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Export-Led Development in China: Examining the Role of Exports in Driving Economic Growth

Understanding the Economic Impact of China's Strategic Shift to Export Promotion and its Increased Exports Policy: A Comprehensive Time Series Analysis

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This research examines the relationship between Exports and GDP Growth as China transitioned from Import Substitution (IS) to Export Promotion (EP) as their strategy to industrialize. China has experienced remarkable economic growth over the years, becoming one of the world's largest economies. A common claim is that China's economic success is due to increased Exports. According to the Export-Led Growth (ELG) theory, Exports play a critical role in boosting economic growth. The research aims to test if the ELG-theory holds in China. To examine the relationship between Exports and GDP Growth, a Time Series Vector Autoregression (VAR) is performed, taking into account the effects of additional factors such as Foreign Direct Investment, Gross Fixed Capital Formation, Population Growth, and Imports. Further, a Granger Causality test is conducted to examine the causal effect between Exports and GDP Growth, and vice versa, to test the ELG-theory. The analysis is based on data from 1979 to 2019. The VAR results show that Exports and GDP Growth have a moderate positive relationship, however, there is no statistical significance in determining GDP Growth when controlling for additional factors' impact. The causal relationship is proven to be asymmetrical, and Exports do not have a causal effect on GDP Growth, while the opposite test exhibits causality. This suggests that in the case of China, the ELG-theory may not hold, implying that other factors may have played a more prominent role in boosting China's economic growth.

Keywords: Industrialization; import substitution; export promotion; export-led growth theory; industrialization approaches; GDP growth; exports; foreign direct investment; gross fixed capital formation; population growth; imports; causality; statistical significance

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List of Abbreviations

IS - Import Substitution

EP - Export Promotion

ELG - Export-Led Growth

EXP - Exports

GDPGR - GDP Growth Rate

GDP - Gross Domestic Product

FDI - Foreign Direct Investment

GFCF - Gross Fixed Capital Formation

POPGR - Population Growth

IMP - Imports

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1. Introduction

Since the late 1970's China has achieved rapid growth and the country is today one of the largest and most rapidly growing economies in the world (Morrison, 2019). Furthermore, China has grown to become the world's largest exporter (Yao, 2020). Before 1979, China's economy was characterized by deprivation, inefficiency, centralized control, and isolation from the international market, due to policymakers maintaining policies that hampered economic growth (Morrison, 2019). After the adoption of economic reforms and trade liberalization in 1979, China's economy underwent a fundamental transformation with a new economic model based on market-oriented reforms, investment, low-cost manufacturing, and *Exports* (Holz, 2008). Further, China's economic resurgence is claimed to have been partly attributed to the country's shift in industrialization approaches, from Import Substitution (IS) to Export Promotion (EP) and its increased export policy (Long, 2010).

Before the late 1970's, China implemented an IS strategy and the country's foreign trade developed slowly. Initially, IS was effective in deploying various economic resources that aided the country's pursuit of industrialization via the planned economy system, and China was able to construct a relatively complete industrial system. However, the industrial system created by the IS strategy was not globally competitive. The IS approach caused China to miss out on growth opportunities and in 1979 the nation's current economic conditions required a reformation of the economic policies and the approach to industrialization. Following the adoption of the trade reform strategy with a focus on increasing the nation's exports, China opened its labor-intensive sectors to the outside world and implemented foreign exchange and taxation policies that favored export-oriented foreign investment (Long, 2010). EP is an industrialization policy that aims to increase a country's exports to earn foreign currency and stimulate economic growth (Grabowski, 1994) and following the implementation, China was able to seize its competitive advantage with a well-built industrial foundation, well-developed infrastructure, and a cheap and flexible labor market (Long, 2010). The transition from IS to EP, with the aim to attract export-oriented foreign investors and increase the international competitiveness of domestic exports, is claimed to have resulted in China simultaneously becoming one of the world's most important processing and manufacturing bases (Long, 2010).

Despite the alleged effects of EP on China's economic development, it is difficult to determine to what extent EP policies and China opening up to foreign trade, by increasing their exports, have affected the country's economic growth (Li & Vinten, 1997).

1.1 Problem Statement

According to the Export-Led Growth (ELG) theory, a nation can experience quick economic growth by increasing its exports. A country can generate foreign exchange, create jobs, increase income, and boost economic growth by promoting exports (Yao, 2014). Higher rates of exports have been proven to be strongly associated with higher rates of economic growth (Kavoussi, 1984, p. 249), however, there is some doubt whether ELG will remain an effective strategy as income levels rise and industrial structures change (Lee & Huang, 2002). Over-reliance on exports induces risks as it is linked to vulnerability to external economic disruptions and the risk of exacerbating income inequality (Lee & Huang, 2002).

China's transition from IS to EP in the late 1970's is claimed to have had a significant impact on China's economic position on the international market and has coincided with a remarkable increase in the country's export sector, potentially having contributed to a surge in GDP growth rates. Hence, it is crucial to understand what caused the shift in industrialization strategies, the approaches' respective characteristics, and their proclaimed impact and effect on China's economic position. Despite EP and its increased export policy's alleged effect on GDP growth, exports do not affect GDP growth alone, and other factors have a critical impact on GDP growth as well. Concluding that exports are the only cause of China's increases in GDP growth can be viewed as rather far-fetched. Additional variables need to be considered in regard to concluding exports' effect on GDP growth.

Lee & Huang (2002) conclude that the relationship between exports and economic growth in East Asian countries is found to be nonlinear, implying that there may be a threshold level of exports required for economic growth to occur. The authors argue that the relationship between exports and economic growth is stronger in countries with a higher level of economic development, greater openness, and a more diverse economy. They claim that over-reliance on exports induces risks as it is associated with exposure to external economic disruptions and the possibility of exacerbating income inequality, and as over-reliance on exports might affect China

negatively, it is by value to examine to what extent China's exports have affected the nation's GDP growth rates (Lee & Huang, 2002).

Marin (1992) claims that as the ELG theory can be a useful tool for economic growth, it can also lead to structural imbalances, vulnerability to outside shocks, and increased inequality. Exports can also be detrimental if they reduce domestic investment and consumption, which leads to a lack of diversification and low productivity. Thus, despite exports having an alleged positive effect on GDP growth (Yao, 2014), investigating the relationship between exports and GDP growth, as well as the impact of additional factors, can clarify the underlying determinants of China's economic development. The conflicting sources regarding the actual influence of export-oriented policies on China's economic growth allow for a thorough examination of the relationship and causality between increased exports and GDP growth rates in China. The research questions, therefore, go as follows:

1.2 Research Questions

(1) *"What is the relationship between Exports and GDP Growth from 1979 to 2019, controlling for additional variables?"*

(2) *"Is there a causal relationship between Exports and GDP Growth, or vice versa, over the period 1979-2019?"*

1.3 Aim and Scope

The scope of this study is limited to an examination of the relationship between China's shift in industrialization policies to EP and its economic growth, with a particular emphasis on the impact of EP's increased export policy on GDP growth rates in the country. The study period extends from 1979, when China implemented economic reforms, to 2019, allowing for an examination of China's export-oriented strategy's impact on economic growth over time. Despite the ELG-theory claiming a positive relationship between exports and GDP growth, it is rather hard to determine to what extent increased exports in China have affected the country's economic growth. Hence, the scope of this research is to examine increased exports' actual effect and relationship with China's GDP growth, as well as additional factors.

The aim of the research is to contribute to the ongoing debate about the relationship between the ELG-theory and economic growth, with a particular emphasis on the case of China. China's experience as one of the world's largest and fastest-growing economies provides important insights into the conditions required for economic growth and the role that industrial policy can play in promoting such growth. This study seeks to provide insights into the effectiveness of the EP strategy and its potential for promoting economic development by examining the impact of China's increase in exports on its economic growth.

The empirical approach used by the majority of research on the causality of exports and GDP growth, and the determinants of GDP growth, will be applied in this study, which is, time series regressions and Granger causality testing (Liu et al, 1997; Tang, 2006; Li et al, 2010). However, previous studies do not include a large set of control variables and the sample sizes of the examined studies are limited (Shan & Tian, 2002). The choice of control variables stems from accumulated conclusions by various authors and scholars on GDP growth determinants, and because this study acknowledges that exports are not the only factor influencing GDP growth. Other factors may have significant impacts on economic growth, and to isolate the impact of China's shift in industrialization policies to EP and its increased exports policy, on its economic growth, this study will control for these variables. This study includes a broader set of control variables compared to many other similar studies to provide a more comprehensive analysis that accounts for potential additional effects, which can improve the accuracy of the findings. There is a large set of studies that are already conducted and published on the relationship between exports and GDP growth in China, however, the period ranging from 1979, when China initially increased its exports, until 2019, is hard to retrieve and find. By considering a longer time than the examined and currently published studies, this research aims to capture the changes and dynamics in the relationship between exports and GDP growth. This provides valuable insights into the evolving nature of this relationship. Clarifying and understanding the causal relationship between Chinese exports and GDP growth can have important policy implications, and this study aims to provide current insights for policymakers. China's success in achieving rapid economic growth through EP has been cited as a possible model for other countries to emulate. However, the lack of research on to what extent increased exports alone, and with additional control variables, has affected GDP growth rates until 2019, makes the research relevant for future studies. Lastly, this research can contribute to the empirical support

of the ELG-theory, which contends that boosting exports can spur economic growth. The study can shed light on the applicability and efficacy of this theory in the Chinese context by looking at the relationship between exports and GDP growth in another country. The research can contribute to methodological advancements in studying the relationship between exports and GDP growth.

1.4 Relevance

The relevance of this research lies in its implications for understanding and examining China's economic growth, which is claimed to be one of the world's largest. China's economic importance and potential impact on the international market make it a focal point for research. The fact that China has one of the largest economies in the world highlights the significance of comprehending the underlying factors influencing its GDP growth. Understanding the mechanisms and dynamics that contribute to the growth of such a significant economic powerhouse provides insightful knowledge. Given China's substantial reliance on exports to boost economic expansion, it is crucial to comprehend how exports and GDP growth are related. Examining this relationship sheds light on the extent to which increased exports affect China's economic performance. The relevance of the study also includes any potential repercussions for other nations. The results of this research can act as an indicator or benchmark for other countries seeking to develop their export-led growth strategies. A time frame of 40 years allows for a thorough analysis of the long-term trends and patterns in China's exports and GDP growth.

