WHAT ARE THE EFFECTS OF GLOBALIZATION ON ECONOMIC GROWTH AND INEQUALITY? AN EMPIRICAL GLOBAL STUDY

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ABSTRACT

The recent event of increased interconnectedness between countries in the last two decades has heightened the interests of scholars around the world, to discuss its impacts towards two important indicators, economic growth and inequality. Although the general agreed consensus suggests that globalization activities are beneficial to those that engage, it is often weighted against its negative impacts upon inequality between and in-within countries. Despite this, this research forms its purpose through identifying that the extensive literature focuses primarily on income measures as the only proxy for inequality. Furthermore, there is a lack of taking into account social factors that contribute to the significance of inequality.

This research therefore branches an innovative approach to form and empirically test accurate proxies as possible, given a set range of available macro data by the World Bank, for social inequalities as measurement variables in conjunction with Globalization and Economic Growth. The aim is to bridge and connect the stories between the three components. In addition, the proxies for social inequalities define for which those (the population) at the lowest echelons of the status quo struggle to access adequate facilities for, technology, general health, employment (with emphasis to female employment) and health of new-borns. The research design uses panel vector-autoregression, Error-Correction, Granger Causality and Impulse Response modelling to capture findings for 35 low-middle- and low-income countries during the period 2000-2016.

The findings show that Globalization and Economic Growth positively affects social inequality in developing countries, and in particular to, a country's access to electricity (with emphasis to technologies for cooking, the internet and mobile cellular usage) and general health. In contrast, to the remaining indices, there were no effects found for Globalization and Economic Growths' contribution to access to employment (with emphasis to female employment) and health of new-borns. In addition, Globalization was found to positively affect Economic Growth.

The findings provide dedicated support for Globalization and provide policymakers with recommendations for improvement in the areas to which no effects were found (in 2 of 4 social inequality indexes). The main limitation to the research surrounds data availability. With technology forever evolving and improving, in the future, more accurate statistics can better provide the econometric models with predicting power

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LIST OF ABBREVIATIONS

SS1 – Access to Electricity (with emphasis to technologies for cooking, the internet and mobile cellular usage)

SS2 – Access to General Health

SS3 – Access to Employment, with emphasis to female employment

SS4 - Access to Health of New-borns

KOFGI – Index of Globalization

GDP – Gross Domestic Product

GDPPC – Gross Domestic Product Per Capita

D – Differenced (First Difference)

L – Logarithm

CHAPTER 1: INTRODUCTION

1.1. Motivation

The rising moral problem of inequality is on alert by many international organizations and governments (United Nations, 2022; International Monetary Fund, 2022; European Union, 2022; OECD, 2022). Many authors and/or influential figures have expressed this problem to be a universal one over the past century, and with the impact scale considered to be much larger and devastating for developing countries.

"God never intended for one group of people to live in superfluous inordinate wealth, while others live in abject deadening poverty"

- *Dr. Martin Luther King Jr (1956)*

"We must work together to ensure the equitable distribution of wealth, opportunity and power in our society."

- *Nelson Mandela (1996)*

"If machines produce everything we need, the outcome will depend on how things are distributed. Everyone can enjoy a life of luxurious leisure if the machine-produced wealth is shared, or most people can end up miserably poor if the machine-owners successfully lobby against wealth redistribution."

- *Stephen Hawking (2015)*

"Disposition to admire, and almost to worship, the rich and the powerful, and to *despise, or, at least, to neglect persons of poor and mean condition" is "the great and most universal cause of the corruption of our moral sentiments."*

- *Adam Smith (1822)*

Poverty has been one the biggest challenges faced by humanity from a global co-operation standpoint. Statistics show that on a global scale, the share of wealth is immensely disproportionate. 8.5% of global total income is shared upon the poorest 50% of the population, meanwhile the richest 10% of the population earn more than 50% of global total income (Credit Suisse, 2021). The coexistence of such wealth as well as poverty suggests a global controversial issue that needs to be addressed. Measured by the Gini coefficient, the differences in average incomes between countries is analysed to account for two-thirds of global income inequality. 10% of the world population are living in absolute poverty (World Bank, 2022). This equates to over 700 million people living on less than $1.90 a day. In Sub-Saharan Africa, this figure has risen to 41% of the population. As a result of this, the quality of life to those of the poorest are restricted to below adequate levels.

Income inequality leads to approximately 21,300 deaths per day (Oxfam, 2022). Furthermore, the mortality rate of children that occur due to undernutrition is estimated to be around 3 million per year (UNICEF, 2018). The risk of a child dying before the age of five, in the lowest income continent, Africa, is found to be eight times more likely (76.5 deaths per 1000 new-borns) than compared to Europe (9.6 deaths per 1000 new-borns). The reasoning behind such statistics indicate that global inequality has led to a misallocation of resources whereby millions of people suffer from lack of essential healthcare, nutrition and safe drinking water facilities.

In recent times, as an example, this global disproportion of shared income has also created an unfair conundrum upon humanity. The Covid-19 pandemic is an example. As vaccines are produced, those of advanced countries are first to acquire such treatment due to their ability to overpower developing countries with their wealth, income and status. Data from the World Health Organization (2022) show that there is global inequality regarding access to the vaccine. The number of Covid-19 vaccine doses in high-income countries were found to be thirteen times higher than those in low-income countries

The process to a more interconnected global system has been the main argument reasoning for its role in increasing income inequality between and within many advanced and developing

countries. An extensive review of empirical literature has also supported this trend and argument (Baddeley, 2006; Dreher and Gaston, 2008; Wan, Lu and Chen, 2008; Milanovic and Squire, 2005; Bergh and Nilsson, 2010) although some studies suggest the opposite (Chakrabati, 2000; Zhou *et al*. 2011). Other authors criticised globalization (and a more interconnected global system), confronting it as a capitalist movement by the west (the advanced economies), and such that western imperialism will inevitably cause these inequalities (Turner and Khondker, 2010; Soborski, 2013). Despite this, the only way to tackle such problems is through global co-operation, to raise awareness to the severity of inequality and providing sufficient policies by governments at the international level to compromise.

1.2. Research Approach

This research project uses an empirical approach to investigate the impacts of globalization on economic growth and social inequality in developing countries. The research design consists of macroeconomic data to measure and quantify social inequality. This is considered as the critical part to the originality contribution of this research. The research aims to discuss the role(s) and significance of globalization. The structure to which globalization can be altered to cater for social inequalities will be discussed and recommendations will be provided in accordance with the relevant literature and empirical findings.

The research consists of 35 developing countries, whereby 16 are considered low-income and 10 low-middle income during the period 2000-2016. The reasoning behind the chosen countries and sample period are due to data availability. Despite this, the panel allows more gathering of information and variability when compared to a standard time series data set. The empirical analysis consists of the implementation of VAR and VECM models to discuss the short and long-term properties of the identified proxies for globalization, economic growth and social inequality.

1.3. Objectives of the research

The aim of the thesis is to examine the relationship between globalization, inequality and economic growth for a large panel of countries. Panel data methods and techniques will be used to extract findings that will help develop policy conclusions.

In order to achieve this aim, the following objectives will be pursued:

- To develop an empirical literature review on globalization (past and present), to critically assess its impacts on inequality and economic growth.
- To ensure that the selection of globalization, inequality and economic growth are good proxies of the measures and reflective of its definitions.
- To use proper economic theory and techniques to analyse the relationship between globalization, economic growth, and inequality.
- To develop the appropriate econometric models and methods for statistical/econometric analysis on the data that we have gathered.
- When the empirical results are finalized and presented in appropriate tables, to form a unique analysis on the relationship between globalization, inequality (social and economic) and economic growth.
- To form a detailed original discussion surrounding policy recommendations and implications for improvements to current pro-globalization organizations where possible.

1.4. Research contributions

This study focuses on the three important aspects of globalization, economic growth and (social) inequality in order to accomplish the goal of an original contribution to research. Although there is an extensive body of research which regards globalization, economic growth and inequality, there is however a lack of studies that cater for social inequalities. The majority of studies in existing literature focus on income inequality measures such as the Gini Coefficient. This study aims to use other measures to proxy for social inequalities, and the data is empirically tested to find the relationship it has toward globalization and economic growth.

Social inequality can be defined as the uneven distribution of resources that occur due to the existence of stratification that categorizes society into different groups. This includes but are not limited to, socioeconomic status, gender, religion and ethnicity.

The collection of development indicators gathered by research from the World Bank (2022) provides a variety of choices to proxy for the measurements of social inequality. Four social inequality indexes are proposed consisting of four averages to four different measures in each index:

- Access to electricity (with emphasis to technologies for cooking, the internet and mobile cellular usage) (SS1_tech)

- Access to General Health (SS2_Helg)
- Access to Employment, with emphasis to female employment (SS3_emp)
- Access to Health of new-borns (SS4_Hel)

This research will shine the light on important aspects of social inequalities that are overlooked by policymakers, regulators, and influential organizations of relevance to globalization activities. The rising moral problem of inequalities between and within advanced and developing countries is an ongoing task that is yet to be solved for decades and centuries to come. This contribution of research provides critical empirical information that has not been yet addressed in current literature. Many developing countries are currently in reform programmes to ensure that they are in a position to economically grow. The methodology explores 35 low to low-middle income countries. Although economic growth is important, there must be some sort of acknowledgement to inequalities as well as social inequalities that it may generate as part of globalization activities. This acknowledgement will make policies more robust and targeted to improve the standard of living of those who need it the most in developing countries.

As a brief overview, the research finds that globalization has a positive impact towards economic growth. This supports the general consensus and expectation of authors' theories (Grossman and Helpman, 2015; Eaton and Kortum, 1999). It also supports the majority of empirical studies in Section 2.6.3. There are also other dynamic findings to economic growth, as it is shown to positively affect social inequality in terms of access to electricity (with emphasis to technologies for cooking, the internet and mobile cellular usage) and general health. The unique finding that contributes to literature opens the discussion that globalization positively affects social inequalities in terms of access to general health, but however not for the other identified inequalities. The rest of the findings are presented in Chapter five and six with the full discussions.

1.5. Thesis structure

Chapter **one** discusses the introductions to the thesis. The backgrounds are highlighted as well as motivations to the research. The summaries of the methodologies used in the research are explained. Discussions upon research objectives and expected contributions to literature are also in this section. This section will explain the thesis structure to the content provided in each chapter.

Chapter **two** provides the extensive detailed main body for the literature review. The topic of globalization mainly focuses on its definition, origins, and its relevance to economic growth and inequality both theoretically and empirically. The histories and theories of globalization are explored and provide context to how it has evolved over the past millennium. The problem of inequality is also explored in both advanced and developing countries. Empirical studies are analysed, and between globalization, economic growth and inequality, a discussion is provided surrounding whether there is positive, negative, or negligible impact among them. The chapter concludes with other ideas and a summary of what is relevant to the thesis.

Chapter **three** consists of the data set. The socio-economic indicators that were found and used to capture proxies for globalization, economic growth and (social) inequality are detailed and explained. The reasoning behind the chosen indicators including where it is sourced are also included. The forming of four social inequalities is discussed meanwhile the characteristics of each variable are presented in appropriate formatting.

Chapter **four** explains the econometric techniques used in the research. The methodology to panel unit root tests, cointegration, Vector Auto-regression (VAR), Vector Error-correction (VECM), and impulse response function methods are presented in a mathematical format.

Chapter **five** presents the empirical results in appropriate tables. The **first** study examines globalization and economic growth. The **second** examines economic growth and (social) inequality. The **third** study examines globalization and (social) inequality. Following this, a unique analysis on the relationship between globalization, economic growth and (social) inequality is formed according to the empirical findings.

Chapter **six** is the conclusion chapter and summarises the main findings of the research. The important implications for what we can depict from this research are explored. The limitations of the research are discussed, and future research recommendations are provided.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

Early classical and neoclassical theories on international trade show that free trade can be beneficial to an economy and increase its national income. Ricardo's (1817) concept of comparative advantage explains that an economy that can produce a good or service at a lower opportunity cost compared to another economy, should trade that good or service in return for a good or service that has a higher opportunity cost to produce when compared to the other economy. According to the theory of comparative advantage, each country should have some specialization and world output would increase.

There is no doubt that free trade (and globalization) has contributed to increasing national income and the reduction of poverty in many countries (World Bank, 2002). The first global free trade agreement was made following the second World War, the multilateral treaty of the General Agreement on Tariffs and Trade (GATT). This integration led to a boost in economic recovery between, in particular, to the developed economies of Europe, North America and Japan during the period of 1950-1980. In addition, the spurring of technological advances and diffusion of ideas in transport and communication from 1980 onwards allowed developing countries to break into global markets for manufactured goods and services. Countries who strongly participated in global trade during this period include India, China, Brazil, Mexico, and Hungary. Developing countries categorized as most globalized increased their GDP per capita growth rate by from one percent in the 1960s to five percent by the 1990s (Dollar and Kraay, 2001). On a more global scale, the World Bank (2002) identified that people living on less than $1 a day have drastically decreased since the 1980's by an estimated 200 million. The rise of capitalism following the end of the cold war and economic growth of a number of East Asian economies are more examples to show the benefits of increased trade and globalization.

Again, there is no doubt that globalization has contributed to the togetherness and advancement of the human race during the last century. The concept of globalization has almost eliminated transaction costs on the movement of goods, services, capital and finances between countries. The political cooperation to which globalization have brought governments of many countries together have also had a positive impact on the improvement of human rights and rights by the beneficiary. The importance for society to respect the rights for women and gender equality have spread more globally than it was ever before. In addition, life expectancy in developing countries has improved.

However, several studies during the last two decades have begun to question the positive effects of globalization with the debate focusing on the distributional effects of globalization. Stolper-Samuelson's theorem, derived within the framework of Heckscher-Ohlin's trade theory, explains that free trade will benefit a country's relatively abundant factors but relatively scarce factors will suffer. There are problems of global outsourcing arising from free trade, creating an imbalance, increasing wages of skilled workers than that of unskilled ones. In addition to other income distributional effects, the non-traded goods sector is disregarded by free trade and some of the trade of certain inputs can be viewed as costly to one's economy, for example, the export of a radiologist. Critics have criticised globalization for its contribution to global financial instabilities. Mendoza and Quadrini (2010) articulated that financial globalization played a key role in the recent financial crises through its contagion of cross-country financial turbulence. In addition, the increased mobility of capital has caused challenges for exchange rate and monetary policy, especially since after the Asian financial crises (Wagner, 2005). Rodrik's (2011) concept of "hyper globalization" suggested that multinational companies were using globalization to avoid certain rules and regulations of nation states. This will allow them to exploit advantages elsewhere for profit rather than to benefit countries abroad. Stiglitz (2002) expresses the discontents of globalization by identifying a number of problems arising from globalization, including the rigidities of institutions, monopolistic tendencies, moral hazard, and adverse selection. The importance for global warming and sustainability have been emphasised by Curtis (2011), that the worlds expansion in global trade have made our economies more vulnerable to climate change.

Kunstler (2005, p.185) quoted in his book that "the moment the world recognizes the passing of the oil production peak as a reality, globalism will be dead both for theory and practice". Furthermore, "… globalization is creating an environment that will prove hostile to its own survival" (Ehrenfeld, 2005, p.319). In contrast, it is not to say that globalization is completely negative toward the environment. Other scholars have praised globalization in its role in helping the world become increasingly interdependent, and with climate change being a problem, it has increased the need for the world to work together to solve it (Stiglitz, 2006). Krugman and Venables (1995) demonstrated the possibility for globalization having an impact on the inequality of nations. In other words, rather than benefiting all nations, the concept of globalization has a loophole where there are nations taking advantage of globalization for growth at others expense.

There is also debate on how globalization should be measured. Globalization as an indicator is hard to pinpoint directly. The complex process of globalization which leads to the increased connectedness in the domain of social, cultural, environmental, and technological is expressed by Marterns and Zywietz (2006), with their creation of the Maastricht Globalization index. Other credible created indices in literature include the GlobalIndex by Raab *et al*. (2008), the CSGR Globalization index (Lockwood and Redoano, 2005), the A.T Kearny/Foreign policy Globalization index in 2001, the New Globalization index (Vujakovic, 2010) and more recently, the DHL connectedness Index (Ghemawat and Altman, 2016). The index that is used most often in literature despite the variety of measurements, has been the KOF index, created by Dreher (2006, 2008). It is an example of many indicators bound into three sections (economic, social and political) and as one whole index to define globalization. The KOF index updates annually and accounts for differentiation between the measures in de facto and de jure type globalization. As evident, there are a variety of different measurements of globalization.

The main indicator for measuring inequality in current literature is the Gini coefficient. Of course, there are alternative measures but are less popular, these include the Theil index and Hoover index. The Gini coefficient uses the Lorenz curve to create a statistical measure of distribution. There are criticisms of the Gini coefficient which will be explored and adjusted upon in the methodology section to create a measure and an original contribution to the empirical literature on the side of inequality.

The aim of this research will be to identify some of the problems relating to these measures and create an alternative measure as well as definition of globalization to fulfil the gap of new information in literature. Also, there will be a test to whether this measure affects growth and inequality. Growth and inequality can be identified and measured in many ways, in which there will be an analysis to which measurement should be most appropriate for globalization as. An empirical application will follow regarding the merits and consequences of globalization as a result of the study whilst comparing to other empirical studies, philosophies, and theories

2.2. General Aspect of Globalization

Many authors and institutions have defined globalization in a number of ways, in which all are similar but have small tweaks. Some suggest that globalization as a definition cannot be pinpointed while others claim certainty on their suggestion. Despite the variety of opinions on this topic, the authors accept that globalization is a broad term and can be interpreted in many different ways. There is no right or wrong answer to the definition of globalization and it also

depends on the view, situation and goal to what the author may interpret. The rationale to exploring different definitions of globalization can help expand new ideas to globalization and challenges in this research.

Going by the Oxford's (2021) definition, it suggests that globalization is "the process by which businesses or other organizations develop international influence or start operating on an international scale". The IMF (2021, p.1) identifies globalization as "the process through which an increasingly free flow of ideas, people, goods, services, and capital leads to the integration of economies and societies". The World Bank (2021) similarly understands the term through its institution's promotion of helping countries to improve their access to global markets and participation in global trading. These are the main economic approaches, however, globalization as a function can be explored through the different streams that it may refer. Soborski (2013) explains the classic liberal ideologies to free markets; Turner and Khondker (2010) conceptualizes Americanization or Westernization to alter-globalization, explaining the significance to Western hegemonic and cultural imperialism that it imposes on the rest of the world, while Giovannetti *et al*. (2003) expands the internet phenomenon and increasing technologies in the 21st century. The exploration of these branches suggest that globalization is a plural process and not singular. These plural possibilities therefore can be dissected into sectors that expand and are not limited to cultural, economic and social ideologies. Current literature depicts and identifies globalization that can be defined using eight types; financial, economic, technological, political, cultural, sociological, ecological and geographical. The components to sociological and geographical globalization will not have its own sub-section as they align similarly to cultural, political and economic aspects.

2.2.1. Financial Globalization

Financial globalizations refer to the interconnectedness between countries in terms of capital flows. An overview of the past few decades, depict that financial institutions such as banks have been expanding their operations to being more active overseas. Across national borders, these banks are significant in channelling funds between lenders and borrowers. Häusler (2002) explained that if one wanted to build a factory in 1970, they would be restricted to borrowing from a domestic bank. In today's interconnected financial system, there are more options for an investor to finance that factory. For example, there is the option to shop internationally to compare which loans offer the most attractive interest rates, for both in foreign or domestic currency. In the domestic and international capital markets, there is also the option to issue stocks or bonds and the choosing of financial products to hedge against risks. For an even more

flexible option, one can also sell equity to another company. The forces that have driven financial globalization to where it is today includes the advancement in technology and information, in which, especially computing, has allowed data to be collected and processed to manage financial instruments in terms of price, trading, financial risk and millions of transactions that take place per second around the globe.

Another force includes the globalization of national economies in terms of imports and exports. As economic activity has risen, such as production, consumption, and physical investment, this has led to the working togetherness of countries to ensure that these components are feasible to the given demand. In today's global economy, the components of a certain product, such as a smartphone, may be manufactured in a foreign country but sold in the domestic country. Apple (2021) is an example of a company that posts a lists of their suppliers each year in which they detail over 200 suppliers that they work with in terms of procurement expenditures for manufacturing, materials and assembly of products. Apple for their smartphone will purchase its components from various suppliers, then have it shipped to China where it is manufactured in its assembly plant. From there, it is possible that it may be shipped by another company such as FedEx or UPS who buy Apple products online. Through distribution channels, Apple may work with third-party cellular network carriers such as EE, Three and Vodafone, as examples in the UK, to sell its products. Apple is an example of a multinational company that has expanded their networks around the globe through domestic expansion and working with foreign companies.

On a more global outlook, the barriers to international trade have lowered between countries and the financial cross-border flows have increased and are increasing as time moves forward. The IMF (2020) explains international capital flows between 1870 – 2014 for 15 countries who are Argentina, Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Spain, Sweden, UK and US. The volume to capital flows as shown by the graph shows globalization and disruption of globalization through the sample years. The current account surplus surge during the late 19th century, were noticeably from UK, Germany, and France, and reflected the increased investment in infrastructure and railways in countries that were abundant in land. These countries were Argentina, Australia, Canada, and the US. The rationale to these investments were so that the production capacity of those borrowing, increases, and in turn their populations' household income. In return to the investing countries, the borrowing countries were able to pay back the given loans and interests.

During the interwar period and the Great Depression in 1929, capital flows from the 15 countries fell from 6.5% to 1.5% of GDP (IMF, 2020). This was because capital flows were controlled and limited during this period. The limitation persisted until between the 1970 to 1980s, which resulted in the start of the liberalization of global capital markets. The rise to capital flows as a % of GDP rose from 1.5% to almost 5%. This shortly dropped due to the global financial crises in 2009. In addition, comparing recent times, international capital flows were not as high as they were during the late 19th century.

So how do these changes in, specific, to financial integration, affect economic growth and inequality in the case for developing countries? Although in principle, financial integration may directly effect of the determinants for economic growth. These may be through the transferring of technology from developed to developing countries, reducing the cost of capital, increasing domestic savings and the quality of domestic infrastructure of financial services. Indirectly, financial integration may provide an improvement in both government and institution practices in terms of managing competition provided by financial globalization (Klein and Olivei, 2000), as well as risk management through increased production specialization (Obstfeld, 1994). Countries with weak institutions and government policies however were predicted in theory to have negative effects to international financial integration, as capital may outflow from capital-scarce countries as there is more attractiveness toward capital-abundant countries (Boyd and Smith, 1992). Furthermore, countries in the presence of trade distortions, may have capital inflows which flow into the wrong sectors in which they have may have comparative disadvantage (Eichengreen, 2001). This will hurt their resource allocation as well as growth.

Although theory suggests that financial integration may have a positive direct and indirect impact on economic growth, the financial integration-growth nexus in current empirical research suggests a non-conclusive answer in the early days. Edison *et al.* (2002), using the IMF-restriction and Quinn measures to capital flows (stock of capital flows, stock of capital inflows) as indicators to financial integration, found no strong significant robust relationship in its assessment to economic growth, in a panel of 57 countries during the period 1980-2000. Kraay (1998) in search for macroeconomic effects of capital account liberalization found scarce empirical evidence.

Kose *et al.* (2009) found from using panel OLS for 179 countries, that financial globalization did not have any immediate impacts in terms of economic growth in the most part for

developing countries. Part of the paper emphasises a threshold effect, that financial globalization only benefits growth when there is a control to government corruption and rule of law to macroeconomic policies. Another part suggests that foreign direct investment, or portfolio inflows, are of more significance to growth when compared to inflows by bank lending, in which indicators, such as total capital flows, may be of less effect to the recipient countries' growth rate due to the risk factors involved from lending.

Bekaert *et al.* (2005) found evidence to support the claim that international portfolio flows were positively correlated with growth, and that equity market liberalizations lead to a 1% increase in real GDP, on average, annually. This effect was analysed empirically to be robust for various types of financial openness indicators, however, does not reflect the business cycle to expansion, peak, contraction, and trough in GDP of countries in the short term. Capital account liberalization does show robustness in future economic growth of countries however this effect is separate to equity market liberalizations. What is important in this study is that growth was shown more effective in countries that have high quality type institutions, and therefore less effective in those of low-quality type institutions, most notably in developing countries. This hypothesis is also supported by other research in (Quinn and Toyoda, 2003) as they found similar results, that capital account liberalization's strength to improving growth is dependent on the countries' legal systems that support good institutions and a condition to where foreign direct investment is favourable.

However, in recent research, Egbetunde and Akinlo (2015) investigated and found there to be existence of a positive long run relationship between financial globalization and economic growth in Sub-Saharan African countries, from a panel of 21 countries between 1980-2013, and by using panel cointegration and a panel vector error correction model. The Granger causality test also revealed there to be a unidirectional causality and bi-directional causality between the two indicators. This dispute however was analysed to be in line with the idea that correct positive macroeconomic policies in Sub-Saharan Africa are put in place by the governments, in order for financial globalization to benefit, due to the political instability that the continent faces.

Although there are mixed views on the empirics to the financial globalization and growth nexus, indeed there is history on the collateral damage that financial liberalization has caused in the past regarding currency crises and financial turmoil in developing countries. Although international capital flows increased the pace from after the 1970s, so has the amount of

financial instabilities that have occurred since (Obstfeld and Taylor, 2005). This includes examples such as the Mexican pesos crises in 1994, the Asian financial crises in 1997 and its contagion among East and Southeast Asia region, the Russian financial crises in 1998, and the most famous global financial crises that happened in 2007. Furthermore, as a result of this, in today's system, the major world financial systems can be described to have major influence upon one another. For example, stock market trading on one international centre such as NYSE may have a direct impact on other international financial centres. An instability or shock to one exchange could influence a wider exchange. The financial crises that happened in 2009 had contagious problems which affected all countries on a global scale.

2.2.2. Technological globalization

Every day of our lives, we walk down the street and at every corner there is someone using their smartphone to access their social life that they may have. In every office and in every job, there is a piece of digital equipment whether it be a computer or telephone to process information. Information technology has taken over how we manage our lives on a daily basis. The IT revolution can refer to our ability to communicate instantaneously and create, store and process data in the form of digital. In the early 1990s, came the advancement to computer hardware as well as software and telecommunications. This has increased the speed to a country's ability to read, write and send information and hence economic potential. The rise to internet innovations include social media and Web2.0 applications, and they have been pivotal to creating new ways to integrate ideas and channels for exchanging information. For example, social networking sites such as, LinkedIn, are widely used by employers to scout for employees; Facebook, Instagram and Twitter are used by people who share their personal information among each other globally. These platforms have also been used for commercial gain.

On a more global scale, technological globalization can refer to the diffusion of new and updated technology across borders. The effects of technological globalization have huge impacts on how an economy is shaped and operated. This is because it can transform the way a country produces and sells its goods and services. For example, instantaneous communication across the globe has been made possible through sophisticated mobile networks, which were not possible before the 1980's era. Even then, when mobile phones were made publicly available, the technology speed to communicate was not as sophisticated as they are today. Information technologies such as processor speed in computers have more than tenfold the quickness than compared to the past and are gradually getting faster each year. Manufacturing

technologies in machinery are now more advanced than before and this means high productivity levels are easier to achieve. The flow to goods, services and people on a global scale have accelerated due to the advancement of air, sea, and road transportation. As a result of this, businesses are creating connections among different countries and are more working together than they used to. Companies that merge on an international level harness both developing and developing countries together through technology, and to increase standard of living for all.

What is fascinating about technological globalization is that the evolution of human interactions made information on technology to be accessible around the globe. There is no lack of information on technology. Furthermore, the role of technology has been important to the development of trade, individual well-being, and interactions socially, culturally, and economically on a global scale. Technology has no doubt had an impact on the intensification and development of globalization in the past century. More specifically, technology has had impacts on businesses and how they operate, in terms of practices, competitiveness and innovations (Weisblat, 2019). Furthermore, technology has also improved human capital across the globe.

The emergence and progression of artificial intelligence since the first computers in the 1940s, can be explained in terms of its ability to calculate more precisely or quicker when compared to the minds of humans (Newborn, 2011). An interesting example includes IBM's (1997) computer scientists, when they evaluated the hypothesis of man against machine in the game of chess. A game of chess involves 16 pieces per player (maximum 2 players) that have simple but unique rules, played on an 8x8 board, and is of strategy. It requires a collection of challenging problems that one must solve in order to win. For clarification, there are diverse ways a game of chess can unfold, the exact number is yet to be discovered by mathematicians. In the first 5 moves, when both players have moved 5 pieces each, there is a possibility of 69,352,859,712,417 games that could be played. Shannon's (1988) number predicted the complexity of solving chess to about 10^{120} possible games, which is greater than the predicted number of atoms in the universe. Furthermore, while chess is solvable in principle, the computational complexity to do so can be considered incomprehensible. Shannon's (1950) paper influenced chess computing over the years from its publishing in 1950, and many teams have tried to develop engines using knowledge engineering to challenge the feat of man. As we know, the computing capabilities in terms of processing power, although many chess engines were run on supercomputers at the time, they are not as sophisticated as they are today.

When competing with the best humans in chess, chess computers were unsuccessful in doing so, as technology was not deemed as strong enough during between the 1950s and 1990s. It was only in 1997 that IBM's Deep Blue defeated the number one ranked chess player in the world at the time, Gary Kasparov. This achievement retrospect's development in ingenious software and processing power, in technology, and can be described as the point to where AI and technology has surpassed the geniuses of humans. Deep Blue's supercomputer was identified to be able to calculate over 200 million positions while choosing the best option to move forward with the game. Since the 1950s, there has been evidence to show that computer chess has been increasing in strength throughout the decades. The increasing processing power of CPUs have allowed computers to make calculations more quickly and efficiently, to analyse chess variants and positions, to generate certain move lists to regard and decide is the strongest before playing the move. Although IBM's Deep Blue was a supercomputer, many of the chess engines in today's era, 2021, can be accessed and played through a modern-day computer and on smartphones. Furthermore, modern chess engines are viewed as significantly much stronger than any human in the world, much more than when Deep Blue defeated Gary Kasparov. There is no doubt that through technology and diffusion, it has changed the way chess has been played around the world. As long as computers dominate human opponents in chess, in which this has been the case since IBM's Deep Blue's achievement, the way chess players will learn to play better, will be from studying through AI intelligence. Various chess engines, such as Stockfish, can be accessed freely via the internet in any country through download on any computer although the most sophisticated engines may require a stronger piece of hardware to function as adequately.

This example is one of many that explains technological progress as well as its impacts on the chess industry and its culture. It certainly created motivation for IBM to proceed technological advancement through research and development on their hardware, and for the way chess has evolved as a sport. Although we have already discussed technological globalization in general terms, this case study reflects the uniqueness of technology and how it can impact even the niche of subjects in the economy. Better technology has impacted the way the top football teams train, for example as drones are used to analyse training sessions; improvements in diet at the top level of sports through research and development; faster technology in terms of processing speed for laptops and computers for scientists and mathematicians to partake their research and development; the providing of a window to learners through access countless of learning resources instantly, especially online, reducing the amount of physical paperwork

when compared to before an advancement in computing technology existed; human capital in the workplace in terms of skill to use that new technology

When referring to literature, it identifies that science and technology plays a massive role in the promotion of economic growth in all types of economies. New Growth Theory presented by Lucas (1988) and Romer (1986) emphasises the importance to human capital and research in terms of technological progress and its impact on growth.

2.2.3. Political Globalization

Political Globalization can be defined as the increased interaction between countries, as well as co-operation, on ideas that are closely linked to how a country is governed (Baylis et al. 2020). The growing worldwide political system can be identified within intergovernmental organizations that have been established within the past 100 years. The IMF, World Bank, United Nations, and the International Court of Justice are notable examples.

These organizations govern on an international level and have power in decision-making that affect multiple member states who are registered. Some of the global challenges in today's era include climate change, human rights, peace among countries and others. For example, the European Union's discussion on climate change has an effect on all member states. This has a direct impact on individual country policies, as the climate law suggests that EU countries must cut greenhouse gas emissions by at least 55% by 2030 (European Union, 2023). Furthermore, this in turn affects the structure of the way business is operated within that particular country, as well as the thought processes of entrepreneurs and individuals (Boussebaa and Faulconbridge, 2019)

Political governance is also closely linked to the dynamics of other globalization topics, such as economic, cultural, financial, and ecological. These ideas are spread across countries and co-operation between countries are formed in order to keep the interests of both parties satisfied. The World Trade Organization (2023) strongly supports and encourages free trade among countries although there are many authors that suggest protectionism is important (Fajgelbaum et al. 2020; Kaempfer et al. 2004; Grossman and Helpman, 2002). Further discussion on the political agenda expresses that free trade has links to inequalities (Panagariya and Krishna, 2002; Kelley and Zagorski, 2004). These discussions align further with other agendas including energy efficiency and inequalities (Pellegrini-Masini et al. 2020).

Nevertheless, the political dimension of globalization is important and is the forefront driver to voice opinion and agendas. The exploration of the political sphere can be further considered in the history of globalization section, whereby its importance in the Archaic and Proto stages to globalization can be described as influential and significant.

2.2.4. Cultural Globalization

Cultural globalization can be referred to by the phenomenon where different ideas, meanings and values are transmitted around the world. These transmissions extend and intensify the social relations and interactions regarding relationships among humans. The formation of shared norms and knowledge allows one to identify as an individual or as a collective. Furthermore, the circulation to culture has allowed more people to be interconnected across the globe. It has also allowed the spreading of different theories and ideas which may have both positive and negative impacts among society. Cultural globalization is mostly explored in the "history of globalization" chapter, meanwhile there has not been much extensive research on this subject in academic literature, despite it being one of the three main dimensions of globalization, with the other two being political and economic. This is because cultural globalization is difficult to measure. Despite this, its impacts can still be reviewed and discussed from a non-empirical standpoint.

The sociology of globalization is normally what is referred to when exploring the cultural aspects. Hybridization is a concept explored by Pieterse (2018), who suggested that cultural globalization has been part of a long-historical process, in which there has been some form of cultural disjuncture and mixing that co-exist between different countries. In other words, it is the process of culture and ethnic mixing which creates something as a result. Furthermore, it could be referred to as the global culture through mixtures of Asian, African, European and American culture.

Others have referred to cultural globalization as imperialism, whereby westernization has dominated in many parts of the world (Turner and Khondker, 2010). Although cultural diversity does exist, especially in developed countries, Americanisation in terms of consumer culture has been described to have created a phase to cultural homogenization, where diversity in culture is reduced.

2.2.5. Ecological globalization

Ecological globalization refers to the phenomenon of an alliance that is formed on a global scale to tackle the ecological issues that arise from the negative effects that occur during the

processes of globalization. Steger (2017) explores the definition as to the inevitable link between all of humanity and planet earth. Within the context of ecological issues, it is evident that the action of humans has created the possibility of a deteriorating earth regarding its land, atmosphere and oceans. The increase of CO_2 and greenhouse emissions in the atmosphere created by humans are identified as problems by scientists due to its negative impacts regarding a hotter planet on ecological systems. In modern history, the industrial revolution to where the economies in Europe and North America, in their manufacturing processes, changed from hand crafting to machinery. Although more efficient, this created many ecological problems as the production process of economies required the increased burning of fossil fuels (coal, natural gas and oil) to create energy, and led to significant amounts of carbon dioxide and other greenhouse gases to become part of Earth's atmosphere during this period and beyond to present (Ekwurzel *et al*. 2017; Martinez, 2007). Furthermore, during the period of the past century, the level of global population, to overpopulation, and resulting in the overuse of resources, pollution, and climate change (Judith *et al*. 2010).

Theory and numerical model projections predict that changes in climate may disturb and intensify extreme weather patterns, causing storms to incur more damage (Emanuel, 2005; Knutsan and Tuleya, 2004; Kossin *et al*. 2020.) and droughts to become more frequent across the globe (Cook *et al.* 2018; Grillakis, 2019). Regarding rainfall patterns in West Africa, Emanuel (2005) found a possible link to the intensity of North American hurricanes. Climate also affects terrestrial ecosystems, whereby air particles are affected and spread over large areas within a continent, causing wildfires to alter their regimes and occur more frequently as a result of a warmer atmosphere (Halofsky, 2020; Bowman, 2020; Sun *et al.* 2019). Serious sand and dust storms that occur in parts of East Asia have atmospheric consequences that spread to other continents such as North America (Uno *et al*. 2001, 2009). Polar regions have their ice caps melting causing sea levels to rise and (Moon *et al*. 2018) and disrupting ecosystems and wildlife surrounding it (Post *et al.* 2019), as well as reducing earths overall ability to reflect the sun's energy, and therefore leading Earth to a warmer climate at a faster rate (Thompson, 2010).

O'neill (2009) described international environmental politics and governance to have five actors, who are: nation states, international organizations, international environmental movement groups, the corporate world, and scientists. The pressure that arises from these five actors on climate change describes the ecological globalization that have occurred in recent history. The Intergovernmental Panel on Climate Change (IPCC), founded and formed by the United Nations in 1988, acted as the leading body for this matter as a result of the arising issue

proposed by scientists following the first calculations of natural greenhouse gases in 1876 (Agrawala, 1988). However, it was not until 1970, that the predicted warmings caused by greenhouse gases became part of scientific favoured of opinion. As more research was being produced on the causes of climate change, this increased the pressure for international organizations to act upon nation states. In 1992, it became the first international environmental movement whereby the United Nations Framework Convention on Climate Change established the treaty to reduce future carbon emissions. It was signed by 152 states, on the basis that governments are aware of their future economic planning, to be of a more sustainable type. Regular meetings between nations were called upon this matter and future scientific research was encouraged on the effects of climate change and ways to reduce it. The Kyoto protocol extended this framework, to base the consensus that increased CO_2 emissions are prominently being caused by human activities in our economies, and that global warming is real and occurring. This international treaty extended the membership agreements to 192 states by 2020 and is planning to keep its prestigious awareness and status as so, for the future. The Paris Agreement, in 2015, further intensified nation states to reduce carbon emissions, creating targets as a world effort to not allow global warming to increase by more than 2 degrees Celsius.

Corporations and businesses are combining knowledge thus far on climate change, to implement and change their legal rules, code of conduct and practices to date, to complement what is expected by individuals (customers) today. Those that do not complement the environment may face backlash and boycott from the public. Theory suggest that it is part of business practice to note that the relationship between environmental concern and ecological purchase intentions exist (Thøgersen, 1995; Arısal and Atalar, 2016; Joshi and Rahman, 2017), and businesses are encouraged to employ this in their vision to benefit themselves regarding consumer behaviour. For example, most, if not all large global companies have their own sustainability report, in which they describe how they promote sustainability in their business practices. Examples include Ikea (2021), Nike (2021), Unilever (2021), Panasonic (2021) and IBM (2021).

