budget 2023 highlighted that starting from

March, a discount of up to 20% on PTPTN loan repayments will be provided for a period of three months (The Edge Markets, 2023). This benefits and financial aid encourage the poor to send their children to pursue higher education in University. Consequently, the income gap can be reduced as the educational inequality decreases, substantially minimizing the composition effect.

5.3 Limitation of the study

It is undeniable that every study will have its own restrictions and shortcomings, including this study. The limitation that could be found is that this study is it does not distinguish the long run and short run effect. It is critical in macroeconomics to distinguish between the short run and the long run. This is because, according to many macroeconomic theories, while monetary and fiscal policy tools impact the economy's potential for production and employment in the short term, their long-term effects are restricted to nominal variables such as prices and nominal interest rates. Real economic numbers, on the other hand, remain constant across time (Beggs, 2021). That is, the FEM model does not really distinguish the long run and short run coefficient and therefore it might be ambiguousness to the policy decision since policy will have different length and lag.

This study does not perform the autocorrelation test. Autocorrelation takes place when the two error terms are dependent or correlated and might cause issue to the model. However, the observations do not fulfil the normality test. According to the Jarque-Bera test, it is obvious that the p-value is less than the significant level at 1%, 5%, and 10%. With this, it can be concluded that the data of this study is not normally distributed. Due to this reason, the assumption for Durbin-Watson d test is not fulfilled. There are a lot of assumptions under this Durbin-Watson d test and one of the most important assumptions is that the error term is assumed to be normally distributed. Unfortunately, it can be noticed from the Jarque-Bera test that this model fails to meet the normality assumption and therefore, the autocorrelation test has been excluded from this study.

Although the scope of this study is within the ASEAN. However, this study does not incur all the ASEAN countries. The countries are excluded from this study are Myanmar, Lao PDR, and Cambodia. Therefore, there might be chances of misleading when the result inferences to the countries.

5.4 Recommendation for future study

There are some of the recommendations for the future researchers. The researchers can use other models such as GMM to estimate the dynamic panel data. Some other model such as autoregressive integrated moving average (ARIMA) and vector autoregression (VAR) model. ARIMA can be used to model the short-term dynamics of a time series, while VAR can be used to model the long-term dynamics of the time series data. It is important to note that different models will have different advantages and disadvantages. Future researchers could select the most appropriate model based on their research objectives.

Furthermore, the future studies can increase the observations. When increasing the number of observations, the data will tend to be normally distributed. Therefore, the research can perform the Durbin-Watson autocorrelation test. This can be done with increasing the time-series and cross-section data. For time-series, the researchers can lengthen the research period, this can help to identify the long run effect as well. For cross-sectional, the research can increase more countries be studied. In the case of ASEAN, the future research might attempt to incur all the ASEAN countries, where the result can be more valid in all the ASEAN countries.

5.5 Conclusion

This chapter listed out what are the major findings and provided some implications and policies to reduce the income gap. Indeed, there are some limitations in this study and some recommendations have been given to the future researchers. In conclusion, the impact of globalization on income inequality is a complex and multifaceted issue. It arises not only in ASEAN but also the whole world. It is an issue that worth to conduct more research on it. In this study, the relationship between globalization and income inequality is not always a clear-cut, and there are still many factors that can contribute to the overall picture as in a macroeconomic level. However, one thing can assure is that globalization has had a significant impact on the economies of ASEAN countries. Globalization has played a role in shaping the distribution of wealth and resources. Moving forward, it is important to continue to explore the implications of globalization on income inequality in the ASEAN region as well as considering policies and implications that can help to mitigate its negative effects. By doing so, it can work towards a more equitable and sustainable future for all members of the ASEAN community.