1.5 Thesis Outline

This thesis provides an introduction section with an overview of the research topic, some initial background information, and objectives. The second section, the context section, analyzes historical and existing literature to clarify the background stemming from the research question. The third section is the theoretical framework which presents a conceptual framework on which the analysis will be based, followed by a literature review which critically examines relevant literature and previous studies. The fourth section, the method part, describes the research design, the sources, the variables, and the analytical techniques. The fifth section is the statistical results, presenting and discussing the findings of the statistical analysis. The two following

sections are the discussion section which interprets the results and examines their implications, and the conclusion section which summarizes the results and limitations.

2. Context

2.1 Historical Context

2.1.1 Import Substitution in China and its Implications

Before the late 1970's, China adopted an IS industrialization strategy in Mao Zedong's closed economy, which was initially successful in implementing various economic resources to support the nation's efforts to industrialize through the planned economy system (Long, 2010). China was one of the world's most isolated countries during Mao's closed economy, with a tiny share of trade; commodities, particularly oil, accounted for the majority of China's exports. Foreign trade and foreign exchange were monopolized by a central government ministry, which used the overvalued currency to support the central plan's IS policies (Li & Vinten, 1997).

IS is a trade policy approach that encourages domestic production while reducing foreign dependency which allows the country to focus on economic growth domestically. It is usually used by developing countries to switch from imports to domestic production that satisfies domestic demand, and implementing this development strategy is justified by the low productivity and low-income elasticity of demand for primary goods produced by developing countries (Jayanthakumaran, 2000, pp. 8-9). Compared to free trade, IS enables the manufacturing sector to initially expand more quickly. By importing fewer manufactured goods, it helps countries to conserve foreign exchange supplies. Additionally, as protected industries are initially shielded from foreign competition, IS enables them to develop more quickly and aids them to have a comparative advantage in the future. IS reduces unemployment by enforcing industrialization through the creation of jobs and increases the variety of goods and services that are available to consumers and decreases a country's vulnerability to sudden changes in the global trade domain (Sawyer & Sprinkle, 2015).

China had built a reasonably complete industrial system by the 1970's, but the system created under the IS strategy and Mao's closed economy was not very competitive on the international market and it caused China's foreign trade to grow relatively slowly (Long, 2010).

Mao's closed economy was permeated by protectionism, aiming for self-sufficiency and less reliance on imports. He restricted trade with high tariffs, import quotas, and domestic company subsidies (Butt & Sajid, 2018). These policies hampered economic growth by impeding innovation and competition (Butt & Sajid, 2018), and China not being internationally competitive produced substitutes for more expensive and lower-quality imports (Sawyer & Sprinkle, 2015). As a result, all consumers and industries in the country faced higher prices, which in turn reduced welfare and the country's ability to produce goods and services at competitive prices. Furthermore, in a free market, protected industries grow larger than they should, causing other industries to shrink. Inefficient resource utilization slowed down China's economic growth (Sawyer & Sprinkle, 2015).

China's economy called for a reformation of the economic policies as the country was suffering both from a savings gap and a foreign exchange gap (Long, 2010). The IS strategy made China ignore the external demand coming from the international export sector, which impeded the expansion of export prospects. Therefore, to eliminate these biases and encourage sustained long-term growth, China implemented an export-oriented policy (Jayanthakumaran, 2000, p. 9).

According to Sawyer & Sprinkle (2015), it is difficult to withdraw IS policies due to the rent-seeking behavior of protected industries. These industries become reliant on government assistance and lobbying to maintain protectionism, making gradual withdrawal difficult. They become more inefficient over time, making it difficult to adjust to global competition. As a result, inefficient infant industries found it difficult to adapt to intense foreign competition. The combination of IS policy and rent-seeking leads to persistent protectionism, which stifles industry growth and development. This opposition to policy change makes eliminating IS policies difficult (Sawyer & Sprinkle, 2015). In the late 1970's the Chinese economy moved from Mao Zedong's "closed economy" to Deng Xiaoping's "open economy" (Li & Vinten, 1997), where Deng began to implement economic reforms designed to modernize the Chinese economy, increase efficiency and, and integrate China into the global market (Butt & Sajid, 2018). China adopted a new trade reform strategy and implemented EP as their approach to industrialization (Long, 2010).

2.1.2 Export Promotion in China and its Implications

During the time of Mao's rule, China had a highly centralized planned economy. From the 1950's to the end of the 1970's some industrial infrastructure was built. However, political movements such as the "Great Leap Forward" phase of rapid industrialization and the "Cultural Revolution" wreaked havoc on China's economy (Li & Vinten, 1997). The "Great Leap Forward" was a campaign launched by the Chinese Communist Party in 1958, led by Mao Zedong, to transform China into a socialist society through rapid industrialization and the collectivization of agriculture. To boost production and turn China into a major industrial power, Mao urged people to produce steel and grain. However, a combination of factors, including ineffective framing methods, natural disasters, and bureaucratic mismanagement, led to the campaign's utter failure. The campaign's effects were disastrous, causing widespread famine and social unrest, and was one of the deadliest periods in human history causing between 18 and 45 million deaths (Brown, 2012 pp. 29-34). From 1966 to 1976, China experienced the "Cultural Revolution", a mass movement led by Mao to promote his socialist ideology. This was a period characterized by profound political and cultural upheaval, with violent attacks on intellectuals, the destruction of cultural artifacts, and the rise of Mao's personality cult. Millions of people were displaced as a result of the movement, which also caused political divisions to widen and left a legacy of mistrust (Lamb, 2007).

Mao died in 1976 and by that time the Chinese economy was on the verge of collapse (Li & Vinten, 1997). Deng Xiaoping took over Chinese rule in 1978 and as a result of Deng's decentralized "open economy" the Chinese economic policies underwent a paradigm shift (Butt & Sajid, 2018). This is by Deng's realization that China could not develop with the current IS policies (Li & Vinten, 1997). Rather, Deng advocated for two major changes in the economic system; The transfer of decision-making powers to producers and the implementation of market laws. Since 1979, China has pursued two goals, namely economic reform and the expansion of international economic ties, through the adoption of EP, which resulted in remarkable progress in its economic development (Li & Vinten, 1997).

As an alternative to IS, EP as an industrialization approach has been proven to be more effective at enhancing economic growth as the approach provides advantages by addressing the shortcomings of IS (Pahariya, 2008). Sawyer & Sprinkle (2015) claim that the purpose of EP is to allow the country to advance based on its comparative advantage and that it necessitates the

expansion of the manufacturing sector which requires active government involvement. Meeting basic growth prerequisites, developing infrastructure, investing in human capital, maintaining competitive taxes and exchange rates, pursuing reasonable foreign direct investment policies, and avoiding protectionism are all part of this. A successful EP strategy can result in faster economic growth, job creation, a more favorable trade balance, and a better outcome than IS (Sawyer & Sprinkle, 2015). Pahariya (2008) coincides with Sawyer & Sprinkle (2015) and summarizes the main benefits of EP to be overcoming the limitations imposed by a small domestic market, enabling developing countries to take advantage of economies of scale, promoting efficiency throughout the economy by producing manufactured goods for export, and avoiding the IS limitations imposed by domestic market expansion.

Long (2010) clarifies that the overall aim of EP is implementing policies to make exports more competitive in the international market, which foreign investors also can take advantage of. Long clarifies these policies to be;

(1) A depreciating exchange rate system to encourage exports, with a previous dual exchange rate system in place to allow exporters to sell foreign currency at higher rates.
(2) Tax rebates for exports. Tax breaks become available for exporters, making their products more affordable in foreign markets. This allows domestic companies to compete in the global market on an equal basis with foreign competitors.
(3) Liberalization of foreign trade rights, allowing a dozen of foreign trade companies to engage in foreign trade.
(4) Export promotion and trade facilitation, such as export fairs, government export promotion efforts, and simplified customs clearance procedures.

Long (2010) further emphasizes that following the adoption of the trade reform strategy, China opened its labor-intensive sectors to the outside world and implemented foreign exchange and taxation policies that favored export-oriented foreign investment. EP policies encouraged innovation and technology transfer as foreign companies now could introduce cutting-edge technologies and management techniques to China. As a result, China became a major exporter of labor-intensive goods such as clothing, electronics, and textiles, gradually moving up the value chain to produce higher-quality goods. China was able to seize its competitive advantage with a well-built industrial foundation, well-developed infrastructure, and a cheap and flexible labor market. China's increased exports had significant spillover effects, such as job creation, the

development of transportation networks and infrastructure, as well as agricultural modernization. This aided the reduction of poverty, the improvement of living standards, and the overall level of economic development. The adoption of economic reforms and the transition from IS to EP, to attract export-oriented foreign investors and increasing the international competitiveness of domestic exports is claimed to have resulted in the nation becoming one of the world's most important processing and manufacturing bases (Long, 2010).

2.2 China's Economic Development

China's economic revival is claimed to have been because of its shift from IS to EP and its increased exports policy. This transformation enabled China to enter global markets, attract foreign investment, and expand its manufacturing sector, resulting in significant economic growth and development, according to Long (2010).

By transitioning to EP and implementing a trade reform policy with a large emphasis on increased exports, China was able to enter the global market and increase its exports to foreign countries, thereby boosting economic growth and expanding its global economic influence (Sawyer & Sprinkle, 2015).

Analyzing the data on China's exports, displayed in *Figure 1. Exports of Goods and Services (% of GDP) - China*, a clear upward trend is detected over the years, from the initial implementation in 1979 to around 2006. This indicates that EP policies, which aimed to strengthen China's integration into the global economy and take advantage of its comparative advantage in manufacturing and export-oriented industries, had been successfully put into practice. The growing importance of international trade for China's economic growth and development is indicated by the increasing contribution of exports to GDP. Further, a substantial decrease in exports from 2006 and onwards can be observed. This highlights the significance of examining the extent to which China has relied on exports in regard to its economic growth and how much of a causal relationship exists between the variables. The observation of the decline aligns with the premise that there may be limits to how much a country can depend on exports. Further, this decline may indicate that China has reached or is close to a threshold in terms of the contribution of exports to its overall GDP growth. However, as can be detected, China's exports have on average increased from 1979 when EP was implemented to 2019.