Furthermore, this describes the coming togetherness of the world on a global scale to tackle a problem that is ecological globalization. This awareness has spread to changes in our economy today. The addressing of such challenges in climate and the environment requires an extensive amount of research by scientists as well as in engineering to provide technical solutions technologically.

2.3. Historical Perspective

Authors have described globalization to have had a few periodization throughout history. Hopkins (2003) explained the historiography of globalization to be of three to four distinct periods over the past three centuries: Archaic (before 1600), Proto-industrialization (1600 – 1800), Modern (1900) and post-colonial (1950). Friedman (2005) suggested three periods: 1492-1800, 1800-2000, and 2000-present. Others including Chumakov (2011), Jaspers (1953) and Grinnin (2011) have presented other frameworks and explanations to discuss globalizations processes throughout history. Zinkina *et al*. (2019) identifies the important global key network-related developments contributing to significant transformations in this section. Nevertheless, there are no right or wrong answers to this topic as authors in literature have brought their own speculations into the mix. Furthermore, it is difficult to pinpoint facts when going back more than a few decades. When scholars write the history of the world. This section will explore the developments and importance to the most significant globalization changes in history and connect it in terms of its impact on today's current stance of economic growth and inequality. Hopkins (2003) framework will be used to analyse the most critical periods to globalization. In this section, only Archaic and Proto type globalization are specified. This is mainly to take a deep dive into the economic, cultural and political histories that are interesting during this time frame. Many modern globalization examples are expressed already throughout this thesis, and specifically in Chapters 2.2.

2.3.1. Archaic Globalization

Archaic globalization, or, very old globalization, was explored by Hopkins (2003). This phase in history lasted between early civilization and up to 1600. Hopkins cited Bayly (2002), in which he emphasised wealth and power being an important aspect to countries during this era. Globalizing networks were created by kings to increase their monetary value and acquisition of land. The spread of culture and belief of, especially, religion within civilization expanded the powers of the state to Islamic and Christianity dominant countries. This influenced how life was to be lived at the time and how cities were built. Furthermore, these ideas flowed across the Middle East by use of force or non-violent influence. An example identifies the Islamic Golden Age, between 800 AD and 1258, in which an empire grew among Muslim countries and local regions. This influenced increased trade and migration. In this era, economics and culture flourished most significantly. More specifically, education, law, politics, philosophy, theology, mathematics, and science were widespread. The accumulation of scientific knowledge was prioritised by the Islamic Empire and this was expressed at the heart of the

House of Wisdom, in Baghdad, which was the largest city in the world at that time. This example is significant because its application can be applied to other empires that existed close to these eras.

The Mongol empire had similar impacts, in its reign, on the monopoly status that it inherited on the control of financial, social, political and culture matters across the Eastern hemisphere. Its terrain extended from "Southern China to the coasts of southern Siberia, Manchuria, Korea and China down to Amman in the east all the way into Hungary, Poland and Belarus in the west, and from the northern borders of Indochina, Burma and India, the shores of the Persian Gulf, The southern border of Iraq across Syria and the southern cost of Turkey in the south up to a latitude of approximately 60 N in Russia and Siberia" (Findlay and Lundahl, 2017, pp. 15). This expansion can be described as the beginning to the creation of an international commerce, and a first glance at the emergence of a world economy. The Mongol empire had profound influence on the trade networks that existed during this time. As far back as to the development of the Silk Roads between the 1st century BC-5th Century-AD and the 13th-14th centuries AD, this early form of globalization has been determined significant to the early developments to trade between Eastern Asia, Central Asia and the Mediterranean, and soon later expanded to the West. The Silk Road were routes that were created to allow a connection physically between empires. This allowed and increased the flow of economic, political, and socio-cultural ideas, such as; trade (goods and services), culture, technology, art and information. Other ancient empires such as India, China, Persia and Rome were given the opportunity to exchange with each other regarding economic interests. The Parthian empire allowed access between China and the Mediterranean. Numbers of important technologies fell through this trade network, including China's silk, paper-making, printing, gunpowder and the compass, was shipped to the West, while grapes and glasses flew to the East. Despite the Mongol empire's ferocity in capturing land and their people, as the majority of Silk Road's routes at the time were occupied by Mongolian territory, the idea of "Pax Mongolica", introduced by the Mongol empire, allowed a period of peace among other empires. This allowed other empires to have access to the trade networks across the Silk Road without harm. This peace pact enabled the beginnings of global communications which allowed cultures to blend. The Mongol empire suggested trade to be their biggest economic asset, in which they decided to keep the routes safe for merchants and traders. This type of globalization is fascinating as no technologies existed but were done through physical interaction, word of mouth and by writing.

This era to Archaic Globalization can be analysed to be focused on early trade liberalization. Through trade liberalization and capturing of land by war, lead to the emergence of different cultures, and a society who shared the same interests and ideas. The empires that existed during that time were suggested to be significant in their role in creating a globalized system which benefitted their survival and economic gain. This proved to be significant as these were the first steps to an interconnected world system.

2.3.2. Proto-Globalization

Hopkins and Bayly explored proto-globalization, which was identified to be in the region of years 1600 and 1800. This is followed by the era of Archaic Globalization. During this period, cultural exchanges and increased trade partnerships were the main focus between countries. The management of global trade was seen as prolific in ensuring the economic success of certain globalizations that countries have taken advantage of. Following Archaic globalization, which saw the emergence of a world system, dominated by empires with Christianity and Islam as bases when referred to religion, trade was increased and as well as the movement of people through the major established trade routes. Proto-globalization followed the pattern of expanding even further to global routes and other complex systems of trade were established within this period. We saw luxuries such as Silk, Gunpowder, paper-making, printing and the Compass as major examples during the Archaic period, however, this paved the way for expansion of other goods in the Proto period, more specifically, the plantation economy and its commodities.

Although unethical in the age of today, the expansion of the slave trade was viewed as a new commercial network to be exploited for economic gain. The advancement to the plantation economy gave the way for slavery to be exploited by strong empires such as the British and the Europeans. Agricultural mass production that included crops such as sugar, tobacco, cotton and rubber were pivotal to some of Western European economies. Exports of these commodities were their main source of economy output and income. Although machinery were not as sophisticated as they are today, for companies to achieve economies of scale, slavery was incorporated by corporations that existed during that time. The triangle trade is an example that indicted the slave trade among the three ports between the Americans, Europeans and Africans in the form of ships. Reflecting upon, the Europeans and Americans traded goods to Africa in return for their resources which included slaves, in which they were shipped to American colonies to help labour their plantations. This included commodities such as sugar, rice, and cotton as examples, and were used to sell to the Europeans who later turned those

products into other goods such as clothing and different types of food. This method to trade benefited the Europeans and Americans at the detriment to the African empires who sold slaves for labour. Furthermore, when the slave trade was abolished during the 19th century by the Europeans, some of Africa's empires struggled financially and collapsed. The view of globalization here shows that during the proto-period, it benefitted the America's and the Europeans in terms of development and progress while it had a negative effect on Africa. It is shown that the Spanish and Portuguese engaged most significantly in the usage of slave labourers on their plantations that they owned within the Mediterranean and Atlantic. Britain as a country was also significant in their engagement, in which slaves were transported among British colonised countries to help fulfil their economic needs and plantation economy.

Europeans during this time found it indistinguishable to separate the moral values between the shipping of enslaved Africans and commodities, they were viewed as equal. The migration of humans as part of labour from one part of the world to another was a vital part to history and to how they helped shape the modern America's and Europe both economically and culturally. Between Western and non-western countries, slavery had a significant impact upon the connection and communication levels that inherited as well as relations. The large influx to migration between the triangle trade from the America's, Africans and Europe provided a crucial workforce, and a step forward to modern globalization.

The significant mark to where we can pinpoint the expansion to the trade links created following Archaic type globalization can refer to the emergence of the East India Company (Damodaran *et al.* 2015). Founded in 1600, after the Anglo-Spanish war, Queen Elizabeth I granted the permission for English merchants to fulfil and monopolize a trade corporation in the region further outside the British Terrain. At first, it was targeted to take advantage of trade opportunities within the routes surrounding the Indian Ocean region. In particular, in countries such as India, Persia, China and Indonesia. At the company's peak, it was described to be the largest corporation of any kind during its time. Its value was valued to be more than several nations at the time. It had control over politics, economics, and cultural values, in its territorial regions, especially in India, which was described to be one of the most productive economies at the time. What made the East India Company such a monopoly was that in its controlling territories, no other British subjects were legally allowed to trade in that area. The company did however face competition from the Spanish and Portuguese, as well as the Dutch East Indies company. This significant event played a role in shaping globalization during the Proto rein. Since the growth to this empire, it introduced control within the British Trade across Asia

and the Mediterranean, spreading access to British commodities to European consumers and later to Asian consumers. Furthermore, it created a significant stamp on the foundations to the British Empire among the Indian people. As a result, Britain were able to establish concrete wealth gains as well as political control among its empire.

To describe the power that the East India Company had, during the late 18th century, the corporation alone commanded forces greater than the British Army itself, and established empire that controlled competition, territory, and politics including taxation that benefited one-sided to the East India Company. Since the company had the crown in its support, it had power to negotiate with local rulers and kings along their way, including the Moghul empire that were present across India. Furthermore, it is an example of the regulation powers that Europe had in which most was within the East India Company's control.

As a result of increased activity within the Indian Ocean region, this led to the increased communications of Europeans, Muslims, Christians, Indians, and Chinese merchants, as well as kings and rulers. The expansion of communications between humans led to differences in trade systems such that the emergence of the East Indian Company created a starting point to international order and early expansion in capitalist activities. Slavery in the workplace became recognised as the driving force to increased commodities that were produced during the Proto-globalization era. Furthermore, practices of war and imperialism, especially British imperialism, among nations continued from the Archaic period with the same rationale of increasing personal economic gain through force and territory expansion. The most notable wars during the Proto period include the English Civil War (1642-1651), Anglo-Dutch war (1652-1654), French Indian War (1754-1763) and the American Revolution War (1755-1783). All these wars had significant impacts on territorial and political control to those on the winning sides. Moreover, there was an increase in treaties and agreements among countries. Economics as a discipline became prominent in regard to the emergence of significant figures such as Ricardian and his development to models in international trade during the Proto era. This had influence on the encouragement to free trade among policies in parliament or within the economy itself. This was most direct to the British economy; however, it may have influenced other countries' policies also during that era.

2.3.3. Deglobalization

Deglobalization refers to the phenomenon that a country experiences a reduction or disconnectedness in its relations towards the global agenda. Many authors discuss the

implication that deglobalization is necessary in order to tackle the multiple re-occurring crises of global capitalism (Bello, 2008; Clark, 2003). Bello expresses that the current infrastructure of global integration, combined with the political power of intergovernmental organizations such as World Bank and IMF, are taken advantage of by industrialized countries at the expense of the poorer ones. The spread of western hegemony is criticized and suggested that we shouldn't be afraid of change in favor of human rights and decreasing poverty for the better of mankind.

Some of the events that have happened in the past 100 years suggest that global integration indeed does have its flaws (Bello, 2013). For example, the Asian financial crisis in 1997. This had huge impacts on neighbouring countries in Asia whereby the reliance of a global system had led to a contagious economic depression and currency devaluations. In addition to events, the global financial crisis in 2007, when the banks crashed, had a negative global effect. Due to these events, protectionist policies were being put in place by countries, and this suggests that deglobalization is necessary in some situations (Evenett, 2019).

In economic theory, it is explained that protectionism is needed in order for emerging firms in developing countries to be able to shield themselves from strong foreign competition. This in the medium or long term would be beneficial as those emerging firms have time to grow to then be able to compete with foreign competition. Furthermore, this is known as the infant industry argument (Krueger and Tuncer; 1982; Saure, 2007; Lane, 2020).

To summarize, there is an argument to go against the entirety concept of globalization through critiques such as the pushing political agenda of western hegemony, and by highlighting its flaws. There is also discussion among literature for when deglobalization is necessary for future growth.

2.4. Economic growth

The Harrod-Domar model was one of the first created exogenous growth model ideas developed by Harrod (1939) and Domar (1946), also known as a Keynesian model of economic growth. This classic economic growth model tries to simplify economic growth through an economy's productivity of capital and savings. The assumption suggests that output is solely a function of capital. In simple terms:

$$Y = AK \tag{2.1}$$

Where Y equals output, A equals output per unit of capital and K is the amount of capital stock. From the model, an equation is derived:

$$Growth\ rate\ of\ output = sA - \delta \tag{2.2}$$

Where s is the rate of savings, A is the average output per unit of capital, and δ is the depreciation of capital.

The Harrod-Domer model emphasises the importance to the savings rate and the productivity of capital. As the savings rate of an economy increases, so does investment and therefore economic growth. As capital is more productive, so does output. Although this is analysed to be acceptive by policy makers in modern day, it is not that simple. The Harrod-Domar model can be examined to be missing certain other key points. Question remains whether labour and population size are to be considered a key aspect to growth. As the Harrod-Domer model focuses on firms and consumers, there was a gap of explanation as to whether government policy may affect the savings rate and productivity of capital.

Many were concerned with the Harrod-Domar model in which labour was considered to produce almost two-thirds of total output, compared to only one-third to what capital produces. This led to the search for new growth models in research. The extension to the Harrod-Domar model, came the Solow model (1956), an alternative model to economic growth which included the labour function in the production function. To capture the relationship between both inputs and outputs at the aggregate level in the production function, the Cobb-Douglas function was used to fulfil that purpose, where total output is determined by capital input, K, labour input, L, total output received by capital input, a, and the share of output received by labour input, where both capital and labour inputs are paid in accordance to their marginal products, $1 - a$.

$$Y = K^a L^{1-a} \tag{2.3}$$

This type of aggregate production function exhibits the properties of constant returns to scale. This suggests that if the inputs of capital and labour are increased by an equal amount, so does output by the equal amount. For example, in an economy that produces silk in a factory, another identical factory in that same economy produces silk with double the amount of inputs in capital and labour, it is rational to assume that double the amount of output of silk should be produced. The partial derivative of the production function is that when either capital or labour is considered fixed, an extra unit of, for example, capital, the marginal product of labour input will have diminishing properties. Furthermore, the property of diminishing marginal product

in the production function ensures that a market equilibrium can exist, and that either capital or labour input can be paid in accordance to its marginal product.

This function suggests that if the economy exhibits a fixed labour force, or population, then economic growth must be as a result of increasing capital. In other words, by increasing the savings rate or investment. However, since capital in this model exhibits diminishing marginal returns, the level of capital may reach a ceiling to where an extra unit of investment may only be able to cover for the amount of depreciation. In this case, economic growth will not increase.

For sustained growth, two elements were added to the model, growth in labour and technology. The production function below is expressed by Solow, where t, represents at time, and, Y_t, is total output determined by:

$$Y_t = K_t^a (A_t L_t)^{1-a} \tag{2.4}$$

The additional variable, A_t, corresponds to technology and is assumed to grow at a constant rate alongside variable, L_t. As technology in this model is considered to be labour augmenting, the effective labour input is expressed as $A(t)\ L(t)$. Furthermore, the capital per unit of effective labour input, is equal to the variable of interest, in the ratio, $k(t) = \frac{K(t)}{A(t)\ L(t)}$.

How $k(t)$ is evolved over time is explained by the central equation to Solow's model:

$$\dot{k} = sk^a - (n + g + \delta)k \tag{2.5}$$

Where s is the rate of savings, δ is the rate of depreciation in capital, n is the growth rate for labour, $L(t)$, and g is the growth rate for technology, $A(t)$. As all parameters are considered exogenous, it suggests that their value is determined by not economic agents in the model but through determinations outside of the model. In addition, $\dot{k}$, which is the rate of change per unit of capital to effective labour, is equal to the savings per unit of effective labour subtracted by outflow of capital stock per unit of effective labour. This may be due to either increases in population, technology, or depreciation. Furthermore, the equation suggests that if savings are equal to the dilution of capital per unit of effective labour, k, will equal to 0 and a steady state to capital per unit of effective labour will exhibit as, k^*.

On a growth path that is considered balanced, all three aspects of output, capital and effective labour will grow at a constant rate to $n + g$. Technological change is the aspect that is the drive to increasing output per capita, as output per capita is grown at a constant rate to technological change. If capital, $k(t)$, is below the steady state, k^*, the economy itself will have a higher

savings rate than what is needed to keep the capital stock at its current level, and so capital will increase until it reaches a steady state. In contrast, if the economy is above the steady state level, the economy will have a lower savings rate than what is needed to keep the capital stock at its current level, and so capital will decrease until the steady state is achieved. As a result, the model predicts that the economy will converge to its planned balanced growth path in the long run.

This model suggests us that if between a number of countries that they have similar rate of savings, growth in population, technological progress, and rate of depreciation, regardless of their output per capita, as this is considered in the short run, in the long run, all countries should follow balanced-growth path and therefore converge. In addition, developing countries are predicted to grow faster than developed countries, and ultimately reach a level of output per capita that is similar.

However, as there are diminishing returns to capital, the accumulation of capital is considered not the only way to sustain growth as extra units of capital may produce zero output at some stage where capital is larger than sufficient levels. In order for there to be sustained growth, effective labour must keep increasing so that the marginal rate of return for capital is above zero in the long run. If technological change cannot be increased, then it must be that the population increases, however in the long run, output per capita will be of constant levels. In order to increase output per capita in the long run, technological change or growth must happen.

Despite this, during the time after the Solow model was published, new research was added to the field of economic growth. Summers and Heston's (1984) cross-country analysis to 124 countries between 1950-1980, found evidence of large differences in growth rates and income per capita levels among them. This did not support Solow's prediction of convergence. Although it can be argued that all countries may not have the same rate of savings, growth in population, technological progress, and rate of depreciation, to explain the differences in growth rates in the data. Treating technology as exogenous however were challenged by further researchers, as it may not be as accurate.

Romer's (1986,1987) development to an endogenous growth theory was then produced and a new way to approach frameworks for economic growth. As technology is treated as endogenous, a model is created whereby economic agents are influential in the market economy and on its economy's technological progress. Furthermore, it is an economy's population exhibiting knowledge or ideas that contribute to the production of goods and

services, which in contrast is different to the machinery that occupies the ideas. Inputs in capital and labour in Romer's model both have opportunities to increase their initial output, however, they have unique properties. Romer suggests that ideas are nonrival, which means that an idea that one produces, can be enjoyed simultaneously by others without rivalry. When compared to a good such as food, one can eat an apple and that product would be diminished. Romer also suggests that ideas are partially excludable. This means that ideas can be patented or owned in a way that it can be sold on the market at the market price given. This protects inventors so that it cannot be copied until given the rights to do so.

Moreover, in the research and development process, the production of ideas is said to be of a high fixed cost at the beginning, with a low or constant marginal cost during the latter stages as the ideas are replicated in quantity. This suggests an increasing return to scale. In a perfectly competitive market, the price of the idea will equal its marginal cost, and therefore the economic agent may not be able to cover its own fixed costs and it would not work. Romer gives a leeway for his idea to account for firms having some sort of monopoly or monopolistic power, by suggesting his model includes "ideas" that are partially excludable.

The model contains three sectors, which are intermediate goods, the final goods and research and development.

Romer's explanation focuses on creating an equation that involves calculating the total output of final goods:

$$Y_t = (\int_0^{A_t} X_t(i)^a di)\ (L_t^F)^{1-a} \tag{2.6}$$

Where interval (0, A_t) portrays all the available intermediate capital goods at time, t, represented as, i, and $X_t(i)$ as the quantities. L_t^F, represents the amount of labour working in the sector of final goods and L_t^R , the amount of labour working in the sector of research and development (explained below). Moreover, as labour have the choice in which sector they work in, it suggests an endogenous variable.

In the research and development sectors, A_t, is considered as a technology terminology, and that, t, is extended over a period of time. The rate of technological change, $A_{t-1} - A_t$, is set on by the current level of technology, A_t, and the amount of labour working within the research and development sector, L_t^R. As a result of this, firms, identified as, i, in the intermediate goods sector, use capital, $k_t(i)$, to create output, $x_t(i)$, and charges a monopoly price to the market.

When compared to the Solow model, A_t, in Romer's model, technology is considered endogenous, as workers are able to choose between working in the research and development or final goods sector, while in Solow's model it is considered exogenous. The growth rate of technology is to be determined by economic agents (workers, managers, consumers, and entrepreneurs) regarding their choices in the market. Furthermore, as the population grows, the more people that work in the research and development sector, the faster the rate of technological progress.

Romer describes the market to exhibit an equilibrium imbalance if an economy has too little research and development. The rate of growth will be slow. This type of market failure is therefore to be corrected by good government policies to promote research and development. Both positive and negative externalities exist in a market that is non-perfect, and the government must help correct each market for a balance in market equilibrium as a whole in the economy through good policies.

2.5. Inequality

Globalization however has been criticised as a term to have contributed to increasing inequality in today's world. Inequality can be defined in many ways. Economic inequality can refer to the distribution of income within or between countries. This information is important because it can highlight a population's household income and compare it between different sections of society, such as the rich, the middle, and poor. This can also be compared between developed and developing countries to discuss the gap problems that may persist. Public debate and academia regard economic inequality as an ongoing growing concern as well as an important social problem that must be tackled (Stiglitz, 2013; Pikkety, 2015; Milanovic, 2016). Income inequality has been part of public debate in the House of Lords, in which the government has provided its commitment to tackle regional inequality throughout the UK each year (Tobin, 2021). The European Parliament also conducts its debate on inequalities. In their recent debate, they expressed commitment to its resolution for change regarding poverty, increasing atypical and precarious employment, and economic and social consequences due to COVID-19 for its member states, outlining a detailed report on the matters (Demirel, 2021). Senate hearings to examine the inequality and wealth crisis in the United States are of similar national magnitudes (Congress.gov, 2021). The topic of inequality can be widened to other areas in social sciences, whereby gender, class, race, participation and education indifferences are included in the definition. Social inequality focuses on the disequilibrium of resources and opportunities that occur due to the different disparities between different groups in society.

The acknowledgement that inequality exists in developed countries suggests that the case should and is much worse for developing countries. According to the World Bank (2021), and the Gini index, as proposed in Appendix 1, it can be analysed that higher income countries tend to have lower levels of income inequality. As a higher Gini index indicates a higher level of income inequality, as examples, developed countries, Germany, United Kingdom, and United States have a Gini index of 31.87, 35.15 and 41.14 respectively, while developing countries Central African Republic, Zambia, South Africa and Mozambique have a Gini index of 56.24, 63.03, 57,14 and 54 respectively. This suggests a huge problem that exists in developing countries across the world according to income inequality.

Inequality, as assessed by OECD (2021), explains that regarding income, between OECD countries, is at its highest level when compared to the past 50 years. The OECD income distribution database depicts that the 90/10 ratio, which compares the 90th percentile to the 10th percentile of the population's income, is nine times across OECD countries. Furthermore, this is an increase of 28.57% compared to 25 years ago. It is observed that only Turkey, Mexico, and Chile showed improvements to income inequality. The magnitude of other statistics show that the top two income-richest OECD countries are 25 times richer when compared to the poorest OECD countries. In emerging economies, India, and China, although have shown strong sustained economic growth in its period, and as a result most definitely eradicated parts of absolute poverty within the millions of its population, the statistics show that growth has been unevenly distributed and income inequality has risen further. Only Brazil among the category of emerging economies have shown improvement in the reduction of its income inequality. Furthermore, it is explained that the identifiers to the increasing income inequality were as a result of skill-based technological change, wrong policy approaches and globalization.

In terms of inequality and gender, it is suggested that tackling the existing problems in employment, education and entrepreneurship may bridge a gap to create a better source for economic growth. The accounting for better education attainment, or human capital, in OECD countries, in the past 50 years, were identified as important indicators to account for over 50% of economic growth. As a result, to increase females reaching a higher level of education attainments and better equality in the number of years spent in education, it has allowed economic growth to follow the pattern that it has. Women earn less than men by 16%, and the top earners for women have still fallen short by 21% in pay when compared to men.

Furthermore, according to parliamentary seats, women occupy less than a fifth when compared to men.

In the jobs market, education is valued to be the leading most valued quality, and those at the lower scale are considered to be disadvantaged. Lower income households are considered to be at a disadvantage in terms of education potential when compared to higher income households. Students in lower income households are more likely to be less competitive than those in higher income households, leading to a lower level of education, overall salary, and life expectancy. The social benefits of education suggest that individuals with high levels of education are more likely to have a higher life expectancy compared to those who have low levels of education. A study consisting of 15 OECD (2013) countries, found that a 30-year-old tertiary male graduate was likely to have lived on average 6 years longer than those who did not graduate from tertiary education. A similar study with women found the life expectancy gap to be smaller than compared to men, and a support to the hypothesis that a higher level of education increases life expectancy.

2.5.1. Identification of non-income measures of inequality

2.5.2. Access to electricity

Statistics show that in 1990, 29% of the world population did not have access to electricity. This figure has since reduced to 13% by 2016. However, this is a worrying figure as it translates to approximately 940 million people. This is a problem for mainly low-income countries and specifically for the Sub-Saharan Africa region. It is estimated by the International Energy Agency (2020) that in 2019, the figure for Africa's population without access to electricity is approximately 572 million people. Moreover, this does not consider 40% of countries in Sub-Saharan Arica that do not have official electricity statistics. Rural communities, women and children are identified to further have access issues in developing countries (World Bank, 2019).

The definition to "Access to Electricity" adopts the cut-off point to very basic lighting and usage. An example would be ones able to charge a phone or to power a radio for a minimum of 4 hours per day. The minimum level of consumption for adequacy identified by the International Energy Agency (IEA, 2016) suggests 250 kilowatts-hours per year for rural households and 500 for urban households.

Table 1: Share of population without access to electricity in 2018 (World Bank, 2022)	
Region	% Of total population
North America	0
Europe	0
Latin America/Caribbean	1.7
East Asia	2
Middle East/North Africa	3.5
South Asia	8.4
Sub-Saharan Africa	52.3

Access to electricity is a basic necessity that all humans should have access to. However, due to social inequalities that exist within and between countries, there are many that are deprived from having this necessity. Electricity access is important for household productivity, and especially in rural areas where agricultural farming is the main source of production (Cabraal *et al*. 2005). Electrification can be classified as most critical for basic human productivity and standards of living, and especially in the region of Sub-Saharan Africa.

Countries that are considered developed by the United Nations were identified to have a 100% electrification rate within the first year of entering that category. This is an important statistic to demonstrate the characteristics of a country that is considered developed, and for what a developing country should aim for.

2.5.3. Access to clean fuels and cooking

Statistics show that in 2000, 45.5% of the world population did not have access to clean fuels and cooking. This figure has since reduced to 35.9% by 2019. However, this still suggests that approximately 2.5 billion people do not have access to clean cooking facilities (IEA, 2022). The alternative of using kerosene, coal or solid biomass as primary cooking fuels have substantial health effects in the household. This is because of the pollution that it produces in the air. The air pollution is estimated to have a contribution of 2.5 million premature deaths every year and is mostly affected in developing countries and to the poorest of countries. This

is a problem in the area of the Asia Pacific and Sub-Saharan Africa. Compared to access to electricity figures, the significance of this problem is more severe and needs to be addressed.

Table 2: Share of population without access to clean fuels and cooking in 2019 (World Health Organization, 2022)

Region	% of total population
North America	0
Europe	0.3
Central and South America	10.6
Middle East	6.3
North Africa	2.1
Asia Pacific	38.2
Sub-Saharan Africa	82.8

The definition of "Access to clean fuels and cooking" is in accordance with the World Health Organization's (2022) identification of household fuel combustions that affect indoor air quality. Cook stoves and/or Fuels are classified as clean if fuels exhibit:

- "Either the annual average air quality guideline level (AQG, 5 $\mu g/m^3$) or the Interim Target- 1 level (IT1, 35 $\mu g/m^3$) for $PM_{2.5;}$ **and**
- Either the 24-hour average air quality guideline level (AQG, 4 mg/m^3) or the Interim Target-1 level (IT-1, 7 mg/m^3) for CO" (World Health Organization, 2022)

Those classified as clean are as follows to; electric, natural gas, solar, alcohol fuels (including ethanol) and liquefied petroleum gas. Furthermore, as similar to access to electricity, access to clean fuels and technologies can also be classified as a basic necessity that all humans should have access to. However, due to social inequalities that exist within and between countries, there are many that are deprived from having this necessity. Clean fuels and technologies access is important for the health of households and especially for those of the poorest. This could affect their day-to-day tasks as well as schooling, employment, and life expectancy.

Women and children can be considered to be most vulnerable to this social inequality as they are the one more likely to be at home (looking after their children) meanwhile the men are working elsewhere. It is also a risk in developing countries that women are likely to be the one to leave their home to look for fuels, such as gathering wood, and this increases their chance of being vulnerable to physical attacks (Clean Cooking Alliance, 2022).

Countries that are considered developed by the United Nations were identified to have a 100% access to clean fuels and technologies rate. This is an important statistic to demonstrate the characteristics of a country that is considered developed, and for what a developing country should aim for.

2.5.4. Access to the internet

Internet access can be considered to be a universal necessity that countries should be able to provide for their population. Given the modern era of technology, the internet allows for individuals to access public information and provides the necessity of basic freedom. The internet in the modern era has shaped the culture to how people work, communicate and educate. The digital divide, as expressed by Scheerder *et al.* (2017), suggest that social inequalities such as age, gender, and labour force status have created a dispersion whereby certain individuals due to their characteristics, are disadvantaged to access to the internet. Other authors support this argument in various of developing countries (Puspitasari and Ishii, 2016; Nishijima *et al*. 2017; Bartikowski *et al*. 2018; Lythreatis *et al*. 2022) The inclusion of mental health during the recent Covid-19 pandemic is also expressed more severe for developing countries (Cheshmehzangi and Su, 2022) and those with disabilities (Cho and Kim, 2022).

Table 3: Share of population without access to the internet in 2020 (World Health Organization, 2022)

Region	% Of total population
North America	8.48
Europe and Central Asia	16.11
East Asia and Pacific	30.78
Middle East and North Africa	22.17
South Asia	61.44
Sub-Saharan Africa	69.96

The definition of "Access to the internet" adopts the share of individuals within a population who have used the internet in the last three months (World Bank, 2022). This includes those who accessed via all forms of technology (digital TV, gaming device, mobile phone and computers).

It is identified that all regions have the problem of the digital divide among their population. However, this is more prominent in developing countries such as South Asia and Sub-Saharan Africa. Access to the internet is important for the well-being as well as the progress for an individual. The exposure to public information allows one to be able to efficiently communicate with others, look for employment opportunities, find medical advice online, find their way of navigation and many other importance to one's personal safety and growth.

Countries that are considered developed by the United Nations were identified to have a near 100% access to the internet rate. This is an important statistic to demonstrate the technological advancement of a country as well as the basic standard of living to individuals in the population. Therefore, developing countries should aim to reduce this figure.

2.5.5. Life expectancy

Statistics show that Africa is the region that is lagging behind other regions in terms of equalizing the figure for life expectancy of its population. Despite this, developing countries in general are more likely to experience social inequalities relating to political priorities and decisions, societal values to fairness, unequal distribution of wealth, and discrimination that lead to a disadvantaged access to health systems and products.

Table 4: Life expectancy in 2019 (United Nations, 2019)

Region	Years
Africa	62.3
Asia	73.6
Americas	76.8
Oceania	78.7
Europe	78.6

The role of health systems can also impact the current and future generations of the population. For example, there may be lack of supply and/or services in rural areas of developing countries that provide Antiretroviral therapy to treat the problem of HIV (World Bank, 2022). Furthermore, the importance of prioritizing the most vulnerable who are the new-borns in terms of health can be identified to be not as sufficient enough in developing countries. The World Bank (2022) suggests in their research that there are statistics to show significant dispersion between developed and developing countries in their rate of protecting new-borns of measles, diphtheria, pertussis, tetanus, and anaemia. As a result, developing countries and more so to those of the poorest may experience poorer levels of wellbeing, life expectancy, morbidity, and mortality. It can be identified that social inequalities regarding socioeconomic differences and the health system in developing countries are further expressed to be of a significant problem and a restraint to proper growth over the past two decades (Braveman and Tarimo, 2002; Pfeiffer, 2003; Frank *et al.* 2006; Kruk and Freedman, 2008; Hone *et al.* 2018; Weng *et al.* 2019; Okoi and Bwawa, 2020; Rudnicka *et al.* 2020). Despite this, social inequality itself is yet to be properly explored by the government and is often overlooked by policymakers.

2.5.6. Prevalence of undernourishment

Statistics show that on a global scale, in 2020, approximately 765.5 million people faced hunger (United Nations, 2022). This equates to 10.4% of the global population. The statistic has not seen major improvements, as in 2005, the figure was 12.4%. The region that is affected the most is Sub-Saharan Africa. Asia also faces a big problem. It is estimated by the United Nations (2022) that 25,000 people die as a result of hunger each day, with 10,000 of them being children.

Table 5: Share of population undernourished in 2017 (United Nations, 2022)

Region	% Of total population
Sub-Saharan Africa	21.40
Southern Asia	13.60
Asia	8.4
Latin America and the Caribbean	6.9

The definition of "prevalence to undernourishment" identifies the minimum calorie intake through food consumption by individuals in the population that is adequate to function for a normal active and healthy lifestyle.

Hunger and undernourishment is a strong indicator to identify the social inequalities that exist within a population. Although poverty is the likely rationale to why an individual may experience undernourishment, it may be the case that the distribution of food resources in an economy is favoured towards those of the upper echelons of society and neglect for those at the lower echelons. For example, the government should make sure that food systems in poorer regions are climate resistant to extreme weather conditions. In addition, food supply chains should be incorporated and prioritized for low-cost nutritious foods. Education and information should also be provided in schools to promote a healthy diet. These factors should be classified as necessities towards all levels of society.

2.5.7. Employment Opportunities (with emphasis to the female gender)

The gender gap that favors the male gender in terms of opportunities in employment are expressed to be more prevalent and stronger in developing countries when compared to developed countries (Morrisson and Jütting, 2005; Hilbert, 2011; Rendall, 2013; Bayeh, 2016). Those who are unemployed may find it difficult to support themselves during desperate times of need. This may impact their health as well as being more likely to fall into poverty. Furthermore, female employment increases household income, savings, and consumption of goods and services. In developing countries, females are considered at a disadvantage because educational opportunities and attainment are limited when compared to males (Morrisson and Jütting, 2005; Morley *et al*. 2009; Hilbert, 2011). Figures show that there is a global gap in the labour force participation rate for females. The International Labour Organization (2022) identifies that in 2017, the labour force participation rate for females was 42% compared to the male, 72%. Although this shows that it is a universal problem, the severity of such problems can be identified to be more severe for those in developing countries. As a result, there is a need to improve women's access to employment in developing countries.

2.6. Literature Review

2.6.1. Theoretical understanding on the relationship between globalization and economic growth

The literature of modern including endogenous growth have provided some of the introduction to tools and models to facilitate the mechanism linking global integration and long-run economic performance. Grossman and Helpman (2015) explained that during the period up

until the mid 1980's, growth models focused on the accumulation of physical capital. However, further observations by Lucas (1998) and Romer (1990) show the existence of diminishing returns. As capital accumulation rises quicker than the rate of population, the marginal product of capital can fall to a point where the incentive to ongoing investment disappears. This led to growth models to focus on the accumulation of knowledge (human capital and technology). Knowledge has the nature of being non-rivalrous, and therefore has no means for diminishing returns.

Linking this to globalization and economic growth, international integration has led to the exchange of goods and ideas, affecting the incentives for accumulating knowledge. The integration to people and culture increases the flow of knowledge that can affect the strategies of the production, supply chain, operations, marketing and distribution of businesses to which idea is most efficient or profit generating. When new knowledge is acquired within a country, it can be transferred to another to facilitate research. Romer's (1990) model suggests that the accumulation of knowledge through conducting research and development allows for the increase in incentives for future efforts in innovation. Helpman (2004) found through empirical research that international knowledge spillovers exist while Eaton and Kortum (1999) find the incompleteness of international spillovers, suggesting that there is still more room for knowledge spillovers if further world integration was to take place. Trade and FDI can be seen as conduits for knowledge as new products and ideas are being injected into the economy. An importing country can gain knowledge through negotiating tactics with their suppliers and an export country can take note of receiving feedback of their product from customers abroad. Increased international trade has also led to increased competitiveness which may fuel the incentive for innovation and therefore knowledge. However, this is subject to whether the scale effect or the competition effect is stronger. The economies of scale effect may boost one's incentive to acquire that knowledge but the competitiveness effect may defer knowledge acquisition if for example there is a patent involved. Furthermore, the interconnectedness between nations has allowed for technological diffusion.

2.6.2 Theoretical understanding on the relationship between globalization and income inequality.

According to the Stolper-Samuelson theorem, early trade liberalization theory suggest that for developing countries, in a two-country two-factor framework, the more a country is open to trade, for example, through tariff reductions, the more increase there will be in the wages of

low-skilled workers in a country where there are abundant low-skilled workers. This is because as trade opens, the increase in exports will be low-skilled intensive. In compensation, this would reduce the wage gap to high-skilled workers as this factor is scarce and misses out on the potential gains of opening for trade. As a result, income inequality is reduced in that country. In this model, this would be the opposite for a country where high-skilled labour is abundant. Exports will be high-skilled intensive and high-skilled workers will gain from trade compared to low-skilled workers where its factor is scarce. This model predicts that income inequality will increase in developed countries.

However, an extension to this model, which includes non-competitive goods, suggests that this may cause a difference in distributional effects between developed and developing countries. When trade liberalization happens, it may be the case that goods that are not being produced in that country are imported instead. This may be because of large differences in endowments between countries. As a result, the prices of non-competitive goods would fall which increases the real wages for households. Non-competitive goods have no impact on the wages and prices of other goods. However, it depends on the properties of this non-competitive good. If its properties match the description that it is part of a large share of a country's consumption in low-income households, then income inequality in that country should fall. This would be the case for both developed and developing countries.

The model above implies a two-factor framework. Jones (1971) as an example, derived the Ricardian model to explain a specifics factor model. The specific factors model has the assumption of an economy producing two goods, in a perfectly competitive market, with capital and labour as factors for production. However, the difference is that one of the factors of production is immobile and specific to a particular industry.