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Appendices

Appendix 1: Data

	LPALMA_RATIO	LFDI	TRADE	FIXED_BR...	GDP_PER...	LSCHOOL...	LPOPULAT...
Malaysia - 01	-0.788117	19.40217	203.3646	4000	3941.123	3.218745	16.97432
Malaysia - 02	-0.796731	21.36207	199.3562	19302	4177.105	3.312120	16.99948
Malaysia - 03	-0.797619	21.47245	194.1951	110402	4454.527	3.421220	17.02391
Malaysia - 04	-0.798730	21.31834	210.3743	252500	4924.338	3.402346	17.04763
Malaysia - 05	-0.788337	21.79864	203.8546	483100	5536.826	3.329300	17.07066
Malaysia - 06	-0.778052	22.75635	202.5771	751000	6137.112	3.346678	17.09301
Malaysia - 07	-0.767871	23.19268	192.4655	1035200	7143.936	3.401367	17.11477
Malaysia - 08	-0.786799	23.45763	176.6683	1329300	8343.386	3.509737	17.13595
Malaysia - 09	-0.806316	22.63144	162.5690	1553600	7167.883	3.569383	17.15544
Malaysia - 10	-0.823256	23.45434	157.9448	2097800	8880.110	3.611698	17.17303
Malaysia - 11	-0.840256	23.61964	154.9377	2506700	10209.38	3.587625	17.18914
Malaysia - 12	-0.857786	23.55039	147.8418	2920900	10601.51	3.627331	17.20532
Malaysia - 13	-0.883340	23.31913	142.7210	2938800	10727.70	3.666472	17.22119
Malaysia - 14	-0.909563	23.49959	138.3122	3061000	11045.45	3.676518	17.23672
Malaysia - 15	-0.909563	23.07863	131.3701	3063800	9699.584	3.819748	17.25172
Malaysia - 16	-0.909563	23.03554	126.8990	2718800	9555.651	3.845073	17.26634
Malaysia - 17	-0.909563	22.44753	133.1552	2687800	9979.801	3.777695	17.28049
Malaysia - 18	-0.909563	22.47513	130.4026	2696000	11074.06	3.809445	17.29365
Malaysia - 19	-0.909563	22.74189	123.0285	2964500	11132.02	3.762632	17.30606
Malaysia - 20	-0.909563	21.91597	116.8286	3358800	10160.78	3.751084	17.31806
Vietnam - 01	-0.747181	NA	111.9559	NA	409.4977	2.254379	18.19526
Vietnam - 02	-0.745072	NA	116.6969	1076	434.8103	2.281704	18.20553
Vietnam - 03	-0.760356	NA	124.3280	9180	485.4509	2.320928	18.21582
Vietnam - 04	-0.770244	NA	133.0165	52709	551.9035	NA	18.22602
Vietnam - 05	-0.790319	17.98990	130.7148	210024	693.1898	2.782535	18.23606
Vietnam - 06	-0.811030	18.25816	138.3136	516569	790.5925	2.820310	18.24575
Vietnam - 07	-0.805197	19.03045	154.6054	1294111	913.3123	2.916839	18.25536
Vietnam - 08	-0.799175	19.51929	154.3175	2048953	1158.102	2.947793	18.26516
Vietnam - 09	-0.759287	20.36669	134.7063	3214179	1225.845	3.007195	18.27546
Vietnam - 10	-0.728567	20.61791	113.9777	3669321	1684.012	3.127675	18.28613
Vietnam - 11	-0.771758	20.67197	125.2606	3838206	1963.557	3.216812	18.29681
Vietnam - 12	-0.814411	20.90559	123.2241	4775368	2190.232	3.226317	18.30753
Vietnam - 13	-0.824852	21.39417	130.8463	5152576	2367.500	3.226518	18.31829
Vietnam - 14	-0.831950	20.86303	135.4105	6000527	2558.779	3.424767	18.32895
Vietnam - 15	-0.828967	20.81858	144.9142	7657619	2595.235	3.369826	18.33938
Vietnam - 16	-0.824852	20.72327	145.4095	9098288	2760.717	3.351481	18.34947
Vietnam - 17	-0.825536	19.98930	160.9601	11269936	2992.072	NA	18.35916
Vietnam - 18	-0.826679	20.20910	164.6639	12994451	3267.225	NA	18.36849
Vietnam - 19	-0.826679	19.99966	164.7042	14802380	3491.091	3.354804	18.37753
Vietnam - 20	-0.826679	19.75568	163.2459	16699249	3586.347	NA	18.38659
Indonesia - 01	-0.919797	NA	69.79321	15000	739.0039	2.652087	19.19593
Indonesia - 02	-0.922812	NA	59.07946	38300	888.9014	2.694860	19.20966
Indonesia - 03	-0.926341	NA	53.61649	61600	1052.413	2.773414	19.22304
Indonesia - 04	-0.886489	21.94939	59.76129	84900	1136.755	2.809106	19.23577
Indonesia - 05	-0.857786	21.84331	63.98794	108200	1249.398	2.846437	19.24838
Indonesia - 06	-0.872992	21.72601	56.65713	194367	1572.798	2.849560	19.26137
Indonesia - 07	-0.857079	22.26553	54.82925	778770	1840.330	2.878914	19.27449
Indonesia - 08	-0.764858	22.49817	58.56140	981562	2144.390	3.028597	19.28751
Indonesia - 09	-0.736472	21.53381	45.51212	1863821	2238.095	3.135021	19.30023
Indonesia - 10	-0.844901	22.15493	46.70127	2280316	3094.443	3.181226	19.31275
Indonesia - 11	-0.802070	22.92454	50.18001	2736379	3613.801	3.269691	19.32530
Indonesia - 12	-0.814411	22.73611	49.58290	2983000	3668.212	3.415396	19.33786
Indonesia - 13	-0.831490	23.13126	48.63737	3251800	3602.886	3.436040	19.34999
Indonesia - 14	-0.834020	23.06387	48.08018	3400000	3476.625	3.430619	19.36159
Indonesia - 15	-0.799175	22.92875	41.93764	3983000	3322.582	3.504076	19.37269
Indonesia - 16	-0.840488	NA	37.42134	5227393	3558.819	3.567767	19.38328
Indonesia - 17	-0.873960	21.42054	39.35550	6215923	3839.785	3.595789	19.39335
Indonesia - 18	-0.758006	22.57944	43.07431	8874116	3902.662	3.592122	19.40301
Indonesia - 19	-0.758006	22.21897	37.62778	10284364	4151.228	NA	19.41239
Indonesia - 20	-0.758006	22.33920	32.97560	11722218	3894.272	NA	19.42079
Philippines - 01	-0.674718	19.86760	84.90039	10000	991.1480	3.412814	18.19285
Philippines - 02	-0.690750	19.49226	83.84480	21000	1037.174	3.407148	18.21348
Philippines - 03	-0.708870	19.53254	87.57464	55000	1049.387	3.369782	18.23366
Philippines - 04	-0.708870	19.99553	87.12528	89000	1122.856	3.344997	18.25353
Philippines - 05	-0.711719	20.49274	83.84567	123000	1245.286	3.314843	18.27289
Philippines - 06	-0.715802	20.78935	80.85054	265030	1452.221	3.326565	18.29173
Philippines - 07	-0.718875	22.40459	73.64498	496151	1741.603	NA	18.31043
Philippines - 08	-0.721341	21.40132	67.68107	1045716	1990.356	3.372769	18.32914
Philippines - 09	-0.720107	21.36361	60.88669	1722407	1893.281	3.349540	18.34754
Philippines - 10	-0.721547	21.72101	66.10428	NA	2201.775	3.386552	18.36556
Philippines - 11	-0.725051	21.57753	60.79584	1791000	2431.202	3.427385	18.38337
Philippines - 12	-0.728360	22.15195	57.84201	2146600	2671.777	3.440626	18.40081
Philippines - 13	-0.737099	22.01716	55.82478	2572800	2847.567	3.512225	18.41768
Philippines - 14	-0.747181	22.63339	57.46817	2900000	2935.926	3.573101	18.43385
Philippines - 15	-0.755661	22.43517	59.14159	2900000	2974.300	3.632312	18.45054
Philippines - 16	-0.766363	21.59737	61.77607	2985452	3038.150	3.699222	18.46828
Philippines - 17	-0.777834	21.91862	68.16837	3399291	3077.436	3.568841	18.48589
Philippines - 18	-0.789658	22.13807	72.16340	3788489	3194.675	3.385999	18.50289
Philippines - 19	-0.789658	21.93251	68.84184	5920087	3413.848	3.453869	18.51945
Philippines - 20	-0.789658	21.99360	58.16966	7936574	3224.423	3.507517	18.53571