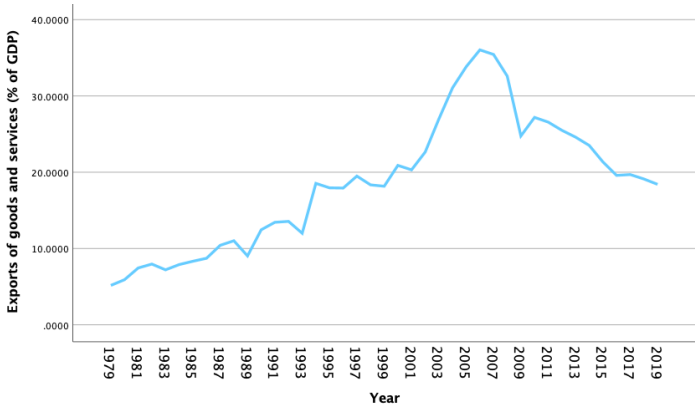

Figure 1. Exports of Goods and Services (% of GDP) - China

Data collected from The World Bank, 2023 (source 1a). Exports of goods and services represent the value of all goods and other market services provided to the rest of the world. Figure conducted in IBM SPSS.

As further can be detected in *Figure 2. GDP Growth (Annual %) - China*, the examined period, 1979–2019, is represented by significant variations in China's GDP growth rates, implying that the country's economic performance is affected by factors other than exports. When examining *Figure 1. Exports of Goods and Services (% of GDP) - China* and *Figure 2. GDP Growth (Annual %) - China,* the trend lines do not follow each other consistently over the entire period, as can be seen in *Figure 3. Exports & GDP Growth - China*. This discrepancy indicates that the relationship between exports and GDP growth in China is more complicated than the ELG-theory's initial prediction that increased exports result in higher GDP growth rates. Further, the observed divergence suggests that the dynamics of China's economic development may not be fully explained by the ELG-theory alone. The fluctuations in the relationship between exports and GDP growth highlight the existence of additional significant external economic factors influencing the nation's economic growth. Hence, conducting a thorough analysis that includes these additional factors to better comprehend the dynamics and causal relationship between exports and GDP growth in China becomes interesting. As a result, we can learn more about the ELG-theory's applicability to the Chinese context and pinpoint the various forces that drive and restrain the nation's economic growth. Further, it is clear when examining *Figure 2. GDP Growth (Annual %) - China,* the GDP growth rate of 1979 is slightly higher than the GDP growth rate of 2019. This may also indicate a potential deviation from the ELG-theory predictions. Because the growth rate was higher in 1979 when EP was implemented and slightly

lower in 2019, 40 years after the implementation, it raises questions about the direct causality between exports and economic growth.

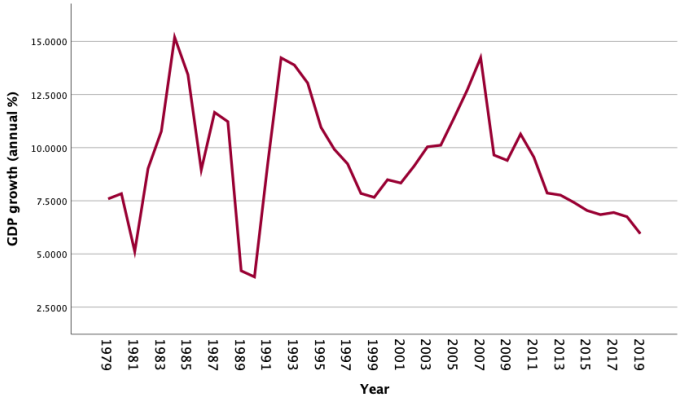

Figure 2. GDP Growth (Annual %) - China

Data collected from The World Bank, 2023 (source 1b). Annual percentage growth rate of GDP at market prices based on constant local currency. Figure conducted in IBM SPSS.

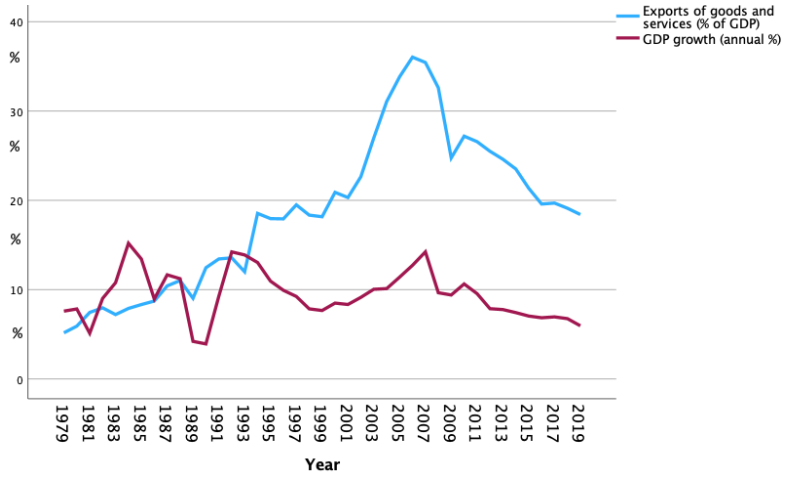

Figure 3. Exports & GDP Growth - China

Data collected from The World Bank, 2023 (source 1a. & 1b). Annual percentage growth rate of GDP at market prices based on constant local currency. Figure conducted in IBM SPSS.

3. Theoretical Framework

The theoretical framework of this research serves as the foundation for the analysis of the research questions in section *1.2 Research Questions.*

Initially, a literature review regarding the ELG-theory and determinants of economic growth will be presented. Thereafter, empirical research on the relationship between exports and economic growth will be presented and addressed. The purpose of this section is to address the theoretical literature's fragmentation by focusing on the ELG-theory as a framework for

comprehending the relationship between exports and economic growth. It investigates the economic growth determinants used within studies examining the relationship between exports and GDP growth. By utilizing the theoretical framework, this research aims to provide a deeper understanding of the level of influence exports have had on China's economic growth after implementing EP.

The theoretical framework for this study will primarily be based on the ELG-theory. The framework will further help guide the selection of control variables in the quantitative analysis based on empirical research and established literature. The study's unit of analysis will be primary data obtained from the World Bank ranging from 1979 to 2019. The theoretical framework based on the theory of ELG provides a quantitative approach for testing the relationship and causality between exports and economic growth. Statistical techniques such as time series regression analysis will be used to examine the relationship between exports and economic growth over time by analyzing the data on these variables. Other factors, such as the complexity of determinants of GDP growth brought up by the authors in section *3.2 Determinants of Economic Growth* are also taken into account by the framework to provide a more comprehensive analysis of the relationship between exports and GDP growth.

Overall, the theoretical framework provides a rigorous and systematic approach to investigating the relationship and causality between exports and economic growth, and it can provide valuable insights for policymakers and researchers alike. It contributes to a thorough and nuanced examination and will provide new insights into the relationship between EP's focus on increased exports and economic growth in China.

3.1 Export-Led-Growth Hypothesis

According to Yao (2014) there is a bidirectional causality between exports and economic growth meaning that while exports can lead to increased economic growth, increased economic growth, thus increased GDP, can also lead to increased exports. Yao categorizes this phenomenon as the ELG-theory and clarifies that a country's economic growth can be driven by its ability to export goods and services. This theory holds that a country can generate export earnings by specializing in the production of goods and services where it has a comparative advantage. These profits can then be used to fund investment and boost economic growth. The ELG theory suggests that

policies that promote exports and remove trade barriers can lead to increased economic growth and development (Yao, 2014).

Sannassee et al. (2014) conducted a meta-analysis to synthesize previous empirical findings on the relationship between exports and economic growth to provide a more profound and comprehensive understanding of the ELG hypothesis. The authors examined and analyzed 151 studies published between 1970 and 2014, covering a wide range of countries and periods, and used statistical techniques to assess the strength and significance of the relationship between exports and economic growth. The authors found that there is evidence to support the ELG hypothesis. However, the strength of the relationship between exports and economic growth varies across countries and over time, with developing countries outperforming developed countries in the short run rather than in the long run. Exchange rates, trade policies, and institutional quality all have an impact on the effectiveness of ELG strategies. As a result, the authors propose that ELG strategies should be implemented alongside policies that address structural development barriers such as poor infrastructure, inadequate education and training, and political instability.

The ELG model may not be universally applicable across different contexts. Marin (1992) examines the validity of the ELG hypothesis in the context of industrialized and developed economies. He contends that the traditional ELG model, which holds that a country's economic growth is determined by its ability to export manufactured goods, may not apply to industrialized countries. Further, the author brings light and identifies limitations of the ELG model which can affect GDP growth negatively. Firstly, the model disregards the role of domestic demand in driving economic growth, which in turn can limit GDP growth. Secondly, the model assumes that external markets will always exist, which is not always the case during global economic downturns. Over-reliance on exports and the assumption that external markets will always be available can expose a country to external shocks, which can lead to a decline in GDP growth. Thirdly, the model may lead to an over-reliance on a limited range of export products, limiting a country's ability to diversify its economy and making it vulnerable to external shocks which in turn can affect GDP negatively. Finally, because export-oriented industries are typically concentrated in certain regions, the ELG model may increase income inequality and regional disparities, and it may not create employment opportunities for the general population, which also can slow GDP growth. This highlights the importance of

investigating the specific relationship between China's EP approach's increased export policy and its economic growth.

According to Kavoussi (1984, p. 249) EP, thus implementing an ELG approach, should be a key policy priority for developing countries as expanding exports can aid countries to achieve higher rates of economic growth. He claims that research has found a strong and positive correlation between increasing exports and economic growth, thus increased GDP growth rates. However, the effectiveness of an ELG strategy is uncertain as economies mature and the industrial structure evolves (Lee & Huang, 2002). The relationship between exports and economic growth may not be linear and may be affected by a variety of factors such as the country's level of development, degree of openness, and economic structure. In East Asian countries, Lee & Huang (2002) concludes that the relationship between exports and economic growth is nonlinear which indicates that there might be a threshold level of exports necessary for economic growth. The authors contend that nations with a higher level of economic development, greater openness, and a more diverse economy have a stronger relationship between exports and economic growth. They agree with Marin (1992) and claim that excessive reliance on exports creates risks because it exposes a country to outside economic disruptions and runs the risk of escalating income inequality (Lee & Huang, 2002).

This research's theoretical framework will employ a quantitative analysis of relevant data to investigate whether the ELG-theory applies to China and how its EP approach focusing on increasing the nation's exports has influenced its economic growth. Furthermore, this research acknowledges the limitations of the ELG model and seeks to contribute to the ongoing debate about the model's relevance to China and its economic development. It emphasizes the importance of more nuanced and context-specific approaches to understanding economic growth, which can provide a more comprehensive understanding of China's EP strategy and how increased exports have affected its economic growth.