2.6.3 Empirical studies on the relationship between globalization and economic growth

On the openness of an economy, empirical work by Levine and Renelt (1992) show that it has a robust unambiguous positive relationship on growth using cross-country estimates. Similarly, Edwards (1992) found there to be a negative relationship between growth and protectionist policies. The protection for domestic firms leads to a lower investment opportunity which therefore slows growth. This is also found evident by Baldwin and Seghezza (1995) in their research of regional integration in developing nations. Ireland, Spain, and Portugal enjoyed investment-led growth due to their integration to a rich trading bloc of the EU. However, Greece's data rejected this hypothesis as their integration failed to overcome the poor

macroeconomic management and market rigidity problems. In addition, there is more to just openness as a means to define integration to the world economy. Further literature arises on the potential impacts of financial integration or investment in research and development on growth. Financial integration is deemed critical to the development or improvement to the microeconomic efficiency of the economy. This increases growth due to the allocating of more efficient capital stock (Roubini and Sala-i-Martin, 1992). Econometric evidence on testing financial repression on growth during the period 1960-1985 for 53 countries show that a higher degree to an economy's financial repression leads to a lower economic growth rate. Other studies including those of Levine and King (1992) and Levine and Zervos (1996) have found evidence to the financial sector having an impact on growth however the results are not necessarily as clear and robust.

The transferring of physical capital or knowledge spillovers from developed countries to developing countries no doubt have played a role in helping them achieve economic growth through adaptation and competitiveness to world markets. For technological integration and diffusion, Coe and Hoffmaister (1994) demonstrated that expenditures on research and development in industrialised economies of developing countries have had a positive impact on their growth rates. Others such as Borensztein, De Gregorio and Lee (1995) have given FDI the nudge over domestic investment in fostering growth in developing countries given that FDI effectively drives more for the transferring of technology from developed to developing countries.

Alonso-Gamo (1997) looked at globalization and the growth prospect in Arab countries. This paper is an interesting outlook because of their economic structure differences when compared to the rest of the world. Arab countries were analysed to be not well integrated within the world economy. Despite richness in oil exports, their integration to international capital markets is described as weak. Furthermore, contrasting Arab countries growth rates, they were described to be almost as poor as for sub-Saharan Africa or Latin America during the periods 1981 to 1995. Empirical analysis of the paper included a series of pooled regressions during the period 1970-1990 for seven countries. Results show that the relationship between integration and growth is necessary if high growth rates are to be attained, and that the poor integration performances of Arab countries had led to the hindering of their potential growth. The indicators that Alonso-Gamo (1997) used to define globalization (integration) were the investment ratio to GDP, Openness (X-M/GDP), FDI, and Terms of trade in percentage changes. There was also discussion on forces that will drive globalization and recommended

Arab countries to increase their integration to world capital markets, take note of the importance of private flows and FDI, advances in telecommunications, transport, and changes in movements of labour.

Akinlo (2004) researched a case study in Nigeria to study the effects of FDI and growth, for the period 1970- 2001. Using an error correction model, they find that private capital and lagged foreign capital have a negligible effect on growth. The effect is not statistically significant on the economic growth of the country. Exports, however, were found to be statistically significant and influence growth positively. This shows that for Nigeria, and the indicators provided, increasing globalization in the form of attracting more FDI may not necessarily help influence economic growth. Improving exports and becoming more globalized in the sense that exports could be shifted to more parts of the world may be more beneficial for growth.

Ivanov and Webster (2012) assessed a more niche part of globalization as opposed to other authors, to question whether globalization affects per capita tourism's contribution to economic growth. The authors used data from 167 countries during the period 2000-2010. For globalization, the KOF index was used. The results show that there is no correlation between globalization and its effect on per capita tourism's contribution to economic growth. This is interesting to unfold as on the one hand, globalization may attract more foreigners to come and spend as part of their per capita tourism contribution to growth, but on the other hand may be part of the leakage to depress GDP as more imports may be taken in, in order to satisfy the consumption by tourists. Therefore, the high or low level of globalization can be seen as both beneficial and disadvantageous in terms of the tourism industry. Since globalization, as defined according to the KOF index, does not affect per capita tourism's contribution, policymakers should take this into account to suggest other economic conditions that will increase tourism GDP.

Rao and Vadlamannati (2010) researched the relationship of globalization and economic growth in the region of 21 low-income African countries. The paper criticised previous research in which many used single indicators to define globalization, such as the ratio of exports plus imports to GDP. For example, in Bigsten *et al*. (2004) research of Cameroon, Ghana, Kenya and Zimbabwe, their OLS estimation shows that a ten percent increase in exports result in an increase in productivity by 0.7%. At the firm level, data from Ghana, Kenya and Ethiopia found that the productivity of firms with exports is 17% higher than when compared

to firms without exports. Van Biesebroeck (2005) study was similar at the firm level which included in addition to other Sub-Saharan African countries such as Cameroon, Burundi, Côte d'Ivoire, Tanzania, Zambia, and Zimbabwe. It was also found that productivity of firms with exports were higher by approximately 25-28% than firms with no exports. Despite this, Rao and Vadlamannati (2010) describe the research as too narrow, as the indicators need to be more descriptive and relevant to globalization. In contrast, the comprehensive measure to Dreher's (2006) KOF index was used in Rao and Vadlamannati's (2010) research. In short, the KOF index is a combination of measures to define the economic, social and political sectors of globalization. Using OLS and data from the period 1979 to 2000, results show that the effects of globalization on GDP growth is small but positive and significant, even in the long run. In addition to panel OLS, FE, and RE, they also used SGMM and SGMMR (system generalized moments). This allows the standard set of equations in first differences to be combined with suitably lagged levels as instruments. Furthermore, this helps reduce the weak instruments problem and biases in endogeneity. However, despite this, SGMM can be criticised as it uses a large number of instrument variables which therefore may cause unreliable estimates of the standard errors. Due to this, the FE results were classified as priority in the deriving of policy conclusions. Moreover, in their interpretation of results, it is calculated that the trend rate of growth of globalization is approximately 1.85%, which is considered not enough to offset the current negative trend of total factor productivity in the poor African countries as at that rate it would take ten years. Despite the results showing that the effects of globalization are positive, robust and significant, the level of growth shown is very small to make a notable impact in Sub-Saharan African countries. The robustness of the model is examined by the extreme bounds analysis.

Gurgul and Lach (2014) examined the relationship between globalization and economic growth using evidence from two decades of transition in 10 of countries within the Central and Eastern European area. Using a dataset formed within a panel of annual observations during the period 1990-2009, and an OLS using fixed and random effects, generated the confirmation that globalization is an important growth factor and has a positive role in the expanding GDP growth. Furthermore, on the methodology, to define globalization, the KOF index indicators were used. This was derived from the published database by the Swiss Economic Institute. The positive results were strong and robust, more so in the economic and social dimensions of globalization. The political dimension of globalization was however found to be statistically insignificant in all of the research variants. More specifically to the results of the variables, the

economic dimensions (to the rise in international trade, growth of foreign investment, import barriers reduction and development of tax policy) had at least as strong a positive impact when compared to the social dimensions (the development of internet, television, and trade of newspapers).

Dreher's (2006) KOF index panel data approach, using the 2002 version of the definition, to 123 countries over the period 1970-2000, found a strong positive correlation to economic growth. Villaverde and Maza (2011) replicated the same globalization indicator with a dataset containing 101 developed and developing countries during the period 1970-2005, a 5-year addition compared to Dreher's study. The estimation was done by OLS using fixed period and country effects, with results showing that the overall index, economic index, and social index measured for globalization positively correlated with economic growth variables. A one-step GMM estimator was also used in the study while treating globalization variables as endogenous. The result of a positive correlation in the overall, economic, social and political indices on growth was also found. Further regarding the GMM estimator, the authors used lagged values of globalization and other explanatory variables as instruments for globalization. Due to this, the employment of instrumental variables means that you cannot test the exclusion restriction, which therefore results in the GMM estimator struggle to be interpreted as casual. More regionally, specifically in the region of Africa, Ali, and Imai (2013) investigated the effects of globalization using data from 41 African countries during the period 1970-2009. A common and dynamic panel model was used, including fixed period and county effects and a system GMM estimator treating globalization as endogenous. The results show that globalization is positively correlated with economic growth.

A problem that can be identified with the studies mentioned is that five-year averages were used in a panel data framework (Rao *et al*. 2011). Using five-year averages of growth is an inadequate use of proxy for the unobservable steady state growth rate and that a country or an economy is unlikely to obtain its SSGR within the time frame of five years. Another criticism includes the use of panel data as they assume homogeneity among the effects between the variables. It would not be a good idea to pool countries together because the effect of globalization varies by country to country. For this reason, Rao *et al* (2011), used annual data between the period 1974-2004 for five countries: Thailand, Malaysia, Singapore, India and the Philippines. All sets of data are calculated separately to bypass the criticism of pooling. The results show that the variables are non-stationary from unit root tests and an error correction model is used. The results show that globalization has different effects for each country. For

example, in the results, India's steady state growth rate can increase by 0.36 percentage points if the globalization index is increased by 10 points, and when compared to the Philippines, to which their steady state growth rate would only increase by 0.07 percentage points. What is interesting about the results is that countries that have a higher level of globalization have higher steady state growth rates. Despite the criticism of five-year averages and homogeneity pooling, we can also identify that this study has only 31 observations and eight explanatory variables which is considered small.

Gygli *et al*. (2019), with a sample including 137 countries both developed and developing, for the period 1975-2010, report that the KOF index has a positive effect on medium-term growth. This type of KOF index is the new updated version of 2018, to which there has been an increase of variables to measure globalization from 23 to 43 when compared to the previous version. For each dimension (economic, social, and political), the results shown that they are all relevant for growth. The KOF index was also found to be statistically significant at the 1% level. Moreover, the new KOF index allows for separation to the de facto and de jure dimensions. This will allow studies to separate the definition more clearly between financial and trade type globalization. The de jure dimension was found to have more of an impact between globalization and economic growth than de facto. The estimation coefficient for de facto overall was positive however was only statistically significant at the 10% level and of smaller size. This is while de jure was approximately double in size and statistically significant at the 1% level. A ten-point increase in de jure type globalization was found to have a positive impact on the annual growth rate by approximately 1.4 percentage points in their study.

The literature mentioned so far generally use GDP or real GDP as their measure for growth. In 23 OECD countries during the period 1970-2006, Chang and Lee (2010) found that per capita GDP and globalization defined by the KOF index are cointegrated, meaning that they have a long run relationship. From using a panel vector error correction model, there is a conclusion to justify that the overall index and the three sub-indices of economic, social and economic globalization, all have a positive influence on per capita GDP. Chang *et al* (2011) used a similar approach but used data from G7 countries during the same period and found only economic globalization and per capita GDP cointegration. Sakyi (2011) studied 31 Sub-Saharan African countries and found similar results for during the period 1980-2005, that economic globalization and per capita GDP were cointegrated. From also using a group mean FMOLS estimator for the cointegrated panel, found that economic globalization has a long run positive relationship on per capita GDP. This study is important in this aspect because it is a case for

developing countries. For annual GDP growth and economic globalization performance, Quinn *et al* (2011), used data from 189 countries and a system GMM estimator. By using the first and third lag of the explanatory variables, they treat globalization as endogenous. The results show that economic globalization influenced positively on per capita GDP annually.

Other measures of globalization and its link to growth include the Maastricht Globalisation Index (MGI). This index takes into account the sustainability and healthiness of a country. One of the criticisms of globalization include its cause for vulnerability to climate change (Ehrenfeld, 2005). The world's increase in interconnectedness in economic activity (trade and capital mobility, labour conditions, wealth creation and distribution, international aid) and demographic changes (population growth, urbanization, increased mobility, social changes, institutions, governance, cultural diffusion) has led to large-scale and systemic environmental impacts. These environmental impacts include the degradation of land and water, depletion of natural resources, disruption of the climate system and ecosystem disturbances (McMichael, 2013). These negative externalities may outweigh the actual value of current used measures of economic growth including real GDP and GDP. For example, despite India being regarded as one of the fastest growing economies and an emerging power, which was made possible due to their recent standing on enhancing globalization through its policies, its current state of increasing environmental degradation can be described to be of serious concern (Kumar, 2008). What is also interesting is the emergence of other definitions in literature to measure economic growth that considers environmental change (Hartwick, 1990; Hamilton, 1994). Nevertheless, research on the MGI index show that countries considered more globalized are also more sustainable (Martens & Raza, 2009; Martens & Amelung, 2010). Furthermore, there is a gap in literature in the link between globalization and green growth. It may be interesting to see whether they may be a change in the stance between globalization and growth if the growth indicator is changed to an indicator that considers the negative externality of climate change.

2.6.4. Empirical studies on the relationship between globalization and inequality

During the period 1970-2000, Dreher and Gaston (2008) investigated the effects of globalization and inequality. The economic, social and political dimensions were depicted from the KOF index and data on industrial wage inequality and the Gini coefficient were used. The data are averages over five years, with an unbalanced panel of 123 countries. The results show that in OECD countries, the economic dimension increased the industrial wage inequality at the five percent level significance, while the political and social dimension had the same effect but less robustly. A one-point increase of globalization is shown to approximately affect the

industrial wage inequality negatively by sixteen percent. In less developed countries, it is shown that globalizations impact on income inequality is negligible. They also find no evidence of a Kuznets curve for both developing and developed economies. On the Gini coefficient and the globalization index, the results are statistically weak and therefore cannot be interpreted with justification on the direction to which the index affects Gini coefficient. A reason for this is because the data for Gini coefficient is only available for 57 countries and with 191 observations, it is almost half less than what was available for the data on industrial wage inequality. The conclusion that globalization is insignificant or irrelevant to the Gini coefficient may be due to data unavailability.

Baddeley (2006) assessed the impact of globalization and found that there has been increasing financial flows and trade to less developed countries between 1976-2003. Using club, absolute and convergence models derived from Solow (1956) and Swan (1956), and an econometric estimation of the two stage least squares method, results show that despite increased financial flows and trade to less developed countries, international inequality has also risen. The conditional convergence model in the empirical results show that increased savings and trade are correlated with the growing divergence and international differences in per capita income. The context to this problem is said to be due to the global financial liberalisation and deregulation of markets.

Wan, Lu and Chen (2008) studied globalization and its potential impact on inter-regional income inequality in the case study of China during the period 1987-2001. A total of 29 regions were included in a panel data set. The box-cox transformation was used to minimise modelling errors. A log-nonlinear model was chosen and according to the IPS test results, confirm that the model represents a long-run regression relationship. From re-estimating the model using the ML technique and using the Gini-coefficient as measure for inequality, results show that globalization has contributed to the positive and huge share of China's inter-regional inequality over time. The variable that was considered most important regarding contribution to inequality was capital. Privatization was also mentioned as one of the characteristics for regional inequality. The further globalisation of China can be predicted from the empirical results to increase inequality in China. Since China is an export economy, and the goal for many policymakers would be to increase economic growth to surpass the US, it may damage parts of China in the sense that the level of inequality will rise within the country. In order to improve inequality and bring balance, the authors recommended policymakers to focus on globalization more so to attract FDI and trade within the western or central side of China, where there is a

regional income gap. The authors acknowledge the different dimensions regarding the definition of globalization however focus on the economic dimension through flow of goods and services and foreign capital. To define globalization, the authors used openness (trade/GDP ratio) and per capita FDI.

Milanovic and Squire (2005) researched the question of whether reducing trade tariffs would influence wage inequality between occupations and industries. Trade liberalization would be a form of increasing a country's level of globalization. According to the Heckscher-Ohlin, two factor, two county model, trade liberalization would increase the relative price of an abundant factor, in which in less developed countries the abundant factor would be unskilled labour. Increasing the price means higher wages and this in turn should reduce inequality. Covering the period 1980-2000, and of over 100 countries, the empirical results show that there is weak support for the claim that trade liberalization in the form of reducing tariffs will increase inter-occupational wage inequality, however, there is stronger support for there to be an increase in wage inequality across industries. In poorer countries, of those below the world median income, reducing tariffs will correlate more strongly with inter-occupational wage inequality and wage inequality across industries. Bergh and Nilsson (2010) studied the same topic similarly, in which the authors used panel data covering 79 countries during the period 1970-2005, to test whether liberalization and globalization increase income inequality. More precisely, they used the KOF index and the Economic Freedom Index to test whether they are related to the within-country Gini-coefficients. Using the GMM estimator, results show that the freedom to trade internationally was found to be robustly related to inequality. Deregulation and social dimension to globalization was found to also link to inequality. The increasing of inequality through economic freedom was found to be more prevalent in richer countries while social globalization affects inequality more from middle to low-income countries.

Zhou *et al.* (2011) investigated the impact of globalization on income distribution inequality in 60 countries, taking account for developed, transitional and developing countries. From using Kearney's data, the authors created two globalization indices (Kearney index, PCA index) and the Gini coefficient of each country are regressed on both indices to determine the impact of globalization on income inequality. The results show a negative relationship between globalization and income inequality in all of 60 countries tested. The test results also indicate that it is robust. Furthermore, this contributes to literature to support the view that globalization helps reduce income inequality. Similarly, Chakrabati (2000) found empirical evidence for globalization to indicate that it reduces income inequality significantly. The research was based

on international trade and its effect on intra-national distribution of income. From a sample of 73 countries, and a span of 18 low income, 22 low-middle income, 9 upper-middle income and 24 high-income countries, estimates from IV and OLS show an inverse relationship between trade and income inequality. For globalization, the trade/GDP ratio was used and for inequality the Gini coefficient was used. Moreover, it is estimated that an increase in a country's trade/GDP ratio by one percent would approximately lower a country's Gini coefficient of inequality by 0.18%. Despite this, the results can only refer to trade and with globalization being of bigger aspect, the empirical evidence supports the trade aspects of globalization but not globalization as a whole. Therefore, the result to this study needs to be treated with caution. Others, in Fieleke (1994), observed and found no significant relationship between the share of the top 20 percent and the degree to globalization in a global study. Edwards (1997) also found no significant relationship.

Barro's (2000) research studies a panel of countries show that overall, there is little relation to the link between income inequality and growth rates. However, higher levels of inequality in poorer countries were found to retard growth. In richer countries, the high levels of inequality encourage growth. The Kuznets curve was also analysed which indicates that in the process of economic development, inequality rises during the beginning but then lowers later. The results show that the presence of a Kuznets curve exists, but does not explain nor relate to why across countries there is a large variation of inequality.

A granger causality test run by Dutt and Mukhopadhyay (2005) show that globalization as reflected by world trade and international capital flows to GDP ratios granger causes inequality of per capita GDP among nations. Despite this, the current state of literature is not clear on the direction of causality between globalization and inequality.

2.6.5. Criticism of Inequality measures

Since many authors prefer the distribution of annual disposable income among households as a measure to compare levels of inequality within a country, there are some important aspects that the Gini coefficient does not capture. One confusing aspect is income. There are many ways to define income, such as household income or individual income. There is also a consideration to whether to consider any financial holdings or just wage earnings. Each consideration to which defines income will lead to different rankings of a Gini coefficient. This therefore will lead to different results when combined with empirical techniques to globalization. Also, to note that Gini coefficient does not capture the differences in absolute incomes. It is possible for a Gini coefficient to show that income inequality has risen, but at

the same time does not take into account that poverty is declining. Similarly, income inequality could be shown to be falling, which may be classified as good, but if all income is also declining, which is possible, we wouldn't be able to know by looking at the Gini coefficient alone.

Since the Gini coefficient focuses on income, it does not capture other bridges of inequality between the rich and the poor. This includes social benefits. Government subsidies toward the poor such as housing, health care, education and other social grants are not captured. These are important as they reduce income inequality, and it is not measured by Gini. The overall measure that Gini has in terms of inequality is therefore reduced in quality.

It is also important to take a look at a country's characteristics demographically before judging the level of inequality through Gini figures. For example, countries with a high ratio of students or the elderly who rely on pensions as their main source of income tend to have naturally higher levels of income inequality.

Other indices including labour share and income share of, top, middle and bottom incomes are interesting measures, however, do not reflect income that may arise from non-labour activities. Furthermore, considering we are analysing developing countries, the data sources for accurate labour share measures may be difficult to acquire. There may be cases of skewed data due to human error of being able to capture the confidential data of top earners in a particular country. In addition, income measures are usually criticised because they do not include social aspects such as access to health facilities and quality of life.

2.6.6. Further discussion

On the contrary, regarding the literature review so far, the majority if not all studies show that there is positive evidence to show that globalization, regardless of which type of indicator, influences economic growth, in terms of GDP, Real GDP and GDP per capita. The level of growth however can be depicted that globalization is most effective within countries that are developing and currently have a stable infrastructure and financial structure in their economy. Countries that are already developed do not gain as much economic growth if they improve their globalization status when compared to developing countries. This could be due to the fact that developing countries have more room for improvement and convergence when compared to the developed countries. Looking at growth rates alone, developing countries tend to have a higher growth rate than developed countries. Therefore, when analysing results on globalization and growth, it would be more accurate to go through case by case to each country

and should not be a whole generalization, or in other words, a pooled assumption. In terms of globalization and inequality, there is a separate problem to globalization in which the distribution of income has let down the idea that it should be heavily pursued. When economic growth is increasing (as a result of globalization), if it benefits more for the higher income families, it is not moral to which the lower income families suffer, and this has been the debate to many authors regarding the matter. The general consensus in empirical literature suggests that globalization has caused inequality among nations and within countries, however, there are some studies that reject this hypothesis. The mixture of results may suggest that it is unclear, and each study is dependent on which models or indicators are used in their methodology which may dictate the direction of results.

Furthermore, the general consensus can be derived that globalization as a whole tends to have mixed reviews but leads toward helping countries facilitate economic growth which is an important aspect. Since the positive effects of globalization on growth are shown to be more impactful on developing countries than developed countries. This may be due to the fact that almost all countries that are considered developed already have a high level of globalization, and extra ounces of globalization may not fuel as much growth as for developing countries. There may be a case for diminishing returns and/or convergence that occur at the high per capita income countries. However, the empirical literature shows that globalization has encouraged inequality between nations and within nations. Within nations, globalization can be viewed as an opportunity more so for already established firms to gain economic potential through profits. In the economic system of capitalism, it is the case where the owners of the capital inherit the profits who are already considered wealthy. This means that inequality will occur as a result of increased economic globalization.

Some may argue that giant corporations that engage in globalization activities cause inequality between and within nations because firms in developing countries find it impossible to compete with them. Furthermore, since the already established corporation has superior knowledge and an unrivalled amount of existing capital, they have opportunity to exploit workers' wages overseas for increased profits that flow back to the state of origin and not to the developing countries for re-investment opportunities. A famous example is Mac Donald's. However, this can be challenged and can be considered not necessarily true. Despite it being true that Mac Donald's may out challenge any fast-food restaurant that a developing country may produce as most likely they will need protectionism to grow, most Mac Donald's restaurants are privately owned as they are a franchise. This means that although the US corporation own all their

restaurants through trademark, the majority of the profits go to the private investor/shareholders of that specific Mac Donald's. Individuals or domestic firms can therefore use the idea of Mac Donald's in their country to succeed their personal goal of profits and create jobs for local people. In terms of wage exploitation, in fact, the private investor can set the wage as they like for their employees, the wages are not set by the US corporation of Mac Donald's. Therefore, the issue of wage inequality or exploitation within developing countries can be said to be an issue of the internal government system of that country.

CHAPTER 3: THE DATA SET

3.1. The Data Set

The current empirics in literature discuss mainly two aspects: globalization and economic growth or globalization and inequality. There is a gap in literature that joins the three aspects of globalization, economic growth and (social and economic) inequality. In addition, the majority of existing literature expresses inequality through economic measures such as income. The creation of a measuring proxy for social inequality will be the unique standpoint to my research. Furthermore, economic inequality measures capture within-country dispersions and check the effects of inequalities on growth from this perspective only, while, the social inequality measures capture between-country measures and allow us to compare the effects of inequalities in this different dimension.[1] The research will use the latest data possible while connecting all three indicators of globalization, economic growth and (social and economic) inequality together as one paper and discussion.

This research uses the database of the World Development Indicators (WB-WDI), extracted from the World Bank (2020). The data set utilizes annual time series observations from 2000 to 2016. The sample size initially was to be a maximum of 189 countries (based on data availability). The rationale behind the chosen time frame is to allow for more countries to be involved in the formation of the social inequality indices. Outside of the time frame, was shown to have lower variety for data selection. In addition, the decision was to use already established up to date globalization and growth indicators in today's literature, the KOF index (KOF Swiss Economic Institute, 2020) and GDP per capita. From analysing the current use of globalization measurements, the KOF Globalization index is arguably the most popular and used index in literature (Gygli *et al.* 2019). This provides trust and validity to the variable that it is the most robust measurement of globalization, hence chosen in this research. Furthermore, Potrafke (2015) reviewed over 100 empirical studies that have used the 2007 version of the KOF globalization index to measure its effects on economic growth, gender equality and human rights, to name a few. This research will be using the newest version of the KOF globalization index, published in 2018.

[1] I would like to thank the examiners for pinpointing this very insightful comment to me and helping me to make my research result clearer in that perspective.

The main focus is to collect socio-economic indicators that capture aspects of inequality in terms of education, health and gender. The database allowed for over 100 indicators. At the beginning, going through one by one, we removed irrelevant indicators and kept the relevant ones which were believed to have contributed to either education, health and gender in terms of proxies of inequality. However, during the process, there was a realization of a lot of unbalanced/or missing data for certain years and for different countries, and therefore had to remove those indicators as part of the list. It took a long process to find a set of indicators that would complement every single country.

Furthermore, some of the data followed a negative pattern in which the higher the value, the increasing negative effect of the figure. Since the data must flow in one direction, a positive direction, some of the data had to be flipped to ensure that the higher the number, that the positive effect flows in that direction. The three indicators that had to be flipped were "Prevalence of undernourishment (% of population)", "Prevalence of anaemia among children (% of children under 5)" and Vulnerable employment (as a % of the population). These were changed to "Prevalence of non-undernourishment (% of population)", "Non-prevalence of anaemia among children (% of children under 5)", and "non-vulnerable employment (as a % of the population)" respectively.

Our final sample consists of 12 indicators for 35 countries. Classified by the World Bank (2020), 19 countries were low-middle income, and 16 countries were low income. The focus of this research is not developed countries. Tables 6 and 7 show the sample countries and the variables that will be employed to capture the social inequality dimensions.

Table 6: The sample countries

Low Income	Benin, Central African Republic, Chad, Ethiopia, Gambia, Haiti, Madagascar, Malawi, Mali, Mozambique, Nepal, Niger, Tanzania, Togo, Uganda, Vietnam
Low middle income	Bangladesh, Bolivia, Cote d'Ivoire, Cameroon, Egypt, Ghana, Indonesia, Kenya, Cambodia, Lao PDR, Lesotho, Morocco, Nigeria, Nicaragua, Philippines, Senegal, El Salvador, Tunisia, Zambia

Table 7: Socio-economic indicators that will be used to capture proxies of:					
Globalization (Gygli *et al.* 2019)	**Economic Inequality** Income measures **(within-measure)**	**Social Inequality** Access to electricity **(between-measure)**	**Social Inequality** Health general **(between-measure)**	**Social Inequality** Employment opportunities **(between-measure)**	**Social Inequality** Health newborn **(between-measure)**
Trade globalization index	90/10 ratio	Access to fuels and technologies for cooking (% of population)	Antiretroviral therapy coverage (% of people living with HIV)	Employers, female (% of female employment) (modelled ILO estimate)	Immunization, DPT (% of children ages 12-23 months)
Financial globalization index	90/50 ratio	Access to electricity (% of population)	Current health expenditure per capita (current US$)	Employment to population ratio, 15+, total (%) (modelled ILO estimate)	Immunization, measles (% of children ages 12-23 months)
Cultural globalization index	50/10 ratio	Individuals using the internet (% of population)	Life expectancy at birth, total (years)	Labour force participation rate, female (% of female population ages 15-64)	New-borns protected against tetanus (%)
Political globalization index		Mobile cellular subscriptions (per 100 people)	Prevalence of non-undernourishment (% of population)	Non-Vulnerable employment, total (% of total employment) (modelled ILO estimate	Non-prevalence of anaemia among children (% of children under 5)

3.2. Social inequality index

Principal component analysis was employed to create a new social inequality index. Principal component analysis allows summarising the time series data of 12 indicators into a smaller set of summary indices which can then be used for further analysis. Furthermore, this factor

analysis considers the total variance in the data and transforms the variables into a smaller set of linear combinations.

Principal component analysis was applied using SPSS. The test was conducted on the 12 variables using all the correct procedures given by Asteriou and Hall (2006). However, the result that PCA gives us when testing for one country with the 12 variables was unclear, there was no sense in the grouping of variables. Furthermore, when using the same test for other countries, PCA would exhibit different results in the grouping of variables. Therefore, using PCA as a method for factor reduction in this panel data was found to not be the right method.

As a result, the decision was to use another method for index construction. Below will explain the construction and logic behind the grouping of variables in which was done manually. The construction of the social inequality index will be split into four parts:

Table 8: Social Inequality Indices	
SSI-1	Access to electricity (with emphasis to technologies for cooking, the internet and mobile cellular usage)
SSI-2	General Health
SSI-3	Employment opportunities
SSI-4	Health of new-borns

The first index, SSI-1, describes a country's access to electricity (with emphasis to technologies for cooking, the internet and mobile cellular usage). It includes variables to show; access to fuels and technologies for cooking (% of population); access to electricity (% of population); individuals using the internet (% of population); and mobile cellular subscriptions (per 100 people). The first two indices, retrospectively, measure basic necessities in technology that everyone including the poor should have in today's world to live a healthy life, in terms of access to light to see, heat to keep warm and gas to allow for cooking. The two remaining indices also include basic needs in communication, measured by mobile cellular subscriptions and internet. Furthermore, this captures how much percent of the population that the country

has, in the ability to access information via the internet or mobile. We will use the average of all four indices to create one index for measurement, SSI_1.
For clarification, this same approach will occur for the remaining indices.

The second index, SSI_2, involves general health; antiretroviral therapy coverage (% of people living with HIV), current health expenditure per capita (current US$), life expectancy at birth, total (years) and prevalence of non-undernourishment (% of population). These capture the access available to medicine to live a normal life with those diagnosed with HIV in low income countries. A country's health expenditure per capita can indicate the level of strength in financing for health. This can include health facilities, health information systems, and human resources. The healthcare system of a country can affect the health of that country which is very important. Utilizing health facilities especially amongst the poorest can make the biggest of differences in terms of its positive multiplier effects it has with employment opportunities and being fit for work. Life expectancy rates for developed countries are significantly higher than for developing countries. Closing the gap is important in equality in terms for health and living between the rich and the poor. The figures determining a country's population that have a below minimum level dietary energy consumption captures the inequality in the distribution of wages, paid employment and resources between different levels in class. Furthermore, good nutrition is required for the development, health, and survival of humans.

The third index, SSI_3, captures employment opportunities. However, there are figures with focus on the female gender. This captures proxies for gender inequality in the workplace. This is important because literature has shown women to be disadvantaged in the workplace in developing countries (Murphy and Cross, 2017; Cuberes and Teignier, 2014; Chen *et al*. 2013). The indicators are as follows: employers, female (% of female employment, ILO estimate); employment to population ratio, 15+, total (%, ILO estimate); labour force participation rate, female (% of female population ages 15-64, ILO estimate); and and vulnerable employment, total (% of total employment, ILO estimate). Employment ratios are important because they capture the activeness of the economy, especially in this case for females because they are normally disadvantaged in lower income countries. Gender disparities in labour force participation rates exist in every country in the world. Men are more likely to participate in labour markets than females (World Bank, 2022). The gap has been closing since the past century however the disparities still exist, and these figures will help measure this type of social inequality.

The fourth index, SSI_4, considers health for new-borns. New-borns are usually the most vulnerable to diseases to their immune systems. The health of new-borns should be first priority in the healthcare system as they are the future of the country's generation. The indicators are: immunization, DPT (% of children ages 12-23 months); immunization, measles (% of children ages 12-23 months); new-borns protected against tetanus (%); and non-prevalence of anaemia among children (% of children under 5). The level of health of a country for the most vulnerable here is captured and can relate to inequality under children's access to the appropriate resources and facilities for healthy development.

For economic inequalities, we will use the income distributions (or Gini coefficient) at the 90/10 ratio to account for inequality of the top 10% of incomes (decile 10) to the lowest 10% of incomes (decile 1). The higher the ratio will mean the higher the inequality. 90/50 ratio could also be used to account for the median and the 50/10 ratio to account for the difference in wages between the middle class and lower class.

3.3. KOFGI Index

This section specifies the formation of the KOFI Index with relevant information regarding individual variables (KOF Swiss Economic Institute, 2020). The methodology uses a weighted index. This will be useful to form the potential discussions following the results.

Table 9: KOFGI Index

Dimension	Variable Name	Variable Definitions
Trade Globalisation, de facto		
	Trade in goods	Exports and imports of goods (% of GDP)
	Trade in services	Exports and imports of services (% of GDP)
	Trade partner diversity	Average of the Herfindahl-Hirschman market concentration index for exports and imports of goods (inverted).
Trade Globalisation, de jure		
	Trade regulations	Average of two subcomponents: Prevalence of non-tariff trade barriers and

		compliance costs of importing and exporting
	Trade taxes	Income from taxes on international trade as percentage of revenue (inverted)
	Tariffs	Unweighted mean of tariff rates.
	Trade agreements	Number of bilateral and multilateral free trade agreements
Financial Globalisation, de facto		
	Foreign direct investment	Sum of stocks of assets and liabilities of foreign direct investments (% of GDP)
	Portfolio investment	Sum of stocks of assets and liabilities of international equity portfolio investments (% of GDP)
	International debt	Sum of inward and outward stocks of international portfolio debt securities and international bank loans and deposits (% of GDP)
	International reserves	Includes foreign exchange (excluding gold), SDR holdings and reserve position in the IMF (% of GDP).
	International income payments	Sum of capital and labour income to foreign nationals and from abroad (% of GDP).
Financial Globalisation, de jure		
	Investment restrictions	Prevalence of foreign ownership and regulations to international capital flows
	Capital account openness	Chinn-Ito index of capital account openness.

	International investment agreements	Number of Bilateral Investment Agreements (BITs) and Treaties with Investment Provisions (TIPs).
Interpersonal Globalisation, de facto		
	International voice traffic	International incoming and outgoing fixed and mobile telephone traffic in minutes (% of population)
	Transfers	Secondary income paid and received. Gross inflows and outflows of goods, services, income or financial items without a quid pro quo (% of population)
	International tourism	Arrivals and departures of international tourists (% of population).
	International students	Inbound and outbound number of tertiary students (% of population).
	Migration	Number of foreign or foreign-born residents (% of population).
Interpersonal Globalisation, de jure		
	Freedom to visit	Percentage of countries for which a country requires a visa from foreign visitors.
	International airports	Number of airports that offers at least one international flight connection (% of population).
Informational Globalisation, de facto		
	Internet bandwidth	Total used capacity of international internet bandwidth in bits per second (% of population)

	International patents	Patent applications by non-residents filed through the Patent Cooperation Treaty procedure or with a national patent office (% of population).
	High technology exports	Exports of high R&D intensity products in current US$ (% of population).
Informational Globalisation, de jure		
	Television access	Share of households with a television set.
	Press freedom	Quantification of the legal environment for the media, political pressure that influence reporting and economic factor that affect access to news and information.
Cultural Globalisation, de facto		
	Trade in cultural goods	Exports and imports of cultural goods defined as in UNESCO (2009) (% of population).
	Trade in personal services	Exports and imports of personal, cultural, and recreational services (% of population)
	International trademarks	Applications to register a trademark with a national or regional Intellectual Property (IP) office by non-residents in percent of all applications.
	McDonald's restaurant	Number of McDonald's restaurants (% of population).
	IKEA stores	Number of IKEA stores (% of population)
Cultural Globalisation, de jure		

	Gender parity	Ratio of girls to boys enrolled in primary education level in public and private schools
	Human capital	Human capital index based on the average years of schooling and an assumed rate of return to education.
	Civil liberties	Quantification of aspects of freedom of expression and belief, associational and organizational rights, rule of law and personal autonomy and individual rights.
Political Globalisation, de facto		
	Embassies	Absolute number of embassies in a country.
	UN peace keeping missions	Personnel contributed to U.N. Security Council Missions (% of population).
	International NGOs	Number of internationally oriented nongovernmental organisations (NGO) operating in that country
Political Globalisation, de jure		
	International organisations	Number of international inter-governmental organisations in which a country is member
	International treaties	International treaties signed between two or more states and ratified by the highest legislative body of each country since 1945.
	Treaty partner diversity	Number of distinct treaty partners of a country with bilateral investment treaties (BITs).

CHAPTER 4: METHODOLOGY

4.1. Introduction

To determine the pathway of which econometric model to employ, there will be a panel unit root test for each variable (globalization, economic growth, income, and social inequalities). The LLC, IPS and Fischer ADF tests will be used as a benchmark to assess the stationarity properties of each variable.

The variables will be split in two categories of, stationary at level, and stationary at first differences. For the variables stationary at level, a panel granger causality statistical test will be conducted on those variables to assess whether, in either direction, if there is a relationship.

For the variables stationary at first difference, a panel cointegration test will be used to establish whether there is a long run relationship (between globalization, economic growth, income, and social inequalities).

In addition, for the grouping of variables that are cointegrated, there will proceed the panel vector error correction model to visualise within the output, the short and long run dynamics, in both directions. For those not cointegrated but are stationary at first differences, a panel VAR model will be conducted, to assess only short run dynamics.

To conclude, the impulse response function will help guide the direction as well as the decay effect of each dynamic. The rationale and equations to each test are explained in each sub section of this chapter.

4.1.1. Testing for Stationarity

Time series data often exhibit properties that suggest unpredictability and cannot be modelled or used for forecasting. This is also known as non-stationary data. This is a problem because one of the fundamental assumptions for the regression model implies that the values of the data set must not be dependent on its previous values. The values must be independent. It is in need for this type of data to be transformed into stationary data if necessary and to do this, one must go through tests for stationarity.

There are differences in properties between stationary and non-stationary time series. When a time series is considered stationary, it means that shocks are temporary, and in a given time, its

effects will have no influence on mean values in the long run. The time series will exhibit the property of fluctuation around a constant long-run mean. Also, it implies that the variance is finite, and is independent of time. When a time series is non-stationary, it means that shocks have permanent effects/or components. The mean and variance will depend specifically on the chosen time point of the time series, and there is no long-run mean for the series to return to when there are shocks. The variance is unpredictable and could approach infinity as time reaches infinity. This makes it difficult for economic forecasting as the time series follows a random walk.