Thailand - 01	-0.576787	19.87394	120.2680	1613	1889.971	3.666383	17.96891
Thailand - 02	-0.600386	18.96562	114.9697	NA	2091.178	3.688757	17.97787
Thailand - 03	-0.569515	20.24989	116.6828	11611	2350.846	3.712351	17.98646
Thailand - 04	-0.594388	18.15491	127.4119	164775	2647.262	3.739421	17.99467
Thailand - 05	-0.600203	20.12804	137.8539	555495	2876.248	3.797217	18.00245
Thailand - 06	-0.606603	20.76322	134.0869	893548	3343.784	3.803498	18.00999
Thailand - 07	-0.613043	21.15969	129.8732	1293341	3934.689	3.892530	18.01761
Thailand - 08	-0.591674	21.57329	140.4370	2072799	4327.798	3.885095	18.02509
Thailand - 09	-0.632993	22.51440	119.2694	2624278	4154.184	3.900005	18.03227
Thailand - 10	-0.592216	22.81899	127.2505	3251851	4996.373	3.919490	18.03899
Thailand - 11	-0.620454	22.69398	139.6754	3896000	5396.649	3.956149	18.04545
Thailand - 12	-0.605319	23.38076	137.6749	4519000	5748.631	3.925512	18.05189
Thailand - 13	-0.658166	23.21825	132.4623	5192000	6041.127	3.909086	18.05797
Thailand - 14	-0.636389	22.47103	130.9055	5440000	5822.384	3.915618	18.06345
Thailand - 15	-0.687364	22.33091	124.8397	6229000	5708.797	NA	18.06820
Thailand - 16	-0.678850	23.31797	120.5752	7219000	5854.461	3.897657	18.07264
Thailand - 17	-0.690551	23.37771	120.8914	8208000	6436.792	3.855416	18.07676
Thailand - 18	-0.703400	23.57789	120.8419	9189000	7124.565	3.827647	18.07999
Thailand - 19	-0.717645	23.06456	109.6685	10108819	7630.040	3.803346	18.08252
Thailand - 20	-0.717645	23.66781	97.82493	11478265	6990.936	3.752722	18.08487
Singapore - 01	-0.767871	23.55688	349.2921	151000	21700.02	NA	15.23573
Singapore - 02	-0.773273	22.54089	349.7460	270000	22159.69	NA	15.24485
Singapore - 03	-0.804973	23.55960	377.2186	417100	23730.15	NA	15.23011
Singapore - 04	-0.855666	23.91745	401.5237	545200	27608.54	NA	15.24263
Singapore - 05	-0.875389	23.68420	420.4305	656200	29961.26	NA	15.26613
Singapore - 06	-0.844901	24.39014	425.3634	787900	33769.15	NA	15.29743
Singapore - 07	-0.869169	24.58058	394.2885	926000	39432.94	NA	15.33909
Singapore - 08	-0.760570	23.33321	437.3267	1071200	40007.47	NA	15.39230
Singapore - 09	-0.802962	23.87754	358.1928	1233500	38927.21	NA	15.42246
Singapore - 10	-0.835633	24.73644	369.6856	1338400	47236.96	NA	15.44018
Singapore - 11	-0.795845	24.61826	379.0986	1408200	53890.43	NA	15.46103
Singapore - 12	-0.799175	24.73623	369.2130	1432800	55546.49	NA	15.48556
Singapore - 13	-0.792747	24.88822	367.0418	1493400	56967.43	NA	15.50175
Singapore - 14	-0.772840	24.95299	360.4673	1474000	57562.53	NA	15.51474
Singapore - 15	-0.771325	24.96854	329.4714	1486200	55646.62	NA	15.52660
Singapore - 16	-0.770460	24.90322	303.3310	1591900	56860.41	4.430114	15.53968
Singapore - 17	-0.770460	25.32051	316.3858	1475700	61150.73	4.440212	15.54046
Singapore - 18	-0.770460	25.11994	324.3204	1493600	66859.34	4.487360	15.54516
Singapore - 19	-0.770460	25.43711	321.8074	1504000	65831.19	4.511837	15.55660
Singapore - 20	-1.112002	25.03742	331.7279	1509700	60729.45	NA	15.55348
Brunei - 01	-1.010601	NA	108.7189	1896	16437.63	2.656108	12.73890
Brunei - 02	-1.010601	NA	108.7480	2757	16817.13	2.633154	12.75841
Brunei - 03	-1.010601	NA	105.2585	3838	18521.19	2.639502	12.77718
Brunei - 04	-1.010601	NA	100.5896	6262	21839.63	2.686891	12.79514
Brunei - 05	-1.010601	NA	97.45782	8126	25991.17	2.678325	12.81235
Brunei - 06	-1.019986	NA	96.94115	8964	30768.39	2.674463	12.82882
Brunei - 07	-1.024711	NA	95.75047	11617	32337.32	2.708865	12.84463
Brunei - 08	-1.028900	NA	105.9138	16891	37426.67	2.756139	12.85988
Brunei - 09	-1.024990	NA	108.5726	20029	27496.96	2.819351	12.87470
Brunei - 10	-1.028900	NA	95.36895	21699	34609.94	2.738200	12.88930
Brunei - 11	-1.037894	NA	99.53654	23185	46139.58	2.856718	12.90298
Brunei - 12	-1.037329	NA	105.6410	19849	46842.96	3.110386	12.91567
Brunei - 13	-1.029459	NA	110.9369	27557	43948.85	3.192125	12.92806
Brunei - 14	-1.016111	NA	102.4210	30259	41037.07	3.377235	12.94002
Brunei - 15	-1.009229	NA	89.89379	34425	30681.68	3.626020	12.95143
Brunei - 16	-0.999672	18.82981	87.31827	36120	26762.95	3.551713	12.96218
Brunei - 17	-1.001304	NA	85.17675	41072	28186.80	3.557443	12.97218
Brunei - 18	-1.004030	NA	93.89632	49452	31241.45	3.440520	12.98143
Brunei - 19	-1.004030	NA	108.5097	54195	30748.74	3.426579	12.99008
Brunei - 20	-1.004030	NA	110.2910	71078	27179.41	3.465526	12.99844