3.2 Determinants of Economic Growth

As economic theories and models differ in their assumptions and methods of analysis, it is not uncommon for different sources to have different perspectives on the factors influencing GDP growth. Furthermore, the relationships between economic variables can be complex and multifaceted, leading to various interpretations and conclusions from various sources. As a

result, when analyzing the factors influencing GDP growth, it is critical to consider multiple sources and perspectives.

As previously mentioned, Yao (2014) and Sannassee et al. (2014) claim that exports have an immense impact on GDP growth, while other scholars such as Marin (1992) and Lee & Huang (2002) accentuate that focusing on increased exports can be complex and that over-reliance on exports induces risks.

Barro (1996) examines factors that contribute to economic growth and concludes that the role of investment and human capital are the most essential factors in driving economic growth. Further, Barro claims low inflation rates and political stability to be additional crucial factors. By having examined data from 98 countries, Barro has found population growth harms economic growth because of strains on resources, diminishing returns to capital, and unemployment. Pritzker et al. (2015) instead claim that population growth can have positive effects on GDP growth. The authors explain that GDP is affected by a wide range of factors, and accentuate the impact of consumer spending, business investment, government spending, international trade, and changes in employment or poverty levels. The authors conclude in their report that measuring GDP is complex and emphasizes the importance of continuous innovation and improvement in GDP measurement.

In conclusion, the authors all claim that GDP can be and is affected by a variety of factors. However, as previously stated, measuring GDP is difficult and has limitations in terms of accuracy. It is difficult to identify the main factors that contribute to GDP growth, and the impact of these factors varies depending on the country, level of development, and institutional quality. While some sources provide insight into the factors influencing GDP, there is still considerable debate and uncertainty about how to accurately measure and analyze GDP.

A more comprehensive understanding of the relationship between China's EP strategy's increased export policy and its economic growth can be established by incorporating other scholars' concepts and ideas into the theoretical framework, facilitating the formulation of variables. Using a quantitative method, this theoretical framework will provide a structured and systematic approach to analyzing the relationship between China's EP strategy's increased exports and its economic growth over time.

3.3 Empirical Studies

The studies discussed in this section are all conducted using a quantitative time series analysis, which examines the historical patterns, trends, and dynamics of exports and GDP growth over a given period. This helps guide the selection of the research approach in the following section *5. Methodology.*

Shan & Tian (2002) tested the ELG-theory using monthly time series data on Shanghai using the Granger Causality procedure. The conducted Vector Autoregression (VAR) model used exports, GDP, total people employed, imports, foreign direct investment, and fixed capital expenditure as variables to test the relationship between exports and GDP for Shanghai in the context of the ELG-theory. The test was based on data for the period 1990-1996 and the results indicated a one-way causality running from GDP to exports for Shanghai. Based on the ELG-theory, the finding of the study indicated that the exceptional economic performance of Shanghai during the 1990's was not primarily caused by an increase in exports. Instead, the research found that economic performance was driven by a combination of factors, such as foreign direct investment. Further, the authors concluded that the findings suggested that while exports may contribute to economic growth, other elements also have a significant impact on the state of the economy as a whole.

Liu et al. (1997) investigated the causal relationship between exports plus imports and economic growth for the period from 1983 to 1995 in East China. The study was conducted, similarly to Shan & Tian (2002), by first including a time series analysis followed by a causality test. The authors included exports, imports, and GNP (gross national product). The results of the study identified a feedback causal relationship, proving that openness and economic growth are mutually reinforcing. However, potential bias and changes in causality direction throughout the study were acknowledged, implying the need for additional research. The results of Liu et al.'s (1997) study show contrasting results compared to the study of Shan & Tian (2002), thus, period, examined variables, and location, can have affecting attributes on the results.

In a study by Tang (2006) testing for the causality between export expansion and economic growth in China, Tang accentuates that adding imports as an additional variable when examining the ELG-theory in China, contributes to a more profound and reliable analysis. The study ranged from 1970 to 2001, and the results of the research were no long-run relationships among exports, real GDP and imports in China. Further, Tang concluded that the results instead

indicated that economic growth causes imports to increase in the short-run, contradicting the ELG-theory claiming that economic growth increases exports and vice versa.

Li et al. (2010) based their study on the relationship between total export and import, and GDP growth of East China. By conducting a time series analysis and testing for causality between exports and GDP growth, with data collected from 28 years, from 1981-2008, they found that exports had a positive relationship with GDP growth. To conclude this, the authors used GDP, total import and export value, exports, and imports as testing variables. This result contradicts the results of Tang (2006) examining a rather similar period, instead concluding that there was no causality between exports and real GDP. However, Li et al. (2010) claim that despite the positive relationship between exports and GDP growth, foreign trade is the variable that was the key source of East China's GDP growth, which includes exports but also imports.

4. Methodology

4.1 Data & Variables

Table 1. Core Variables presents the core variables, thus GDP Growth and Exports, related to the research question, along with its abbreviation, scale, and definition. *Table 2. Control Variables* present the control variables in the same way as *Table 1. Core Variables*, and are the variables included in the analysis to help control for additional factors that may affect the relationship between the core variables. Including control variables in the time series analysis improves the results' interpretability, validity, and reliability. It enables accounting for potential confounding factors and captures the multidimensional nature of GDP growth, which in turn results in a more profound analysis and a comprehensive understanding of the relationship between the core variables.

The examination will reach from 1979 until 2019, thus, data beyond the year 2019 will not be included in the data set. This stems from the deviating and inevitably decreasing data following the Covid-19 pandemic. Excluding data from 2020 and forward is to ensure the avoidance of bias in the analysis because of the exogenous shock caused by the pandemic and its subsequent socio-economic ramifications, as it is irrelevant to the purpose of this research.

This research will collect primary data on China's GDP Growth rates, as well as on the nation's Exports, Foreign Direct Investment, Gross Fixed Capital Formation, Population Growth,

as well as Imports. The data will be obtained from the World Bank which is a reliable and frequently used source. The data will be collected as time-series data, allowing for the analysis of trends and patterns over time.

Across the data set, all variables used in the time series regression model will be measured consistently and accurately. To ensure the accuracy and consistency of the data it has been carefully checked for errors, missing values, and outliers, by visually examining the datasets through plotting. Further, to validate the data's accuracy, the datasets were compared to external sources and established data banks such as Our World in Data and OECD Data. Cross-referencing the data obtained from the World Bank with other reliable data sources ensures that the data being analyzed aligns with established standards. It verifies the integrity of the data and identifies any inconsistencies or discrepancies. The data obtained are all in the same scale and are obtained in "%", which facilitates the analysis as it allows for easier comparison and interpretation of the results. It helps avoid biases and simplifies the statistical model.

Due to the complex nature of GDP determinants, capturing all relevant variables affecting GDP Growth in the quantitative time series regression analysis is rather difficult. Hence, in this research, a limited set of variables based on the theoretical framework and the complexity of determining factors affecting GDP Growth was chosen to examine the relationship between exports and GDP Growth.

4.2.1 Choice of Core Variables

The ELG-hypothesis, which suggests that increasing a country's Exports can lead to increased economic growth, motivated the choice of Exports as an independent variable (X). According to the theory, a country can generate more income and jobs by exporting more goods and services, which in turn can lead to higher levels of investment and consumption, thus boosting economic growth (Yao, 2014). Further, the choice of GDP Growth rate as the dependent variable (Y), stems from this variable being widely used and known as a measure of economic growth and the economy's performance as a whole. GDP Growth measures the change in real GDP from one year to the next and is an important indicator of economic health (Mankiw & Taylor, 2020).

Examining the relationship and causality between Exports and GDP Growth contributes to understanding the validity of the ELG-theory in the case of China. It helps determine to what extent Exports affect and boost economic growth, which in turn can provide insights to

policymakers and economists seeking to boost economic growth in other underdeveloped countries.

Table 1. Core Variables

Variable	***Abbreviation***	***Scale***	***Definition***	***Source***
GDP Growth Rate	*GDPGR*	*Annual %*	*The percentage change in real GDP from one year to the next, adjusted for inflation. An indication of the rate of economic growth or contraction over a given year.*	*The World Bank Database*
Exports of Goods and Services	*EXP*	*% of GDP*	*The percentage share of a country's total economic output (GDP) that is represented by the value of all goods and services it exports to other countries.*	*The World Bank Database*

4.2.2 Choice of Control Variables

The choice of the control variables of this quantitative analysis stems from the theoretical framework and the simplicity of the time series regression model. Having all variables in the same scale, thus in percentages, offers a range of advantages which contributes to the simplicity of the analysis. It is easier to compare the variables' respective magnitude and their impact on the dependent variable GDP Growth. However, the choice of variables does not solely depend on their respective scale, it is primarily based on the theoretical framework and empirical evidence, as well as the variables' potential effects on GDP Growth.

As stated in section *3.2 Determinants of Economic Growth*, economic growth is influenced by a variety of factors other than exports. The ELG theoretical framework and established research investigating the relationship between Exports and GDP Growth helped guide the choice of the independent control variables.

Barro (1996) claims that investment is a crucial factor to consider when examining GDP Growth, hence, the choice of including Foreign Direct Investment, and Gross Fixed Capital Formation as control variables stems from this statement. Foreign Direct Investment refers to investments made by foreign entities in domestic companies or assets, which typically involve long-term ownership and control (OECD, 2002). Gross Fixed Capital Formation is also a type of investment and refers to the total value of newly produced physical assets used for economic production, such as infrastructure, machinery, and buildings (OECD, 2023). Pritzker et al. (2015) accentuate that Population Growth can have a positive effect on GDP Growth, which motivates

the choice of Population Growth as a control variable. Lastly, the authors also bring light on the importance of international trade, which motivates the choice of the last control variable, Imports of goods and services (Pritzker et al, 2015). Exports and Imports collectively define trade, and the sum of these variables reflects the level of international trade and the exchange of goods and services between countries (Mankiw & Taylor, 2020), hence, including Imports is suitable in regard to Pritzker et al's. (2015) statement.