Non-stationary data could lead to spurious regressions. Time series data in macroeconomics can be analysed to have trends. Take a look at for example, GDP, investment, exports and imports. They show non-stationary properties because it is expected that its statistics will trend either positively or negatively, while also receiving shocks during certain or random times in the year or seasonally. Consider two unrelated non-stationary time series. We would expect at some point that the data in both series will take a "random walk" and drift either up or down. Then, if there were to be a regression analysis between the two, the results would ought to show a significantly positive relationship if the random walks were in the same direction, and a significantly negative relationship if in the opposite direction. This is a problem because both events were unrelated. Using a non-stationary time series to generate a regression in OLS may therefore lead to inaccurate conclusions.

Other ways in which spurious regressions are detected are from Granger and Newbold's (1974) idea of suggested procedure of using the coefficient of determination (R^2) and autocorrelation (Durbin-Watson test statistic) to detect for a spurious regression. For example, If R^2 > Durbin-Watson test statistic, it is said that the regression most likely would be spurious. Furthermore, the stationary and non-stationary behaviour of a time series can also be predicted through inspections of a plot graph. However, in order for clarity, there must be some form of formal hypothesis testing of the series to determine whether they contain unit roots or not.

4.1.2. Stationarity

A stationary series exhibits properties that show a constant mean, variance, and auto covariances for every lag given. This means that if there is a shock in the series, it will only be temporary and will fade given time. In addition, a shock in the series of time t will have a lesser effect in time $t + 1$ and so on. Comparing to a non-stationary series, the effects would be opposite and a shock in the series of time t is considered infinite and will not have a lesser effect in given time of $t + 1$ and so on. As one variable is regressed on another, the value of

R^2 is expected to be very low, with the t-ratio on the slope coefficient to not be significantly different from 0. In other words, the variables are suggested to not be related to each other.

Suppose we have the following AR (1) process:

$$\gamma_t = p\,\gamma_{t-1} + x_t'\delta + \epsilon_t \tag{4.1}$$

Where x_t are exogenous regressors consisting of either, a constant, or a constant and trend, p and δ being the estimated parameters, and ϵ_t as white noise. When p is greater or equal to 1, then γ is considered a non-stationary process and its variance is increased with time, with possibility of approaching to infinity. If p is less than the value of 1, γ will be considered as a trend stationary series. Furthermore, the null hypothesis being tested suggest that H_0: $p = 0$ and this is against the one-sided alternative of H_1: $p < 1$.

In addition, the standard Dickey and Fuller (1979) test estimates from the equation after subtracting γ_{t-1} from both sides.

$$\Delta\gamma_t = a\,\gamma_{t-1} + x_t'\delta + \epsilon_t \tag{4.2}$$

Where $a = p - 1$, Δ being the first difference operator, and with the null and alternative hypothesis rewritten as:

$$H_0: a = 0$$

$$H_1: a < 0$$

Furthermore, this equation can be evaluated using the conventional t-ratio for a.

$$t_a = \frac{\hat{a}}{[se(\hat{a})]} \tag{4.3}$$

Where $\hat{a}$ is the estimate of a, and $se(\hat{a})$ is the standard error coefficient. However, under the null hypothesis of a unit root, the traditional t-ratio critical values do not fit this model. The Dicker-Fuller (1979) table must be used.

The simple DF test fits for only the AR (1) process as described above. This becomes a problem when a series is correlated at a higher order of lags. This means that the white noise ϵ_t disturbance assumption becomes disrupted. In order to correct for a higher-order lag correlation, the Augmented Dicker-Fuller test is more appropriate. The difference is that this model considers the y series as AR (p), with and adding p as lagged difference terms of y from the left side to the equation, to the right side. In addition, the number of first lagged differences is independent to the asymptotic distribution of the t-ratio for a. In addition, the statistic used in this test is a negative number and the higher the value of the negative number, the stronger the rejection to the null hypothesis. The specification therefore becomes:

$$\Delta\gamma_t = a\,\gamma_{t-1} + x_t'\delta + \beta_1\,\Delta\,\gamma_{t-1} + \beta_2\,\Delta\gamma_{t-2} + \cdots + \beta_\rho\Delta\gamma_{t-\rho} + \epsilon_t \qquad (4.4)$$

This augmented equation is then tested using the same method to the Dicker-Fuller t-ratio critical values tables and through the same null and alternative hypothesis. However, MacKinnon (1991, 1996), updated the critical values tables using computer simulations for larger sets. These calculations and procedures are used in the software, EViews. The augmented version to the Dickey-Fuller test allows for appropriateness in larger sets of time series models. Moreover, the test regression allows for the choosing to add for exogenous variables. This includes adding a constant, a constant and a linear trend, or neither.

4.1.3. Panel unit root tests

As same as all types of time-series data, it is a must that we test all variables to ensure that they are stationary in this panel data set. In literature to panel unit root tests, they are extensions to Dickey-fuller's (1979) DF and ADF unit root tests. The current literature on time-series data suggests a concrete answer to stationarity problems. However, this adoption is debatable and more complicated when given panel data. Asteriou and Price (2001) suggest that given T and N being relatively larger in panel data, it also gives different evaluations for testing. Such as, as N grows, so does the power to panel unit root tests. The different degrees to heterogeneity within parameters also affect test approaches. In addition, in panel data analysis for unit roots, it is given a more difficult task to determine the validity to rejecting a unit root. The additional cross-sections or say individuals, in a panel, may exhibit different properties, that some may be stationary and some not, or some cointegration and some not. There is the question to what extent we would be able to call a panel data time series stationary. This makes application to

panel unit root tests more complicated. Given the complications, panel data may have an advantage over single time series data as it can provide a stronger initiative and power to panel unit root tests when compared to standard ADF tests. When evaluating non-stationarity and cointegration, the added cross-sectional dimension may give a selected variable more confidence due to the addition of sample size when compared to a normal time series and therefore power to the statistical tests (Baltagi and Kao, 2000).

The development of panel unit root tests in literature have created some challenges. For example, some tests require balanced panels while others allow for unbalanced panels. There have been debates about the formulation of certain null hypotheses. Where all series in the panel are considered or assumed stationary, this is a generalization to the Dickey-Fuller test of the null. On the other hand, the null can be considered as the opposite, as when there are enough evidence to support evidence for non-stationarity, it is rejected. On the theoretical side, there are also different assumptions on the asymptotic distribution to the test statistics. This refers to the rates to which the cross-sectional dimension, N, and time dimension, T, tend to infinity or are fixed. This is important for analysis to determine the asymptotic properties of the estimators and for which test is most appropriate for certain types of panel data properties (Phillips and Moon, 1999, 2000). The power to unit root tests can be limited to as when the data is of short span (Pierce and Snell, 1995). By the power to manipulate increasing N and T in the use of data, panel unit root tests were surrounded by the idea of suggesting more power when compared to a normal one (Levin *et al*. 2002).

As a result, to these analyses, this research will concentrate on using a variety of panel unit root tests. These will be from Levin, Lin and Chu (2002), Im, Perasan, and Shin (2003) and Maddala and Wu (1999). Given test results, there will be a comparison to each test to conclude whether which variables are stationary or non-stationary.

4.1.4. Common unit root processes

Levin, Lin, and Chu (LLC) employ the panel unit root test which assume common unit root processes, where p_i is identical across cross sections. LLC argued the possibility that individual unit root processes may provide less power against the alternative hypothesis that the panel has highly persistent deviations from its equilibrium. The LLC test employs the null hypothesis of a unit root against the alternative hypothesis of no unit root. The procedure includes pooling of t-statistics in regard to the estimator that all cross-sections contain unit roots against the

alternative that all cross-sections are stationary. Thus, there is the assumption that autoregressive coefficients for all individuals are homogenous.

LLC considers the ADF specification:

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j=1}^{p_i} \beta_{ij} \Delta y_{it-j} + X'_{it}\delta + \epsilon_{it} \quad (4.5)$$

This assumes a common $\alpha = p - 1$, and allows the lag orders for the difference terms, p_i to vary across different cross-sections. Therefore, the null and alternative hypothesis can be written as:

$$H_0 = a = 0$$

$$H_1 = a < 0$$

The LLC method derives the estimation of a from proxies for Δy_{it} and y_{it} , which are standardized and free from autocorrelations and deterministic components. The process estimates from two sets of equations alongside the given set of lag orders. Δy_{it} and y_{it-1} are regressed on the lag terms Δy_{it-j} (for where $j = 1, \dots, p_i$) and X_{it} which are the exogenous variables. These estimated coefficients are therefore noted as ($\hat{\beta}$: $\widehat{\delta}$) and ($\dot{\beta}$: $\dot{\delta}$) in their paper.

In regard to the first set of auxiliary estimations shown below, $\Delta \underline{y}_{it}$ is defined by using y_{it} and removing it from autocorrelations and deterministic components.

$$\underline{y}_{it-1} = y_{it-1} - \sum_{j=1}^{p_i} \beta_{ij} \Delta y_{it-j} - X'_{it}\dot{\delta} \quad (4.6)$$

By standardizing $\Delta \underline{y}_{it}$ and $\underline{y}_{it}$, dividing both by the estimated standard errors of the regression and each ADF (s_i), the test is allowed to obtain their proxies.

$$\Delta y_{it} = \left(\frac{\Delta \underline{y}_{it}}{s_i}\right)$$

$$y_{it-1} = \left(\frac{\underline{y}_{it-1}}{s_{it}}\right)$$

Furthermore, coefficient α, by using a pooled proxy equation shown below, can be estimated.

$$\Delta y_{it} = \alpha y_{it-1} + \eta_{it}$$

The LLC test also assumes that under the null, the t-statistic for resulting $\hat{a}$ is asymptotically normally distributed.

$$t_a * = \frac{t_a - (NT) S_N \hat{\sigma}^{-2} se(\hat{a}) \mu_{mT} *}{\sigma_{mT} *} \rightarrow N(0,1) \quad (4.7)$$

Where t_a implies the standard statistic for $\hat{a} = 0$, $se(\hat{a})$ being the standard error of $\hat{a}$, and $\hat{\sigma}^2$ as the estimated variance for the error term, η. In addition:

$$T = T - \left(\frac{\sum_i p_i}{N}\right) - 1 \tag{4.8}$$

S_N defines the average standard deviation ratio, $\mu_{MT} *$,for adjustment of the mean and, $\sigma_{MT} *$,the same for standard deviation.

Since the test assumes that the individual processes are cross-sectionally independent, the conditions to which the test derives. Suggest that the pooled OLS estimator for p, under the null hypothesis, follows a standard normal distribution.

4.1.5. Individual unit root processes

Since the LLC test suggest a common root process, it is restrictive in the sense that across, i, p is homogenous. For each cross section, Im, Perasan, and Shin (2003) uses specification to address for a separate ADF regression. This allows for calculation of individual root processes, which suggest that the value p_i , could and is able to vary across different cross-sections. The test combines individual unit root tests of cross sections to derive a result for the panel.

For allowing heterogeneity on the coefficient to the $\gamma_{i,t-1}$ variable, the IPS test extends the LLC test to provide the testing procedure by using the average to the individual unit-root test statistics through separate estimations for each cross section, i. The model is given by:

$$\Delta\gamma_{it} = a\,\gamma_{it-1} + \sum_{j=1}^{pi} \beta_{ij}\Delta\gamma_{it-j} + X'_{it}\delta + \epsilon_{it} \tag{4.9}$$

The null hypothesis for this equation is given by:

$$H_0: a_i = 0, for\ all\ i$$

The alternative hypothesis for this equation is given by:

$$H_1\{a_i = 0\ for\ i = 1,2,\dots,N_1\ a_i < 0\ for\ i = N+1, N+2,\dots,N$$

where i may be reordered, the condition to the alternative hypothesis requires for it to be interpreted as a non-zero fraction of the individual processes that are stationary, where $limN \to \infty \left(\frac{N1}{N}\right) = \delta$ and $0 < \delta \leq 1$. This allows for the panel unit root test to be consistent. Moreover, the null hypothesis can be formally presented in the case that all series are non-stationary processes, while the alternative suggests that a fraction of the series in the panel are stationary. In comparison to the LLC test, the LLC test assumes the alternative that all series in the panel are stationary.

Following the estimation of the individual ADF tests as shown by the formula above within the panel, the t-statistics of a_i from the individual ADF regressions are then averaged and adjusted accordingly to form test statistics.

$$t_{i_{Ti}}(\rho_i): \underline{t_{NT}} = \frac{\left(\sum_{i=1}^{N} t_{i_{T_i}}(\rho_i)\right)}{N} \tag{4.10}$$

Within the case that the lag order is at permanent zero, $(\rho_i = 0, for\ all\ i)$, the computer simulation of critical values for $\underline{t_{NT}}$ that Im, Perasan And Shin provides in their paper, account for the number of cross sections, N, series lengths, T, and for the containing of intercepts or intercepts and linear trends in the test equation.

Furthermore, in the cases where the lag orders may vary (not be non-zero) in certain cross sections of the panel, the IPS test show that a correctly standardized $\underline{t_{NT}}$ has an asymptotic standard normal distribution. This is shown as:

$$W_{\underline{t_{NT}}} = \frac{\sqrt{N}(\underline{t_{NT}} - N^{-1}\sum_{i=1}^{N} E\left(\underline{t_{iT}}(p_i)\right)}{\sqrt{N^{-1}\sum_{i=1}^{N} Var\left(\underline{t_{iT}}(p_i)\right)}} \to N(0,1) \tag{4.11}$$

The expected mean and variance for the ADF test regression t-statistics are as follows, $E(\underline{t_{iT}}(p_i))$ and Var $(\underline{t_{iT}}(p_i))$, respectively. Simulations from Monte Carlo suggest that the small sample performance of the IPS test is greater than the LLU test. The asymptotic properties to the IPS test requires $N/T \to 0$ for $N \to \infty$. Size distortions would show if either N is small or if N is larger relative to T. Also, the test statistic follows the similar specification to choosing number of lags and the deterministic component for every cross-section ADF equation. These are either individual constraints, or individual constant and trend terms. Furthermore, by adding deterministic terms into the equation, it will decrease its power.

4.1.6. Fisher ADF and PP

An alternative approach to heterogeneous panel unit tests alongside IPS, suggest the Fisher ADF and PP tests developed by Maddala and Wu (1999). The proposal by Maddala and Wu, demonstrated a model to allow testing for unbalanced panels. Although they agree with the assumption that a heterogenous alternative is preferred, it is disagreed upon that using average ADF-statistics to determine stationarity is the best option. Instead, by combining the average of p-values of individual tests, this idea was argued to be of better measurement.

Where π_i , is defined by p-values of individual unit root tests for cross sections, i, and under the null hypothesis of a unit root for N (cross-sections), an asymptotic result can be derived that:

$$P = -2\sum_{i=1}^{N} log\ \log(\pi_i) \to X_2^2\ N \tag{4.12}$$

In addition to the equation, it is demonstrated that:

$$Z = \frac{1}{\sqrt{N}}\sum_{i=1}^{N} \phi^{-1}(\pi_i) \to X_2^2 N \tag{4.13}$$

Where, ϕ^{-1} , is defined as the inverse of the standard normal cumulative distribution function. The asymptotic X^2 and standard normal statistics are derived through using the Phillips-Perron individual unit root tests and ADF on Eviews. The null and alternative hypothesis is identical

to the IPS test. P-values are obtained by Monte Carlo simulations and exogenous variables for the test equations must be specified for both tests.

In conclusion, there are no dominant performances of each test (IPS, LLC and Fischer). It is difficult to separate which test is most appropriate in which therefore a summary of panel unit roots will be presented and compared in this research.

4.2. Panel cointegration

This section will explain the panel cointegration tests to be used in the research as well as its purpose. The use of cointegration techniques help determine whether there are stable, long-run relationships between two or more non-stationary time series. Suppose we have two variables in a regression, X_{it} and Y_{it}. They may integrated of the same order, however, there are possibilities that the residuals u_{it} are not of the same order. To test for cointegration, it is necessary that all three are integrated in the same order. When one or more I(1) series are considered cointegrated, this suggests that they exhibit the properties of moving together in a long-run equilibrium fashion. This research will focus on three methods to panel cointegration. These are Pedroni (1999, 2004) and Kao (1999), which are residual based and are taken from the Engle-Granger two-step variation.

Model

Consider the following regression:

$$y_{it} = a_i + \delta_i t + \beta_i X_{it} + e_{it} \tag{4.14}$$

The regression refers to a panel time series of observables y_{it} and X_{it} whereby individuals, classified as $i = 1,2, \dots, N$, time periods, $t = 1,2, \dots, N$. y_{it} and X_{it} represents non-stationary dependent variables whereby the first difference to this variable suggests stationarity. Under the null hypothesis of no cointegration, the residual to e_{it} is considered to be integrated in order of I(1). a_i and δ_i represent parameters in the model allowing for member specific fixed effects and deterministic trends. Furthermore, to allow for cointegrating vectors to be heterogeneous across individuals in the panel, the slope coefficient β_i can vary across the panel. This regression is then to be tested with the null, of,

H_0: $All\ of\ the\ individuals\ are\ not\ cointegrated$,

to the alternative,

H_1: $All\ of\ the\ individuals\ are\ cointegrated$.

However, this will be the case if the data generating process requires that all individuals be cointegrated or not cointegrated under the null and alternative. If individual members are allowed to differ in terms of whether they are cointegrated or not, then the regression is to be tested with the alternative of,

$$H_1: a\ significant\ amount\ of\ individuals\ are\ cointegrated.$$

The null to the tests in Kao (1999) and Pedroni (1999,2004) share the null that y_{it} and X_{it} are not cointegrated. Therefore, the rejection to the null hypothesis suggests that e_{it} have stationarity properties and that y_{it} and X_{it} are cointegrated.

In the Pedroni specification, exogenous regressors are an option to be included within the second-stage regression. More specifically, these are individual fixed effects, individual effects and trends, or none. Kao only allows for individual fixed effects. The optimum lag length is to be calculated for each cross section to where T_i represents lengths to the cross-sections, i:

$$int(min\left(\frac{T_i - K}{3}, 12\right)\left(\frac{T_i}{100}\right)^{\frac{1}{4}}) \tag{4.15}$$

4.2.1. Pedroni (Engle-Granger) Cointegration

Pedroni's (1999, 2004) is an extension to the Engle-Granger (1987) framework to allow for tests involving panel data. The development to the seven test statistic was introduced to test the null hypothesis of no cointegration in nonstationary panels. The test is residual-based and allows for heterogeneity in the slope and intercept coefficients. This model would therefore apply for both short run dynamics and long run slope coefficients across the panel. The regressions below show the test statistics and residuals that are obtained from:

$$y_{i,t} = a_i + \beta_{1i}\chi_{1i,t} + \beta_{2i}\chi_{2i,t} + \cdots + \beta_{Mi}\chi_{Mi,t} + e_{i,t} \tag{4.16}$$

$$\Delta y_{i,t} = \sum_{m=1}^{M} \beta_{mi}\Delta\chi_{mi,t} + \eta_{i,t} \tag{4.17}$$

$$\hat{e}_{i,t} = \hat{\gamma}_i\hat{e}_{i,t-1} + \hat{\mu}_{i,t} \tag{4.18}$$

$$\hat{e}_{i,t} = \hat{\gamma}_i\hat{e}_{i,t-1} + \sum_{k=1}^{K} \hat{\gamma}_{i,k}\Delta\hat{e}_{i,t-k} + \hat{\mu}_{i^*,t} \tag{4.19}$$

where the number of individuals in the panel is determined by, $i = 1,2,\dots,N.$, the number of time periods, $t = 1,2,\dots,T.$, and the number of regressors $m = 1,2,\dots,M.$, and the number of lags within the ADF regression, $k = 1,2,\dots,K.$

Following this, series and parameters are to be calculated from the regressions above and achieving:

$$\hat{s}_i^{*2} = \frac{1}{T}\sum_{t=1}^{T}\hat{\mu}_{i,t}^{*2}, \qquad \tilde{s}_{N,T}^{*2} = \frac{1}{N}\sum_{n=1}^{N}\hat{s}_i^{*2} \tag{4.20}$$

$$\hat{L}_{11i}^{-2} = \frac{1}{T}\sum_{t=1}^{T}\hat{\eta}_{i,t}^2 + \frac{2}{T}\sum_{s=1}^{k_i}\left(1-\frac{s}{k_i+1}\right)\sum_{t=s+1}^{T}\hat{\eta}_{i,t}\hat{\eta}_{i,t-s} \tag{4.21}$$

$$\hat{\lambda}_i = \frac{1}{T}\sum_{s=1}^{k_i}\left(1-\frac{s}{k_i+1}\right)\sum_{t=s+1}^{T}\hat{\mu}_{i,t}\hat{\mu}_{i,t-s} \tag{4.22}$$

$$\hat{s}_i^2 = \frac{1}{T}\sum_{t=1}^{T}\hat{\mu}_{i,t}^2, \qquad \hat{\sigma}_i^2 = \hat{s}_i^2 + 2\hat{\lambda}_i, \qquad \hat{\sigma}_{N,T}^2 = \frac{1}{N}\sum_{n=1}^{N}\hat{L}_{11i}^{-2}\hat{\sigma}_i^2 \tag{4.23}$$

The deriving of these statistics are split into categories based on, within-dimension (panel-specific) and between-dimension (group-specific). Pedroni explains that this is dependent on whether the AR parameters have individual slope coefficients, or if they are considered homogenous over the panel. Moreover, seven statistics are constructed and formed from the following equations:

Panel v:

$$T^2N^{\frac{3}{2}}\left(\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{i,t-1}^2\right)^{-1} \tag{4.24}$$

Panel p:

$$T\sqrt{N}\left(\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{i,t-1}^2\right)^{-1}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\left(\hat{e}_{i,t-1}\Delta\hat{e}_{i,t}-\hat{\lambda}_i\right) \tag{4.25}$$

Panel t:

$$\left(\tilde{\sigma}_{N,T}^2\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{i,t-1}^2\right)^{-\frac{1}{2}}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\left(\hat{e}_{i,t-1}\Delta\hat{e}_{i,t}-\hat{\lambda}_i\right) \tag{4.26}$$

Panel ADF: $\left(\tilde{s}_{N,T}^{*2}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{i,t-1}^{*2}\right)^{-\frac{1}{2}}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{i,t-1}^{*}\Delta\hat{e}_{i,t}^{*}$ (4.27)

Group p:

$$T\ \frac{1}{\sqrt{N}}\sum_{i=1}^{N}\left(\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{e}_{i,t-1}^2\right)^{-1}\sum_{t=1}^{T}\left(\hat{e}_{i,t-1}\Delta\hat{e}_{i,t}-\hat{\lambda}_i\right) \tag{4.28}$$

Group t:

$$\frac{1}{\sqrt{N}}\sum_{i=1}^{N}\left(\hat{\sigma}_i^2\sum_{t=1}^{T}\hat{e}_{i,t-1}^2\right)^{-\frac{1}{2}}\sum_{t=1}^{T}\left(\hat{e}_{i,t-1}\Delta\hat{e}_{i,t}-\hat{\lambda}_i\right) \tag{4.29}$$

Group ADF:

$$\frac{1}{\sqrt{N}}\sum_{i=1}^{N}\left(\sum_{t=1}^{T}\hat{s}_i^{*2}\hat{e}_{i,t-1}^{*2}\right)^{-\frac{1}{2}}\sum_{t=1}^{T}\hat{e}_{i,t-1}\Delta\hat{e}_{i,t} \tag{4.30}$$

Despite this, the test statistics are adjusted so that they are distributed as $N\ (0,1)$ under the null hypothesis. This is given by:

$$\frac{\chi_{N,T}-\ \mu\sqrt{N}}{\sqrt{v}} \tag{4.31}$$

Where $\chi_{N,T}$ is represented by the standardized form of the above test statistics regarding N and T. μ and v are parameters of the mean and variance to the simulated test statistics. The adjustment terms may vary depending on factors such as the number of regressors, type of test and whether time trends are included within the equations. Furthermore, as the null hypothesis is rejected, the panel v statistic is described to go to positive infinity while the other statistics go to negative infinity.

4.2.2. Kao (Engle-Granger) cointegration test

The Kao cointegration test follows similar to the Pedroni test, as it is also an extension to the Engle-Granger variation, however, it specifies cross-section specific intercepts and homogeneous coefficients on the regressors in the first stage. The tests present ADF and DF type tests for panel cointegration.

Given the bivariate regression:

$$y_{it}=a_i+\ \beta x_{it}+\ e_{it} \tag{4.32}$$

$$y_{it}=y_{it-1}+\ u_{i,t}$$

$$x_{it}=x_{it-1}+\ \epsilon_{i,t}$$

Where $t=1,\dots,T.$, and $i=\ 1,\dots,I.$, a_i may be required to heterogeneous but β_i homogenous across cross-sections. In addition, trend coefficients, γ_i, will be set to zero.

Two specifications to the Kao regressions are then run, either the pooled auxiliary DF regression or the augmented type of the ADF pooled specification, shown below:

$$e_{it} = pe_{it-1} + \upsilon_{it} \tag{4.33}$$

$$e_{it} = \tilde{p}e_{it-1} + \sum_{j=1}^{p} \psi_j \Delta e_{it-j} + \upsilon_{it} \tag{4.34}$$

The following statistics are developed under the null hypothesis of no cointegration:

$$DF_p = \frac{T\sqrt{N(\hat{p}-1)} + 3\sqrt{N}}{10.2} \tag{4.35}$$

$$DF_t = \sqrt{1.25}t_p + \sqrt{1.875N} \tag{4.36}$$

$$DF_p^* = \frac{\sqrt{NT(\hat{p}-1)} + 3\sqrt{N}\hat{\sigma}_v^2/\hat{\sigma}_{0v}^2}{\sqrt{3 + 36\hat{\sigma}_v^4/(5\hat{\sigma}_{0v}^4}} \tag{4.37}$$

$$DF_t^* = \frac{t_p + \frac{\sqrt{6}N\hat{\sigma}_v}{2\hat{\sigma}_{0_v}}}{\frac{\sqrt{\frac{\hat{\sigma}_{0v}^2}{2\hat{\sigma}_v^2} + 3\hat{\sigma}_v^2}}{10\hat{\sigma}_v^2}} \tag{4.38}$$

For the augmented version, where $p > 0$, the following alternative is presented:

$$ADF = \frac{t_{\underline{p}} + \frac{\sqrt{6}N\hat{\sigma}_v}{2\hat{\sigma}_{0_v}}}{\frac{\sqrt{\frac{\hat{\sigma}_{0v}^2}{2\hat{\sigma}_v^2} + 3\hat{\sigma}_v^2}}{10\hat{\sigma}_v^2}} \tag{4.39}$$

as the model converges to $N(0,1)$ asymptotically, the estimated variance is $\hat{\sigma}_v^2 = \hat{\sigma}_u^2 - \hat{\sigma}_{u\epsilon}^2 \hat{\sigma}_\epsilon^{-2}$ and the estimated long run variance, $\hat{\sigma}_{0v}^2 = \hat{\sigma}_{0u}^2 - \hat{\sigma}_{0u\epsilon}^2 \sigma_{0\epsilon}^{-2}$.

Furthermore, the covariance of, $\omega_{it} = [u_{it}\ \epsilon_{it}\ ]$, is to be estimated as the following:

$$\sum = [\hat{\sigma}_u^2 \quad \widehat{\hat{\sigma}_{u\epsilon}}\ \hat{\sigma}_{u\epsilon} \quad \hat{\sigma}_\epsilon^2\ ] = \frac{1}{NT}\sum_{i=1}^{N}\sum_{t=1}^{T} \omega_{it}\omega_{it}' \tag{4.40}$$

With the long run covariance being estimated in accordance to the kernel estimator,

$$\widehat{\Omega} = [\hat{\sigma}_{0u}^2 \quad \hat{\sigma}_{0u\epsilon}\ \hat{\sigma}_{0u\epsilon} \quad \hat{\sigma}_{0\epsilon}^2\ ] = \frac{1}{N}\sum_{i=1}^{N}\left[\frac{1}{T}\sum_{t=1}^{T}\widehat{\omega}_{it}\widehat{\omega}_{it}' + \frac{1}{T}\sum_{\tau=1}^{\infty}\kappa\left(\frac{\tau}{b}\right)\sum_{t=\tau+1}^{T}(\widehat{\omega}_{it}\widehat{\omega}_{it-\tau}' + \widehat{\omega}_{it-\tau}\widehat{\omega}_{it}')\right] \tag{4.41}$$

With κ being the supported kernel functions and b implying bandwidth.

4.3. Granger Causality and Vector Auto Regression Models

The granger causality test was first introduced in 1969 (Granger, 1969) and was used to statistically hypothesise whether a time series has properties to show that it is useful in forecasting another. In addition, it measures whether a lagged time series has a correlation toward another. The VAR model can also be considered as a means of conducting this type of methodology.

VAR models were first introduced by Sims (1980). This is a technique mainly used in time series macroeconomics to characterize the dynamic behaviors between two or more variables. The model allows the identification of structural parameters without the requirement of strong restrictions. It is quite common in econometrics to have variables which are not just explanatory variables in an equation given a suitable dependent variable. It also may be the case that they are relevant when the explanatory variables and dependent variables are reversed. Furthermore, it is argued that simultaneity should suggest that all variables should be treated as endogenous. Following this, it is determined that each equation in a VAR model ought to have the same regressors.

Given a VAR that contains a set of m variables, each expressed as a linear function, and of p lags of itself as well as all other $m-1$ variables, and additionally the error term.

This is shown below:

$$y_{ti} = \beta_{yi0} + \beta_{yyi1} y_{ti-1} + \cdots + \beta_{yyip} y_{ti-p} + \beta_{yxi1} x_{ti-1} + \beta_{yxip} x_{ti-p} + v_{ti}^{y} \quad (4.42)$$

$$x_{ti} = \beta_{xi0} + \beta_{xyi1} x_{ti-1} + \cdots + \beta_{xyip} y_{ti-p} + \beta_{xxi1} x_{ti-1} + \beta_{xxip} x_{ti-p} + v_{ti}^{x} \quad (4.43)$$

To clarify, β_{xyp}, is the coefficient of y in the second equation for x at given lags of p. For further clarification if there was to be a third variable, the third equation would be written as β_{xzp}, given p as number of lags for variable z, and be added to the right-hand side to each of three equations.

The assumptions of the two equations are written that both, y_t and x_t, are stationary, and error terms, v_t^y and v_t^x, are considered uncorrelated white-noise error terms. As only lagged variables are included in the right-hand side of the equations and not current form variables, it is assumed that the regressors are weakly exogenous, and that OLS can provide an estimation that is appropriate. This is because there is no issue of simultaneity in the VAR model.

4.3.1 Vector Error Correction Model

In the case where we have two or more variables that are cointegrated, a vector error correction model (VECM) can be used to analyse long-run dynamics as well as short-run. A VECM is a specification that restricts a VAR according to cointegration properties. The restriction to long-term behaviour, known as the error term, allows the identification of partial short-run adjustments that correct for the deviations to its intended long-run equilibrium.

This is shown below:

$$\Delta y_t = \beta_{y0} + \beta_{y1} \Delta y_{t-1} + \beta_{yp} \Delta y_{t-p} + y_{y1} \Delta x_{t-1} + \cdots + y_{yp} \Delta x_{t-p} - \lambda_y (y_{t-1} - a_0 - a_1 x_{t-1}) + v_t^y \quad (4.44)$$

$$\Delta x_t = \beta_{x0} + \beta_{x1} \Delta y_{t-1} + \beta_{xp} \Delta y_{t-p} + y_{x1} \Delta x_{t-1} + \cdots + y_{xp} \Delta x_{t-p} - \lambda_x (y_{t-1} - a_0 - a_1 x_{t-1}) + v_t^x \quad (4.45)$$

Where $y_t = a_0 + a_1 x_t$ identifies the long run cointegration relationship between y_t and x_t, and λ_y and λ_x are the error correction parameters.

This can also be re-written as:

$$\Delta y_{i,t} = a_0 + a_{1i} \sum_{j=1}^{2} \Delta y_{i,t-j} + a_{2i} \sum_{k=1}^{2} \Delta x_{i,t-k} + \pi \, ecm_{t,t-1} + u_{i,t} \quad (4.46)$$

Given this, we expect that as both series are stationary at first differences, $y_{t-1} - a_0 - a_1 x_{t-1}$, must also be stationary to confirm this. Furthermore, the expectation is that either $\lambda_y < 0$ or $\lambda_x < 0$. This is because if y_{t-1} is above its long-run intended equilibrium value in relation to x_{t-1}, the value of the parenthesis relating to the error correction term should be positive, in which will lead y_t to a downward movement to correct for its deviation to long-run equilibrium. This also works for the opposite. If x_{t-1}

is of higher value in relation to y_{t-1}, the value of the parenthesis relating to the error correction term should be negative, in which will lead y_t to an upward movement to correct for its deviation to long-run equilibrium. In this case we also expect Δx_t to be of negative value. However, this depends on whether there is granger causality that exists in both directions. A cointegration relationship suggests that granger causality must exist in at least one direction between the variables in the system. Furthermore, as y causes x, it may also or not be the case that x causes y.

4.3.2. Impulse Response Function (IRF)

To further extend VAR modelling, impulse response functions can be used to evaluate the dynamic properties of vector auto regressions (Lutkepohl, 1990). This includes forecasting with emphasis toward both short and long run if there is found to be cointegration. Furthermore, the effect of a one standard deviation shock is measured from one variable to another.

Accordingly, to the lag structure of the VAR, the shock of i^{th} variable will not only have an impact upon the i^{th} variable itself but is transmitted towards all other endogenous variables. The one-time shock effect of an i^{th} variable is traced by the impulse response function on the current and future values of all variables. Assuming that the errors of all innovations, $\in_{t,i}$, in the model are contemporaneously uncorrelated, $\in_{t,i}$ can be viewed as the value for the shock toward the endogenous variable, $y_{t,i}$. If the errors are contemporaneously correlated, an alternative transformation is applied:

$$u_t = P \ \in_t \ \sim (0, D) \tag{4.47}$$

whereby D represents the diagonal covariance matrix, and P, as the response standard errors.

CHAPTER 5: RESULTS

Chapter **five** presents the empirical results in appropriate tables. The **first** study examines globalization and economic growth. The **second** examines economic growth and (social) inequality. The **third** study examines globalization and (social) inequality. Following this, a unique analysis on the relationship between globalization, economic growth and (social) inequality is formed according to the empirical findings.

In regard to the robustness and diagnostics of each econometric model, the panel vector error correction and VAR models show that, in the Appendix, that it is reasonable to conclude that there are no major first-order serial auto-correlation as well as heteroskedasticity issues. Furthermore, robust standard error methods cross-checks find no issues. In addition, all variables are tested in their stationary form.

Furthermore, the impulse response function explanations regarding its graph interpretations should be treated with caution. The confidence intervals at 2 standard errors suggest that the movement may fluctuate between these bands.

5.1. Panel unit root tests

The importance of testing the panel for possible unit roots is explored in chapter 4. In this testing procedure, there are usage of a variety of panel unit root tests. Table 10 presents the results. Levin, Lin and Chu (2002), Im, Pesaran and Shin (2003), and Maddala and Wu (1999), all test the null hypothesis of all panels possessing a unit root and thus non-stationary processes.

The table represents the panel unit root tests in level and first difference where necessary. When a variable is shown to be stationary at level, in any of the intercept or intercept and trend specifications, an additional test, at first difference, is not required. The rejection of the null hypothesis is determined by either at the 1% of 5% significance level. The decision will be based on a comparison between four tests within both specifications. The third specification of, no trend, is not shown because they were non-significant at both l(0) and l(1) orders of integration.

Also to note that the null hypothesis for the LLC assumes common root processes while the IPS, ADF and PP tests assume individual root processes. LLC is a homogenous approach whilst the IPS, ADF and PP are heterogenous approaches when testing against the alternative. Moreover, LLC is evaluated under the null that all countries have unit roots while IPS, ADF and PP tests allow some countries in the panel to have unit roots.

The results show for variable, **SS1**, that in the intercept specification, the null hypothesis could not be rejected at either the 1% or 5% level for all four tests. In the intercept and trend, only one out of four, the LLC test, showed a rejection of the null hypothesis at the 1% level. For the variable in the first

difference, **ΔSS1**, all tests (apart from LLC in intercept and trend) show that the series possesses no unit root at the 1% level. Furthermore, this suggests that the variable, SS1, is stationary at first difference. The significant LLC test alone in the intercept and trend suggesting stationary at level can be said to be not enough and is outweighed by the other tests. In other words, this variable is integrated in order of I(1).

Table 10: Panel Unit Root Test Results

Unit Root Tests Results - Levels								
Model	**Intercept**				**Intercept and Trend**			
Variable	**LLC**	**IPS**	**ADF**	**PP**	**LLC**	**IPS**	**ADF**	**PP**
SS1	7.26	12.16	20.58	6.24467	-4.09***	0.92	78.15	60.73
SS2	-3.60	8.30	17.66	15.86	0.10	2.66	49.14	43.54
SS3	-4.22***	-1.40	97.85**	93.69**	-5.71***	-2.45***	105.45***	87.79
SS4	-9.42***	-5.18***	146.89***	118.74***	-5.58***	-2.23**	102.90***	106.25***
GDP	7.18	10.08	38.87	31.18	-3.27***	2.09	68.35	68.93
KOFGI	-7.37***	-0.76	81.02	112.47***	-0.02	1.75	81.25	74.84
90/50 ratio	-16.77***	-9.47***	215.61***	154.89***	-3.00***	-2.20***	103.91***	112.77***
90/10 ratio	-16.23***	-6.66***	148.39***	113.11***	-1.38	0.30	73.70	92.69**
50/10 ratio	10.00***	-8.01***	176.59***	152.06***	-6.66***	-4.16***	117.39***	123.47***
Unit Root Tests Results – First Differences								
Model	**Intercept**				**Intercept and Trend**			
Variable	**LLC**	**IPS**	**ADF**	**PP**	**LLC**	**IPS**	**ADF**	**PP**
Δ(SS1)	-7.33***	-6.66***	162.79***	169.5***	-	-5.09***	142.96***	155.11***
Δ(SS2)	-8.86***	-8.24***	193.27***	201.55***	-9.79***	-6.42***	159.78***	195.34***
Δ(SS3)	--	-7.08***	--	--	--	--	--	169.20***
Δ(GDP)	-8.22***	-7.83***	195.34***	216.95***	--	-7.27***	173.86***	199.03***
Δ(KOFGI)	--	-15.79***	343.96***	--	-18.38***	-16.07***	328.34***	392.26***
Δ(90/10 ratio)	--	--	--	--	-16.97***	-9.60***	197.16***	--

Notes: This tables reports Panel Unit Root test results for all variables. LLC, IPS, ADF, and PP are notations for Levin, Lin and Chu (2002), Im, Pesaran and Shin (2003), Maddala and Wu (1999), and Choi (2001) tests, respectively. Δ denotes variables in first differences. The critical values at 5% and 1%, respectively, for IPS are -1.73 and -1.82 (intercept), and -2.38 and -2.46 (intercept and trend). For LLC, these are -1.82 and -2.5 (intercept), at 5%, and -1.93 and -2.62 (intercept and trend), at 1%.