Appendix 2: Test results

Appendix 2.1: Descriptive statistic

	PALMA RA...	FDI	TRADE	FIXED BR...	GDP PER...	SCHOOL ...	POPULATION
Mean	0.446174	7.01E+09	115.1078	2359422.	10968.99	32.91782	81768651
Median	0.449800	2.06E+09	109.9797	1528800.	3937.906	30.74335	69769773
Maximum	0.565800	1.11E+11	324.3204	14802380	66859.34	91.08899	2.67E+08
Minimum	0.354200	-1.16E+10	37.42134	1076.000	434.8103	9.793350	340748.0
Std. Dev.	0.055468	1.71E+10	56.88738	2852633.	15009.37	14.99461	78886508
Skewness	0.101830	4.564924	1.538084	1.730216	2.060970	1.554248	1.129544
Kurtosis	2.413917	24.92202	6.510522	6.337774	6.653565	6.950066	3.248879
Jarque-Bera	1.796531	2631.668	101.6707	107.8716	141.5817	117.9069	24.10530
Probability	0.407276	0.000000	0.000000	0.000000	0.000000	0.000000	0.000006
Sum	49.97150	7.85E+11	12892.08	2.64E+08	1228527.	3686.795	9.16E+09
Sum Sq. Dev.	0.341510	3.24E+22	359215.3	9.03E+14	2.50E+10	24957.06	6.91E+17
Observations	112	112	112	112	112	112	112

Appendix 2.2: POLS

Dependent Variable: LPALMA_RATIO
Method: Panel Least Squares
Date: 02/22/23 Time: 23:24
Sample: 2001 2020
Periods included: 20
Cross-sections included: 7
Total panel (unbalanced) observations: 88