Further, the ELG theory implies that Exports can serve as a growth factor for a country's economy. According to the hypothesis, an increase in Exports can lead to an increased GDP because Exports generate revenue that can be reinvested in the economy, resulting in higher levels of consumption and production (Yao, 2014). Based on this, it makes sense to include export-related variables as control variables in the regression analysis. Foreign Direct Investment, to exemplify, can improve Export performance by supplying capital for investment in export-oriented sectors. Gross Fixed Capital Formation can also contribute to increased export capacity, similar to trade openness. Thus, in accordance with the ELG-theory, including these variables as control variables in the regression analysis can help account for additional variables that might influence the relationship between Exports and GDP Growth.

Table 2. Control Variables

Variable	***Abbreviation***	***Scale***	***Definition***	***Source***
Foreign Direct Investment	*FDI*	*% of GDP*	*The total value of net inflows of investment by foreigners to acquire a long-term interest in China, as a percentage of China's GDP.*	*The World Bank Database*
Gross Fixed Capital Formation	*GFCF*	*% of GDP*	*The value of net additions to fixed asset stock plus net acquisition of land and intangible assets.*	*The World Bank Database*
Population Growth	*POPGR*	*Annual %*	*The change in the number of people in a population over a given time period.*	*The World Bank Database*
Imports of Goods and Services	*IMP*	*% of GDP*	*The percentage share of a country's total economic output (GDP) that is represented by the value of all goods and services it imports from other countries.*	*The World Bank Database*

4.2 Method

The theoretical framework and research objectives presented in the preceding sections guide the methodology of this study. A quantitative approach is deemed the most appropriate

methodological choice for effectively addressing the research question and validating the hypothesis. This study aims to examine the relationship between Exports and GDP Growth in China from 1979 to 2019, controlling for additional variables, and test the causality between Exports and GDP Growth, and vice versa. A combination of time series regression analysis and Granger Causality test will be used to answer the research question.

According to Jose (2022) time series analysis is a statistical method used to analyze time series data and trends. The data used in time series are periodic periods that have been measured at regular intervals, thus, it is a collection of data points arranged chronologically, and time series analysis is the process of interpreting this data. The primary goal of time series analysis is to comprehend, interpret, and evaluate change in economic phenomena in the hope of more accurately examining the relationship between variables over time. Additionally, it is a quantitative approach that enables the identification of patterns and the evaluation of the dynamic over a specific time (Jose, 2022).

Before conducting a time series analysis, a test for stationarity was conducted as this will ensure that the data exhibit consistent statistical properties over time. Stationarity is desirable as it enables the analysis to provide valid statistical conclusions. An Augmented Dickey-Fuller (ADF) test was conducted before the time series analysis and the Granger Causality test, which is a commonly used tool for testing stationarity because it accounts for potential trends and data autocorrelation. The ADF test determines whether a variable has a unit root and is non-stationary. In the presence of non-stationarity, there may be spurious regression, which means that the results show a high R^2 and P-value that appear significant but have no significance (Granger & Newbold, 1974). After the ADF test, further adjustments were required to achieve stationarity since the results initially showed non-stationarity. A logarithmic followed by a first difference transformation was applied to ensure stationary throughout the dataset, which involves taking the first difference of the logarithmic value transformations. This is an appropriate method to transform non-stationary data to become stationary (Bex, 2021). This made the dataset exhibit stationarity which indicates that the trends and non-stationarity patterns were effectively removed, allowing for a more reliable analysis of their relationship over time. The reached stationarity allowed for the time series to be conducted.

The null hypotheses and the respective equations of the Augmented Dickey-Fuller stationarity tests are presented below:

Null Hypothesis:

(1) The variables GDPGR, EXP, FDI, GFCF, POPGR, and IMP are non-stationary.

(2) The variables GDPGR, EXP, FDI, GFCF, POPGR, and IMP do not have a long-run relationship.

ADF Stationarity Test Equations:

$$(1)\quad Y(t) = \alpha + \beta t + \gamma Y(t-1) + \delta 1 \Delta Y(t-1) + \delta 2 \Delta Y(t-2) + \ldots + \delta p \Delta Y(t-p) + \varepsilon(t)$$

$$(2)\quad \Delta Y(t) = \alpha + \beta t + \gamma Y(t-1) + \delta 1 \Delta Y(t-1) + \delta 2 \Delta Y(t-2) + \ldots + \delta p \Delta Y(t-p) + \varepsilon(t)$$

Where:

$Y(t)$ represents the original time series of each variable.

$\Delta Y(t)$ represents the logarithmic and differenced time series of each variable.

α represents the long-term mean or level of the variable.

β represents the coefficient of the trend term (t).

γ represents the coefficient of the lagged level of the variable (t-1).

$\delta 1, \delta 2, \ldots, \delta p$ represents the coefficients of the lagged differenced values (Δ) of the variable.

$\varepsilon(t)$ represents the error term.

A Vector Autoregression (VAR) analysis was performed to examine the impact of various variables on GDP growth over time, similar to other studies (Shan & Tian, 2002; Liu et al, 1997; Tang, 2006; Li et al, 2010). Because it allows for the simultaneous examination of the dynamic relationships among multiple variables, the VAR model is an appropriate approach for analyzing how different variables have affected GDP Growth. The VAR model was conducted after the variables had been adjusted and determined to be stationary. The VAR model estimates the relationships between variables by taking into account their lagged values. It enables us to evaluate how changes in one variable affect the other variables in the system while accounting for their lag values. The dynamic relationships between GDP Growth and the other variables, such as Exports, allow us to better understand their effects on economic growth. This is accomplished by using the VAR model with a lag length of two. The lag length of 2 was chosen based on the Akaike Information Criterion (AIC) (Forster & Sober, 2011), capturing the impact of variables up to two time periods prior.

Based on similar studies on the causal relationship between exports and GDP Growth (Shan & Tian, 2002; Liu et al, 1997; Tang, 2006; Li et al, 2010), a Granger Causality test, an econometric test used to verify the usefulness of one variable in affecting and forecasting another, was conducted (Eric, 2021). The choice of performing a Granger causality test stems from this type of test being frequently used in similar studies, and it being considered an appropriate measure of assessing the causal relationship between variables (Eric, 2021). The

purpose of this test is to examine whether past values of Exports provide useful information for predicting and determining GDP Growth beyond its own past values, and vice versa. Based on the theoretical framework and the ELG-theory suggesting that Exports can be a crucial determinant of economic growth and that GDP Growth can affect Exports to grow, examining whether there is a causal relationship between the core variables Exports and GDP Growth, and vice versa, will help conclude whether there is evidence to support the ELG-theory in the case of China.

The goal of this research is to test the ELG-theory in the case of China, and by adapting the presented quantitative approach, the results can shed light on the role of exports in boosting economic growth in China. By including and controlling potential confounding variables the validity and reliability of the findings will be improved, which in turn increases the robustness of the analysis and the credibility of the conclusions. The analysis is conducted using the statistical software R Studio.

The null hypotheses to be tested, based on the methodology of this research, together with the respective equations for the Vector Autoregression and Granger causality test are presented below:

Null Hypothesis:

(1) Of the estimation results for equation GDPGR in the VAR model, there is no positive relationship between GDPGR and the lagged values of EXP.

(2) Of the estimation results for equation GDPGR in the VAR model, there is no positive relationship between GDPGR and the lagged values of FDI, GFCF, POPGR, and IMP.

(3) The coefficients of EXP, FDI, GFCF, POPGR, and IMP in the VAR model are all statistically non-significant, indicating that these variables do not have a significant impact on GDPGR.

(4) Changes in GDPGR do not affect changes in EXP.

(5) Changes in EXP do not affect changes in GDPGR.

Regression & Causality Models:

(1) Vector Autoregression: $\Delta GDPGR(t) = \alpha + \beta 1 \Delta GDPGR(t-1) + \beta 2 \Delta GDPGR(t-2) + \beta 3 \Delta EXP(t-1) + \beta 4 \Delta EXP(t-2) + \beta 5 \Delta FDI(t-1) + \beta 6 \Delta FDI(t-2) + \beta 7 \Delta GFCF(t-1) + \beta 8 \Delta GFCF(t-2) + \beta 9 \Delta POPGR(t-1) + \beta 10 \Delta POPGR(t-2) + \beta 11 \Delta IMP(t-1) + \beta 12 \Delta IMP(t-2) + \varepsilon(t)$

Applied to answer Research Question (1): "What is the relationship between Exports and GDP Growth from 1979 to 2019, controlling for additional variables?"

(2) Granger Causality Test: $\Delta EXP(t) = c + \beta 1 \Delta EXP(t-1) + \beta 2 \Delta EXP(t-2) + \gamma 1 \Delta GDPGR(t-1) + \gamma 2 \Delta GDPGR(t-2) + \varepsilon(t)$

(3) Granger Causality Test: $\Delta GDPGR(t) = c + \beta 1 \Delta GDPGR(t-1) + \beta 2 \Delta GDPGR(t-2) + \gamma 1 \Delta EXP(t-1) + \gamma 2 \Delta EXP(t-2) + \varepsilon(t)$

Applied to answer Research Question (2): "Is there a causal relationship between Exports and GDP Growth, or vice versa, over the period 1979-2019?"

Where:

$\Delta Y(t)$ represents the logarithmic and differenced time series of each variable.

α represents the long-term mean or level of the variable.

β represents the coefficients associated with the respective lagged variables.

c represents the intercept term which is the constant value of Y when all other variables are zero.

γ represents the coefficients associated with the lagged values of X.

t-1 & t-2 represents the lagged values of the variables.

$\varepsilon(t)$ represents the error term.

4.3 Limitations

The study does have some limitations. As factors affecting GDP Growth are various and rather hard to determine, there will be some factors, thus variables, that are not included in the analysis but still have an impact on China's GDP Growth. Another drawback is that the study does not take into account the effects of external factors, thus, variables, such as modifications to international trade agreements or changes in world economic conditions. These external factors could have an impact on the relationship between exports and GDP Growth in China. In regards to generalizability, the results of this research will be specific to the context of China which in turn means that the findings may not be directly applicable to other countries.

The study will focus on the period from 1979 to 2019, when China implemented EP as their industrial policy, therefore, any changes in economic growth rates before this period will not be considered. The sample size of the research has 41 observations, of each variable, is very small. Although it covers a significant period for studying the relationship between Exports and GDP Growth, it is important to note that economic conditions and policies may have changed over time, potentially affecting the results.