SS2, in both the intercept, and intercept and trend specification, all four tests showed that the null hypothesis of unit root processes could not be rejected at either the 1% or 5% level. For variable in the first difference, **ΔSS2**, all four tests show that the series possesses no unit root at the 1% significance

level. This shows a clear result for the variable to be non-stationary at level but stationary at first difference. Furthermore, this variable is integrated in order of I(1).

SS3, in the intercept specification, three out of four agree to reject the null hypothesis of unit root processes. The LLC test rejects the null hypothesis at the 1% significance level, while the ADF and PP tests only agree and apply at the 5% significance level. However, IPS test shows that the null hypothesis cannot be rejected at any significance level. In the intercept and trend specification, the LLC, IPS, and ADF tests reject the null at the 1% level. The PP test, however, disagrees and suggests that the null hypothesis cannot be rejected. For variables in the first difference, **ΔSS3**, in the intercept and trend specification, for both IPS and PP tests, the null is rejected at the 1% significance level. From the results, we can see that there is a majority leaning toward the variable being stationary at level. This means that the variable, SS3, is integrated in order of I(0).

SS4, in both the intercept, and intercept and trend specification, show that all four tests reject the null hypothesis. The only difference is that the IPS test, in the intercept and trend specification, rejects the null at the 5% significance level. All other tests reject the null at the 1% significance level. Furthermore, this implicates that SS4 is stationary at level and is integrated in order of I(0).

GDP, in the intercept specification, shows that in the four tests, the null hypothesis cannot be rejected at any significance level. In the intercept and trend specification, only the LLC test rejects the null, at the 1% significance level. For the variable in the first difference, **ΔGDP**, all four tests reject the null at the 1% level in both specifications. The result majority therefore implies that ΔGDP is integrated in order of I(1).

KOFGI, in the intercept specification, shows that the LLC and PP tests reject the null hypothesis at the 1% significance level. The IPS and ADF tests do not agree. In the intercept and trend specification, all four tests agree that the null hypothesis cannot be rejected. For variables in the first difference, **ΔKOFGI**, show a rejection of the null hypothesis at 1% level for all remaining tests. This result majority suggests that this variable possesses a unit root (non-stationary) at level but stationary first difference. This means that the variable KOFGI is integrated in order of I(1).

90/50 ratio, in both the intercept, and intercept and trend specification, show a rejection of the null hypothesis at the 1% significance level for all four tests. This variable shows strong evidence to be stationary at level and is therefore integrated in order of I(0).

90/10 ratio, in the intercept specification, shows a rejection to the null hypothesis at the 1% significance level for all four tests. In contrast to the intercept and trend specification, only the PP test rejects the null hypothesis, and this is at the 5% significance level. The LLC, IPS and ADF tests disagree and suggest that this variable is non-stationary at level. For variables at the first difference, **Δ90/10 ratio,** show a rejection of the null hypothesis at the 1% level in the intercept and trend specification, for the

LLC, IPS and ADF tests. Comparing the results, the result majority suggests that the 90/10 ratio is stationary at level. This means that the variable is integrated in order of l(0).

For additional context, D annotates the first difference, meanwhile L specifies that there is a log transformation of that variable.

	Table 11: Test results for Optimal Lag Length (GDP) Granger Causality		
Relationship	Lag structure	AIC	SIC
DLGDP -----> 90/10 Ratio	2,2	-3.760	-3.713
	2,1	**-3.763**	**-3.725**
	1,2	-3.705	-3.66
	1,1	-3.708	-3.68
90/10 Ratio -----> DLGDP	2,2	6.682	6.73
	2,1	**6.631**	6.669
	1,2	6.677	6.717
	1,1	6.632	**6.660**
DLGDP ----> 50/10 Ratio	2,2	-3.755	-3.707
	2,1	**-3.758**	**-3.720**
	1,2	-3.697	-3.662
	1,1	-3.701	-3.67
50/10 Ratio ----> DLGDP	2,2	1.845	1.89
	2,1	**1.783**	**1.821**
	1,2	1.85	1.89
	1,1	1.807	1.83
DLGDP ----> 90/50 Ratio	2,2	-3.743	-3.696
	2,1	**-3.747**	**-3.71**
	1,2	-3.685	-3.649
	1,1	-3.689	-3.66
90/50 Ratio ----> DLGDP	2,2	0.985	1.036

	2,1	**0.945**	0.983
	1,2	0.98	1.026
	1,1	0.94	**0.975**
DLGDP ----> SS3	2,2	**-3.830**	-3.788
	2,1	-3.829	**-3.795**
	1,2	-3.771	-3.739
	1,1	-3.769	-3.74
SS3 ----> DLGDP	2,2	1.078	1.121
	2,1	**1.050**	1.082
	1,2	1.08	1.12
	1,1	1.057	**1.08**
DLGDP ----> SS4	2,2	**-3.830**	-3.78
	2,1	-3.830	**-3.796**
	1,2	-3.771	-3.73
	1,1	-3.77	-3.74
SS4 ----> DLGDP	2,2	4.783	4.826
	2,1	4.780	4.813
	1,2	4.781	4.815
	1,1	**4.779**	**4.804**

	Continued: Test results for Optimal Lag Length (KOFGI) Granger Causality		
Model	Lag Structure	AIC	SIC
DLKOFGI -----> 90/10 Ratio	2,2	-4.478	-4.431
	2,1	**-4.483**	**-4.446**
	1,2	-4.448	-4.412
	1,1	-4.449	-4.423

90/10 Ratio -----> DLKOFGI	2,2	6.671	6.721
	2,1	6.633	6.671
	1,2	6.666	6.706
	1,1	**6.633**	**6.662**
DLKOFGI ----> 50/10 Ratio	2,2	-4.480	-4.433
	2,1	**-4.485**	**-4.447**
	1,2	-4.449	-4.413
	1,1	-4.452	-4.425
50/10 Ratio ----> DLKOFGI	2,2	1.833	1.884
	2,1	**1.784**	**1.822**
	1,2	1.839	1.880
	1,1	1.808	1.836
DLKOFGI ----> 90/50 Ratio	2,2	-4.477	-4.429
	2,1	**-4.481**	**-4.443**
	1,2	-4.443	-4.408
	1,1	-4.447	-4.420
90/50 Ratio ----> DLKOFGI	2,2	0.991	1.041
	2,1	0.945	0.983
	1,2	0.991	1.031
	1,1	**0.948**	**0.976**
DLKOFGI ----> SS3	2,2	-4.500	-4.457
	2,1	**-4.504**	**-4.469**
	1,2	-4.473	-4.441
	1,1	-4.475	-4.451
SS3 ----> DLKOFGI	2,2	1.083	1.126
	2,1	1.053	1.086
	1,2	1.092	1.126

	1,1	**1.061**	**1.085**
DLKOFGI ----> SS4	**2,2**	**-4.515**	**-4.472**
	2,1	-4.502	-4.468
	1,2	-4.477	-4.445
	1,1	-4.471	-4.446
SS4 ----> DLKOFGI	2,2	4.784	4.827
	2,1	4.780	4.812
	1,2	4.782	4.816
	1,1	**4.778**	**4.802**

50/10 ratio, in both the intercept, and intercept and trend specification, show a rejection in the null hypothesis for all four tests, at the 1% significance level. This implicates there is strong evidence to suggest that this variable is stationary at level. Therefore, variable, 50/10 ratio, is integrated in order of l(0).

To summarise, according to the results, five out of nine variables, SS3, SS4, 90/50 ratio, 90/10 ratio and 50/10 ratio, are considered to be stationary at level. These are to be described as l(0) variables. The remaining four variables, SS1, SS2, GDP and KOFGI, are non-stationary at level. In first difference, however, the results show that they are stationary and therefore will be described as l(1) variables.

To further proceed from these results, the non-stationary variables (SS1, SS2, GDP and KOFGI) are to be converted to first difference to allow for only stationary variables to be used in the estimated models. The notation to first differences is to be represented by the Greek letter Δ. The non-stationary variables are therefore transformed as ΔSS1, ΔSS2, ΔGDP and ΔKOFGI.

5.2. Short-Run Effects

Following the results and combination specifically for I(0) and I(1) variables, we will predict using the Enger Granger causality test, to test for which time series is useful in forecasting another. In addition, the Granger Causality tests suggest short-run implications of these variables. As the model requires both variables to be stationary, we will use the differentiated log variables of KOFGI and GDP as proxies for globalization and economic growth as they are stationary at first difference. As the test is sensitive to the number of lags, we use the AIC and SIC criteria comparison to select the optimal number of lags for each relationship individually. The lag structure test we have used is of 4 vectors consisting of models: 2,2, 2,1, 1,2, and 1,1.

Then, each model is run and compared with the values of AIC and SIC criteria. The model with the lowest value is chosen as the most appropriate lag structure model. The results reveal that for the relationship between, whereby the first variable is considered the dependent variable, DLGDP and 90/10, DLGDP and 50/10, DLGDP and 90/50, DLKOFGI and 90/10, DLKOFGI and 50/10, DLKOFGI and 90/50, 50/10 and GDP, and 50/10 and DLKOFGI, it is agreed upon both criteria that the most appropriate lag structure model is of 2,1. For DLKOFGI and SS4, both criteria agree the lag structure of 2,2 and for SS4 and DLKOFGI, its 1,1. The rest of the series for, 90/10 and DLGDP, 90/50 and DLGDP, DLGDP and SS3, SS3 and DLGDP, DLGDP and SS4, 90/10 and DLKOFGI, 90/50 and DLKOFGI, SS3 and DLKOFGI, reveal that both criteria disagree on which is the most appropriate lag structure model.

Table 13: Test results for Pairwise Granger Causality (GDP)		**Table 14: Test results for Pairwise Granger Causality (KOFGI)**	
Null Hypothesis, H0:	F-Statistic	Null Hypothesis, H0:	F-Statistic
DLGDPPC does not Granger Cause _90_10_RATIO	1.294 (0.255)	DLKOFGI does not Granger Cause _90_10_RATIO	0.697 (0.404)
_90_10_RATIO does not Granger Cause DLGDPPC	6.823 (0.009***)	_90_10_RATIO does not Granger Cause DLKOFGI	1.295 (0.255)
_50_10_RATIO does not Granger Cause DLGDPPC	4.883 (0.027**)	_50_10_RATIO does not Granger Cause DLKOFGI	2.005 (0.157)
DLGDPPC does not Granger Cause _50_10_RATIO	0.702 (0.402)	DLKOFGI does not Granger Cause _50_10_RATIO	0.387 (0.533)
_90_50_RATIO does not Granger Cause DLGDPPC	0.231 (0.630)	_90_50_RATIO does not Granger Cause DLKOFGI	0.367 (0.544)
DLGDPPC does not Granger Cause _90_50_RATIO	0.135 (0.712)	DLKOFGI does not Granger Cause _90_50_RATIO	0.009 (0.923)
SS3_EMP does not Granger Cause DLGDPPC	0.461 (0.497)	SS3_EMP does not Granger Cause DLKOFGI	10.923 (0.001***)

DLGDPPC does not Granger Cause SS3_EMP	2.124 (0.145)	DLKOFGI does not Granger Cause SS3_EMP	0.032 (0.857)
SS4_HEL does not Granger Cause DLGDPPC	0.829 (0.362)	SS4_HEL does not Granger Cause DLKOFGI	3.178 (0.042**)
DLGDPPC does not Granger Cause SS4_HEL	0.158 (0.691)	DLKOFGI does not Granger Cause SS4_HEL	1.093 (0.296)
H0: Variable 1 Does not Granger Cause Variable 2. Lag length is selected using the previous test results for lag length. Table shows the test statistics ***,**,* denote statistical significance at the 1%, 5% and 10% respectively.			

In this case, however, a review of model fit statistics imply that SBC is better suited for when the data set is of very large in observations (Grimm *et al*. 2021; Yang, 2006). In contrast, AIC has better properties for small samples (Burnham and Anderson, 2002).

As a result, for the series' that disagree on the lag structure model, we lean toward using the results that SIC presents. This means that for, 90/10 and DLGDP, 90/50 and DLGDP, SS3 and DLGDP, 90/10 and DLKOFGI, 90/50 and DLKOFGI, and SS3 and DLKOFGI, the most appropriate lag structure model is 1,1, and for, DLGDP and SS3, and DLGDP and SS4, its 2,1.

Following this, each regression is run using the least squares method on the chosen lag structure model. The coefficient diagnostics regarding coefficient restrictions using the Wald test allows for the viewing of results for the F-statistic, in which the probability will be used to determine whether to accept or reject the null hypothesis that the independent variable does not granger cause the dependent variable.

The results in Table 13 indicate the existence of a unidirectional causality running from _90_10_Ratio to DLGDPPC, at the 1% significance level, when two lags are applied to DLGDPPC as the dependent variable and one lag is applied to _90_10_Ratio as the independent variable. This shows a very strong signal of causality between the two variables in that direction. Furthermore, this suggests that _90_10_RATIO does Granger Cause DLGDPPC. From DLGDPPC to _90_10_RATIO, the null cannot be rejected at any level, suggesting that DLGDPPC does not Granger Cause _90_10_RATIO.

There is evidence to show the existence of a unidirectional causality running from _50_10_RATIO to DLGDPPC, however only at the 5% level, when two lags are applied to DLGDPPC as the dependent variable and one lag is applied to _50_10_Ratio as the independent variable. This suggests a strong signal of causality between the two variables in that direction. Furthermore, this suggests that

_50_10_RATIO does Granger Cause DLGDPPC. From DLGDPPC to _50_10_Ratio, the null cannot be rejected at any level, suggesting that DLGDPPC does not granger cause _50_10_Ratio.

There is no evidence to suggest the existence of a unidirectional nor bidirectional causality running between the variables _90_50_RATIO and DLGDPPC, as the null hypothesis cannot be rejected at any level. In addition, this means that _90_50 RATIO does not granger cause DLGPPC and DLGDPPC does not granger cause _90_50_RATIO.

There is no evidence to suggest the existence of a unidirectional nor bidirectional causality running between the variables SS3_EMP and DLGDPPC, as the null hypothesis cannot be rejected at any level. In addition, this means that SS3_EMP does not granger cause DLGPPC and DLGDPPC does not granger cause SS3_EMP.

There is no evidence to suggest the existence of a unidirectional nor bidirectional causality running between the variables SS4_HEL and DLGDPPC, as the null hypothesis cannot be rejected at any level. In addition, this means that SS4_HEL does not granger cause DLGPPC and DLGDPPC does not granger cause SS4_HEL.

The results in Table 14 indicate the existence of a unidirectional causality running from SS3_EMP to DLKOFGI, at the 1% significance level, when two lags are applied to DLKOFGI as the dependent variable and one lag is applied to SS3_EMP as the independent variable. This suggests a very strong signal of causality between the two variables in that direction. From DLKOFGI to SS3_EMP, the null cannot be rejected at any level.

There is evidence to indicate the existence of a unidirectional causality running from SS4_HEL and DLKOFGI, at the 5% level, when two lags are applied to both DLKOFGI as the dependent variable and SS4_HEL as the independent variable. This suggests a strong signal of causality between the two variables in that direction. For the rest of the series regarding KOFGI, there is no evidence to show neither a unidirectional nor bidirectional causality as the null cannot be rejected at any level.

There is no evidence to suggest the existence of a unidirectional nor bidirectional causality running between the variables _90_10_RATIO and DLKOFGI as the null hypothesis cannot be rejected at any level. In addition, this means that _90_10 RATIO does not granger cause DLKOFGI and DLKOFGI does not granger cause _90_10_RATIO.

There is no evidence to suggest the existence of a unidirectional nor bidirectional causality running between the variables _50_10_RATIO and DLKOFGI as the null hypothesis cannot be rejected at any level. In addition, this means that _50_10 RATIO does not granger cause DLKOFGI and DLKOFGI does not granger cause _50_10_RATIO.

There is no evidence to suggest the existence of a unidirectional nor bidirectional causality running between the variables _90_50_RATIO and DLKOFGI as the null hypothesis cannot be rejected at any level. In addition, this means that _90_50 RATIO does not granger cause DLKOFGI and DLKOFGI does not granger cause _90_50_RATIO.

Results gathered so far are for the short run and show significant unidirectional short-run causality running from inequality to economic growth. More specifically, that the 90/10 ratio (the top 10% of incomes compared to the lowest 10% of incomes) and the 50/10 ratio (the middle class, at 50% of incomes, compared to the lower class, 10%) can be used to predict forecasting the rate of GDP growth, for when GDP is lagged by 2 years, and both ratios by 1 year. Furthermore, two of the social inequality indexes, regarding a developing country's employment and health of new-borns, show a significant unidirectional short-run causality toward globalization, for when globalization is lagged by 2 years, and the social inequality indexes by 2 and 1, respectively. This result suggests for the short run information how the two series move together given time.

Table 15: Results of VAR lag length selection criteria

VAR Lag Order Selection Criteria
Endogenous variables: **LGDPPC LKOFGI**
Exogenous variables: C

Lag	AIC	SC	HQ
0	0.243714	0.261826	0.250849
1	-8.396974	-8.342640	-8.375568
2	-8.480052	**-8.389496***	-8.444376*
3	-8.485623*	-8.358845	-8.435678
4	-8.484602	-8.321601	-8.420386

VAR Lag Order Selection Criteria
Endogenous variables: **LGDPPC SS1_TECH**
Exogenous variables: C

Lag	AIC	SC	HQ
0	9.996935	10.02076	10.00645
1	1.007939	1.079417	1.036497
2	0.935450	**1.054579***	0.983046*
3	0.921028	1.087809	0.987663
4	0.925096	1.139529	1.010770

VAR Lag Order Selection Criteria
Endogenous variables: **LGDPPC SS2_HELG**
Exogenous variables: C

Lag	AIC	SC	HQ

0	9.878796	9.896908	9.885931
1	0.456783	0.511116	0.478188
2	0.331983	**0.422539***	0.367658
3	0.315486	0.442265	0.365432*
4	0.304763*	0.467764	0.368978

VAR Lag Order Selection Criteria
Endogenous variables: **LKOFGI SS1_TECH**
Exogenous variables: C

Lag	AIC	SC	HQ
0	7.228120	7.251946	7.237640
1	-0.221624	-0.150146	-0.193066
2	-0.272379	**-0.153250***	-0.224782*
3	-0.281132	-0.114351	-0.214496
4	-0.285592*	-0.071159	-0.199918

VAR Lag Order Selection Criteria
Endogenous variables: **LKOFGI SS2_HELG**
Exogenous variables: C

Lag	AIC	SC	HQ
0	7.241632	7.259743	7.248767
1	-0.435115	-0.380781	-0.413710
2	-0.490162	**-0.399606***	-0.454486*
3	-0.498806	-0.372027	-0.448861
4	-0.500200*	-0.337199	-0.435985

The results from the VAR lag length criteria selection, explain that 2 lags as the most appropriate. This is the case for all models. For **LGDPPC** and **LKOFGI,** the SC and HQ criterion agree on 2 lags while AIC does not. When the model is tested under 2 maximum lags, all criterions agree on 2 lags. For **LGDPPC** and **SS1_tech**, the SC and HQ criterion agree on 2 lags while AIC does not. When the model is tested under 2 maximum lags, all criterions agree on 2 lags. For **LGDPPC** and **SS2_helg**, all criterions agree on different lag structures. When the model is tested under 2 maximum lags, all criterions agree on 2 lags. For **LKOFGI** and **SS1_tech**, both SC and HQ agree on 2 lags while AIC does not. When the model is tested under 2 maximum lags, all criterions agree on 2 lags. For **LKOFGI** and **SS2_helg**, the SC and HQ criterion agree on 2 lags while AIC does not. When the model is tested under 2 maximum lags, all criterions agree on 2 lags. Furthermore, to proceed, this specifies that for the cointegration test and the panel VECM, where applicable, 2 lags will be selected for all models.

5.3. Panel cointegration

The importance of testing the panel for panel cointegration is explored in chapter 4. In this testing procedure, we use the Engle-Granger Cointegration method. This includes the Pedroni within and between dimension models as well as the Kao residual test.

Table 16: Panel (Engle-Granger) Cointegration Results		
LGDPPC and LKOFGI		
Model	**Intercept**	**Intercept and Trend**
Pedroni Within-Dimension		
Panel-v	2.225 (0.013**)	18.576 (0.000***)
Panel-Rho-Statistic	-0.656 (0.2556)	-1.094163 (0.1369)
Panel PP-Statistic	-0.579 (0.2810)	-4.845 (0.000***)
Panel ADF-Statistic	-0.544 (0.2931)	-5.658 (0.000***)
Pedroni Between-Dimension		
Group rho-Statistic	1.315360 (0.9058)	2.803 (0.997)
Group PP-Statistic	0.903481 (0.8169)	-1.694 (0.045**)
Group ADF-Statistic	-1.078 (0.140)	-3.947 (0.000***)
Kao Residual Cointegration test		
ADF-Statistic	-1.549 (0.060*)	
H_0: No cointegration. Lag length is selected using the SIC criteria. Table shows the test statistics ***,**,* denote statistical significance at the 1%, 5% and 10% respectively.		

The results in Table 16 explain the existence of panel cointegration between **LGDPPC and LKOFGI**, according to the intercept and trend model of the Pedroni (Engle-Granger) cointegration tests. For the Pedroni within-dimension model, the Panel-v, PP, and ADF statistic show that there is a rejection of the null hypothesis of no cointegration, at the 1% level. For the panel-rho statistic, there cannot be a rejection of the null hypothesis of no cointegration at all levels. For the Pedroni between-dimension model, two out of the three models, the Group-PP and ADF statistic show that there is a rejection of the null hypothesis of no cointegration, at the 5% and 1%, respectively. The Group rho-statistics suggest that there cannot be a rejection of the null hypothesis of no cointegration at all levels. For the majority results of both models, we can conclude that there is somewhat strong cointegration between **LGDPPC and LKOFGI.**

For the model to the intercept and the Pedroni within-dimension specification, only the Panel-v statistic shows a rejection of the null hypothesis of no cointegration at the 5% level. The panels-PP and ADF statistics suggest that the null hypothesis of no cointegration cannot be rejected at all levels. Furthermore, for the Pedroni between-dimension model, all statistics show that the null hypothesis cannot be rejected at all levels. This means that for the intercept specification, as the majority of statistics reject, we can conclude that there is no cointegration between **LGDPPC and LKOFGI**.

Table 17: Pedroni (Engle-Granger) Cointegration Results		
LGDPPC and SS1_Tech		
Model	**Intercept**	**Intercept and Trend**
Pedroni Within-Dimension		
Panel-v	0.996 (0.159)	9.819 (0.000***)
Panel-Rho-Statistic	-1.271 (0.101)	2.304 (0.989)
Panel PP-Statistic	-2.931 (0.001***)	1.316 (0.906)
Panel ADF-Statistic	-3.760 (0.000***)	-0.533 (0.296)
Pedroni Between-Dimension		
Group rho-Statistic	1.464 (0.928)	3.490 (0.999)
Group PP-Statistic	-1.353 (0.08*)	0.616 (0.731)
Group ADF-Statistic	-4.430 (0.000***)	-3.352 (0.000***)
Kao Residual Cointegration test		
ADF-Statistic	-3.846 (0.000***)	
H_0: No cointegration. Lag length is selected using the SIC criteria. Table shows the test statistics ***,**,* denote statistical significance at the 1%, 5% and 10% respectively.		

The results in Table 17 show that there is evidence for panel cointegration among the variables, **LGDPCC and SS1_tech** in the intercept specification. For the Pedroni within-dimension model, two out of four models, the panel-PP and ADF statistic, show a rejection of the null hypothesis of no cointegration both at the 1% level. The panel-v and rho statistics show that the null hypothesis cannot

be rejected at any level. For the Pedroni between-dimension model, two out of three show a rejection of the null hypothesis. The group-PP and group-ADF statistic reject the null hypothesis of no cointegration both at the 1% level, while the group-rho statistic does not, at any level.

For the model to intercept and trend, for the Pedroni within-dimension model, one out of four models, the panel-v statistic, show a rejection of the null hypothesis of no cointegration at the 1% level. For the rest of the statistics in this model, the panel-PP, ADF and rho, imply that the null hypothesis cannot be rejected at all levels. Furthermore, this means that there is evidence to show that there is cointegration for the intercept specification for **LDPPC and SS1_tech**, however, only of moderate strength. For the intercept and trend specification, there is weak evidence to show that there is cointegration, as only two statistics are significant in rejecting the null. Therefore, we can say that there is no cointegration for this type of specification.

Table 18: Pedroni (Engle-Granger) Cointegration Results

LGDPPC and SS2_HELG		
Model	**Intercept**	**Intercept and Trend**
Pedroni Within-Dimension		
Panel-v	3.037 (0.001***)	3.165 (0.000***)
Panel-Rho-Statistic	-1.040 (0.149)	1.911 (0.972)
Panel PP-Statistic	-2.145 (0.016**)	-1.374 (0.084*)
Panel ADF-Statistic	-2.941 (0.001***)	-3.308 (0.000***)
Pedroni Between-Dimension		
Group rho-Statistic	0.866 (0.806)	3.554 (0.999)
Group PP-Statistic	-2.234 (0.012**)	-2.174 (0.014**)
Group ADF-Statistic	-4.143 (0.000***)	-4.144 (0.000***)
Kao Residual Cointegration test		
ADF-Statistic	-2.478 (0.006***)	

H_0: No cointegration. Lag length is selected using the SIC criteria. Table shows the test statistics ***,**,* denote statistical significance at the 1%, 5% and 10% respectively.

The results in Table 18 show that for **LGDPPC and SS2_Helg**, there is evidence of cointegration in both specifications. In the intercept and the Pedroni within-dimension model, three out of four models, the panel-v and ADF statistic show a rejection of the null hypothesis at the 1% level, and panel-pp at the 5% level. For the Pedroni between-dimension model, two out of three models, the group-pp and ADF statistic show a rejection of the null hypothesis at the 5% and 1% level, respectively. The group-rho statistic suggests that the null cannot be rejected at all levels.

Table 19: Pedroni (Engle-Granger) Cointegration Results		
LKOFGI and SS1_TECH		
Model	**Intercept**	**Intercept and Trend**
Within-Dimension-based tests		
Panel-v	0.466 (0.320)	4.598 (0.000***)
Panel-Rho-Statistic	-0.322 (0.373)	1.580 (0.943)
Panel PP-Statistic	-2.365 (0.00***)	-0.716 (0.237)
Panel ADF-Statistic	-3.520 (0.000***)	-2.136 (0.01***)
Between-Dimension-based tests		
Group rho-Statistic	1.093 (0.862)	2.651 (0.996)
Group PP-Statistic	-3.853 (0.000***)	-5.005 (0.000***)
Group ADF-Statistic	-5.990 (0.000***)	-5.679 (0.000***)
Kao Residual Cointegration test		
ADF-Statistic	-4.599 (0.000***)	
H_0: No cointegration. Lag length is selected using the SIC criteria. Table shows the test statistics ***,**,* denote statistical significance at the 1%, 5% and 10% respectively.		

For the intercept and trend, and the Pedroni within-dimension model, three out of four models, the panel-v and ADF statistic show a rejection of the null hypothesis at the 1% level, and panel-pp at the

10% level. For the Pedroni between-dimension model, two out of three models, the group-pp and ADF statistic show a rejection of the null hypothesis at the 5% and 1% level, respectively. The group-rho statistic suggests that the null cannot be rejected at all levels. Therefore, for **LGDPPC and SS2_Helg**, there is a strong case for cointegration in both specifications, in the intercept and the intercept and trend.

The results in Table 19 show that there is evidence for panel cointegration among the variables, **LKOFGI and SS1_tech,** in both the intercept and intercept and trend specifications. In the intercept specification, two out of four statistics in the Pedroni within-dimension model, the panel-pp and panel-ADF statistic, indicate a rejection of the null hypothesis of no cointegration both at the 1% level. The panel-v and pp statistics show that the null cannot be rejected at any level. For the Pedroni between-dimension model, two out of three, the group-pp and ADF statistic show a rejection of the null hypothesis of no cointegration both at the 1% level. The group-rho statistic cannot reject the null at any level.

In the intercept and trend specification, two out of four, in the Pedroni within dimension model, the panel-v and ADF statistic show a rejection of the null hypothesis of no cointegration both at the 1% and 5% respectively. The panel-rho and panel-pp statistics show that the null hypothesis cannot be rejected at any level. For the Pedroni between dimension model, two out of three statistics, the group-PP and group-ADF statistic, show that the null hypothesis can be rejected both at the 1% level. The group-rho statistic suggests that the null hypothesis cannot be rejected at all levels. Therefore, for **LKOFGI and SS1_tech**, there is a strong case for cointegration for both specifications, in the intercept and the intercept and trend.

The results in Table 20 show that for **LGDPPC and SS2_Helg**, there is evidence of cointegration in both specifications. In the intercept and the Pedroni within-dimension model, three out of four models, the panel-v and ADF statistic show a rejection of the null hypothesis at the 1% level, and panel-pp at the 5% level. For the Pedroni between-dimension model, two out of three models, the group-pp and ADF statistic show a rejection of the null hypothesis at the 5% and 1% level, respectively. The group-rho statistic suggests that the null cannot be rejected at all levels.

For the intercept and trend, and the Pedroni within-dimension model, three out of four models, the panel-v and ADF statistic show a rejection of the null hypothesis at the 1% level, and panel-pp at the 10% level. For the Pedroni between-dimension model, two out of three models, the group-pp and ADF statistic show a rejection of the null hypothesis at the 5% and 1% level, respectively. The group-rho statistic suggests that the null cannot be rejected at all levels. Therefore, for **LGDPPC and SS2_Helg**, there is a strong case for cointegration in both specifications, in the intercept and the intercept and trend.

Table 20: Panel (Engle-Granger) Cointegration Results		
LKOFGI and SS2_HELG		
Model	**Intercept**	**Intercept and Trend**
Pedroni Within-Dimension		
Panel-v	1.925 (0.027**)	2.153 (0.015**)
Panel-Rho-Statistic	-1.157 (0.123)	0.930 (0.823)
Panel PP-Statistic	-3.153 (0.000***)	-2.053 (0.020**)
Panel ADF-Statistic	-4.896 (0.000*)	-2.984 (0.001*)
Pedroni Between-Dimension		
Group rho-Statistic	-0.101 (0.459)	2.238 (0.987)
Group PP-Statistic	-4.70 (0.000***)	-3.704 (0.000***)
Group ADF-Statistic	-5.615 (0.000***)	-4.911 (0.000***)
Kao Residual Cointegration test		
ADF-Statistic	-3.293 (0.000***)	
H0: No cointegration. Lag length is selected using the SIC criteria. Table shows the test statistics ***,**,* denote statistical significance at the 1%, 5% and 10% respectively.		

5.4. Panel Vector Error Correction Model and Impulse Response

Table 21 below presents results for the error correction models for all possible cases, using the following equation:

$$\Delta y_{i,t} = a_0 + a_{1i} \sum_{j=1}^{2} \Delta y_{i,t-j} + a_{2i} \sum_{k=1}^{2} \Delta x_{i,t-k} + \pi \, ecm_{t,t-1} + u_{i,t} \qquad (5.1)$$

The causal relationship is shown in the last column of the table. A discussion of the results and the corresponding impulse response functions for each pair of variables is given in the next sections.

Table 21: Panel Vector Error Correction Model

General Model: $\Delta y_{i,t} = a_0 + a_{1i} \sum_{j=1}^{2} \Delta y_{i,t-j} + a_{2i} \sum_{k=1}^{2} \Delta x_{i,t-k} + \pi \, ecm_{t,t-1} + u_{i,t}$

Variables definition	*test*	lags	F-stat [prob]	Causality relationship
$y_{i,t}$ = LGDPPC; $x_{i,t}$ = LKOFGI (With trend)	$\pi = 0$	2	-1.256 [0.209]	LKOFGI →LGDPPC (Short run effects only)
	$a_{2i} = 0$	2	2.474 [0.085]*	
$y_{i,t}$ = LKOFGI; $x_{i,t}$ = LGDPPC (With trend)	$\pi = 0$	2	0.096 [0.922]	No effects
	$a_{2i} = 0$	2	1.713 [0.181]	
Variables definition	*test*	lags	F-stat [prob]	Causality relationship
$y_{i,t}$ = LGDPPC; $x_{i,t}$ = SS1_tech (Without trend)	$\pi = 0$	2	-1.238 [0.216]	No effects
	$a_{2i} = 0$	2	0.037 [0.962]	
$y_{i,t}$ = SS1_tech; $x_{i,t}$ = LGDPPC (Without trend)	$\pi = 0$	2	3.466 [0.0006]**	LGDPPC → SS1_tech (Short and long run effects)
	$a_{2i} = 0$	2	2.565 [0.077]*	
Variables definition	*test*	lags	F-stat [prob]	Causality relationship
$y_{i,t}$ = LGDPPC; $x_{i,t}$ = SS2_helg (Without trend)	$\pi = 0$	2	0.235 [0.627]	SS2_helg → LGDPPC (Short run effects only)
	$a_{2i} = 0$	2	2.998 [0.050]**	
$y_{i,t}$ = SS2_helg; $x_{i,t}$ = LGDPPC (Without trend)	$\pi = 0$	2	12.834[0.0004]***	LGDPPC → SS2_helg (Short and long run effects)
	$a_{2i} = 0$	2	3.065 [0.047]**	
$y_{i,t}$ = LGDPPC; $x_{i,t}$ = SS2_helg	$\pi = 0$	2	0.838 [0.360]	SS2_helg → LGDPPC

(With trend)	$a_{2i} = 0$	2	3.131[0.044]**	(Short run effects only)
$y_{i,t}$ = SS2_helg; $x_{i,t}$ = LGDPPC (With trend)	$\pi = 0$	2	5.923[0.015]**	LGDPPC →SS2_helg (Short and long run effects)
	$a_{2i} = 0$	2	5.447[0.004]***	
Variables definition	*test*	lags	F-stat [prob]	Causality relationship
$y_{i,t}$ = LKOFGI; $x_{i,t}$ = SS1_tech (Without trend)	$\pi = 0$	2	21.935[0.000]**	SS1_tech → LKOFGI (Short and long run effects)
	$a_{2i} = 0$	2	3.436[0.032]**	
$y_{i,t}$ = SS1_tech; $x_{i,t}$ = LKOFGI (Without trend)	$\pi = 0$	2	15.160[0.000]**	LKOFGI → SS1_tech (Long run effects only)
	$a_{2i} = 0$	2	0.799[0.450]	
$y_{i,t}$ = LKOFGI; $x_{i,t}$ = SS1_tech (With trend)	$\pi = 0$	2	22.325[0.000]**	SS1_tech → LKOFGI (Short and long run effects)
	$a_{2i} = 0$	2	3.430[0.033]**	
$y_{i,t}$ = SS1_tech; $x_{i,t}$ = LKOFGI (With trend)	$\pi = 0$	2	15.071[0.000]**	LKOFGI →SS1_tech (Long run effects only)
	$a_{2i} = 0$	2	0.800[0.449]	
Variables definition	*test*	lags	F-stat [prob]	Causality relationship
$y_{i,t}$ = LKOFGI; $x_{i,t}$ = SS2_helg (Without trend)	$\pi = 0$	2	20.138[0.000]**	SS2_helg → LKOFGI (Short and long run effects)
	$a_{2i} = 0$	2	3.254[0.039]**	
$y_{i,t}$ = SS2_helg; $x_{i,t}$ = LKOFGI (Without trend)	$\pi = 0$	2	13.247[0.000]**	LKOFGI → SS2_helg (Short and long run effects)
	$a_{2i} = 0$	2	6.895[0.001]**	
$y_{i,t}$ = LKOFGI; $x_{i,t}$ = SS2_helg (With trend)	$\pi = 0$	2	17.044[0.000]**	SS2_helg → LKOFGI (Short and long run effects)
	$a_{2i} = 0$	2	3.253[0.039]**	
$y_{i,t}$ = SS2_helg; $x_{i,t}$ = LKOFGI (With trend)	$\pi = 0$	2	15.249[0.000]**	LKOFGI →SS2_helg (Short and long run effects)
	$a_{2i} = 0$	2	7.070[0.000]**	

*,** indicate significance for the 90%, 95% respectively

5.5. Globalization and Economic Growth

For variables, **LGDPPC and LKOFGI**, whereby **LGDPPC** is the dependent variable and **LKOFGI** is the independent variable, the intercept and trend specification was chosen as the appropriate model for the panel VECM. The intercept specification was not chosen in this test because the cointegration results showed non-convincing evidence (for cointegration).

The Wald Test F-statistic [2.474] testing for $a_{2i} = 0$, from panel VECM estimation and p-value [0.085] suggest that there is evidence for short-run causality. However, as the null hypothesis can be rejected

at the 10% level but not at the 5% or 1% level, it can be expressed that the certainty of short-run causality between the two variables is of moderate strength. Moreover, the error cointegrating vector coefficient was shown to not be statistically significant as the null hypothesis cannot be rejected at all levels, interpreted by the Wald Test F-statistic [-1.256] testing for $\pi = 0$**,** from panel VECM estimation and p-value [0.209]. This means that there is non-convincing evidence to suggest causality in the long run. Moreover, there is no convergence from short run dynamics towards long run equilibrium. Any shocks in the short run have permanent effects regarding the long run in the VECM model.

For the variables, when **LKOFGI** is the dependant variable and **LGDPPC** is the independent variable, the Wald Test F-statistic [1.713] testing for $a_{2i} = 0$, from panel VECM estimation and p-value [0.181], suggest that there is no evidence for short-run causality as the null cannot be rejected at all levels. The cointegrating vector was also not shown to be statistically significant at all levels, as interpreted by the Wald Test F-statistic [0.096] testing for $\pi = 0$, from panel VECM estimation and p-value [0.922]. This means that there are no causal effects in both the short and long run. Furthermore, this suggests that **LGDPPC** does not granger cause **LKOFGI**.