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.330572	0.242609	-9.606293	0.0000
LFDI	-0.026671	0.006063	-4.398984	0.0000
TRADE	0.000646	0.000177	3.645252	0.0005
FIXED_BROADBAND_SUBSCRIPTIONS	-8.47E-09	2.59E-09	-3.275104	0.0016
GDP_PER_CAPITA	-2.88E-06	1.01E-06	-2.863638	0.0053
LSCHOOL_ENROLLMENT	0.263893	0.028588	9.230785	0.0000
LPOPULATION	0.065847	0.011279	5.838246	0.0000

R-squared	0.563724	Mean dependent var	-0.767920
Adjusted R-squared	0.531408	S.D. dependent var	0.091666
S.E. of regression	0.062749	Akaike info criterion	-2.623147
Sum squared resid	0.318932	Schwarz criterion	-2.426086
Log likelihood	122.4185	Hannan-Quinn criter.	-2.543756
F-statistic	17.44375	Durbin-Watson stat	0.403051
Prob(F-statistic)	0.000000		

Appendix 2.3: FEM

Dependent Variable: LPALMA_RATIO
Method: Panel Least Squares
Date: 02/22/23 Time: 23:24
Sample: 2001 2020
Periods included: 20
Cross-sections included: 7
Total panel (unbalanced) observations: 88

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.209057	1.592626	2.014947	0.0475
LFDI	0.004054	0.004319	0.938553	0.3510
TRADE	0.000627	0.000278	2.259524	0.0268
FIXED_BROADBAND_SUBSCRIPTIONS	-5.32E-09	1.90E-09	-2.791228	0.0067
GDP_PER_CAPITA	-5.93E-06	3.02E-06	-1.962948	0.0534
LSCHOOL_ENROLLMENT	0.105624	0.026995	3.912714	0.0002
LPOPULATION	-0.247765	0.090034	-2.751895	0.0074

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.906809	Mean dependent var	-0.767920
Adjusted R-squared	0.891898	S.D. dependent var	0.091666
S.E. of regression	0.030139	Akaike info criterion	-4.030403
Sum squared resid	0.068126	Schwarz criterion	-3.664433
Log likelihood	190.3377	Hannan-Quinn criter.	-3.882963
F-statistic	60.81630	Durbin-Watson stat	1.088352
Prob(F-statistic)	0.000000		

Appendix 2.4: REM

Dependent Variable: LPALMA_RATIO
Method: Panel EGLS (Cross-section random effects)
Date: 02/22/23 Time: 23:24
Sample: 2001 2020
Periods included: 20
Cross-sections included: 7
Total panel (unbalanced) observations: 88
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.330572	0.116527	-20.00030	0.0000
LFDI	-0.026671	0.002912	-9.158685	0.0000
TRADE	0.000646	8.51E-05	7.589416	0.0000
FIXED_BROADBAND_SUBSCRIPTIONS	-8.47E-09	1.24E-09	-6.818766	0.0000
GDP_PER_CAPITA	-2.88E-06	4.83E-07	-5.962094	0.0000
LSCHOOL_ENROLLMENT	0.263893	0.013731	19.21849	0.0000
LPOPULATION	0.065847	0.005417	12.15523	0.0000

Effects Specification

	S.D.	Rho
Cross-section random	8.29E-08	0.0000
Idiosyncratic random	0.030139	1.0000

Weighted Statistics

R-squared	0.563724	Mean dependent var	-0.767920
Adjusted R-squared	0.531408	S.D. dependent var	0.091666
S.E. of regression	0.062749	Sum squared resid	0.318932
F-statistic	17.44375	Durbin-Watson stat	0.403051
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.563724	Mean dependent var	-0.767920
Sum squared resid	0.318932	Durbin-Watson stat	0.403051

Appendix 2.5: Poolability test

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	46.018777	(6,75)	0.0000
Cross-section Chi-square	135.838475	6	0.0000

Cross-section fixed effects test equation:
Dependent Variable: LPALMA_RATIO
Method: Panel Least Squares
Date: 02/22/23 Time: 23:24
Sample: 2001 2020
Periods included: 20
Cross-sections included: 7
Total panel (unbalanced) observations: 88

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.330572	0.242609	-9.606293	0.0000
LFDI	-0.026671	0.006063	-4.398984	0.0000
TRADE	0.000646	0.000177	3.645252	0.0005
FIXED_BROADBAND_SUBSCRIPTIONS	-8.47E-09	2.59E-09	-3.275104	0.0016
GDP_PER_CAPITA	-2.88E-06	1.01E-06	-2.863638	0.0053
LSCHOOL_ENROLLMENT	0.263893	0.028588	9.230785	0.0000
LPOPULATION	0.065847	0.011279	5.838246	0.0000

R-squared	0.563724	Mean dependent var	-0.767920
Adjusted R-squared	0.531408	S.D. dependent var	0.091666
S.E. of regression	0.062749	Akaike info criterion	-2.623147
Sum squared resid	0.318932	Schwarz criterion	-2.426086
Log likelihood	122.4185	Hannan-Quinn criter.	-2.543756
F-statistic	17.44375	Durbin-Watson stat	0.403051
Prob(F-statistic)	0.000000		

Appendix 2.6: BPLM test

Lagrange Multiplier Tests for Random Effects
Null hypotheses: No effects
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives

	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	94.36983 (0.0000)	0.023971 (0.8770)	94.39380 (0.0000)
Honda	9.714414 (0.0000)	-0.154824 (0.5615)	6.759651 (0.0000)
King-Wu	9.714414 (0.0000)	-0.154824 (0.5615)	8.666751 (0.0000)
Standardized Honda	20.41081 (0.0000)	0.009531 (0.4962)	5.086479 (0.0000)
Standardized King-Wu	20.41081 (0.0000)	0.009531 (0.4962)	10.53977 (0.0000)
Gourieroux, et al.	--	--	94.36983 (0.0000)

Appendix 2.7: Hausman test

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	276.112664	6	0.0000

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
LFDI	0.004054	-0.026671	0.000010	0.0000
TRADE	0.000627	0.000646	0.000000	0.9433
FIXED BROADBAND SUBSCRIPTIONS	-0.000000	-0.000000	0.000000	0.0291
GDP PER CAPITA	-0.000006	-0.000003	0.000000	0.3062
LSCHOOL ENROLLMENT	0.105624	0.263893	0.000540	0.0000
LPOPULATION	-0.247765	0.065847	0.008077	0.0005

Cross-section random effects test equation:
Dependent Variable: LPALMA RATIO
Method: Panel Least Squares
Date: 02/22/23 Time: 23:25
Sample: 2001 2020
Periods included: 20
Cross-sections included: 7
Total panel (unbalanced) observations: 88

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.209057	1.592626	2.014947	0.0475
LFDI	0.004054	0.004319	0.938553	0.3510
TRADE	0.000627	0.000278	2.259524	0.0268
FIXED BROADBAND SUBSCRIPTIONS	-5.32E-09	1.90E-09	-2.791228	0.0067
GDP PER CAPITA	-5.93E-06	3.02E-06	-1.962948	0.0534
LSCHOOL ENROLLMENT	0.105624	0.026995	3.912714	0.0002
LPOPULATION	-0.247765	0.090034	-2.751895	0.0074

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.906809	Mean dependent var	-0.767920
Adjusted R-squared	0.891898	S.D. dependent var	0.091666
S.E. of regression	0.030139	Akaike info criterion	-4.030403
Sum squared resid	0.068126	Schwarz criterion	-3.664433
Log likelihood	190.3377	Hannan-Quinn criter.	-3.882963
F-statistic	60.81630	Durbin-Watson stat	1.088352
Prob(F-statistic)	0.000000		

Appendix 2.8: Correlation matrix

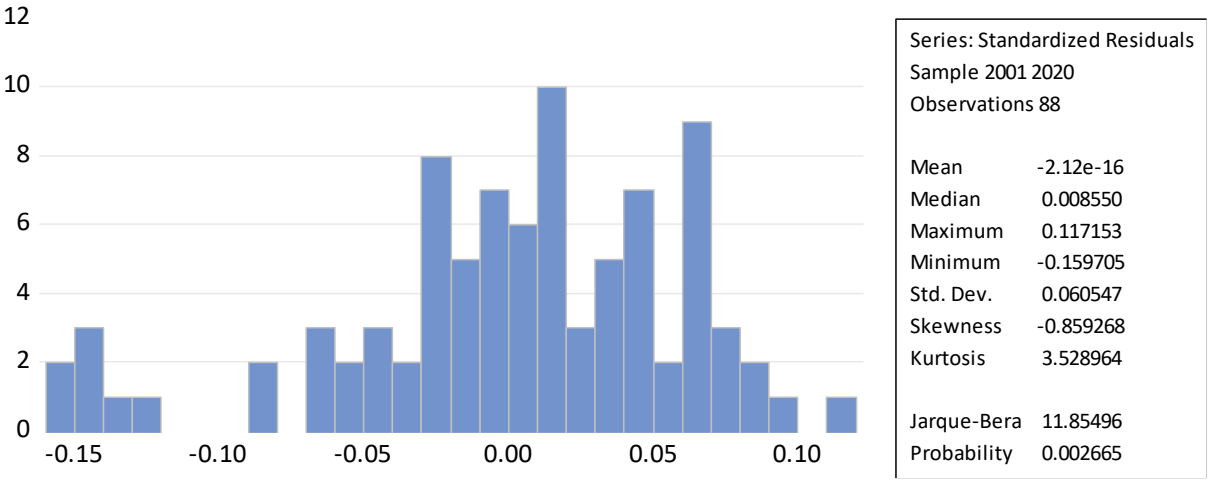
	LPALMA_R...	LFDI	TRADE	FIXED_BR...	GDP_PER...	LSCHOOL...	LPOPULAT...
LPAL...	1.000000	-0.131483	0.020556	-0.037387	-0.130637	0.290674	0.172467
LFDI	-0.131483	1.000000	0.270299	0.244350	0.540937	0.595167	-0.184906
TRADE	0.020556	0.270299	1.000000	-0.112853	0.716482	0.482141	-0.737005
FIXED...	-0.037387	0.244350	-0.112853	1.000000	-0.074532	0.190790	0.220502
GDP ...	-0.130637	0.540937	0.716482	-0.074532	1.000000	0.660297	-0.691700
LSCH...	0.290674	0.595167	0.482141	0.190790	0.660297	1.000000	-0.518922
LPOP...	0.172467	-0.184906	-0.737005	0.220502	-0.691700	-0.518922	1.000000