The data on GDP Growth and Population Growth is retrieved in an "annual %" scale, while the remaining variables' data are retrieved in a "% of GDP" scale. This is a limitation as the interpretation of the coefficients needs to be carefully done. The variables are all in a percentage scale, however, based on different percentages, thus, when interpreting the coefficients, one must be aware that a one-unit change in an independent variable may have a

different meaning depending on the scale. Thus, the interpretation of the coefficients needs to be carefully done.

The World Bank has a reputation for being reliable, using standardized methodologies, and having expertise in economic analysis. Further, The World Bank is an international organization that operates independently from individual countries, which helps to ensure the impartiality and objectivity of its data. However, despite the World Bank providing easily accessed and reliable data that concerns the examined period, the accuracy and reliability of the data collected in the earlier years of the chosen period can be questioned as the collection processes of this data can have been more limited compared to the later years examined. China as a country is known for its high confidentiality and state protection. This is another factor that might affect the quality and reliability of the collected data, as the country might have covered up essential data and real numbers because of the country's high confidentiality policies. The analysis and the findings will however neglect the potential variance in data collection throughout the years examined as well as the uncertainties about China's confidentiality.

5. Summary Statistics

5.1 Stationarity Tests

Table 3. Augmented Dickey-Fuller Test displays the results of the initial ADF test and shows that none of the variables have P-values less than the chosen significance level of 0.05. As a result, there is lack of evidence to reject the null hypothesis: *The variables GDPGR, EXP, FDI, GFCF, POPGR, and IMP are non-stationary*. This implies that the variables have unit roots and are non-stationary (see Appendix B).

Table 3. Augmented Dickey-Fuller Stationarity Test

Variable	***P-value***
GDPGR	*0.07837*
EXP	*0.8964*
FDI	*0.895*
GFCF	*0.3447*
POPGR	*0.5471*
IMP	*0.836*

Author's own calculations
Calculated in R Studio

Additional steps such as logarithm and differencing transformations were required before proceeding with the analysis or modeling of these variables. Thus, the variables needed to be tested for stationarity again. Subsequently to the transformation techniques were applied the variables finally exhibited stationarity. The reached stationarity indicates that the trends and non-stationarity patterns were effectively removed, allowing for a more reliable analysis of their relationship over time. Hence, after having applied the transformation techniques, and having reached stationarity, the null hypothesis: *The variables GDPGR, EXP, FDI, GFCF, POPGR, and IMP do not have a long-run relationship,* can be rejected. The new stationary p-values are displayed in *Table 4. Adjusted Augmented Dickey-Fuller Stationarity Test.*

Table 4. Adjusted Augmented Dickey-Fuller Stationarity Test

Variable	***P-value***
ΔGDPGR	*0.01*
ΔEXP	*0.01767*
ΔFDI	*0.01*
ΔGFCF	*0.01*
ΔPOPGR	*0.01*
ΔIMP	*0.02466*

Author's own calculations
Calculated in R Studio

P-value smaller than printed P-value

5.2 Results

Estimates, also known as coefficients, obtained from the VAR model show the impact of a one-unit change in one variable on GDP growth while maintaining the same values for other variables, and can be seen in *Table 5. Results of Estimated Vector Autoregression (VAR) Model - GDP Growth*. The displayed VAR model in *Table. 5* provide valuable insights into the relationship between GDP Growth and its lagged values (see Appendix C:1 for full VAR), as well as the impact of various independent variables. GDP Growth is considered the dependent variable, while the lagged values of GDP Growth and the additional independent variables (Exports, Foreign Direct Investment, Gross Fixed Capital Formation, Population Growth, and Imports) are examined.

The R^2, adj. R^2, and the P-value provide information about the goodness-of-fit and overall significance of each equation. The R^2 value represents the percentage of the variance in the dependent variable that can be explained by the independent variables. The adj. R^2 accounts for the number of observations and variables in the model, which results in a more reliable measure of goodness-of-fit. In a regression model, the P-value is typically used to assess the statistical significance of the relationship between the independent and dependent variables. The statistical significance level will, for this analysis, be 0.05. Thus, if the P-value is less than the significance level, it suggests that the relationship is statistically significant and we can reject the null hypothesis.

The $GDPGR_{t-1}$ coefficient of 0.29953 indicates a positive relationship, implying that higher GDP Growth in the previous period leads to higher GDP Growth in the current period. In contrast, the $GDPGR_{t-2}$ coefficient of -0.21283 indicates a negative relationship, implying that lower GDP Growth in the preceding period is associated with lower GDP Growth in the current period. Furthermore, the coefficient of 0.29045 for EXP_{t-1} indicates that a one-unit increase in the lagged value of Exports leads to a 0.29045-unit increase in current GDP Growth when all other variables are held constant. This demonstrates the beneficial effect of Export performance on GDP Growth. Thus, the null hypothesis: *Of the estimation results for equation GDPGR in the VAR model, there is no positive relationship between GDPGR and the lagged values of EXP,* can be rejected.

In regards to the additional control variables and the null hypothesis: *Of the estimation results for equation GDPGR in the VAR model, there is no positive relationship between GDPGR*

and the lagged values of FDI, GFCF, POPGR, and IMP, we see that the coefficient of -0.98232 for IMP_{t-1} indicates that a one-unit increase in the lagged value of Imports results in a 0.98232 unit decrease in current GDP Growth, assuming all other variables remain constant. This implies that higher import levels may have a negative impact on GDP Growth, thus, we can not reject the null hypothesis. Further, we can not reject the null hypothesis on Foreign Direct Investment or Population Growth, but we can reject it on Gross Fixed Capital Formation. The estimation results show that a positive coefficient indicates that the independent variable and GDP Growth have a positive relationship, and a negative coefficient denotes a negative relationship.

With an R^2 of 0.46, the independent variables explain 46% of the variation in GDP Growth. The adj. R^2 value of 0.1899 indicates that when the number of variables and degrees of freedom are taken into account, the adj. R^2 decreases slightly, indicating a less optimal fit. The P-value of 0.1289 indicates the overall statistical significance of the model, and in this case, the P-value indicates that the model as a whole is not statistically significant at the conventional significance level (0.05). This means that the model's independent variables may not have a significant impact on GDP Growth (see Appendix C:2 for Covariance & Correlation). Hence, the null hypothesis: *The coefficients of EXP, FDI, GFCF, POPGR, and IMP in the VAR model are all statistically non-significant, indicating that these variables do not have a significant impact on GDPGR* can not be rejected.

Table 5. Results of Estimated Vector Autoregression (VAR) Model - GDP Growth

Variable	***ΔGDPGR***
$\Delta GDPGR_{t-1}$	*0.29953*
$\Delta GDPGR_{t-2}$	*-0.21283*
ΔEXP_{t-1}	*0.29045*
ΔEXP_{t-2}	*-0.29082*
ΔFDI_{t-1}	*-0.04165*
ΔFDI_{t-2}	*0.07463*
$\Delta GFCF_{t-1}$	*0.30271*
$\Delta GFCF_{t-2}$	*-0.43975*
$\Delta POPGR_{t-1}$	*-0.25310*
$\Delta POPGR_{t-2}$	*0.24114*
ΔIMP_{t-1}	*-0.98232*
ΔIMP_{t-2}	*-0.29978*
R^2	*0.46*
$Adj\text{-}R^2$	*0.1899*
P-value	*0.1289*

Author's own calculations
Calculated in R Studio

Because of the nature of this research, and the primary goal being the examination of the relationship between Exports and GDP Growth, based on the ELG-theory, two Granger Causality tests were conducted which are displayed in *Table 6. Granger Causality Tests*. *Test 1.* was conducted based on Exports being the dependent variable and GDP Growth being the independent variable, and *Test 2.* was conducted based on GDP Growth being the dependent variable and Exports being the independent variable. The Granger Causality test is especially useful in the context of the ELG-theory because it determines whether changes in Exports precede and potentially cause changes in GDP Growth, and vice versa. The Granger Causality test in this case, which examines the causal relationship between Exports and GDP Growth, further provides insights into the dynamics of export-led growth and its implications for economic theory and policymaking. The results of *Test 1.* indicate that the lagged values of GDP

Growth have a significant causal effect on the current values of Exports at a significance level of 0.03403. However, the results of *Test 2.* show that the lagged values of Exports do not have a causal effect on the current values of GDP Growth as the p-value is 0.6667, which is greater than the significance level of 0.05.

We can conclude from these findings that there is evidence to suggest that past values of GDP Growth cause changes in the values of Exports, indicating a causal relationship between GDP Growth and Exports. There is, however, no significant evidence to support the reverse causal relationship between Exports and GDP Growth. Thus, the null hypothesis: *Changes in GDPGR do not affect changes in EXP* can be rejected, and the null hypothesis: *Changes in EXP do not affect changes in GDPGR* can not be rejected.

This particular scenario, where GDP Growth has a causal effect on Exports, but Exports do not have a causal effect on GDP Growth, can be referred to as an asymmetric causality. The causal relationship between variables in asymmetric causality is unidirectional, which means that the impact of one variable on the other is significant, but the reverse relationship is not observed or is weak. In this case, the asymmetry suggests that changes in GDP Growth have a greater impact on Exports than Exports have on GDP Growth (McBreen, 2018).

It is more likely that GDP Growth causes Exports to rise rather than the other way around. A common assumption is that when an economy's GDP grows, it typically leads to increased production and consumption, which can lead to higher demand for goods and services, including exports. As a result, GDP growth is frequently regarded as a driver of Export performance. While Exports can contribute to GDP Growth, they may not be a direct cause of it. Global demand, competitiveness, exchange rates, and trade policies can all have an impact on export performance. As a result, while there may be a relationship between Exports and GDP Growth, it is often more plausible to interpret GDP Growth as the driving factor behind changes in Exports (Mankiw & Taylor, 2020).

Table 6. Granger Causality Tests

Granger Test	***F-statistics***	***P-value***
1	*3.7643*	*0.034303*
2	*0.4105*	*0.6667*

Author's own calculations
Calculated in R Studio

5.3 Summary of the Statistical Results

When analyzing the statistical results against the null hypotheses presented in section *4.1 Method,* we can conclude that the null hypothesis (1): *Of the estimation results for equation GDPGR in the VAR model, there is no positive relationship between GDPGR and the lagged values of EXP,* can be rejected. There is a positive relationship between Exports and GDP Growth showing that for every one-unit increase in the lagged value of Exports, current GDP Growth increases by the same amount when all other variables are held constant. Further, similarly to the explanation of Exports' positive relationship with GDP Growth, we can reject the null hypothesis (2): *Of the estimation results for equation GDPGR in the VAR model, there is no positive relationship between GDPGR and the lagged values of FDI, GFCF, POPGR, and IMP* for Gross Fixed Capital Formation. However, for Foreign Direct Investment, Population Growth, and Imports, we can not reject the null hypothesis as a one-unit increase in the lagged values of each variable instead results in a one-unit decrease in current GDP Growth, when all other variables are held constant.