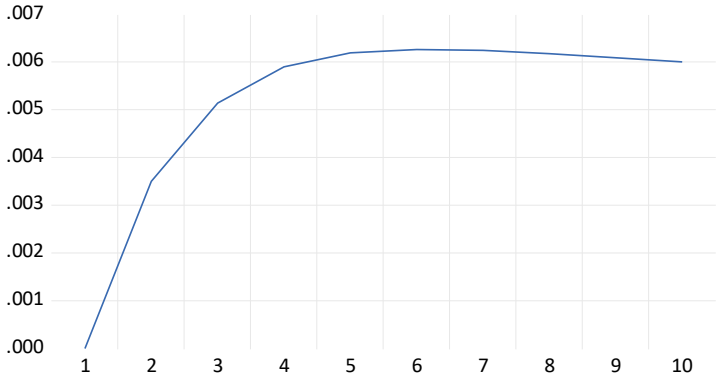
As the ECM term indicates that there is no long-run granger effect found in either direction, we can confirm to disagree with the panel cointegration tests that suggested cointegration. In this case, we will keep the short run dynamics from the VECM in first differences and run an additional VAR in stationary to compare the findings for forecasting.

Before we discuss the coefficients and t-statistics of the VAR model, we first run the VAR Granger-Causality/Block Exogeneity Wald Tests to examine and confirm the causal relationship between **DLGDPPC** and **DLKOFGI**. The results show that, from interpreting the Wald Chi-Sq. statistic [4.959] and p-value [0.083], that there is evidence to suggest that **DLKOFGI** does granger cause **DLGDPPC**. The null hypothesis is rejected at the 5% level. In contrast, there is evidence to suggest that **DLGDPPC** does not granger cause **DLKOFGI**, interpreted by the Wald Chi-sq. statistic [3.423] and p-value [0.1805]. The null hypothesis in this case cannot be rejected at all levels.

Furthermore, the coefficients and t-statistics of the VAR in appendix ( ), explain that a 1% increase change in **DLKOFGI**(-1) causes **DLGDPPC** to increase by 13.208%. The Wald-test Chi-sq. [4.612] and p-value [0.031] suggest that the null of the coefficient is rejected at the 5% level and is statistically significant at the 95% level. Given 2 lags, **DLKOFGI**(-2), it is also shown to increase **DLGDPPC** by 3.978%. However, the Wald-test Chi-sq. [0.406] and p-value [0.523] suggest that the null of the coefficient cannot be rejected at any level. The whole regression for two lags, interpreted by the Wald-test Chi-sq. [4.959] and p-value [0.083] suggest that the null of the coefficient is rejected at the 10% level, and is statistically significant at the 90% level.

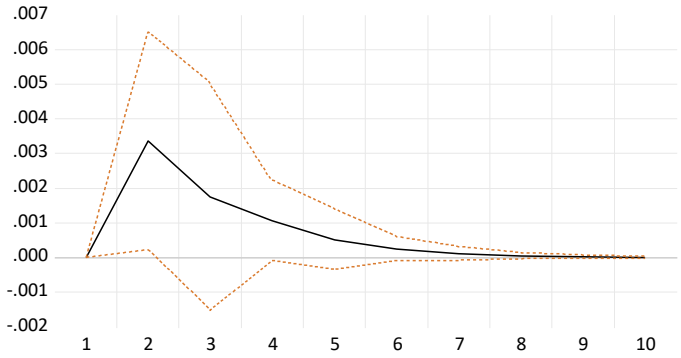
The evidence from VECM impulse response functions shows that when a shock occurs of one standard deviation, from the first until the fifth year, **LGDPPC** responds to **LKOFGI** very sharply. From the fifth year, it shows that the effects are no longer upward trending, but somewhat slightly downward trending instead indicating the end of short run effects.

Response of LGDPPC to LKOFGI Cholesky One S.D. (d.f. adjusted) Innovation



The evidence from VAR impulse response functions shows that when a shock occurs of one standard deviation, from the 1st to the 2nd period, **DLGDPPC** positively responds to **DLKOFGI** very sharply, reaching its peak. From the 2nd to 3rd period, the response decreases sharply but is still positive. From the 3rd until the 5th period, the response slowly deescalates but is still positive until the 5th period to where the short run effects end.

Response of DLGDPPC to DLKOFGI Cholesky One S.D. (d.f. adjusted) Innovation
± 2 analytic asymptotic S.E.s



Furthermore, it can be concluded that for **LGDPCC and LKOFGI**, the direction of causality is unidirectional (for only when **LGDPPC** is the dependent variable) and of moderate strength certainty to short-run causality.

5.6. Economic growth and Income Inequality

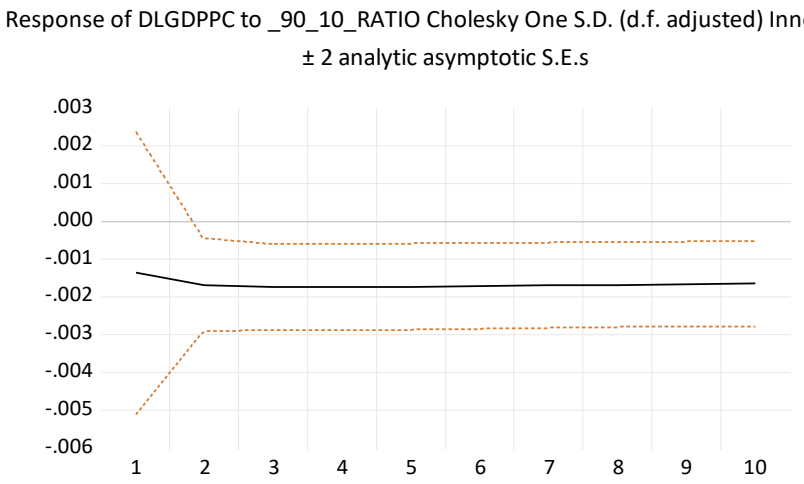
5.6.1. _90_10_Ratio and LGDPPC

As the unit root tests confirm that the inequality variable (_90_10_Ratio) is stationary at level, it is suggested that two variables that are I(0) and I(1) cannot be cointegrated. Following this, we will skip the VECM phase and run the VAR model in stationary for forecasting. The VAR model will be run

with a lag structure of 1,1 as previously determined. The results confirm the short-run granger causality relationship between **_90_10_Ratio** running to **DLGDPPC**. The results show that, from interpreting the Wald Chi-Sq. statistic [6.8237] and p-value [0.0093], that there is evidence to suggest that **_90_10_Ratio** granger causes **DLGDPPC**. The null hypothesis is rejected at the 1% level.

Furthermore, the coefficients and t-statistics of the VAR in Appendix (), explain that a 1 unit increase in **_90_10_Ratio**(-1) causes **DLGDPPC** to decrease by a 0.02% percentage change. The Wald-test Chi-sq [9.8241] and p-value [0.0017] suggest that the null of the coefficient is rejected at the 1% level, and is statistically significant at the 99% level.

The evidence from VAR impulse response functions shows that when a shock occurs of one standard deviation, from the 1st to the 10th period, the response of **DLGDPPC** to **_90_10_Ratio** is shown to be constantly at a negative value. It does not go back to a negligible or nil value.



Furthermore, it can be concluded that for **DLGDPPC** and **_90_10_Ratio**, the direction of short run causality is unidirectional, from when **DLGDPPC** is the dependant variable. As both are of different orders of integration, they are considered not cointegrated. Despite this, the strength regarding short run causality can be described as bidirectionally strong.

The panel vector error correction and VAR diagnostics show that from analyzing the Durban-Watson test statistics, in Appendix (??), it is reasonable to suggest that there is no serious first-order serial auto-correlation issues with the model residuals regarding **DLKOFGI** and **_90_10_Ratio**. Furthermore, all variables are in stationary form. The set of residual diagnostics therefore concludes that the model is robust.

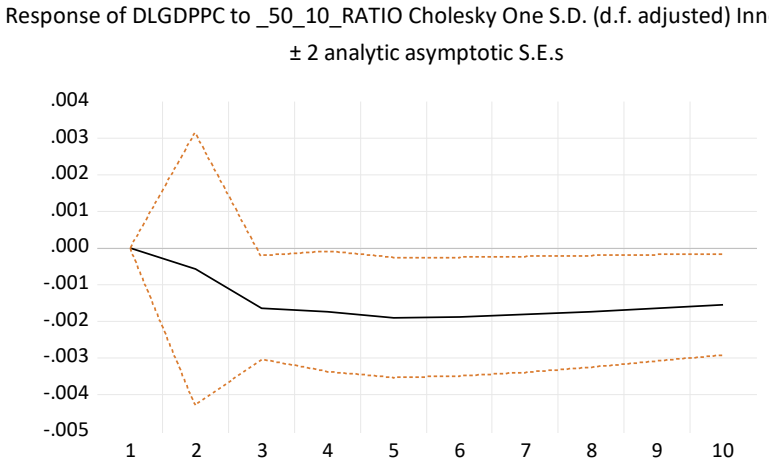
5.6.2. _50_10_Ratio and LGDPPC

As the unit root tests confirm that the inequality variable (_50_10_Ratio) is stationary at level, it is suggested that two variables that are I(0) and I(1) cannot be cointegrated. Following this, we will skip the VECM phase and run the VAR model in stationary for forecasting. The VAR model will be run with a lag structure of 2,1 as previously determined. The results confirm the short-run granger

causality relationship between **_50_10_Ratio** running to **DLGDPPC**. The results show that, from interpreting the Wald Chi-Sq. statistic [4.8830] and p-value [0.0227], that there is evidence to suggest that **_50_10_Ratio** granger causes **DLGDPPC**. The null hypothesis is rejected at the 5% level.

Furthermore, the coefficients and t-statistics of the VAR in Appendix (), explain that a 1 unit increase in **_50_10_Ratio**(-1) causes **DLGDPPC** to decrease by a 0.1% percentage change. Given 2 lags, 50_10_Ratio(-2) is shown to decrease DLGDPPC by 0.09% percentage change. The whole regression for two lags, interpreted by the Wald-test Chi-sq. [6.7755] and p-value [0.0338] suggest that the null of the coefficient is rejected at the 5% level, and is statistically significant at the 95% level.

The evidence from VAR impulse response functions shows that when a shock occurs of one standard deviation, from the 1st to the 3rd period, the response of **DLGDPPC** to **_50_10_Ratio** is shown to reduce beyond negative value, slowly but sharply. From the 3rd period until the 10th period, the response does not go back to a negligible or nil value, but stays constantly negative.



Furthermore, it can be concluded that for **DLGDPPC** and **_50_10_Ratio**, the direction of short run causality is unidirectional, from when **DLGDPPC** is the dependant variable. As both are of different orders of integration, they are considered not cointegrated. Despite this, the strength regarding short run causality can be described as bidirectionally strong.

5.7. Economic Growth and Social Inequality

5.7.1. LGDPPC and SS1_tech

For variables, **SS1_tech** and **LGDPPC**, whereby **SS1_tech** is the dependent variable and **LGDPPC** is the independent variable, the intercept only specification was chosen as the appropriate model for the panel VECM. The intercept and trend specification was not chosen in this test because the cointegration results showed non-convincing evidence (for cointegration).

The Wald Test F-statistics [2.565] testing for $a_{2i} = 0$, from panel VECM estimation and p-value [0.077] suggests that there is evidence for short-run causality. However, as the null hypothesis can be

rejected at the 10% level but not at the 5% or 1% level, it can be expressed that the certainty of short-run causality between the two variables is of moderate strength.

The error correction term for, **SS1_tech**, specified by COINTEQ1_GDP_SS1_TECH(-1), in appendix 1, interpreted by the Wald Test F-statistic [3.466] testing for $\pi = 0$, from panel VECM estimation and p-value [0.0006], is found to be statistically significant but however not with the anticipated negative sign. The adjustment coefficient associated with **SS1_tech** is 0.896. This suggests that any disturbances to the system will cause a divergence from the intended equilibrium, implying an unstable long-run relationship. This means that any shocks will diverge rather than converging to an equilibrium. The unexpected sign suggests that there is no long run equilibrium. Therefore, **LGDPPC** does not granger-cause **SS1_Tech** in the long run.

For the variables, when **LGDPPC** is the dependant variable and **SS1_tech** is the independent variable, the Wald Test F-statistic [0.037] testing for $a_{2i} = 0$, from panel VECM estimation and p-value [0.962], suggest that there is no evidence for short-run causality as the null cannot be rejected at all levels. The cointegrating vector was also not shown to be statistically significant at all levels, as interpreted by the Wald Test F-statistic [-1.238] testing for $\pi = 0$, from panel VECM estimation and p-value [0.216]. This means that there are no casual effects in both the short and long run.

As the ECM term indicates that there is no long-run granger effect found in either direction, we can confirm to disagree with the panel cointegration tests that suggested cointegration. In this case, we will keep the short run dynamics from the VECM in first differences and run an additional VAR in stationary to compare the findings for forecasting.

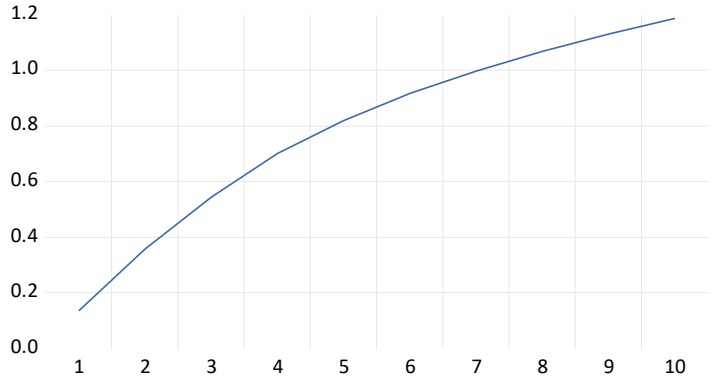
Before we discuss the coefficients and t-statistics of the VAR model, we first run the VAR Granger-Causality/Block Exogeneity Wald Tests to examine and confirm the casual relationship between **DLGDPPC** and **DSS1_Tech**. The results show that, from interpreting the Wald Chi-Sq. statistic [4.687] and p-value [0.095], that there is evidence to suggest that **DLGDPPC** does granger cause **DSS1_Tech**. The null hypothesis is rejected at the 10% level. In contrast, there is evidence to suggest that **DSS1_Tech** does not granger cause **DLGDPPC**, interpreted by the Wald Chi-sq. statistic [0.019] and p-value [0.99]. The null hypothesis in this case cannot be rejected at all levels.

Furthermore, the coefficients and t-statistics of the VAR in Appendix (2), explain that a 1% increase change in **DLGDPPC**(-1) causes **DSS1_Tech** to increase by 4.98 units. The Wald-test Chi-sq [3.355] and p-value [0.067] suggest that the null of the coefficient is rejected at the 10% level, and is statistically significant at the 90% level. Given 2 lags, **DLGDPPC**(-2), it is also shown to increase **DSS1_Tech** by 1.73 units. However, the Wald-test Chi-sq. [0.406] and p-value [0.523] suggest that the null of the coefficient cannot be rejected at any level. The whole regression for two lags, interpreted by the Wald-

test Chi-sq. [4.678] and p-value [0.095] suggest that the null of the coefficient is rejected at the 10% level, and is statistically significant at the 90% level.

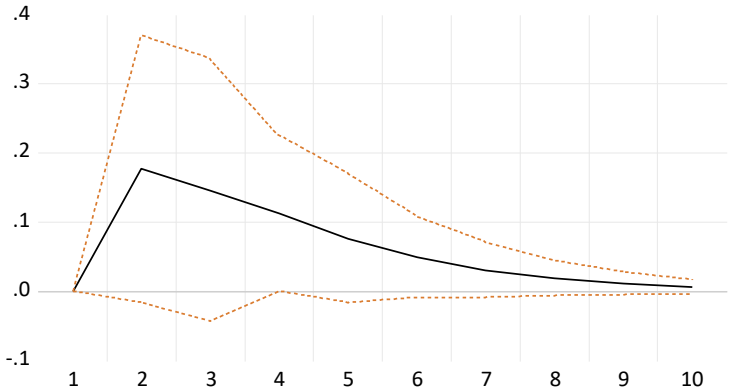
The evidence from VECM impulse response functions shows that when a shock occurs of one standard deviation, from the 1st to the 10th year, the **SS1_tech** index responds to **LGDPPC** very sharply and gradually. Moreover, the curve suggests that **SS1_tech** will continue to increase in the long run, however, as the evidence shows that there is no intended long run equilibrium, the impulse response function for this phase cannot be considered reliable for interpretation.

Response of SS1_TECH to LGDPPC Cholesky One S.D. (d.f. adjusted) Innovation



The evidence from VAR impulse response functions shows that when a shock occurs of one standard deviation, from the 1st to the 2nd period, **DSS1_Tech** positively responds to **DLGDPPC** very sharply, reaching its peak. From the 2nd to 4th period, the response decreases sharply but still positive. From the 4th until the 10th period, the response slowly further deescalates but still positive. and becomes negligible. Towards the 10th period becomes a negligible effect.

Response of DSS1_TECH to DLGDPPC Cholesky One S.D. (d.f. adjusted) Innovation
± 2 analytic asymptotic S.E.s



Furthermore, it can be concluded that for **LGDPPC and SS1_tech**, the direction of short run causality is unidirectional, in the direction whereby **SS1_tech** is the dependant variable. The strength regarding short run causality can be described as moderate. For the long run, there are no effects. This further

implies that there is no cointegration between **LGDPPC** and **SS1_tech** as the results failed to find a long run granger causality for both directions.

5.7.2. LGDPPC and SS2_helg

For variables, **LGDPPC** and **SS2_helg**, whereby **LGDPPC** is the dependent variable and **SS2_helg** is the independent variable, both the intercept and the intercept and trend specification was chosen as the appropriate models for the panel VECM. For the intercept only specification, the Wald Test F-statistics [2.998] testing for $a_{2i} = 0$, from panel VECM estimation and p-value [0.050] suggests that there is evidence for short-run causality. As the null hypothesis can be rejected at the 5% level but not at the 1% level, it can still be expressed that the certainty of short-run causality between the two variables is of strong strength. Moreover, the error cointegrating vector coefficient was shown to not be statistically significant as the null hypothesis cannot be rejected at all levels, interpreted by the Wald Test F-statistic [0.235] testing for $\pi = 0$, from panel VECM estimation and p-value [0.627].

For the intercept and trend specification, the results were similar in comparison to the intercept only specification. Both specifications agree similarly without much dispersion on the level of significance of coefficients. The Wald Test F-statistic [3.131] testing for $a_{2i} = 0$, from panel VECM estimation and p-value [0.044] suggests that there is evidence for short-run causality. As the null hypothesis can be rejected at the 5% level but not at the 1% level, it also to be expressed that the certainty of short-run causality between the two variables is of strong strength. Moreover, the error cointegrating vector coefficient was also shown to not be statistically significant as the null hypothesis cannot be rejected at all levels, interpreted by the Wald Test F-statistic [0.838] testing for $\pi = 0$, from panel VECM estimation and p-value [0.360]. This means that, from combining the two specifications, we can conclude that there is strong evidence to express the certainty of short-run causality but non-convincing evidence to suggest causality in the long run. As the results show that the error cointegrating vector coefficient is insignificant, there is no casual long run effects nor convergence from short run dynamics towards long run equilibrium.

For the variables, when **SS2_helg** is the dependant variable and **LGDPPC** is the independent variable, in the intercept only specification, the Wald Test F-statistic [3.065] testing for $a_{2i} = 0$, from panel VECM estimation and p-value [0.047], suggest that there is evidence for short-run causality. As the null hypothesis can be rejected at the 5% level but not at the 1% level, it can be expressed that the certainty of short-run causality between the two variables is of strong strength. For the intercept and trend specification, the results are similar in comparison to the intercept only specification. Both specifications agree similarly with a few exceptions. The Wald Test F-statistic [5.447] testing for $a_{2i} = 0$, from panel VECM estimation and p-value [0.004] suggests that there is evidence for short-run causality. As the null hypothesis can be rejected at the 1% level, this suggests very strong evidence.

Comparing the results to the intercept only specification, the 99% significance level is much stronger evidence compared to 95% significance level for short-run causality.

The error correction term for, **SS2_helg**, specified by CointEq1_gdp_ss2_helg, in Appendix ( ), is shown to be statistically significant, interpreted by the Wald Test F-statistic [12.834] testing for $\pi = 0$, from panel ECM estimation, and p-value [0.0004]. The intercept and trend specification had similar results; Wald Test F-statistic [5.923] testing for $\pi = 0$, from panel ECM estimation and p-value [0.015]. The null hypothesis is both rejected at the 1% level, however, not with the anticipated negative sign. The adjustment coefficient associated with **SS2_helg** is 0.727228. This suggests that any disturbances to the system will cause a divergence of 0.727% per annual period from the intended equilibrium, implying an unstable long-run relationship. This means that any shocks will diverge rather than converge to an equilibrium. The unexpected sign suggests that there is no long run equilibrium. Therefore, **LGDPPC** does not granger-cause **SS2_Tech** in the long run.

As the ECM term indicates that there is no long-run granger effect found in either direction, we can confirm to disagree with the panel cointegration tests that suggested cointegration. In this case, we will keep the short run dynamics from the VECM in first differences and run an additional VAR in stationary to compare the findings for forecasting.

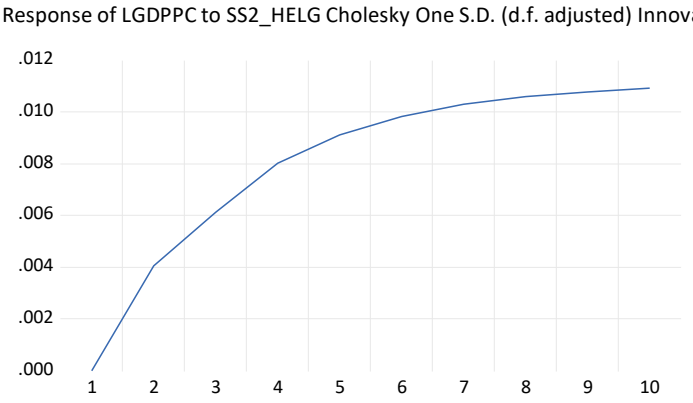
Before we discuss the coefficients and t-statistics of the VAR model, we first run the VAR Granger-Causality/Block Exogeneity Wald Tests to examine and confirm the casual relationship between **DLGDPPC** and **DSS2_Tech**. The results show that from interpreting the Wald Chi-Sq. statistic [5.401] and p-value [0.067], that there is evidence to suggest that **DLGDPPC** does granger cause **DSS2_Helg**. The null hypothesis is rejected at the 10% level. In contrast, there is evidence to suggest that **DSS2_Helg** does granger cause **DLGDPPC**, interpreted by the Wald Chi-sq. statistic [5.782] and p-value [0.055]. The null hypothesis is rejected at the 10% level.

Furthermore, the coefficients and t-statistics of the VAR in Appendix (4), explain that a 1% increase change in **DLGDPPC**(-1) causes **DSS2_Helg** to increase by 5.277 units. The Wald-test Chi-sq [4.921] and p-value [0.026] suggest that the null of the coefficient is rejected at the 5% level, and is statistically significant at the 95% level. Given 2 lags, **DLGDPPC**(-2), it is also shown to increase **DSS2_Helg** by 1.73 units. However, the Wald-test Chi-sq. [0.032] and p-value [0.856] suggest that the null of the coefficient cannot be rejected at any level. The whole regression for two lags, interpreted by the Wald-test Chi-sq. [5.401] and p-value [0.067] suggest that the null of the coefficient is rejected at the 10% level, and is statistically significant at the 90% level.

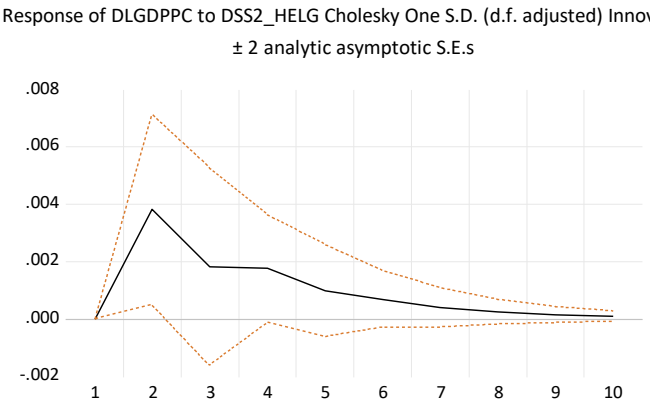
A one unit increase in **DSS2_Helg**(-1) causes **DLGDPPC** to increase by 0.2% percentage change. The Wald-test Chi-sq [5.334] and p-value [0.0209] suggest that the null of the coefficient is rejected at the 5% level, and is statistically significant at the 95% level. Given 2 lags, **DSS2_Helg**(-2), it is also shown

to increase **DLGDPPC** by a 0.01% percentage change. However, the Wald-test Chi-sq. [0.001] and p-value [0.899] suggest that the null of the coefficient cannot be rejected at any level. The whole regression for two lags, interpreted by the Wald-test Chi-sq. [5.782] and p-value [0.055] suggest that the null of the coefficient is rejected at the 10% level, and is statistically significant at the 90% level.

The evidence from VECM impulse response functions shows that when a shock occurs of one standard deviation, from the 1st to the 10th year, the **DLGDPPC** responds to **DSS2_Helg** very sharply and gradually. Moreover, the curve suggests that **DSS2_Helg** will continue to increase in the long run, however, as the evidence shows that there is no intended long run equilibrium, the impulse response function for this phase cannot be considered reliable for interpretation.



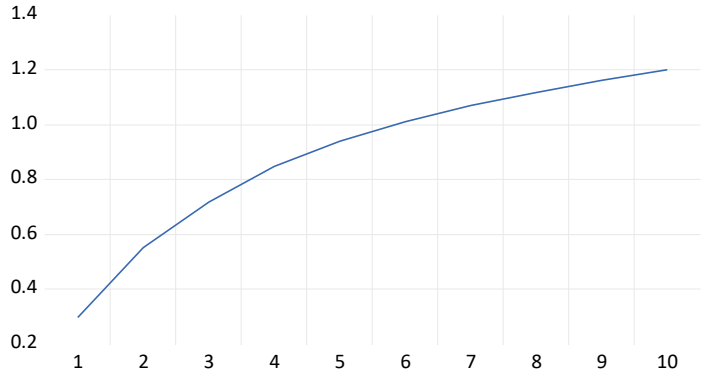
The evidence from VAR impulse response functions shows that when a shock occurs of one standard deviation, from the 1st period to the 2nd period, the response from **DLGDPPC** to **DSS2_Helg** is shown to already be at its peak. Following to the 2nd period to the 3rd period, the response declines sharply by almost half of its value, however still positive. From the 3rd to the 4th period, the response is stable but still positive. From the 4th period until the 10th period, the response sharply deescalates although still positive, and ultimately becomes negligible.



The evidence from VECM impulse response functions shows that when a shock occurs of one standard deviation, from the 1st to the 10th year, the **DSS2_Helg** index responds to **DLGDPPC** very sharply

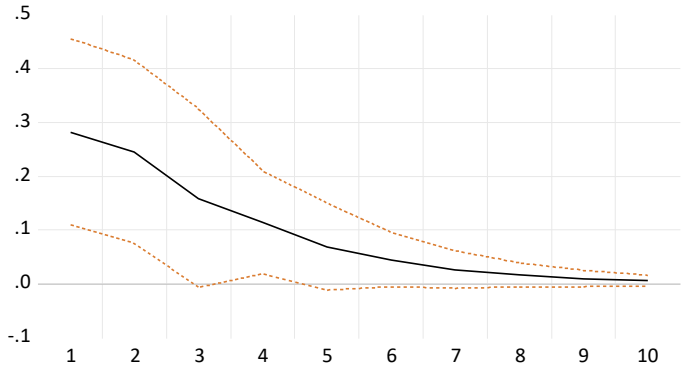
and gradually. Moreover, the curve suggests that **DSS2_Helg** will continue to increase in the long run, however, as the evidence shows that there is no intended long run equilibrium, the impulse response function for this phase cannot be considered reliable for interpretation.

Response of SS2_HELG to LGDPPC Cholesky One S.D. (d.f. adjusted) Innovation



The evidence from VAR impulse response functions shows that when a shock occurs of one standard deviation, from the 1st period, the response from **DSS2_Helg** to **DLGDPPC** is shown to already be at its peak. Following too the 2nd period, the response is declining however still positive. From the 2nd to 3th period, the response further decreases but more sharply and still positive. From the 3rd period until the 10th period, the response slowly further deescalates although still positive, and ultimately becomes negligible.

Response of DSS2_HELG to DLGDPPC Cholesky One S.D. (d.f. adjusted) Innovation
± 2 analytic asymptotic S.E.s



Furthermore, it can be concluded that for **DLGDPPC** and **DSS2_helg**, the direction of short run causality is bidirectional, meanwhile for the long run, suggests no causality. This further implies that there is no cointegration between **DLGDPPC** and **DSS2_helg** as the results failed to find a long run granger-cause effect for both directions. Despite this, the strength regarding short run causality can be described as bidirectionally strong.

5.8. Globalization and Social Inequality

5.8.1. LKOFGI and SS1_tech

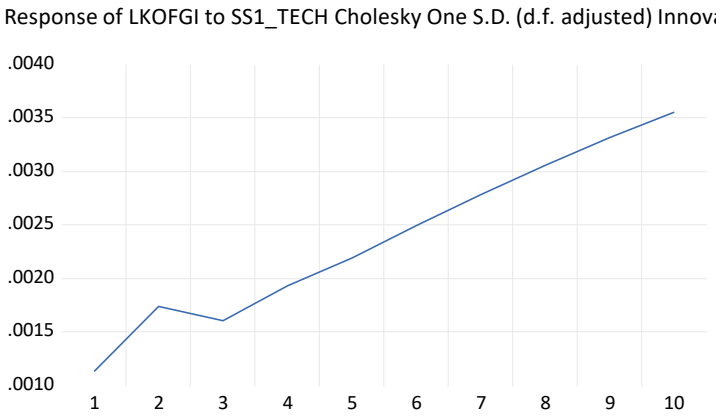
For variables, **LKOFGI** and **SS1_tech**, whereby **LKOFGI** is the dependent variable and **SS1_tech** is the independent variable, both the intercept and the intercept and trend specification was chosen as the appropriate models for the panel VECM. For the intercept only specification, the Wald Test F-statistics [3.436] testing for $a_{2i} = 0$, from panel VECM estimation and p-value [0.032] suggests that there is evidence for short-run causality. As the null hypothesis can be rejected at the 5% level but not at the 1% level, it can be expressed that the certainty of short-run causality between the two variables is of strong strength. Moreover, the error cointegrating vector is shown to be statistically significant, interpreted by the Wald Test F-statistic [21.935] testing for $\pi = 0$, from panel VECM estimation and p-value [0.0000]. As the null hypothesis can be rejected at the 1% level, and the very high F-statistic, this suggests very strong evidence for long-run causality. To conclude, the results show that there is convergence from short run dynamics towards long run equilibrium between the **LKOFGI** and **SS1_tech**.

For the intercept and trend specification, the results were similar in comparison to the intercept only specification. Both specifications agree similarly without much dispersion on the level of significance of coefficients. The Wald Test F-statistic [3.430] testing for $a_{2i} = 0$, from panel VECM estimation and p-value [0.033], suggests that there is evidence for short-run causality. As the null hypothesis can be rejected at the 5% level but not at the 1% level, it also to be expressed that the certainty of short-run causality between the two variables is of strong strength. Moreover, the error cointegrating vector coefficient was also shown to be statistically significant as the null hypothesis be rejected at the 1% level, interpreted by the Wald Test F-statistic [22.325] testing for $\pi = 0$, from panel VECM estimation and p-value [0.000]. The very high F-statistic comply with the intercept only specification that there is very strong evidence for long-run causality. This means that, from combining the two specifications, we can conclude that there is strong evidence to express the certainty for short-run causality and very strong to strong evidence to suggest certainty for causality in the long run.

The error correction term for, **LKOFGI**, specified by COINTEQ1_KOFGI_SS1_TECH(-1), in appendix 3, was found to be statistically significant with the anticipated negative sign. The adjustment coefficient associated with **SS2_helg** is -0.05. This is sufficient to reject the null to “no cointegration” and suggests a stable long-run relationship between the two variables whereby **LKOFGI** is the dependent variable. In addition, this indicates that when the system experiences a disequilibrium, the speed of adjustment suggests it is corrected by 5% each year.

The evidence from impulse response functions shows that when a shock occurs of one standard deviation, from the first to the second time period, **LKOFGI** responds to **SS1_tech** index positively by 0.00174, corresponding to an increase to **LKOFGI** by 0.174%. Following the third time period, it is

shown that there is a stable effect, reducing by 0.0016, corresponding to an increase to **KOFGI** by 0.16%. From the third time period and until the end time period of the sample, **LKOFGI** increases very sharply, surpassing its previous peak from the second time period at the fourth time period, and by the tenth time period, **LKOFGI** responds to **SS1_tech index** positively by 0.003 units, corresponding to an increase to **KOFGI** by 0.3%. Moreover, the curve suggests that **LKOFGI** will continue to increase in the long run as supported by the cointegration hypothesis.



For the variables, when **SS1_tech** is the dependant variable and **LKOFGI** is the independent variable, in the intercept only specification, the Wald Test F-statistic [0.799] testing for $a_{2i} = 0$, from panel VECM estimation and p-value [0.450], suggest that there is no evidence for short-run causality as the null hypothesis cannot be rejected at all levels. For the intercept and trend specification, the results were similar in comparison to the intercept only specification. Both specifications agree similarly without much dispersion on the level of statistical significance of coefficients. The Wald Test F-statistic [0.800] testing for $a_{2i} = 0$, from panel VECM estimation and p-value [0.449] suggests that there is no evidence for short-run causality. This means that, from combining the two specifications, we can conclude that there is no evidence for short run granger causality.

The error correction term for, **SS1_tech**, specified by COINTEQ1_KOFGI_SS1_TECH(-1), in appendix 4, is shown to be statistically significant, interpreted by the Wald Test F-statistic [15.071] testing for π=0, from panel VECM estimation and p-value [0.000]. The intercept and trend specification had similar results; Wald Test F-statistic [15.071] testing for $\pi = 0$, from panel ECM estimation and p-value [0.000]. The null hypothesis is both rejected at the 1% level, however, not with the anticipated negative sign. The adjustment coefficient associated with **SS1_tech** is 3.66. This suggests that any disturbances to the system will cause a 3.66% divergence from the intended equilibrium per annual period, implying an unstable long-run relationship. This means that any shocks will diverge rather than converge to the equilibrium. The unexpected sign suggests that there is no long run equilibrium. Therefore, **LKOFGI** does not granger-cause **SS1_Tech** in both the short and the long run. There are no effects found.

As cointegration implies that granger causality exists, in at least one direction, we can confirm to agree with the panel cointegration tests that suggested cointegration. As the ECM term is found to not be the anticipated negative sign, when **SS1_tech** is the dependent variable and **LKOFGI** the independent variable, we will run an additional VAR in stationary to confirm whether there are short run effects or not.

Before we discuss the coefficients and t-statistics of the VAR model, if any, we first run the VAR Granger-Causality/Block Exogeneity Wald Tests to examine and confirm the casual relationship between **DLKOFGI** and **DSS1_Tech**. The results show that, from interpreting the Wald Chi-Sq. statistics [0.305] and p-value [0.858], that there is no evidence to suggest that **DLKOFGI** granger causes **DSS1_Tech** at all levels. Therefore, for both models, we have found that there are no effects running from **LKOFGI** to **SS1_Tech**.

5.8.2. LKOFGI and SS2_helg

For variables, **LKOFGI** and **SS2_helg**, whereby **LKOFGI** is the dependent variable and **SS2_helg** is the independent variable, both the intercept and the intercept and trend specification were chosen as the appropriate models for the panel VECM. For the intercept only specification, the Wald Test F-statistics [3.254] testing for $a_{2i} = 0$, from panel VECM estimation and p-value [0.039] suggests that there is evidence for short-run causality. As the null hypothesis can be rejected at the 5%, we can express that the certainty of short-run causality between the two variables is of strong strength. Moreover, the error cointegrating vector is shown to be statistically significant, interpreted by the Wald Test F-statistic [20.138] testing for $\pi = 0$, from panel VECM estimation and p-value [0.0000]. As the null hypothesis can be rejected at the 1% level, and the very high F-statistic, this suggests very strong evidence for long-run causality between the two variables.

For the intercept and trend specification, the results were similar in comparison to the intercept only specification. Both specifications agree similarly without much dispersion on the level of statistical significance of coefficients. The Wald Test F-statistic [3.253] testing for $a_{2i} = 0$, from panel VECM estimation and p-value [0.039] suggests that there is evidence for short-run causality. As the null hypothesis can be rejected at the 5%, we can express that the certainty of short-run causality between the two variables is of strong strength. Moreover, the error cointegrating vector coefficient was also shown to be statistically significant, and the null hypothesis is also to be rejected at the 1% level, interpreted by the Wald Test F-statistic [17.044] testing for $\pi = 0$, from panel VECM estimation and p-value [0.000]. This means that, from combining the two specifications, we can conclude that there is strong evidence for a short-run causality however very strong evidence to suggest certainty of causality in the long run.

The error correction term for, **LKOFGI**, specified by COINTEQ1_KOFGI_SS2_HELG(-1), in appendix 5, was found to be statistically significant with the anticipated negative sign. The adjustment

coefficient associated with **LKOFGI** is -0.039. This is sufficient to reject the null to "no cointegration" and suggests a stable long-run relationship between the two variables whereby **LKOFGI** is the dependent variable. In addition, this indicates that when the system experiences a disequilibrium, the speed of adjustment suggests it is corrected by 3.9% each year.

The evidence from impulse response functions shows that when a shock occurs of one standard deviation, from the first to the second time period, **LKOFGI** responds to **SS2_helg** index very sharply and positively by 0.00077, corresponding to an increase to **KOFGI** by 0.077%. Following the third time period, it is shown that there is a substantial negative effect to 0.00001, corresponding to a decrease to **KOFGI** by 0.001%. From the third time period and the fourth time period of the sample, **LKOFGI** increases quite sharply. **LKOFGI** recovers positively by an increase to 0.00023 units, corresponding to an increase to **KOFGI** by 0.023%. To the fourth period, the sharp growth movement is considered less sharp, but still increasing by, to 0.003, corresponding to an increase to **KOFGI** by 0.03%. From the fifth time period until the tenth time period, we see a gradually very sharp increase, surpassing its previous peak at approximately the seventh time period and to **LKOFGI** by 0.001, corresponding to an increase to KOFGI by 0.1%. Moreover, the curve suggests that **LKOFGI** will continue to increase in the longer run as supported by the cointegration hypothesis.