Appendix 2.9: VIF test

Variance Inflation Factors
Date: 02/22/23 Time: 23:26
Sample: 2001 2020
Included observations: 88

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	2.536457	245730.5	NA
LFDI	1.87E-05	865.4464	2.064018
TRADE	7.71E-08	111.1809	2.344505
FIXED_BROADBA...	3.63E-18	5.485696	2.453021
GDP_PER_CAPITA	9.14E-12	48.67675	2.790192
LSCHOOL_ENROL...	0.000729	877.5547	2.184200
LPOPULATION	0.008106	253893.8	4.533157

Appendix 2.10: Jarque-Bera test



Appendix 2.11: Pedroni Residual Cointegration test

Pedroni Residual Cointegration Test
Series: LPALMA RATIO LFDI TRADE FIXED BROADBAND SUBSC RIPTIONS GDP PER CAPITA LSCHOOL ENROLLMENT LPOPULATION
Date: 02/23/23 Time: 13:34
Sample: 2001 2020
Included observations: 140
Cross-sections included: 5 (2 dropped)
Null Hypothesis: No cointegration
Trend assumption: Deterministic intercept and trend
Automatic lag length selection based on SIC with lags from 0 to 2
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-0.121922	0.5485	-2.261604	0.9881
Panel rho-Statistic	2.457218	0.9930	2.575796	0.9950
Panel PP-Statistic	-5.730360	0.0000	-5.671847	0.0000
Panel ADF-Statistic	-2.825670	0.0024	-3.894001	0.0000

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	3.197692	0.9993
Group PP-Statistic	-7.826505	0.0000
Group ADF-Statistic	-3.821157	0.0001

Cross section specific results

Phillips-Peron results (non-parametric)

Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
Malaysia	0.050	0.000120	0.000111	2.00	19
Vietnam	-0.439	7.60E-05	1.00E-05	10.00	11
Indonesia	-0.270	0.000531	8.98E-05	11.00	12
Philippines	0.161	5.64E-06	2.53E-06	5.00	15
Thailand	-0.608	0.000120	0.000120	0.00	15
Singapore	Dropped from Test				
Brunei	Dropped from Test				

Augmented Dickey-Fuller results (parametric)

Cross ID	AR(1)	Variance	Lag	Max lag	Obs
Malaysia	0.050	0.000120	0	2	19
Vietnam	-0.439	7.60E-05	0	0	11
Indonesia	-0.270	0.000531	0	1	12
Philippines	-0.338	3.37E-06	1	1	12
Thailand	-0.608	0.000120	0	1	15
Singapore	Dropped from Test				
Brunei	Dropped from Test				

Appendix 2.12: Unit root (Level form)

LPR

Panel unit root test: Summary
Series: LPALMA RATIO
Date: 02/23/23 Time: 13:41
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	0.19242	0.5763	7	126
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.95400	0.8300	7	126
ADF - Fisher Chi-square	11.5122	0.6454	7	126
PP - Fisher Chi-square	6.52547	0.9515	7	133

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

LFDI

Panel unit root test: Summary
Series: LFDI
Date: 02/23/23 Time: 13:42
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.72275	0.0032	6	98
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.01387	0.1553	6	98
ADF - Fisher Chi-square	15.0478	0.2388	6	98
PP - Fisher Chi-square	20.9528	0.0511	6	105

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

TRD

Panel unit root test: Summary
Series: TRADE
Date: 02/23/23 Time: 13:42
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.07476	0.4702	7	126
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.25681	0.6013	7	126
ADF - Fisher Chi-square	13.7743	0.4667	7	126
PP - Fisher Chi-square	8.63032	0.8540	7	133

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

FBS

Panel unit root test: Summary
Series: FIXED BROADBAND SUBSCRIPTIONS
Date: 02/23/23 Time: 13:42
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	4.19046	1.0000	7	120
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	6.83720	1.0000	7	120
ADF - Fisher Chi-square	7.23892	0.9251	7	120
PP - Fisher Chi-square	9.92335	0.7678	7	128

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

GDPpc

Panel unit root test: Summary
Series: GDP PER CAPITA
Date: 02/23/23 Time: 13:43
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-1.47860	0.0696	7	126
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.59072	0.7226	7	126
ADF - Fisher Chi-square	9.67942	0.7852	7	126
PP - Fisher Chi-square	7.95787	0.8915	7	133

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

LSE

Panel unit root test: Summary
Series: LSCHOOL ENROLLMENT
Date: 02/23/23 Time: 13:44
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-1.16352	0.1223	6	93
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	1.00538	0.8426	6	93
ADF - Fisher Chi-square	5.25393	0.9490	6	93
PP - Fisher Chi-square	5.39428	0.9435	6	102

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

LPOP

Panel unit root test: Summary
Series: POPULATION
Date: 02/23/23 Time: 13:44
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-1.49717	0.0672	7	126
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	1.36348	0.9136	7	126
ADF - Fisher Chi-square	9.12301	0.8231	7	126
PP - Fisher Chi-square	208.557	0.0000	7	133