The null hypothesis (3): *The coefficients of EXP, FDI, GFCF, POPGR, and IMP in the VAR model are all statistically non-significant, indicating that these variables do not have a significant impact on GDPGR* was not rejected. This stems from the fact that the P-value of 0.1289 indicates that the overall statistical significance of the VAR model on GDP Growth was not statistically significant at the conventional significance level of 0.05. Thus, the independent variables may not have a significant impact on GDP Growth.

In regards to the Granger Causality tests and the null hypotheses (4) and (5): *Changes in GDPGR do not affect changes in EXP* and *Changes in EXP do not affect changes in GDPGR,* we failed to reject null hypothesis (5). Exports do not have a causal effect on the current values of GDP Growth as the p-value is 0.6667, which is greater than the significance level of 0.05. However, we can reject null hypothesis (4) as GDP Growth has a significant causal effect on the current values of Exports at a significance level of 0.03403.

6. Discussion

6.1 Statistical Results in Relation to the Theoretical Framework

There is a wide range of studies on Exports' impact on GDP Growth, and vice versa. Similarly, a wide range of literature about the ELG-theory is available.

According to Yao (2014) there is a bidirectional causality between Exports and GDP Growth, however, the statistical results of this research are contradictory. The results from the Granger Causality tests showed a case of asymmetric causality. Contradictingly to the statement about Exports having a causal effect on GDP Growth, and GDP Growth having a causal effect on Exports, the results on China and the causality between the variables, showed that GDP Growth has a causal effect on Exports, while Exports do not have a causal effect on GDP Growth. However, as the ELG-theory goes both ways, we can still conclude that the findings partly support the ELG-theory explained by Yao (2014). Sanasssee et al. (2014), found that the strength of the relationship between Exports and economic growth can vary depending on the country and time. This validates the fact that China's GDP Growth from 1979 to 2019 has had a slightly positive relationship with Exports, however, with different strengths throughout the time. The fact that Exports, together with the additional variables, did not prove to have a significant impact on GDP Growth in China contradicts Kavoussi's (1984, p. 249) statement about Exports being a key driver of economic growth. If this was true, and Exports aid countries to achieve higher rates of GDP Growth, the result of Exports and the additional variable's impact on GDP Growth would indicate a statistical significance. Further, Kvaoussi emphasized that research has found a strong and positive relationship between Exports and economic growth, however, despite the relationship between Exports and GDP Growth in China being positive, the correlation was moderate and not particularly strong.

As claimed by Lee & Huang (2002) the effectiveness of an ELG strategy is uncertain, the relationship between Exports and GDP Growth may not be linear and may be affected by various factors. The results provided in the analysis, proving that Exports and GDP Growth indeed have a relationship, but rather vague, corroborate the claims made by Lee & Huang (2002) about the fact that there might be a threshold level of exports necessary for economic growth. However, Lee & Huang further claim that the relationship between the variables is stronger in countries

with a higher level of economic growth, and as China became one of the largest economies in the world after its transition to EP (Holz, 2008), this is rather contradicting as the positive relationship between the variables was relatively weak.

The fact that Exports did not have a causal effect on GDP Growth in China supports Marin's (1992) claim about the ELG-theory not being universally applicable across different contexts. He claims that the traditional ELG model, stating that a country's economic growth is determined by its ability to export, may not apply to all countries. Thus, the case of China's economic growth and its relationship with Exports can be explained by Mankiw & Taylor's (2020) claims about GDP growth affecting Exports more than the other way around.

In regard to the determinants of economic growth, various scholars have concluded that different factors have essential impacts. Barro (1996) claims that the role of investment is the most crucial factor in boosting GDP Growth, however, in the case of China, the results indicated that both Foreign Direct Investment did not have a positive relationship with GDP Growth, while Gross Fixed Capital Formation had. Further, Barro stated that Population Growth had a negative impact on economic growth, while Prtizker et al. (2015) instead claim that Population Growth can have positive effects on GDP Growth. The results from this research validate Barro's (1996) statement, as China's GDP Growth did not exhibit a positive relationship with Population Growth.

Similarly to the methodological approach of this research, Shan & Tian (2002) tested the ELG-theory using time series data on Shanghai from 1990-1996 using the Granger Causality test. Further, the researchers conducted a VAR model on Exports, GDP, total people employed, Imports, Foreign Direct Investment, and fixed capital expenditure as variables to test the relationship between exports and GDP for Shanghai in the context of the ELG-theory. In Shanghai, they concluded that GDP had a causal effect on Exports, similar to the results of this research. Further, Shan & Tian found that Shanghai's economic growth was not primarily caused by an increase in Exports, which in turn supports the results of this research and Exports not having a causal effect on China's GDP Growth. Similarly to the research of Shan & Tian (2002) this study found that China's economic performance was driven by a combination of factors. Liu et al. (1997) found in their study that there was a bidirectional causality between Exports and GDP Growth in China from 1983 to 1995, as Yao (2014) also claims is the case between the variables. However, when examining a longer period, we know based on the results of the study

that this is not applicable. The different results of Shan & Tian's (2002) and Li et al.'s (1997) studies, and the results of this study examining the whole of China from 1979-2019, implies that time period, examined variables, and location, can have affecting attributes on the results.

Tang (2006) tested the causality between Export expansion and economic growth in China from 1970 to 2001 and added imports when examining the ELG-theory. The scholar concluded that GDP Growth was caused by imports in the short-run, which contradicts the results of this study suggesting that Imports in China have a negative relationship with GDP Growth. Lastly, Li et al. (2010) also conducted a time series study and a Granger Causality test on East China's Exports' effect on GDP Growth from 1981-2008. The scholar's found that Exports had a positive effect on GDP Growth, contradictingly to the results of this study. However, they concluded that foreign trade was the key source of East China's GDP Growth, which includes both Exports and Imports and if this would hold in the case of this study, there would be a statistically significant value when examining the overall impact of all the variables on China's GDP Growth, which was not the case.

6.2 Statistical Considerations and Limitations

The causality between GDP Growth and Exports has implications for the theoretical framework of the ELG-theory. According to the theory of ELG, an increase in exports stimulates economic growth. However, the findings of this study suggest that the direction of causality in the context of the analysis is primarily driven by GDP Growth affecting Export performance rather than the other way around. This calls into question the conventional assumptions of ELG-theory and emphasizes the importance of taking into account the specific dynamics of the data under consideration.

The analysis assumed that the relationships between GDP Growth, Exports, and the additional variables were unaffected by external factors. However, endogeneity and reverse causality may exist, implying that the variables can influence each other in both directions. Omitted variables or unobserved factors may also have an impact on the results.

The results are limited to the dataset and period examined, and they may apply to other countries, regions, or periods. Economic conditions, policy environments, and structural characteristics can differ across contexts, so results should be applied with caution in other contexts. It is also worth noting that the sample size of this research, with only 41 observations,

is relatively small. This, in turn, may limit the applicability and generalizability of the results to other contexts and countries further.

The VAR model and the lag length selected may have an impact on the results. Different model specifications or lag structures may produce different results. Sensitivity analyses or robustness checks could provide additional insight into the results' stability and robustness. Further, the VAR model assumes stationarity. Violations of this assumption may have an impact on the accuracy and dependability of the results. Furthermore, while the VAR model captures short-term dynamic relationships among variables, it may fall short of capturing long-term or structural relationships.

Despite these limitations, this research provides important insights into the relationships between GDP Growth, Exports, and additional relevant variables, challenging the traditional assumptions of ELG-theory. The findings add to the existing literature on ELG-theory and highlight the need for additional research into the complex interactions of economic variables.

7. Conclusion

China shifted to Export Promotion as their approach to industrialization in 1979, and this shift in approaches and its increased Exports policy is claimed to have had substantial effects on China's GDP Growth. According to the Export-Led Growth (ELG) theory, Exports have a direct impact on economic growth and the relationship between Exports and GDP Growth is claimed to be strong and positive. However, there has been contradicting evidence from previous studies examining the ELG-theory, as well as differing results when having examined the relationship between the factors within the borders of China. The determinants of GDP Growth have been widely discussed and it is hard to determine what factors are more prominent in affecting economic growth than others as this can not be universally applicable across different contexts.

The aim of this research was to examine the relationship between Exports and GDP Growth in China from 1979 to 2019, controlling for additional variables, and to investigate whether there was a bidirectional or asymmetrical causal relationship between the core variables Exports and GDP Growth during the same period. Further, this study set out to widen the framework of GDP Growth determinants as well as contribute to the research of the ELG-theory.

In the case of China, from 1979 until 2019, the results of this study suggest that Exports and GDP Growth have a positive relationship, however, not substantially strong. Furthermore,

the findings indicate that Gross Fixed Capital Formation has a slightly positive relationship with China's GDP Growth. When examining all independent variables, thus Exports, Foreign Direct Investment, Gross Fixed Capital Formation, Population Growth, and Imports, the findings suggest that these variables did not have a significant impact on GDP Growth.

Further, contradictingly to the ELG-theory, the results of this study showed that Exports did not affect changes in GDP Growth in China, however, the causality was proven to be asymmetrical, as GDP Growth showed results of having a causal impact on Exports.

The results of this study both corroborate and contradict additional studies in the same field, thus, this prompts the need for additional research on the complexity behind the ELG-theory and the determinants of economic growth.