For the variables, when **SS2_helg** is the dependant variable and **LKOFGI** is the independent variable, in the intercept only specification, the Wald Test F-statistic [6.895] from panel VECM estimation and p-value [0.001], suggest that there is evidence for short-run granger causality. As the null hypothesis can be rejected at the 1% level, it can be expressed that the certainty of short-run granger causality between the two variables is of very strong strength. For the intercept and trend specification, the results were similar in comparison to the intercept only specification. Both specifications agree similarly without much dispersion on the agreement to the level of statistical significance of coefficients. The Wald Test F-statistic [7.070] testing for $a_{2i} = 0$, from panel VECM estimation and p-value [0.000] suggests that there is evidence for short-run granger causality. As the null hypothesis can be rejected at the 1% level, it can be expressed that the certainty of short-run granger causality between the two variables is of very strong strength. This suggests that, from combining the two specifications, we can conclude that there is strong to very strong evidence for short-run granger causality.

The error correction term for, **SS2_helg**, specified by COINTEQ1_KOFGI_SS2_HELG(-1), in appendix 4, is shown to be statistically significant, interpreted by the Wald Test F-statistic [13.247] testing for π=0, from panel VECM estimation and p-value [0.000]. The intercept and trend specification had similar results; Wald Test F-statistic [15.249] testing for $\pi = 0$, from panel ECM estimation and p-value [0.000]. The null hypothesis is both rejected at the 1% level, however, not with the anticipated negative sign. The adjustment coefficient associated with **SS2_helg** is 2.805124. This suggests that any disturbances to the system will cause a divergence of 2.805% per annual period from the intended

equilibrium, implying an unstable long-run relationship. This means that any shocks will diverge rather than converge to an equilibrium. The unexpected sign suggests that there is no long run equilibrium. Therefore, **LKOFGI** does not granger-cause **SS2_helg** in the long run.

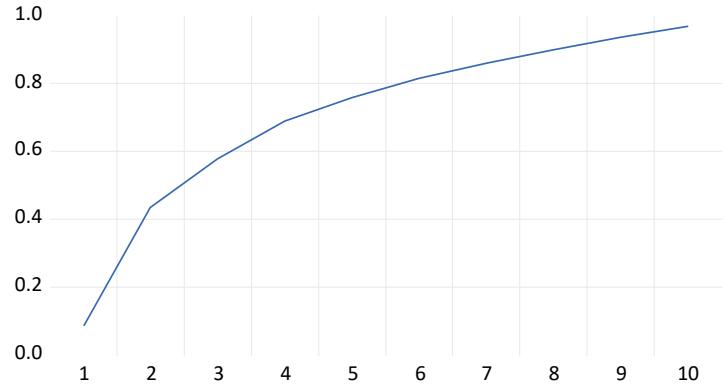
As cointegration implies that granger causality exists, in at least one direction, we can confirm to agree with the panel cointegration tests that suggested cointegration. However, as the ECM term is found to not be the anticipated negative sign when **SS2_helg** is the dependant variable and **LKOFGI** the independent variable, we will keep the short run dynamics from the VECM in first differences and run an additional VAR in stationary to compare the findings for forecasting.

Before we discuss the coefficients and t-statistics of the VAR model, if any, we first run the VAR Granger-Causality/Block Exogeneity Wald Tests to examine and confirm the casual relationship between **DLKOFGI** running to **DSS2_Helg**. The results show that, from interpreting the Wald Chi-Sq. statistics [8.215] and p-value [0.016], that there is evidence to suggest that **DLKOFGI** granger causes **DSS2_Helg**. The null hypothesis is rejected at the 1% level.

Furthermore, the coefficients and t-statistics of the VAR in Appendix (?), explain that a 1% increase change in **DLKOFGI**(-1) causes **DSS2_Helg** to increase by 9.489 units. The Wald-test Chi-sq [8.214] and p-value [0.004] suggest that the null of the coefficient is rejected at the 1% level, and is statistically significant at the 99% level. Given 2 lags, **DLGDPPC**(-2), it is also shown to increase **DSS2_Helg** by 0.04 units. However, the Wald-test Chi-sq. [0.000] and p-value [0.989] suggest that the null of the coefficient cannot be rejected at any level. The whole regression for two lags, interpreted by the Wald-test Chi-sq. [8.215] and p-value [0.01] suggest that the null of the coefficient is rejected at the 1% level, and is statistically significant at the 99% level.

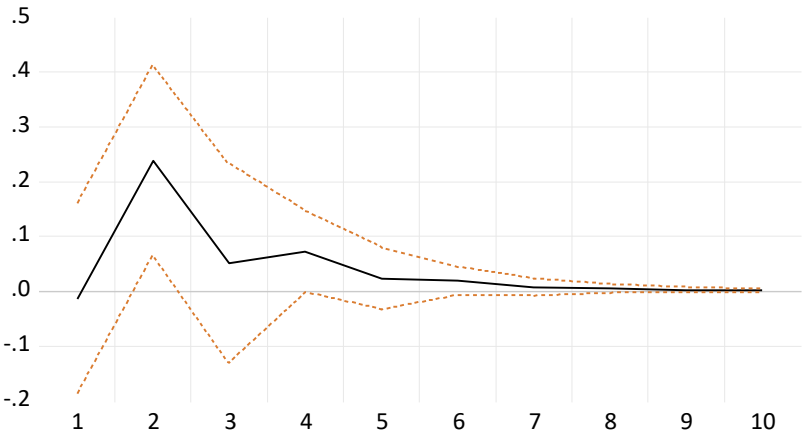
The evidence from impulse response functions shows that when a shock occurs of one standard deviation, from the first to the second time period, **SS2_helg** responds to **LKOFGI** very sharply and positively by 0.44 units. Following to the third time period and until the tenth time period, we see a less sharp but an increasing curve to by 0.96 units. Moreover, as the curve suggests that **SS2_helg** will continue to increase in the longer run, that it will deviate from the long run by 2.805% per annual period, as the evidence shows that there is no intended long run equilibrium, the impulse response function for this phase cannot be considered reliable for interpretation.

Response of SS2_HELG to LKOFGI Cholesky One S.D. (d.f. adjusted) Innovation



The evidence from VAR impulse response functions shows that when a shock occurs of one standard deviation, from the 1st period to the 2nd period, the response of **DSS2_Helg** to **DLKOFGI** is shown to already be at its peak. Following to the 2nd period to the 3rd period, the response declines sharply to almost no value, however still positive. From the 3rd to the 4th period, the response is stable but still positive. From the 4th period until the 10th period, the response sharply deescalates although still positive, and ultimately becomes negligible.

Response of DSS2_HELG to DLKOFGI Cholesky One S.D. (d.f. adjusted) Innovation
± 2 analytic asymptotic S.E.s

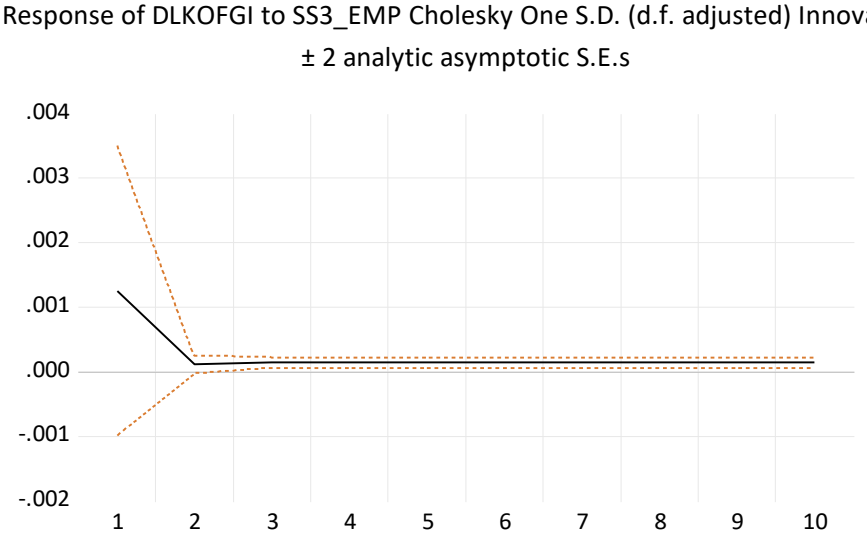


5.8.3. DLKOFGI and SS3_Emp

As the unit root tests confirm that social inequality index 3 (SS3_Emp) is stationary at level, it is suggested that two variables that are I(0) and I(1) cannot be cointegrated. Following this, we will skip the VECM phase and run the VAR model in stationary for forecasting. The VAR model will be run with a lag structure of 1,1 as previously determined. The results confirm the short-run granger causality relationship between **SS3_Emp** running to **DLKOFGI**. The results show that, from interpreting the Wald Chi-Sq. statistics [10.92387] and p-value 0.0010], that there is evidence to suggest that **SS3_Emp** granger causes **DLKOFGI**. The null hypothesis is rejected at the 1% level.

Furthermore, the coefficients and t-statistics of the VAR in Appendix (), explain that a 1 unit increase in **SS3_Emp**(-1) causes **DLKOFGI** to increase by 0.03% percentage change. The Wald-test Chi-sq [11.967] and p-value [0.0005] suggest that the null of the coefficient is rejected at the 1% level, and is statistically significant at the 99% level.

The evidence from VAR impulse response functions shows that when a shock occurs of one standard deviation, from the 1st period, the response of **DLKOFGI** to **SS3_Emp** is shown to already be at its peak. Following the 2nd period, the response declines sharply to almost nil or negligible, however still positive during the process until the end of the 2nd period. From the 2nd period onwards, until the 10th period, the response is nil or negligible.



Furthermore, it can be concluded that for **DLKOFGI** and **SS3_Emp**, the direction of short run causality is unidirectional, from when **SS3_Emp** is the dependent variable. As both are of different orders of integration, they are considered not cointegrated. Despite this, the strength regarding short run causality can be described as bidirectionally strong.

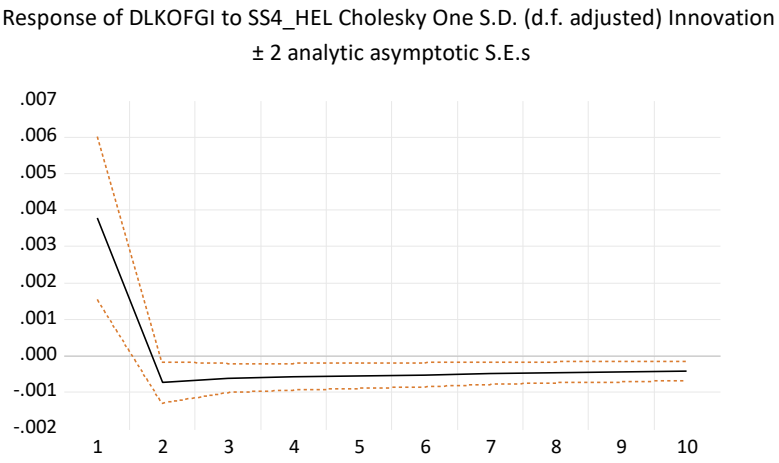
5.8.4. DLKOFGI and SS4_Hel

As the unit root tests confirm that social inequality index 4 (SS4_hel) is stationary at level, it is suggested that two variables that are I(0) and I(1) cannot be cointegrated. Following this, we will skip the VECM phase and run the VAR model in stationary for forecasting. The VAR model will be run with a lag structure of 1,1 as previously determined. The results confirm the short-run granger causality relationship between **SS4_Hel** running to **DLKOFGI**. The results show that, from interpreting the Wald Chi-Sq. statistics [3.1783] and p-value [0.0425], that there is evidence to suggest that **SS4_Hel** granger causes **DLKOFGI**. The null hypothesis is rejected at the 5% level.

Furthermore, the coefficients and t-statistics of the VAR in Appendix (), explain that a 1 unit increase in **SS4_Hel**(-1) causes **DLKOFGI** to decrease by a 0.02% percentage change. The Wald-test Chi-sq

[9.765] and p-value [0.0018] suggest that the null of the coefficient is rejected at the 1% level, and is statistically significant at the 99% level.

The evidence from VAR impulse response functions shows that when a shock occurs of one standard deviation, from the 1st period, the response of **DLKOFGI** to **SS4_Hel** is shown to already be at its peak. Following the 2nd period, the response is positive but declines sharply to negative values. From the 2nd period onwards, until the 10th period, the response is negative and slowly declines back to a negligible effect.



Furthermore, it can be concluded that for **DLKOFGI** and **SS4_Hel**, the direction of short run causality is unidirectional, from when **SS4_Hel** is the dependent variable. As both are of different orders of integration, they are considered not cointegrated. Despite this, the strength regarding short run causality can be described as bidirectionally strong.

5.8.5. Summary of Results

Key Findings

Globalization positively affects economic growth in the short run
Globalization positively affects access to health facilities
Economic growth positively affects access to electricity - with emphasis to technologies
Economic growth positively affects access to health facilities (and vice versa)
Access to health facilities positvely affect Globalization
Access to electricity - with emphasis to technologies positively affects Globalization

CHAPTER 6: Discussion

In our results, we find positive short-run granger causality effects from globalization towards economic growth. There were no short nor long-run granger causality effects found from economic growth towards globalization. In either direction, there were no long-run granger causality effects. We find positive short-run granger causality effects from economic growth towards social inequality index 1 (SS1_tech). There were no short-run granger causality effects found from social inequality index 1 (SS1_tech) and economic growth. In either direction, there were no long-run granger causality effects. We find positive short-run granger causality from economic growth towards social inequality index 2 (SS2_Helg). In the opposite direction, we also find positive short-run granger causality effects from social inequality index 2 (SS2_Helg) and economic growth. In either direction, there were no long-run granger causality effects. We find positive short and long-run effects from social inequality index 1 (SS1_tech) towards globalization. In the opposite direction, for both the short and long run, we find no effects from globalization towards social inequality index 1 (SS1_tech). We find positive short-run granger causality effects from globalization towards social inequality index 2 (SS2_Helg). There were no long-run granger causality effects found from globalization towards social inequality index 2 (SS2_Helg). In the opposite direction, we find positive short and long-run granger causality effects from social inequality index 2 (SS2_Helg) towards globalization.

This section discusses the reasoning behind what we have found. This is expressed using the knowledge of what I have learned as part of my research alongside the literature review. As globalization, growth and social inequality are broad topics, the explanations are narrowed down to relevant sub-sections.

Furthermore, to remind, in this section, the social inequality measures capture between-country measures and allow us to compare the effects of inequalities in this dimension. The mechanisms and discussions below are as interpreted in this way.

6.1. Globalization and Economic Growth

From the results, we find that there is a positive short-run granger causality relationship stemming from globalization towards economic growth. Economic growth was measured using GDP per capita meanwhile globalization was measured using the components of trade, financial, cultural and political indexes. This finding is rather reasonable, and a possible mechanism for this with regards to every sub-index is discussed below.

6.1.1. Economic Globalization

6.1.1.1. Trade Globalization

A (developing) country that is considered more open to international trade may experience an increase in activity relating to the exports and imports of goods and services. This also includes trade regulations,

trade taxes, trade tariffs, and trade agreements that favor the openness to international trade. For domestic firms', this allows them to enter a wider market range to sell their product or service and gain additional revenue. An example would be the introduction of exporting goods overseas. This would not be possible if there was a barrier that prohibits trade from one country to another. When foreign demand is favorable for domestic firms, it should boost the economy in terms of national income. In addition, an increase in foreign demand, by market forces, should result in an equilibrium that encourages domestic firms to be more productive to match demand, increasing GDP in the short term. As domestic firms gain revenue, this may increase the income per capita levels as the owners to the domestic firms have more income. In return, this may create more jobs for the local communities as domestic firms' supply would need to increase to match foreign demand. Owners may have to employ more labor to their production function. Individuals in those local communities and the economy as a whole will therefore experience an increase in their income level.

The entering of a wider market range may also benefit domestic firms with the opportunity to lower their production costs. The possibility of a wider range of imports, considering input costs, could be found as a cheaper alternative overseas when compared to domestic prices. In addition, the quality of inputs in the overseas market may be better than when compared to domestically, and depending on firm decisions, may lead to an improvement in the quality of that product or service. Newer technologies that are not available in a particular developing country, but are in another country, can be imported. This may further increase the efficiency and quality of the production processes of domestic firms.

However, this is dependent on the level of trade partner diversity. A country that is open to a more diversified trade portfolio is more likely to have access to a wider range of resources for inputs and selling opportunities. This also includes the number of bilateral and multilateral free trade agreements that that country is involved in. Furthermore, trade taxes may impact the magnitude of domestic firms' gain in revenues. A reduction or removal in trade taxes and a more diversified trade portfolio by a country (developing) will therefore increase the magnitude of benefits towards domestic firms' and its economy. Ultimately, because of a country (developing) being more open to international trade, and to the explanations above, the positive reaction is that the value of domestic firm's goods and services will grow, and therefore to the economic growth indicator, GDP per capita.

6.1.1.2. Financial Globalization

A country (developing) that is considered more financially integrated to international capital markets may experience an increased inflow of foreign direct investment. This includes investment policies, capital account openness and international investment agreements that favor liberalization to international capital markets. An overseas country that invests in a particular country (developing) directly promotes economic growth as there is direct capital flow injection in the economy. One of the positive effects of foreign direct investment include the creation of new jobs for the local communities

in the economy. This helps lower the unemployment rate in the area where FDI is injected, translating into higher incomes for individuals and overall on average in the economy. Furthermore, FDI also aids the development of human capital in the developing country's workforce. The creation of new jobs for the local communities in the economy has a ripple effect in which the training provided given the FDI, boosts the skills and education of those in the workforce permanently. When FDI is injected, and especially from a developed country, the introduction of modern technologies and business practices, provides a positive distribution to the local economy and industry that relates to that specific FDI. In addition, this improves the competitiveness and overall effectiveness to that specific industry FDI, resulting in a higher industry productivity rate. The more competitive an industry is, the more likely that it will be able to foster and encourage innovation, resulting in better-quality product offerings and competitively priced products for the local economy to consume.

However, this is dependent on the level of capital account openness, which allows for the freedom of capital to inflow and outflow of the economy. International investment agreements and investment restrictions regarding policies are also relevant in the case that they either boost or slow down the rate of potential FDI that could occur in that particular developing country's economy. Ultimately, because of a country (developing) being more open to international capital markets, and to the explanations above, the positive reaction is that the local economy will be of higher value regarding goods and services following FDI, and therefore to the economic growth indicator, GDP per capita.

6.1.2. Social Globalization

6.1.2.1. Interpersonal Globalization

Increased inflow of international tourism and migration can be explained for a country that is considered more interpersonally globalized. This includes the freedom to visit that particular developing country and the number of international airports that allows the possibility of travel. An inflow of international tourism is very crucial for industries such as hospitality where the rising demand and consumption results in the generating of foreign currency for the local economy. Tourism can be the direct reason for how some businesses survive in the local economy. As the likelihood of consumption is high for tourists, many local food shops, transportation companies and attraction activities, including historical museums and theme parks as examples, are reliant on tourists to generate their revenue. In addition, as the level of tourism increases, this potentially creates more jobs in the local community as there will be more inputs in labor needed for businesses to match demand. When tourism is low or lacking, these industries may lackluster, causing unemployment problems and a lower income level for owners, individuals, and the local economy as a whole. In simple terms, an increased inflow of international tourism equals more consumption and hence the raising of GDP per capita in the local economy.

The inflow of migration is also important for the local economies of a particular developing country. For example, migration boosts the working-age population of the economy. The more of the population

of the economy that is employed, the higher the productivity and output level. In addition, migrants also carry their skills with them to the labor market and contribute to the human capital development and level of the economy. Furthermore, migration can contribute to the economy by increasing the total spending regarding consumption and raising tax revenues for the government.

However, the magnitude to these factors are dependent on the level of whether migrants and tourists have the freedom to visit and their access abilities to get in the country. The ability to work regarding visa requirements are also important. The country being more interpersonally globalized would therefore reduce the barriers and increase the incentive to enter for tourists and migrants. Ultimately, because of a country (developing) being more open to interpersonal globalization, and to the explanations above, the positive reaction is that the local economy will be of higher value regarding goods and services following the rise in tourism and migration, and therefore to the economic growth indicator, GDP per capita.

6.1.2.2. Informational Globalization

Informational globalization can be linked to increases in high technology exports and international patents. The outflows of high technology exports in a developing country, which are products of high intensity R&D, such as within the aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery, are important to the growth of the economy because they represent the monopoly and brand power of firms in that particular developing country. At the high R&D level, it is only possible that these exports are sold overseas if the economy is informationally globalized. When the economy is not informationally globalized, the exporting of high R&D products would be restricted as the economy may be in the position that it does not want to spill that information. In simple terms, an increase in the exporting of high technology exports, given that these industries are monopolies, would generate a substantial amount of revenue and income for the economy. This further creates jobs especially for high-skilled workers given that foreign demand is favorable.

However, this is dependent on the level to which the country is involved with international patents. Being involved within the pool of international patents allows the inventor to be protected for at least 20 years. The idea of being more informationally globalized can be identified as there is protection for the high R&D sectors of the economy in developing countries and help favor the exports to these products. Ultimately, because of a country being more open to informational globalization, and to the explanations above, the positive reaction is that the high intensity R&D sector of the economy will be of higher value regarding its production of goods and services. In addition, this is following the rise in high technology exports and international patents, and therefore to the economic growth indicator, GDP per capita.

6.1.2.3. Cultural globalization

Being culturally globalized may lead to an increase in the trade of cultural goods and personal services. The characteristics surrounding cultural globalization suggest that businesses within that country should be open to converge with the many cultures of consumers. The allowing of inflows to migration in the economy and international integration requires the acknowledgement by firms and individuals to the different countries around the world. This also reflects the standardization of cultural expressions and the diffusion of commodities and ideas. An increase in the trade of cultural goods and personal services can bring consumption to a higher level within an economy. This is because individuals and firms have a wider range of things to sell and consume, raising the bar for aggregate demand in the economy.

International trademarks are also important as this also relates to inward FDI. The allowing of internationally established cultural goods around the world to be implemented within the cities of developing economies can boost consumption and create jobs for the local community. An example would be international brands McDonald's and IKEA in which they are leading global monopolies for the fast food and home furniture retailing industries, respectively. As they are proven for global popularity and world class business practices, it is almost guaranteed that they will do well in terms of generating revenue, profit, and providing a wider range of selection for local and regional consumption.

However, this is dependent on the basis of whether that particular country is open culturally at the international level. This also includes civil liberties. The freedom of expression and belief, associational and organizational rights, rule of law and personal autonomy and individual rights, are important to manifester the increase in trade of cultural goods and personal services without any barriers to investors and consumers. Ultimately, because of a country being more open to cultural globalization, and to the explanations above, the positive reaction is that international established trademarks are encouraged to directly invest (FDI), as well as cultural goods and services being introduced into the economy for consumption, resulting in a higher value of the economy regarding its production of goods and services. In addition, this raises the growth indicator, GDP per capita, for that particular country.

6.1.2.4. Political Globalization

Overall sustainability of growth can be a mechanism of political influence. Having political stability between countries is important as it allows for a smoother transaction when it comes to economic discussions. The building of alliances is important especially for developing countries as they can get smoother access to help from developed countries. International organizations such as the World Trade Organization and the International Monetary Fund are examples of globalization at the political level. The expansion of a global political system whereby developing countries are involved and engaged within these systems, may foster policies that encourage growth. Examples include encouraging policies for free trade, and freedom of movement. As there are more absolute numbers of embassies within a particular developing country, there is more likelihood of tourism and migration whereby they may

have significant positive growth impacts on the local economy, as discussed in the interpersonal globalization section.

However, this is dependent on the basis of whether that particular country is open to join internationally inter-governmental organizations to which it is willing to be a member. International treaties are also important, as well as their willingness to contribute to UN peacekeeping missions and treaty partner diversity. The more a country is politically involved at the global scale, the more options that the government will have to ensure that its policies are accurate (as will be evaluated by world class research, by for example the WTO) to ensure economic growth occurs. Ultimately, because of a country being more open to political globalization, and to the explanations above, the positive reaction is that governments are encouraged to foster various types of globalization policies (mainly economic) and therefore resulting in a higher value of the economy regarding its production of goods and services as discussed within the economic globalization section. In addition, this raises the growth indicator, GDP per capita, for that particular country.

To briefly conclude, these are the many reasons why we have found globalization to have a positive effect upon economic growth. The results support these explanations. Although there are disadvantages to globalization as we will discuss later in a different section, the results support globalization that the advantages outweigh the disadvantages, and ultimately that globalization has a permanent short run positive effect on economic growth..

6.3. Economic Growth and Social Inequality

From the econometric analyses a clear result was that there is a positive short-run granger causality relationship stemming from economic growth towards social inequality index 1 (SS1_tech). In addition, this correspond to improvements between the countries' social inequalities. This index was constructed including an average approach of four indices; access to electricity, access to fuels and technologies for cooking, individuals using the internet and mobile cellular subscriptions. This finding is rather intuitive, and a possible mechanism for this with regards to every sub-index is discussed below.

6.3.1. Access to Electricity

Increasing growth levels per capita may experience an improvement to social inequality regarding its population's access to electricity. As economic growth per capita improves, a higher number of individuals at the lower echelons of society, on average, have higher income levels and therefore are more able to afford and sustain a reliable energy source for their basic standard of living purposes. As electricity is the basic necessity for human development and to survive, it is at the forefront that any increase in per capita income will most likely result in electricity being the priority for households.

Furthermore, as economic growth is presently occurring in an economy, important firms such as those in the energy industry have incentive to further invest, improve or expand upon its existing

infrastructure within that economy. The reasoning behind this is because business confidence will be at high levels during times where there is an economic boom in the economy. The demand for electricity will further enhance productivity levels and utility gain from the per capita income levels. Firms will also have extra revenue to spend upon the importing of fossil fuels to generate for readily further use of electricity by its population. This possibly improves the availability of extra fuels put on hold when it is needed in case of an emergency regarding supply or a fuel's shortage to generate electricity. As there is confidence in the supply of fuels, this could also keep prices stable, in which the price level and affordability remains constant and does not fluctuate wildly throughout time.

As economic growth occurs, the government will also be collecting more tax revenues. In developing countries, the government is at the forefront of the preoccupation of electricity services to its population, and more so among the poorest of its people. Most of the major energy companies in developing countries are state owned. The higher tax revenues that the government collects resulting in a higher government budget, could be a factor in which in regard to whether the government spending is spent correctly, it is a possibility that economic growth provides the government with the opportunity to further invest in their country's existing energy infrastructure. This may help to heighten the accessing range or quality of electricity to its population. In addition, this gives governments a building platform of a future plan for firms and individuals within the economy, to which the economic growth is to be either sustained or to be heightened, as well as social inequality, in the upcoming years and beyond.

Ultimately, because of a country that experiences economic growth, and to the explanations above, the positive reactions are that individuals, firms and the government will all play a role in the manifesting of electricity access and minimizing the gap of social inequality in the economy.

6.3.2. Access to clean fuels and technologies for cooking

A country (developing) that is increasing in growth levels per capita may experience an improvement to social inequality regarding its population's access to cleaner fuels and technologies for cooking. As a country gains wealth in terms of GDP per capita, individuals, and especially those at the lower echelons of society, will have a higher income level and are therefore able to make improvements to their current stock of household technology. Those that are considered socially disadvantaged are forced to use wood, crop residue, dung, charcoal, and coal as the main alternatives as fuels for cooking and heating. This has profoundly serious health implications to those in the household and the surrounding area. A higher income level will allow for households to upgrade their current cooking technology that allows for cleaner fuels. This includes the change to non-solid fuels such as natural gas, ethanol, or electric technologies. Furthermore, the change to non-solid fuels would not be possible without the correct cookstove technologies.

As economic growth is presently occurring in an economy, there will be a growing market for cleaner cooking solutions. There is always demand for cleaner cooking technologies in developing countries as

those without are socially disadvantaged. Firms that manufacture and sell clean cookstoves will be more able to finance their production and hence increase their supply in the economy. Firms that sell clean cookstoves alone through other sources such as overseas imports, will also find it easier in a growing economy to finance their costs. As supply increases, the price level to cleaner cooking technologies should stabilize and be affordable among the population. This will be the same explanation to firms that acquire and sell non-solid fuels as economic growth affects all industries positively in the economy.

For the public sector and governments', the explanation is similar to the access to electricity of developing countries. Governments are also at the forefront of providing and doing their best as possible to the rolling out of cleaner cooking technologies for their population. With higher tax revenues and a greater government budget made possible by a recent positive shock of economic growth, the government is able to confidently subsidize and help among those that are socially disadvantaged.

Ultimately, because of a country that experiences economic growth, and to the explanations above, the positive reactions are that individuals, firms and the government will all play a role in the manifesting of clean fuels and technologies for cooking in the economy. In addition, this improves the social inequality regarding access to basic technology for a healthy adequate lifestyle, in that particular country.

6.3.3. Individuals using the internet and mobile cellular subscriptions

Increasing growth levels per capita may experience an improvement to social inequality regarding its population's access to the internet. As economic growth is occurring in an economy, a higher GDP per capita suggests that individuals are more able to afford technologies such as computers, mobile phones, a games machine and a digital tv. These technologies make it possible for individuals to be able to access the internet. Furthermore, it is deemed a useful investment for individuals to start looking to spend on technologies that allow for internet access from when they have acquired extra income to do so. This is more likely in the case when an economy is experiencing short or extended periods of economic growth. In short, but as explained in the literature review on the benefits to internet access, the classification to individuals using the internet as a basic necessity surrounds the importance to communication, health, education, freedom of expression and employment opportunities.

For firms, it is likely that they already employ a certain number of computer technologies for their access to the internet. However, as many firms may suffer from a shortage to where a computer may be shared between multiple people, in an economic growth period, these firms may find themselves additional revenue. The additional revenue could be used to invest in a number of computer technologies for access to the internet, further improving the statistics of individuals using the internet as a % of the population. Firms that sell computer technologies and electronics are more likely to experience a higher demand from their population when income levels rise.

For governments', it is important that the level of accessibility to the internet is of adequate levels for its population. What is more important than actual hardware, is the infrastructure to where broadband and the internet can be reached among certain areas. A piece of computer technology hardware is not as useful unless it can be connected to a reliable sustained connectivity rate regarding the internet. The governments in developing countries are at the forefront of ensuring that the level of social inequality regarding access to the internet is minimized. In addition to this, governments are to be leading the economy in the direction to where it is classified as more modern. An example would be to encourage, employ intelligent transport systems, and smart electric grids among areas that are not in range for broadband or mobile connectivity. Only this is possible whereby the government has confidence, and the indicator to economic growth per capita can give them confidence.

Ultimately, because of a country that experiences economic growth, and to the explanations above, the positive reactions are that individuals, firms and the government will all play a role in the manifesting of internet use and mobile cellular subscriptions in the economy.

6.3.4. General health

6.3.4.1. Prevalence of non-undernourishment, Life expectancy, and Health Expenditure

Growth levels per capita may link toward improvements to social inequality regarding its population's issues regarding prevalence of non-undernourishment, antiretroviral therapy coverage, life expectancy and health expenditures. As a country gains wealth in terms of GDP per capita, individuals will have a higher income level and are therefore able to make improvements to their nutrition and consumption of health products and services. In addition, economic growth enables governments to make investments to improve its country's current public health infrastructures, medical technology advances, and current state of domestic and international (imports) food supplies. Examples include but are not limited to; the building of new hospitals, dentists, health-related education, clean water infrastructure facilities, and support for health services and products through domestic production or imports. A higher government budget through tax revenues due to a growing economy allows for the possibility of subsidies to food programs and effective policy making to improve the availability and access of food and water to their population. As a result of economic growth, life expectancy is also expected to improve.

On the contrary, as the prevalence of non-undernourishment, health expenditure and ultimately life expectancy improves in a country (developing), this means that individuals are healthier and have enough adequate energy to be part of the working population for a longer period of time. This affects productivity whereby workers would work slower if they do not have sufficient energy. Those malnourished are also more likely to risk illness, mortality, and morbidity rates. This lowers the working-age population of the economy. As the structure of developing countries mostly require labor-

intensive work, a reduction in labor (working-age population) could mean an overall decline in productivity of the economy.

Ultimately, because of a country that experiences economic growth, and to the explanations above, the positive reactions are that individuals, firms and the government will all play a role in the manifesting of its population's social inequalities regarding the general health index..

6.4. Globalization and Social Inequality

In our empirical findings, we find that there is a positive effect from globalization towards access to general health (social inequality index 2). In addition, these results correspond to improvements between the countries' social inequalities. We also find that this index has a positive effect towards globalization (bi-directional). These findings, although rather intuitive, will explore the potential mechanisms in relation to each of the sub-indexes as discussed below.

6.4.1. Economic Globalization

6.4.1.1. Trade Globalization

Engagement in international trade refers to the increase in activity relating to the exports and imports of goods and services. This includes trade regulations, trade taxes, trade tariffs, and trade agreements that favor the openness to international trade. The process of global integration in terms of trade allows the introduction of more health-related goods and services, as well as basic supplies for nourishment, to be added into the economy. In addition, as a developing country is lacking in technological innovation and knowledge compared to developed countries, the fostering of trade may help close the R&D and technology gap in terms of the health-related goods and services sector. The assisting with the transfer of appropriate technologies, including low-cost health technologies, through trade openness may benefit developing countries as adequate supply is increased in conjunction with the usage of those appropriate technologies.

At the international level, trade globalization affects the domestic prices of goods and services. As there is more choice for price comparison in the international market, this may lead to lower prices for consumers domestically. Entering the global market also allows the activation of possible wholesale bulk purchases. Due to this, firms in a particular developing country are able to supply more in terms of quantity as well as quality of that particular good or service to their consumers.

To further explain, trade may help foster a wider range of affordable health-related goods and services, as well as basic supplies for nourishment, in the consumer market. Without trade, as developing countries lack the R&D and infrastructure compared to developed countries, it would be less likely to be achievable. Trade therefore allows the lowering of a developing country's social inequality by providing the opportunity for those at the lower echelons to society to be able to consume health-related

goods and services, as well as have access to the basic supplies for nourishment. Furthermore, trade improves the convenience as well as affordability for individuals to be able to consume.

We also find on the flip side that improving social inequality in terms of general health also has a positive effect on globalization. In terms of trade globalization, the reasoning behind this may suggest that as the population is improving in terms of general health, this increases the communication that firms and individuals have with the global economy. The boosting of productivity given that globalization improves economic growth as well as access to health-related goods and services, and including lower cost technologies for the socially disadvantaged, leads to individuals and firms to further engage in the globalized market given that it had benefitted society at all levels.

However, it is important to note that trade globalization is dependent on the level of trade partner diversity. A country that is open to a more diversified trade portfolio is more likely to have access to a wider range of countries to compare the available choice and bulk buy potential of health-related goods and services as well as basic supplies for nourishment. This also includes the number of bilateral and multilateral free trade agreements that that country is involved in. Furthermore, trade taxes may impact the magnitude of the supply that firms are able to bring into the domestic economy. A reduction or removal in trade taxes and a more diversified trade portfolio by a country (developing) will therefore increase the magnitude of benefits towards supply and its economy. Ultimately, because of a country (developing) being more open to international trade, and to the explanations above, the positive reaction is that social inequality will improve in terms of the population's access to general health facilities as well as access to basic supplies for nourishment.

6.4.1.2. Financial Globalization

The mechanism to financial integration to international capital markets may exhibit increased inflows of foreign direct investment. This includes investment restrictions, capital account openness and international investment agreements that favor liberalization to international capital markets. An overseas country that invests in a particular country (developing) directly promotes the introduction of new capital as well as technologies in the economy. Furthermore, in regard to developing countries, as a given example, it may be the case that financial globalization opens the door for health companies to invest, and for developing countries to import (also relating to trade globalization) low-cost as well as high-quality technologies supporting for infrastructure in health facilities including but not limited to; hospitals, clinics, pharmacies, dentists, and factories for the production of food-related products. This supports the population's access where possible to these health-related products and services, and those in rural areas where both access to health facilities and food are further limited. In regard to health-related product and services, international firms that already benefit from large amounts to R&D and economies of scale such as GlaxoSmithKline and Novo Nordisk, are able to invest, market and inject

supply of their low-cost technological goods relevant to medicine and drugs, into the domestic market without substantial barriers.

In addition, the effective embedding of infrastructure programmes focusing on long-term development strategies for capacity in terms of health facilities in developing countries would not be feasible without financial globalization. In addition, the borrowing opportunities for the government, firms and individuals are more available if cross-border capital flows are less restricted.

However, this is dependent on the level of capital account openness that allows for the freedom of capital to inflow and outflow of the economy. International investment agreements and investment restrictions regarding policies are also relevant in the case that they either boost or slow down the rate of potential FDI or cross-border transactions that could occur in that particular developing country's economy. Ultimately, because of a country (developing) being more open to international capital markets, and to the explanations above, the positive reaction is that the economy will be more financially able to fund for improving the population's access to general health facilities as well as access to basic supplies for nourishment.

6.4.2. Social Globalization

6.4.2.1. Interpersonal Globalization

International tourism and migration is an important component in the definition of interpersonal globalization. This includes the freedom to visit that particular developing country and the number of international airports that allows the possibility of travel.

An inflow of international tourism and migration is very crucial for maintaining and/or increasing the gross domestic product of developing economies as they are critical to the survival of many industries in both urban and rural areas. This impacts the income of firms, jobs, and individuals at all levels. The effects of economic growth and social inequality is further discussed in the "Economic growth and social inequality" results section. The section discusses international tourism and migration, and its positive effects on social inequality regarding the general health index.

Following this, as an indirect effect, for countries to maintain the smooth flow and satisfaction of visiting tourists and its industries, the planning of more available health facilities spread across different tourist destinations in the economy is important. This puts pressure on the government to work together among themselves and with firms to extend their current infrastructure regarding facilities for health-related access and to match forthcoming demand. The increase in migration in conjunction with higher inflows to international tourism also adds pressure as the government as well as firms are forced to project even higher demands for health products and services. The higher demands may imply a higher supply in reserves, as well as improved infrastructure. This means that individuals in the population

may benefit from the economy's confidence of increased supply as well as facilities to cater for health-related issues.

Furthermore, it may be the case that migrants are likely to relocate to places where there is infrastructure that can provide a reliable access to health facilities as well as food (supermarkets, food banks, crop fields etc.). The lack of access to these in their previous location can be explained to be the reasoning behind why they have migrated. Increased migration may therefore be the result of a social inequality problem that persisted in the area that they were originally located. The trend and thought behind migrant activities suggest that they are more likely to move to countries or areas within their own country that have a better infrastructure to cater for their survival.

We also find on the flip side that improving social inequality in terms of access to health-related goods and services as well as adequate food supplies also has a positive effect on globalization. In terms of interpersonal globalization, the reasoning behind this may suggest the importance of tourists' quality of leisure as well as safety. A country that is considered to lack health facilities, provisions for food, as well as a high HIV % of the population that is scarce in treatment services, can be identified to be less attractive for both tourism and migration. Therefore, we can assume that improvements to the population's social inequality regarding the general health index, has a logical reasoning as to why it may have a positive impact on the level of tourism and migration.