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 2.13: Unit root (First difference)

LPR

Panel unit root test: Summary
Series: D(LPALMA RATIO)
Date: 02/23/23 Time: 13:45
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.21726	0.0133	7	119
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-3.96827	0.0000	7	119
ADF - Fisher Chi-square	42.9717	0.0001	7	119
PP - Fisher Chi-square	102.028	0.0000	7	126

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

LFDI

Panel unit root test: Summary
Series: D(LFDI)
Date: 02/23/23 Time: 13:45
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-4.34845	0.0000	6	91
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-5.06184	0.0000	6	91
ADF - Fisher Chi-square	48.6268	0.0000	6	91
PP - Fisher Chi-square	117.254	0.0000	6	98

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

TRD

Panel unit root test: Summary
Series: D(TRADE)
Date: 02/23/23 Time: 13:45
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-5.44721	0.0000	7	119
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-4.95104	0.0000	7	119
ADF - Fisher Chi-square	50.9741	0.0000	7	119
PP - Fisher Chi-square	77.1818	0.0000	7	126

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

FBS

Panel unit root test: Summary
Series: D(FIXED BROADBAND SUBSCRIPTIONS)
Date: 02/23/23 Time: 13:46
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	1.84023	0.9671	7	112
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	2.18576	0.9856	7	112
ADF - Fisher Chi-square	4.08458	0.9949	7	112
PP - Fisher Chi-square	11.6805	0.6319	7	120

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

GDPpc

Panel unit root test: Summary
Series: D(GDP PER CAPITA)
Date: 02/23/23 Time: 13:46
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.79449	0.0026	7	119
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-3.57106	0.0002	7	119
ADF - Fisher Chi-square	37.0771	0.0007	7	119
PP - Fisher Chi-square	40.2773	0.0002	7	126

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

LSE

Panel unit root test: Summary
Series: D(LSCHOOL ENROLLMENT)
Date: 02/23/23 Time: 13:47
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-4.59677	0.0000	6	84
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-3.42852	0.0003	6	84
ADF - Fisher Chi-square	34.5986	0.0005	6	84
PP - Fisher Chi-square	37.3829	0.0002	6	93

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

LPOP

Panel unit root test: Summary
Series: D(LPOPULATION)
Date: 02/23/23 Time: 13:47
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.59002	0.2776	7	119
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	1.51262	0.9348	7	119
ADF - Fisher Chi-square	12.4654	0.5690	7	119
PP - Fisher Chi-square	6.83447	0.9409	7	126

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 2.14: Unit root (Second difference)

LPR

Panel unit root test: Summary
Series: D(LPALMA_RATIO,2)
Date: 02/23/23 Time: 13:48
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-5.21769	0.0000	7	112
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-7.16386	0.0000	7	112
ADF - Fisher Chi-square	71.9411	0.0000	7	112
PP - Fisher Chi-square	369.599	0.0000	7	119

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

LFDI

Panel unit root test: Summary
Series: D(LFDI,2)
Date: 02/23/23 Time: 13:48
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-9.07758	0.0000	6	84
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-9.57848	0.0000	6	84
ADF - Fisher Chi-square	91.6121	0.0000	6	84
PP - Fisher Chi-square	1025.26	0.0000	6	91

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

TRD

Panel unit root test: Summary
Series: D(TRADE,2)
Date: 02/23/23 Time: 13:49
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-8.94009	0.0000	7	112
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-8.66068	0.0000	7	112
ADF - Fisher Chi-square	86.9601	0.0000	7	112
PP - Fisher Chi-square	464.564	0.0000	7	119

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

FBS

Panel unit root test: Summary
Series: D(FIXED BROADBAND SUBSCRIPTIONS,2)
Date: 02/23/23 Time: 13:49
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.33857	0.0097	7	104
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-3.73764	0.0001	7	104
ADF - Fisher Chi-square	45.9789	0.0000	7	104
PP - Fisher Chi-square	368.181	0.0000	7	112

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

GDPpc

Panel unit root test: Summary
Series: D(GDP PER CAPITA,2)
Date: 02/23/23 Time: 13:49
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-3.75930	0.0001	7	112
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-6.11803	0.0000	7	112
ADF - Fisher Chi-square	61.6294	0.0000	7	112
PP - Fisher Chi-square	185.598	0.0000	7	119

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

LSE

Panel unit root test: Summary
Series: D(LSCHOOL ENROLLMENT,2)
Date: 02/23/23 Time: 13:50
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-8.01415	0.0000	6	76
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-6.89546	0.0000	6	76
ADF - Fisher Chi-square	65.1149	0.0000	6	76
PP - Fisher Chi-square	119.766	0.0000	6	84

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

LPOP

Panel unit root test: Summary
Series: D(LPOPULATION,2)
Date: 02/23/23 Time: 13:50
Sample: 2001 2020
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-5.63513	0.0000	7	112
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-4.52347	0.0000	7	112
ADF - Fisher Chi-square	46.3947	0.0000	7	112
PP - Fisher Chi-square	31.7450	0.0044	7	119

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.