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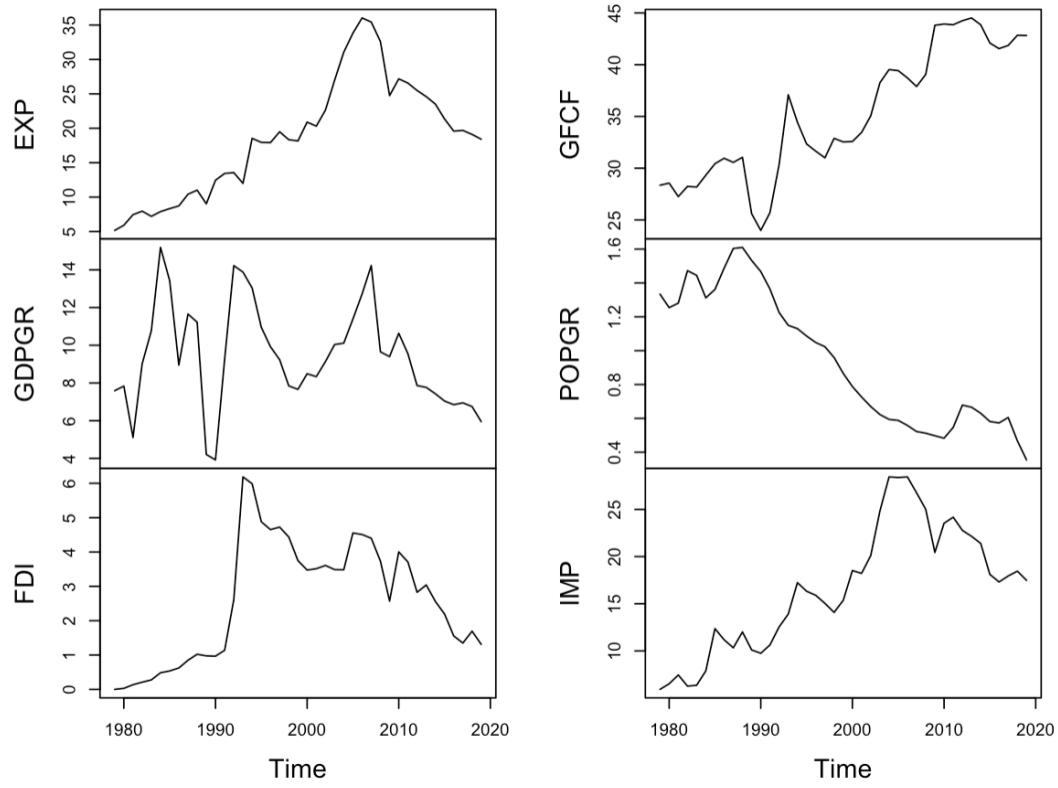
8. Appendices

Appendix A: Dataset
Collected by the Author from the WorldBank

Year	Exports of goods and services (% of GDP)	GDP growth (annual %)	Foreign direct investment, net inflows (% of GDP)	Gross fixed capital formation (% of GDP)	Population growth (annual %)	Imports of goods and services (% of GDP)
1979	5.16284335734386	7.5913246800003	0.000044873083502658	28.3514408388555	1.33392795351687	5.92373477325849
1980	5.91161214157888	7.83414501593799	0.0298196364663713	28.5606132573974	1.25422105193987	6.51323638607585
1981	7.44757798971743	5.11276109058912	0.135296316146172	27.2577140423572	1.28095234429252	7.4496039902587
1982	7.95978953352709	9.01711391382203	0.209664356764914	28.2394193326262	1.47267476016581	6.26499768691374
1983	7.20471973655622	10.7702025065715	0.275698542655107	28.1772688797515	1.4449496950092	6.36107437331215
1984	7.89354531549557	15.1915400236134	0.483945714588724	29.321047033346	1.31206876113779	7.87633298324378
1985	8.32744409232092	13.4306775204064	0.536046583129515	30.4312407901785	1.36169911825369	12.3621617971214
1986	8.71924863992301	8.94996176438008	0.623424605798281	30.9595619449795	1.48739892914903	11.178367007316
1987	10.4169849534329	11.6574277931357	0.847702964733309	30.558436985113	1.6036050865576	10.3280184515527
1988	11.0149045926492	11.222594982521	1.02255894629729	31.0528220163255	1.61007108578698	12.0106268111316
1989	9.02734505345022	4.20633435547815	0.97565028966922	25.6060676575195	1.53316999599862	10.1073620342885
1990	12.4516026163156	3.92025136776569	0.966308310992784	23.9887536439349	1.46730321087928	9.74787071062572
1991	13.4363711715803	9.26278608462174	1.13883773180262	25.7037988539868	1.36443400840349	10.6299635510086
1992	13.5555444626349	14.2245295924457	2.61316219287254	30.3473196457713	1.2255362283362	12.5420329260081
1993	11.9978832856194	13.8837293020436	6.1868820761248	37.0922329877971	1.14961943083465	13.9025469036305
1994	18.5367485700923	13.0368066326902	5.98715629420307	34.4406164197285	1.13026063215591	17.2330664184822
1995	17.9525228274662	10.9539543420185	4.88044415984949	32.3409688064297	1.08650915088974	16.3244462361363
1996	17.9232955521271	9.92255675288459	4.65182665077089	31.6420047394574	1.04814151412165	15.8914499144708
1997	19.493164459713	9.23677989169124	4.72533415243528	31.0030962033048	1.02345002419879	15.039852899528
1998	18.3421000328063	7.84595178733933	4.43557710153157	32.882594583582	0.959550406298151	14.0822045922729
1999	18.1624767570614	7.66165150045002	3.74900388026637	32.5371258863645	0.865851392993279	15.3616850048872
2000	20.8936972015295	8.49009340601468	3.47508224574174	32.5774175906845	0.787956592953992	18.5173176505339
2001	20.3121457448267	8.33573347821324	3.51300212008009	33.4535263709326	0.726380637838525	18.2152135311025
2002	22.64474567395	9.13363078988934	3.60909988460748	35.0583660516495	0.669999567758626	20.1026579597863
2003	26.9807565341729	10.0380304808371	3.48740330983945	38.2576853287827	0.622860936133583	24.823231465803
2004	31.0613375826931	10.1136213778964	3.4836411137418	39.5296637268803	0.593932815112141	28.4441866417059
2005	33.8298575661784	11.3945918098662	4.55425403392961	39.4258155677945	0.588124989556992	28.3780352999888
2006	36.0350255522637	12.7209556651723	4.50857901572192	38.7254881039361	0.558374367373002	28.4438583515049
2007	35.4347985287719	14.2308609332879	4.40096483008155	37.8924683375744	0.522271866392275	26.7585649479347
2008	32.6027140173977	9.65067891934387	3.73363488970446	39.0611780866356	0.51238693163744	25.0100013259279
2009	24.7498559389096	9.39872563258297	2.56888829067473	43.8115710188599	0.497381400884935	20.4350144396449

2010	27.1853327203776	10.6358710645426	4.00356290026293	43.9293047683925	0.482959688678361	23.5317449423591
2011	26.5681893450684	9.55083217886425	3.70882890211806	43.8613614635205	0.546457594880274	24.1727152412906
2012	25.4925222244964	7.86373644864966	2.82709055579985	44.249831988839	0.678345458846803	22.7750001428849
2013	24.5992544368742	7.76615009763002	3.03987546926686	44.5187655501809	0.666072977690069	22.1451211404376
2014	23.5100609073931	7.42576365632598	2.55923344660685	43.8560937014827	0.630326389541893	21.3951550469572
2015	21.3540798828228	7.04132887877194	2.1921816030386	42.0943282754663	0.581456146657648	18.1100894524219
2016	19.5843800536153	6.84876220493844	1.55564214957722	41.5523649218844	0.573050906069647	17.3100349634158
2017	19.6922769882613	6.94720079330668	1.34913267883962	41.8611852979241	0.605245013482969	17.9401362522382
2018	19.1121035363869	6.74977383254181	1.69390529382619	42.8430311361549	0.467672053461959	18.4536805657087
2019	18.4099923155293	5.9505007536746	1.31071877840365	42.8225843508999	0.354740890170827	17.4801037187357

Appendix B: Stationarity Testing - Plot



Appendix C: Results of Estimated Vector Autoregression (VAR) Model

Table C:1 Results of Estimated Vector Autoregression (VAR) Model (All Variables)

Variable	*ΔGDPGR*	*ΔEXP*	*ΔFDI*	*ΔGFCF*	*ΔPOPGR*	*ΔIMP*
$\Delta GDPGR_{t-1}$	0.29953	0.019173	0.735231	0.0594232	-0.002360	0.248242
$\Delta GDPGR_{t-2}$	-0.21283	-0.351508	-1.150823	0.1132155	-0.008762	-0.142314
ΔEXP_{t-1}	0.29045	-1.163641	-0.958926	0.1188013	-0.024873	-0.605308
ΔEXP_{t-2}	-0.29082	-0.331823	0.359793	-0.0617947	0.004367	-0.349375
ΔFDI_{t-1}	-0.04165	0.105049	-0.350978	0.0161279	0.053349	0.069085
ΔFDI_{t-2}	0.07463	0.043972	0.213794	0.0014003	0.010243	0.012429
$\Delta GFCF_{t-1}$	0.30271	-0.455763	-0.413490	-0.2271853	-0.18850	-0.131518
$\Delta GFCF_{t-2}$	-0.43975	0.718520	-0.754098	-0.3337448	-0.075747	0.198905
$\Delta POPGR_{t-1}$	-0.25310	0.117442	0.688618	0.0313546	-0.009444	-0.169587
$\Delta POPGR_{t-2}$	0.24114	0.107049	1.599447	-0.1577876	-0.515271	0.055641
ΔIMP_{t-1}	-0.98232	0.319263	-0.018762	-0.1942304	0.027465	-0.120993
ΔIMP_{t-2}	-0.29978	0.104583	0.665345	-0.0298456	0.054111	-0.094088
R^2	0.46	0.7371	0.3722	0.2475	0.3627	0.575
Adj-R^2	0.1899	0.6057	0.05835	-0.1288	0.0441	0.3626
P-value	0.1289	0.0001691	0.3464	0.7729	0.377	0.01828

Author's own calculations
Calculated in R Studio

Table C:2 Covariance & Correlation Matrix of Residuals from VAR model

	Covariance	***Correlation***
Variables	***ΔGDPGR***	***ΔGDPGR***
ΔGDPGR	*0.10363*	*1.00000*
ΔEXP	*0.02005*	*0.50927*
ΔFDI	*0.05694*	*0.57682*
ΔGFCF	*0.01481*	*0.55993*
ΔPOPGR	*-0.00212*	*-0.07808*
ΔIMP	*0.01145*	*0.26025*

Author's own calculations
Calculated in R Studio
The interpretation of the covariance values depends on the scale and nature of the variables.
The correlation coefficients range from -1 to 1, where -1 indicates a perfect negative correlation, 1 indicates a perfect positive correlation, and 0 indicates no correlation.