However, the magnitude to these factors are dependent on the level of whether migrants and tourists have the freedom to visit and their access abilities to get in the country. The ability to work regarding visa requirements are also important. The country being more interpersonally globalized would therefore reduce the barriers and increase the incentive to entry for tourists and migrants. Ultimately, because of a country (developing) being more open to interpersonal globalization, and to the explanations above, the positive reaction is that there will be an improved social inequality status regarding the population's access to general health facilities as well as to basic supplies for nourishment.

6.4.2.2. Informational Globalization

A country (developing) that is considered more informational globalized may experience an increase in internet bandwidth speeds, high technology exports within the economy, international applicants in patents and press freedom. As information is more freely accessible through quicker internet bandwidth speeds, individuals are more able to educate themselves to ensure that they are up to standards with health information as well as education in general for them to have a higher chance of being able to find employment. Also, individuals and firms are more able to express the problems surrounding social inequality in the press. This puts pressure on the government to ensure that these problems are addressed and further likening the possibility that social inequality improves regarding access to the population's access to general health facilities as well as access to basic supplies for nourishment.

High technology exports and international patents are more factors that impact the economic growth of the economy. The effects of globalization and economic growth is discussed in the "Globalization and Economic growth" results section. For economic growth and social inequality, this is further discussed in the "Economic growth and Social inequality" results section.

Ultimately, because of a country being more open to informational globalization, and to the explanations above, the positive reaction is that individuals in the population are to be more educated and freer to speak about the problems to their society in the press. This leads to a positive reaction by the government whereby social inequality problems regarding the population's access to general health facilities as well as access to basic supplies for nourishment, are supplemented in policies and other amendments.

6.4.2.3. Cultural globalization

A country (developing) that is considered more culturally globalized may experience an increase in the trade of cultural goods and personal services, and international trademarks. The characteristics surrounding cultural globalization suggest that businesses within that country should be open to converge with the many cultures of consumers. The allowing of inflows to migration in the economy and international integration requires the acknowledgement by firms and individuals to the different countries around the world. This also reflects the standardization of cultural expressions and the diffusion of commodities and ideas. Furthermore, this allows migrants and ethnic minorities within a society to be more recognized. Increasing recognition is important because it helps migrants and ethnic minorities to be part of the society and to not be excluded. It also minimizes the language barrier whereby the minority may have difficulty communicating with locals. This has significant effects regarding social inequality as one may be disadvantaged in terms of finding access to general health facilities, as well as to basic supplies for nourishment, as a result of the lack of cultural globalization within that country.

International trademarks are also important as this also relates to inward FDI. The allowing of internationally established cultural goods around the world to be implemented within the cities of developing economies can be analyzed to be beneficial to raising the awareness to social inequality globally. Many international brands such as McDonald's and IKEA, in which they are leading global monopolies, have a huge influence in which their voice of opinion has a significant impact upon the political agendas of that country. For example, McDonald's diversity, equity, and inclusion strategy in their practices helps support and cater for the United Nations Sustainable Development Goals in developing countries. The strong voice of opinion by McDonalds supports gender equality, employment rights, reducing inequalities, and sustainable development. IKEA has similar views in which they are passionate about inequality in topics such as improving children's opportunities in developing countries They also emphasize the root causes to poverty, in which they actively seek to support the United

Nations Sustainable Development Goals, in supplementing and voicing for the lack of resources that is required for basic living standards.

However, this is dependent on the basis of whether that particular country is open culturally at the international level. This also includes civil liberties. The freedom of expression and belief, associational and organizational rights, rule of law and personal autonomy and individual rights, are important to manifester the increase in trade of cultural goods and personal services without any barriers to investors and consumers. Ultimately, because of a country being more open to cultural globalization, and to the explanations above, the positive reaction is that social inequality will be more spoken and heard within the economy.

6.4.2.4. Political Globalization

A country experiencing an upward change in political globalization may experience a change in their contacts available for economic assistance. Having political stability as a result of being more politically globalized between countries is important as it allows for a smoother transaction when it comes to economic discussions. The building of alliances is important especially for developing countries as they can get smoother access to help from developed countries. International organizations such as the World Trade Organization and the International Monetary Fund are examples of globalization at the political level. The expansion of a global political system whereby developing countries are involved and engaged within these systems, may foster policies that favor social inequalities. The World Bank is at the forefront and a global leader in research regarding social inequality in developing countries, alongside other international bodies such as the International Energy Agency, The United Nations, and the World Health Organization. The research by international bodies provides the awareness and significance of social inequality in developing countries. Furthermore, the research that they produce includes valuable information and policy recommendations which governments can use. They are also able to get in contact with international bodies if they need any financial or informational assistance that encourages the improvement of social inequalities in their country.

However, this is dependent on the basis of whether that particular country is open to join internationally inter-governmental organizations to which it is willing to be a member. International treaties are also important, as well as their willingness to contribute to UN peacekeeping missions and treaty partner diversity. The more a country is politically involved at the global scale, the more options that the government will have to ensure that its policies are accurate (as will be evaluated by world class research, by for example the WTO) to ensure that social inequality improves. Ultimately, because of a country being more open to political globalization, and to the explanations above, the positive reaction is that governments are encouraged to foster various types of policies in favor for the improvement of social inequalities.

6.5. Relevance to literature

6.5.1. Globalization and Economic Growth

The findings are consistent with existing empirical literature that support the hypothesis that globalization has a positive effect towards economic growth (Levine and Renelt, 1992; Baldwin and Seghezza, 1995). Although their proxies for globalization focuses on trade openness, other studies found financial integration to be an important indicator for managing economic growth (Roubini and Sala-i-Martin, 1992, Levine and King, 1992; Levine and Zervos, 1996). Studies that focused on technology integration as proxies for globalization found a positive effect on growth (Coe and Hoffmaister, 1994; Borensztein, De Gregorio and Lee, 1995). More recent studies, that use the KOFGI index (Dreher, 2006; Villaverde and Maza, 2011; Rao *et al*. 2011; Quinn *et al*. 2011; Ali and Imai, 2013), to express relevance to our model, also found globalization to have a significant positive effect on economic growth.

The findings do not agree with the few that suggest or found globalization to have nil or negative effects towards economic growth. This is explained whereby countries have weak institutions (Acemoglu *et al*. 2005), political instability (Barro and Sala-i-Martin, 1995), or poor human capital levels (Borenzstein *et al.* 1998). Furthermore, the 35 countries involved in this research are low and low-middle income, and many of those countries have poor human capital levels, weak institutions and are considered not as strong politically when compared to developed countries.

The findings also do not agree with empirical studies that find and emphasise positive long run effects of globalization towards economic growth (Rao *et al*. 2011; Salifou and Haq, 2017). Historical studies that focus on the very long run emphasise the importance of globalization on its relation to income levels. Authors mention the British Empire as examples (Findlay, 1982; Clark *et al*. 2008) regarding their successful usage of exports and trade policies. Donaldson (2008) identified India's new establishment of its railway connections to other regions during the late 19th century, opening the door for faster, smoother transportation regarding agriculture and raising income in the long run. Despite this, our methodology does not fit the purpose for historical periods or over the longer run (over 20 years) as the KOFGI index is limited to the modern period. Furthermore, the period to modern globalization post year 2000, can be analysed to be vastly different to when compared to previous periods and therefore may have different effects and interpretations regarding economic growth.

In regard to international trade and economic growth theories, the classical trade theory involving Smith and Ricardo express the importance of international trade, that all countries will gain from trade, and although some countries may gain more than others. The classical view to specialization and efficient distribution of resources regarding the absolute and comparative cost advantage theory, suggest that all countries will prosper from foreign trade. Furthermore, the classical theorists explain that trade will

bring in modern technology and skills, inevitably contributing to higher efficiencies regarding the economy and therefore economic growth. From the neoclassical growth perspective (Solow, 1956), an increase in inputs (capital, labour) will higher the level of production and the savings rate, resulting in a short-term positive impact on output growth per capita. In the long run, output growth per capita is determined by technical progress. Newer growth theories propose knowledge accumulation including international knowledge spillovers, technology diffusion, R&D, and advances in human capital (Grossman and Helpman, 1991; Coe and Helpman, 1995; Eaton and Kortum, 1999; Romer, 1990; Lucas, 1988) as important motors for economic growth.

The globalization variable, KOFGI, captures a diverse range of statistics, including de facto and de jure trade and financial globalization (or openness). This is relevant to and supports all growth theories ranging from classical, neoclassical, and newer growth theories, as they proxy and allow for improvements in factor productivity, effective allocation of domestic resources, augmentation of capital and encouragement to the transferring of newer technologies (Grossman and Helpman, 2015). In addition, and in particular to, informational de facto globalization, this captures international patents and high technology exports, which is further relevant to growth theories regarding knowledge, R&D, and technology diffusion. FDI is also included and considered as an important vehicle for the transfer of technology as well as investment/savings. Although the findings do support, for example, Solow's model of short-term positive impact on output growth per capita, the long run insignificant finding between globalization and economic growth suggest that globalization does not cause technical progress. Furthermore, in a trade setting, Grossman and Helpman (2015) discuss a reduction in trade costs in an economy, although firms gain extra profit in the short term, those profits are offset due to a loss in international market share to foreign producers. This explains globalization to have nil or no effect for long run growth. The increase in globalization will cause a transitory shock to GDP per capita but will not influence GDP per capita in the long run. This research finds that ultimately the long run effects of GDP per capita are of other causes. A possible explanation to why this may be the case considers the globalization variable, KOFGI, to be as weak in capturing the full extent to long run growth. Although the KOFGI variable does feature the majority of long growth determinants as explained by the classical, neoclassical, and new growth models, the strength of the index is more suited toward short-term economic growth that affects the production inputs of an economy.

6.5.2. Globalization and Inequality

This study adds to the bulk of other studies that discuss the impacts of globalization and inequality. The empirical literature suggests that findings are mixed however it leans more toward the narrative that globalization negatively affects inequality. A bulk of empirical literature including, Dutt and Mukhopadhyay (2005), Milanovic and Squire (2005), Baddeley (2006), Wan, Lu and Chen (2008), Bergh and Nilsson (2010), and Zhou *et al*. (2011) find that globalization negatively affects inequality. Others, in Fieleke (1994) and Edwards (1997) find no significant contribution between globalization

and inequality. However, to the majority of these studies, they focus on income inequality. This includes the likes of the Gini Coefficient and other income-based only measures.

One of the major critiques to globalization that we can derive from existing empirical literature, it is narrated that globalization raises the between and within income inequality among nations of the developed compared to the developing. However, as Adam Smith famously mentioned, countries participating in globalization activities may experience different growth rates due to the structure of each economy as they are unique regarding endowment of resources. In the context of social inequality, due to the sensitivity surrounding extreme poverty and basic necessities for survival, any level of improvement is very significant for developing countries. This is regardless of any positive trade-offs whereby other countries may gain more.

6.5.3. Access to electricity (with emphasis to technologies for cooking, the internet and mobile cellular usage) and Economic Growth

This study adds to the bulk of other studies that discuss the impacts of electricity and economic growth/and or productivity. The empirical literature suggests that findings are mixed. Easterly and Levine, R. (1997), Ayogu (1999), Fan *et al.* (2002), and Noumba *et al*. (2009) find that the effects of infrastructure and electricity are positive towards economic growth/and or productivity. Calderón and Servén (2008) and Canning and Pedroni (2004) further find positive long run effects towards economic growth. Despite this, other studies find no significant or a negligible contribution (Fan *et al.* 2004; Straub *et al*. 2008). Balisacan (2001) and Fan *et al*. (2000) find no significant impact on poverty reduction. Although the studies mentioned above focus on electrification rates and/or infrastructure, our study defines more for social inequalities regarding access to basic technologies. Additionally, to access to electricity, that our index includes, 3/4 to the rest of our index proxy for the population's access to clean fuels and technologies, the internet and mobile cellular subscriptions. For internet usage and economic growth, Choi and Yi (2009), Sassi and Goaied (2013), Kurniawati (2001), and Vu and Asongu (2021) find positive effects. Noh and Yoo (2008) find negative effects in countries that have high income inequality. Moreover, there is scarcity in empirical literature regarding access to clean fuels and technologies and growth.

Comparing our findings to existing empirical literature, there are no effects that we have found running from social inequality to economic growth. Despite this, in general, and to the studies above, there is a lack of empirical literature surrounding the direction to causality between growth and the indicators above. In addition, our study finds that economic growth has a positive significant impact on the social inequality of developing countries. The finding that social inequality regarding access to electricity (with emphasis to technologies for cooking, the internet and mobile cellular usage) does not improve economic growth is somewhat surprising. This is because it does not agree with some of the important indicators mentioned in existing literature regarding its positive effects on growth.

We would assume that the increase in the population's usage of electricity through a channel of easier accessibility and availability, results in the increased productivity of the economy. In regard to energy economics, physical laws and thermodynamics suggest that that energy is required in the production function of economic systems. The elasticity of substitution between energy and capital in a production function of being less than one implies that energy is almost as important as capital, and that a continuous stream of energy is required to sustain as well as increase the productivity of an economy (Stern, 1997; Koetse *et al*. 2008). For access to clean fuels and technologies for cooking, we would assume that the health of the population significantly factors and facilities for the productivity of the economy. For individuals accessing the internet and mobile cellular subscriptions, we would assume that the increased use of basic technology results in the increased productivity in the economy. Technology is shown to play a huge role in growth theory (Romer, 1996).

Despite the above explanations suggesting that we should find a positive correlation between access to electricity (with emphasis to technologies for cooking, the internet and mobile cellular usage) and economic growth per capita, it can be objectively evaluated that this may not be the case for many reasons. The indicators chosen are meant proxies for social inequality, which means that any increases to these proxies reflect those to low-income individuals and households that are socially disadvantaged. It is assumed that the individuals and households who hold a middle-income or high-income status in a developing country, will already have adequate or good access to electricity, clean fuels and cooking technologies, the internet, and mobile cellular subscriptions. Therefore, any increases in, for example, individuals and households' access to electricity, may not contribute to the productivity of the economy. This is because as the indicator targets the low-income section of the population, the majority may be using the electricity for basic living purposes and not for productivity purposes. Furthermore, for individuals accessing the internet and mobile cellular subscriptions, this indicator only proxies for basic necessities regarding technology. Many technology-led growth theories regard higher levels of R&D.

6.5.4. General Health and Economic Growth

The findings are consistent with existing empirical literature that support the hypothesis that economic growth has a positive effect towards general health (Hamoudi and Sachs, 1999; Dreger and Reimers, 2005; Spiteri and Brockdorff, 2019; Hone *et al.* 2019). In regard to health economics, the health-led growth hypothesis emphasized by Mushkin (1962), and further by others supporting empirical evidence (Li and Huang, 2009; Tobing and Jeng, 2012), suggest that health as part of the production function is also important. Although as many studies mentioned, their proxies for general health focuses on health expenditure and mortality rates. Our study defines more for social inequalities. Additionally, to health expenditure, that our index includes, ¾ to the rest of our index proxy for the population's access to antiretroviral therapy coverage, life expectancy at birth and prevalence of non-undernourishment. With emphasis to other studies that relate to social inequalities, Haddad *et al*. (2003) found that economic growth reduces malnutrition rates significantly for both within and across countries. In addition, studies

that focused on birthweight found that as economic growth increases, the probability of underweight birth rates decreases (Behrman and Rosenzweig, 2004). This suggests that social inequalities regarding the general health index is more significantly dangerous to the female gender. As pregnant women are suffering from undernourishment and other health issues, this is a further detrimental effect to the economy's future generation. Our study therefore finds that economic growth supports social inequality with slight emphasis on the female gender inequalities. Comparing our findings to existing empirical literature, in general, and to the studies above, there is a lack of empirical literature surrounding the direction to causality between growth and the indicators above. In addition, our study finds that economic growth has a positive significant impact on the social inequality and vice versa, that social inequality has a positive significant impact on economic growth of developing countries

CHAPTER 7: CONCLUSIONS

7.1 Summary of findings

The main finding of this thesis suggests that globalization positively affects economic growth in developing countries. Therefore, any observed increase in the definitions to the economic, social and political dimensions of globalization within developing countries, will lead to increases in economic growth per capita. The panel VECM shows insignificant findings for the long run but significant findings for causality in the short run. The direction for causality is unidirectional stemming from globalization to growth only. There were no significant effects found for both short and long run regarding economic growth toward globalization.

The findings also show that globalization positively affects social inequality in developing countries and in particular to, a country's access to electricity (with emphasis to technologies for cooking, the internet and mobile cellular usage) and general health. This implies that, regarding the definitions of economic, social and political dimensions of globalization, any increases will correspond to improvements between the countries' social inequalities and in particular to, access to electricity (with emphasis to technologies for cooking, the internet and mobile cellular usage) and general health.

In addition, improvements to a country's social inequality, in particular to, access to electricity (with emphasis to technologies for cooking, the internet and mobile cellular usage) and general health, are also found to have long-run casual effects towards globalization. For the short-run, the panel VECM results show only significant findings for general health (SS2_helg) having a causal effect on globalization. Although the direction of causality is concluded as bi-directional, the short-run causality effects between social inequality and globalization, whereby social inequality is the dependent variable, and for the access to electricity (with emphasis to technologies for cooking, the internet and mobile cellular usage) variable (SS1_tech), were found insignificant.

For variables regarding social inequality indexes 3 and 4, in particular to, employment (with emphasis to female employment) and health of new-borns, there were no significant effects found towards globalization and social inequality indexes 3 and 4, and vice versa in both directions.

Furthermore, economic growth in the results shows that it positively affects social inequality, in particular to, a developing country's access to electricity (with emphasis to technologies for cooking, the internet and mobile cellular usage) and general health. Both short and long run casual effects were found significant. From analysing the variables, it does make sense that as economic growth per capita increases, the population in a developing country would have extra income to spend on technology, further increasing their possibilities for access and including health facilities.

When economic growth is the dependent variable, the results were insignificant when testing for both the short and long run effects in particular to access to electricity (with emphasis to technologies for cooking, the internet and mobile cellular usage). This suggests that social inequality regarding differing levels of access to electricity (with emphasis to technologies for cooking, the internet and mobile cellular usage) for different countries has no significant effects towards economic growth per capita, in that direction. For general health, the results imply that there are only short-run significant effects toward increasing economic growth. Long-run effects were found insignificant. The direction of causality is shown to be bi-directional however with deviations in short and long run effects between the two social inequality variables and economic growth per capita.

There were no effects found from economic growth towards social inequality indexes 3 and 4, in particular to, employment (with emphasis to female employment) and health of new-borns, in both directions.

7.2 Limitations of the study

It is important to note the limitations to the study to make rational conclusions regarding what is measured and to make space for further recommendations. The methodology of the research only uses secondary data. The database to World Development Indicators (WDI) used to develop and create the social inequality index were limited to variables that were readily available. The most appropriate variables were thus handpicked, and the variability may be limited to what was available at that specific time. This means that the statistics best to describe social inequality were restricted to what was available by the database. Furthermore, what was difficult was accumulating variables that had the actual data and not missing data. For example, some variables that were considered very appropriate for the definition may have had data missing for a few or many developing countries. Therefore, some variables had to be disregarded. The goal was to have a balanced panel consisting of the most available time period for as many developing countries as possible. The data frequency that was selected for this research was yearly from 2000-2016, to which the time period limits the power of the results.

Another limitation of the study suggests that the mechanisms of the econometric model are limited to general explanations, rather than insightful and specific. This again was due to lack of secondary data. Furthermore, It was only possible to conduct a balanced panel model for 35 low-middle and low-income countries, by using a generalised approach index (KOFGI) to measure globalization. For further research, I propose to be more specific in the type of globalisation activities as well as through other methods (by using primary data, case studies, local village interviews in developing countries etc.).

7.3 Policy implications

The findings to globalization's effects on social inequality is a new contribution to literature. It suggests that the encouragement to globalization further betters social inequality in developing countries. In regard to our four social inequality indexes, access to electricity (with emphasis to technologies for cooking, the internet and mobile cellular usage), general health, employment opportunities (with emphasis to female employment), and health of new-borns, we did not find any short or long run significant granger causality effects running from globalization to social inequality in three out of four indexes. We did only find globalization to have a positive effect on social inequality index 2 (general health). For social inequality indexes 3 and 4 (health of new-borns), we did find that these social inequalities had an impact on globalization but not vice versa. For social inequality index 1, we did not find any short or long run significant granger causality effects running from either direction. In terms of income inequality ratios, we also did not find globalization to have an impact on all three ratios.

The reasoning behind why we have found globalization to have had a positive effect on social inequality in terms of general health but not towards access to electricity (with emphasis to technologies for cooking, the internet and mobile cellular usage), employment opportunities and health of new-borns can be of many speculations. The global overview of projects in developing countries from the World Bank (2022) shows that health only ranks 4th while the top three focus on public administration, agriculture, and social protection. Energy and extractions, and information and communications technologies are ranked 9th and 10th respectively. This suggests that World Bank intervention programmes are less focused on social inequalities, and in particular to, access to electricity (with emphasis to technologies for cooking, the internet and mobile cellular usage), employment opportunities (with emphasis to female employment) and health of new-borns. When reviewing the amount of finance or direction of policies by the World Bank, they are less directed towards these identified key areas. Furthermore, this may explain why we have not found globalization to have a positive effect on social inequality indexes 1, 3 and 4. According to the World Bank (2019) Report, although social protection is ranked 2nd on the projects list, their statement of objectives and scope does not reflect enough for employment opportunities, but rather focus on workers' rights and firm collapse prevention. In regard to social inequality index 2 (general health), it is evident that the World Bank's (2022) policies in developing countries can be described to have been mainly targeted at nutrition and health system strengthening. Most of their highest contributions in terms of finance injection are from those two components. This can explain why we have seen a positive influence that globalization has toward social inequality index 2, but not for 1, 3 and 4.

Governments' can also be seen as a responsible agent for social inequalities that exist in their country. There is a need for governments to specify and push more for social inequality agendas in their political reign regarding basic needs and necessities to survive. In order for this to happen, influential

organizations such as the World Bank or IMF need to help and push further the agenda for governments to pursue such policies that directly target social inequalities. Many developing countries' governments have difficulties providing and complementing for all echelons of society, especially for the lower class. Of course, the elite will have access to a higher range of technologies and standards of living, even in developing countries. However, it can be reviewed that the lower echelons to society that includes the majority of the population, in low to low-middle income countries, that difference in social inequalities are significant and especially when compared to developed countries. In regard to social class, they should have equal access to at least the minimum to the four social inequality indexes mentioned in this study. These ideas could pin the blame solely on income issues in developing countries, however, it can be argued that governments in developing countries are not being given the adequate support that they need.

Despite this, it is shown that globalization so far, has had a significant impact on social inequality in terms of general health. This shows that globalization is necessary for the improvement of developing countries. However, ultimately, it is down to both domestic as well as foreign policymaking, and both need to work together in order to achieve a goal that is improving social inequality in developing countries. Furthermore, as we have discussed the reasons why we have found globalization to have a positive effect on social inequality in terms of the sub-sections; economic, social, and political globalization, those sub-sections can be altered to cater for the other social inequality indexes in terms of policy making both domestically and foreign.

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Appendix 1:

Dependent Variable: D(LGDPPC)
Method: Panel Least Squares
Date: 03/20/22 Time: 21:44
Sample (adjusted): 2003 2016
Periods included: 14
Cross-sections included: 35
Total panel (balanced) observations: 490

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.015785	0.002375	6.647335	0.0000
COINTEQ1_GDP_KOFGI(-1)	-0.005289	0.004209	-1.256468	0.2096
D(LGDPPC(-1))	0.218219	0.043456	5.021584	0.0000
D(LGDPPC(-2))	0.131289	0.042568	3.084234	0.0022
D(LKOFGI(-1))	0.134843	0.061501	2.192539	0.0288
D(LKOFGI(-2))	0.026156	0.063312	0.413133	0.6797

R-squared	0.106787	Mean dependent var	0.027419
Adjusted R-squared	0.097560	S.D. dependent var	0.037227
S.E. of regression	0.035364	Akaike info criterion	-3.834048
Sum squared resid	0.605313	Schwarz criterion	-3.782688
Log likelihood	945.3417	Hannan-Quinn criter.	-3.813877
F-statistic	11.57284	Durbin-Watson stat	2.025617
Prob(F-statistic)	0.000000		

Vector Autoregression Estimates

	DLGDPPC	DLKOFGI
DLGDPPC(-1)	0.220994	0.003415
	(0.04343)	(0.03139)
	[5.08899]	[0.10880]
DLGDPPC(-2)	0.128158	-0.055766
	(0.04252)	(0.03073)
	[3.01406]	[-1.81469]
DLKOFGI(-1)	0.132082	8.59E-05
	(0.06150)	(0.04445)
	[2.14774]	[0.00193]
DLKOFGI(-2)	0.039789	0.075082
	(0.06241)	(0.04511)
	[0.63752]	[1.66452]
C	0.015672	0.014343
	(0.00237)	(0.00172)
	[6.60053]	[8.35816]

Equation: DLGDPPC = C(1)*DLGDPPC(-1) + C(2)*DLGDPPC(-2) + C(3)
*DLKOFGI(-1) + C(4)*DLKOFGI(-2) + C(5)

Durbin-Watson stat 2.023228

Equation: DLKOFGI = C(6)*DLGDPPC(-1) + C(7)*DLGDPPC(-2) + C(8)
*DLKOFGI(-1) + C(9)*DLKOFGI(-2) + C(10)

Durbin-Watson stat 1.914329

Appendix 2:

Dependent Variable: D(SS1_TECH)
Method: Panel Least Squares
Date: 03/17/22 Time: 20:32
Sample (adjusted): 2003 2016
Periods included: 14
Cross-sections included: 35
Total panel (balanced) observations: 490

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.312420	0.175671	7.470891	0.0000
COINTEQ1_GDP_SS1_TECH(-1)	0.896725	0.258655	3.466875	0.0006
D(LGDPPC(-1))	5.450968	2.692775	2.024294	0.0435
D(LGDPPC(-2))	1.218588	2.656842	0.458660	0.6467
D(SS1_TECH(-1))	0.223240	0.047091	4.740604	0.0000
D(SS1_TECH(-2))	0.182185	0.048043	3.792164	0.0002

R-squared	0.142228	Mean dependent var	2.448360
Adjusted R-squared	0.133367	S.D. dependent var	2.370892
S.E. of regression	2.207137	Akaike info criterion	4.433439
Sum squared resid	2357.784	Schwarz criterion	4.484799
Log likelihood	-1080.193	Hannan-Quinn criter.	4.453610
F-statistic	16.05054	Durbin-Watson stat	2.066566
Prob(F-statistic)	0.000000		

Vector Autoregression Estimates

	DSS1_TECH	DLGDPPC
DSS1_TECH(-1)	0.243765	2.83E-05
	(0.04725)	(0.00075)
	[5.15958]	[0.03753]
DSS1_TECH(-2)	0.167366	-0.000108
	(0.04839)	(0.00077)
	[3.45851]	[-0.14055]
DLGDPPC(-1)	4.980026	0.233146
	(2.71973)	(0.04334)
	[1.83108]	[5.38002]
DLGDPPC(-2)	1.736379	0.130906
	(2.68261)	(0.04274)
	[0.64727]	[3.06256]
C	1.302723	0.017949
	(0.17763)	(0.00283)
	[7.33379]	[6.34170]

Equation: DSS1_TECH = C(1)*DSS1_TECH(-1) + C(2)*DSS1_TECH(-2) + C(3)*DLGDPPC(-1) + C(4)*DLGDPPC(-2) + C(5)

Durbin-Watson stat 2.051360

Equation: DLGDPPC = C(6)*DSS1_TECH(-1) + C(7)*DSS1_TECH(-2) + C(8)*DLGDPPC(-1) + C(9)*DLGDPPC(-2) + C(10)

Durbin-Watson stat 2.022674

Appendix 3:

Dependent Variable: D(SS2_HELG)
Method: Panel Least Squares
Date: 03/17/22 Time: 21:28
Sample (adjusted): 2003 2016
Periods included: 14
Cross-sections included: 35
Total panel (balanced) observations: 490

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.040148	0.141978	7.326110	0.0000
COINTEQ1_GDP_SS2_HELG(-1)	0.727228	0.202991	3.582562	0.0004
D(LGDPPC(-1))	5.629872	2.352189	2.393461	0.0171
D(LGDPPC(-2))	0.191217	2.307743	0.082859	0.9340
D(SS2_HELG(-1))	0.180190	0.047244	3.814058	0.0002
D(SS2_HELG(-2))	0.180072	0.049106	3.667028	0.0003

R-squared	0.130682	Mean dependent var	1.850552
Adjusted R-squared	0.121701	S.D. dependent var	2.023506
S.E. of regression	1.896381	Akaike info criterion	4.129941
Sum squared resid	1740.591	Schwarz criterion	4.181302
Log likelihood	-1005.836	Hannan-Quinn criter.	4.150112
F-statistic	14.55162	Durbin-Watson stat	2.039377
Prob(F-statistic)	0.000000		

Vector Autoregression Estimates

	DLGDPPC	DSS2_HELG
DLGDPPC(-1)	0.214556	5.277070
	(0.04382)	(2.37863)
	[4.89680]	[2.21854]
DLGDPPC(-2)	0.118180	0.421817
	(0.04301)	(2.33482)
	[2.74783]	[0.18066]
DSS2_HELG(-1)	0.002010	0.206223
	(0.00087)	(0.04725)
	[2.30976]	[4.36476]
DSS2_HELG(-2)	0.000115	0.176324
	(0.00092)	(0.04969)
	[0.12583]	[3.54848]
C	0.014752	1.004729
	(0.00264)	(0.14335)
	[5.58646]	[7.00886]

Equation: DLGDPPC = C(1)*DLGDPPC(-1) + C(2)*DLGDPPC(-2) + C(3)
*DSS2_HELG(-1) + C(4)*DSS2_HELG(-2) + C(5)

Durbin-Watson stat 2.018761

Equation: DSS2_HELG = C(6)*DLGDPPC(-1) + C(7)*DLGDPPC(-2) +
C(8)*DSS2_HELG(-1) + C(9)*DSS2_HELG(-2) + C(10)

Durbin-Watson stat 2.034908

Appendix 4:

Dependent Variable: D(SS2_HELG)
Method: Panel Least Squares
Date: 03/17/22 Time: 21:28
Sample (adjusted): 2003 2016
Periods included: 14
Cross-sections included: 35
Total panel (balanced) observations: 490

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.040148	0.141978	7.326110	0.0000
COINTEQ1_GDP_SS2_HELG(-1)	0.727228	0.202991	3.582562	0.0004
D(LGDPPC(-1))	5.629872	2.352189	2.393461	0.0171
D(LGDPPC(-2))	0.191217	2.307743	0.082859	0.9340
D(SS2_HELG(-1))	0.180190	0.047244	3.814058	0.0002
D(SS2_HELG(-2))	0.180072	0.049106	3.667028	0.0003

R-squared	0.130682	Mean dependent var	1.850552
Adjusted R-squared	0.121701	S.D. dependent var	2.023506
S.E. of regression	1.896381	Akaike info criterion	4.129941
Sum squared resid	1740.591	Schwarz criterion	4.181302
Log likelihood	-1005.836	Hannan-Quinn criter.	4.150112
F-statistic	14.55162	Durbin-Watson stat	2.039377
Prob(F-statistic)	0.000000		

Vector Autoregression Estimates

	DLGDPPC	DSS2_HELG
DLGDPPC(-1)	0.214556	5.277070
	(0.04382)	(2.37863)
	[4.89680]	[2.21854]
DLGDPPC(-2)	0.118180	0.421817
	(0.04301)	(2.33482)
	[2.74783]	[0.18066]
DSS2_HELG(-1)	0.002010	0.206223
	(0.00087)	(0.04725)
	[2.30976]	[4.36476]
DSS2_HELG(-2)	0.000115	0.176324
	(0.00092)	(0.04969)
	[0.12583]	[3.54848]
C	0.014752	1.004729
	(0.00264)	(0.14335)
	[5.58646]	[7.00886]

Equation: DLGDPPC = C(1)*DLGDPPC(-1) + C(2)*DLGDPPC(-2) + C(3)
*DSS2_HELG(-1) + C(4)*DSS2_HELG(-2) + C(5)

Durbin-Watson stat 2.018761

Equation: DSS2_HELG = C(6)*DLGDPPC(-1) + C(7)*DLGDPPC(-2) +
C(8)*DSS2_HELG(-1) + C(9)*DSS2_HELG(-2) + C(10)

Durbin-Watson stat 2.034908

Appendix 5:

Dependent Variable: D(LKOFGI)

Method: Panel Least Squares

Date: 03/17/22 Time: 21:33

Sample (adjusted): 2003 2016

Periods included: 14

Cross-sections included: 35

Total panel (balanced) observations: 490

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.017767	0.002118	8.388699	0.0000
COINTEQ1_KOFGI_SS1_TECH(-1)	-0.050204	0.010625	-4.724944	0.0000
D(LKOFGI(-1))	-0.064872	0.044593	-1.454765	0.1464
D(LKOFGI(-2))	0.052899	0.043572	1.214044	0.2253
D(SS1_TECH(-1))	-0.000135	0.000533	-0.253877	0.7997
D(SS1_TECH(-2))	-0.001280	0.000541	-2.364874	0.0184

R-squared	0.064130	Mean dependent var	0.014148
Adjusted R-squared	0.054462	S.D. dependent var	0.025615
S.E. of regression	0.024908	Akaike info criterion	-4.535113
Sum squared resid	0.300270	Schwarz criterion	-4.483753
Log likelihood	1117.103	Hannan-Quinn criter.	-4.514942
F-statistic	6.633161	Durbin-Watson stat	1.911278
Prob(F-statistic)	0.000005		

Appendix 6:

Dependent Variable: D(LKOFGI)

Method: Panel Least Squares

Date: 03/17/22 Time: 21:57

Sample (adjusted): 2003 2016

Periods included: 14

Cross-sections included: 35

Total panel (balanced) observations: 490

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.017270	0.002035	8.487010	0.0000
COINTEQ1_KOFGI_SS2_HELG(-1)	-0.039389	0.009541	-4.128485	0.0000
D(LKOFGI(-1))	-0.052271	0.044636	-1.171053	0.2422
D(LKOFGI(-2))	0.045505	0.044213	1.029215	0.3039
D(SS2_HELG(-1))	-6.70E-05	0.000618	-0.108524	0.9136
D(SS2_HELG(-2))	-0.001553	0.000641	-2.420405	0.0159

R-squared	0.053036	Mean dependent var	0.014148
Adjusted R-squared	0.043254	S.D. dependent var	0.025615
S.E. of regression	0.025055	Akaike info criterion	-4.523329
Sum squared resid	0.303829	Schwarz criterion	-4.471969
Log likelihood	1114.216	Hannan-Quinn criter.	-4.503158
F-statistic	5.421461	Durbin-Watson stat	1.923483
Prob(F-statistic)	0.000073		

Appendix 7:

Dependent Variable: D(SS2_HELG)

Method: Panel Least Squares

Date: 03/17/22 Time: 22:00

Sample (adjusted): 2003 2016

Periods included: 14

Cross-sections included: 35

Total panel (balanced) observations: 490

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.922459	0.153207	6.021003	0.0000
COINTEQ1_KOFGI_SS2_HELG(-1)	2.805124	0.718320	3.905119	0.0001
D(LKOFGI(-1))	12.62391	3.360635	3.756405	0.0002
D(LKOFGI(-2))	0.957568	3.328812	0.287661	0.7737
D(SS2_HELG(-1))	0.197956	0.046513	4.255908	0.0000
D(SS2_HELG(-2))	0.200796	0.048299	4.157394	0.0000

R-squared	0.139821	Mean dependent var	1.850552
Adjusted R-squared	0.130935	S.D. dependent var	2.023506
S.E. of regression	1.886386	Akaike info criterion	4.119372
Sum squared resid	1722.291	Schwarz criterion	4.170732
Log likelihood	-1003.246	Hannan-Quinn criter.	4.139543
F-statistic	15.73478	Durbin-Watson stat	2.051159
Prob(F-statistic)	0.000000		

Appendix 8: D(LGDPPC) and D(LKOFGI)

Heteroskedasticity tests

Joint test:

Chi-sq	df	Prob.
42.01109	24	0.0129

Individual components:

Dependent	R-squared	F(8,481)	Prob.	Chi-sq(8)	Prob.
res1*res1	0.006343	0.383823	0.9292	3.108197	0.9274
res2*res2	0.038826	2.428727	0.0140	19.02486	0.0147
res2*res1	0.033903	2.109954	0.0335	16.61249	0.0344

Appendix 9: D(LSS1_Tech) and D(LGDPPC)

Heteroskedasticity tests

Joint test:

Chi-sq	df	Prob.
102.8309	24	0.0000

Individual components:

Dependent	R-squared	F(8,516)	Prob.	Chi-sq(8)	Prob.
res1*res1	0.172299	13.42671	0.0000	90.45708	0.0000
res2*res2	0.008097	0.526544	0.8368	4.251117	0.8338
res2*res1	0.017260	1.132790	0.3393	9.061242	0.3372

Appendix 10: D(SS2_HELG) and L(GDPPC)

Heteroskedasticity tests

Joint test:

Chi-sq	df	Prob.
58.60492	30	0.0014

Individual components:

Dependent	R-squared	F(10,479)	Prob.	Chi-sq(10)	Prob.
res1*res1	0.075987	3.939121	0.0000	37.23383	0.0001
res2*res2	0.012047	0.584112	0.8274	5.903273	0.8233
res2*res1	0.017238	0.840198	0.5900	8.446769	0.5853

Appendix 11: D(LKOFGI) and D(SS1_Tech)

Heteroskedasticity tests

Joint test:

Chi-sq	df	Prob.
144.1434	30	0.0000

Individual components:

Dependent	R-squared	F(10,479)	Prob.	Chi-sq(10)	Prob.
res1*res1	0.124501	6.811685	0.0000	61.00572	0.0000
res2*res2	0.137583	7.641599	0.0000	67.41584	0.0000
res2*res1	0.042775	2.140502	0.0203	20.95994	0.0214

Appendix 12: D(LKOFGI) and D(SS2_Helg)

Joint test:

Chi-sq	df	Prob.
130.6692	30	0.0000

Individual components:

Dependent	R-squared	F(10,479)	Prob.	Chi-sq(10)	Prob.
res1*res1	0.124082	6.785505	0.0000	60.80035	0.0000
res2*res2	0.096221	5.099677	0.0000	47.14824	0.0000
res2*res1	0.044918	2.252745	0.0141	22.00966	0.0151