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Measuring the impact of some Indices of economic efficiency of foreign trade on the economic growth of Singapore for the period (1990-2022)

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Abstract
The research seeks to examine whether the economic efficiency indices of foreign trade have an impact on Singapore's economic growth. The theory advanced by the research is that there is a significant and positive effect of economic efficiency indices of foreign trade on economic growth. To test the worth of this hypothetical proposition, a counteraction relationship linking economic efficiency indices of foreign trade with economic growth will be measured on the one hand using six major indices that express Indexes of economic efficiency for foreign trade (coverage rate index, economic exposure index, export significance index, import significance index, economic participation index, the average per capita share imported by foreigners indexes) and on the other using one which expresses economic growth (Gross domestic product) through eviews12 software. After running a routine test series, a statement of conclusions was drawn. Under the ARDL methodology based on estimated parameter results for short-term and long-term data, from this point of view, all of the economic efficiency indexes for foreign trade except for the (Import importance) index are positively correlated to gross national product: Increase one ann increase in Gross National Product. This result is consistent with economic logic and theory. The report included a set of recommendations, such as increasing the level of support that the Singaporean government gives to its foreign trade sector in a way which can maintain social value; judgments are made about Singapore's economic behavior. With foreign trade being a major foreign exchange provider to help finance projects and growth in nation-building year after year.

Keywords: Foreign trade efficiency Indices, economic efficiency, economic growth

Introduction

Economic efficiency Indices are among the most important primary tools for measuring the performance of foreign trade of countries, as these Indices reflect the efficiency of using economic resources and production in foreign trade operations, as they contribute to determining the level of economic competitiveness of countries participating in foreign trade at the regional and global levels. They also help improve foreign trade performance, increase opportunities for economic growth and enhance trade exchange between countries. The economic efficiency indicators in foreign trade, on the other hand, are one of the main yardsticks for people who want to understand just what sort of an impact foreign trade has had on a country's economy. These measure how efficiently resources and output are utilized in trade, and show a country's ability to compete in the foreign exchange market. Given the importance and position of Singapore in foreign trade, it is one of the world's largest commerce centers. Being an important part of foreign trade (and in a way a confluence), at the same time its geographical location gives it access to both East-West markets. In addition, it has an advanced infrastructure that facilitates transportation and shipping operations, and it has open and transparent economic policies that attract international companies to invest in it. It is a base for global companies for trade and investment, and the Singaporean government encourages innovation, research and development, which has made it enjoy an attractive environment for technology companies. All of these things have made Singapore one of the most scientific countries that achieve economic growth and have been

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classified as one of the Asian tigers, and therefore it was chosen to be the subject of research.

Research Problem

The Singaporean economy has witnessed developments during the last three decades and has achieved high growth rates. Singapore has been classified as one of the Asian tigers. Various economic sectors have played an important role in achieving this growth. Among these sectors is the foreign trade sector, which has contributed to providing foreign currency to finance development and achieve economic growth. From this standpoint, the research problem can be formulated with the following question: - What is the extent of the impact of foreign trade, represented by Indices of its economic efficiency, in achieving economic growth?

Research Aim

The study is to examine the metrics of economic efficiency in foreign commerce and economic growth in Singapore, thereafter assessing the correlation between the two.

Importance of the Research

The significance of the study lies in its elucidation of the principal economic sectors in Singapore, specifically international trade, and its analysis of economic efficiency indices to ascertain their influence on economic growth.

Research Hypothesis

The investigation posits that economic efficiency indices for foreign commerce positively influence the national product being an indicator of economic growth.

Research Methodology

The research relied on the analytical method to analyze economic efficiency Indices for foreign trade and economic growth, then the quantitative method to measure the relationship and determine its type between the research variables.

Research Structure

The study was categorized into three dimensions: The first focus is on the notion and research of economic efficiency indices pertaining to international commerce in Singapore. The second pertains to the notion and examination of Singapore's economic growth index. The third axis assesses the influence of economic efficiency. Foreign trade indices and their impact on economic growth in Singapore.

Section One: The concept and analysis of economic efficiency Indices for foreign trade in Singapore
## First: The concept of economic efficiency Indices for foreign trade

The concept of economic efficiency Indices for foreign trade refers to the factors that measure the efficiency of the economy in the field of foreign trade. These Indices are used to analyze the performance of the national economy in dealing with foreign trade, and to estimate how to use economic resources and production efficiently to achieve a positive trade exchange rate with other countries (25: 2008: Salvatore Dominick),

These efficiency indices can also be used by international organizations and institutions, economists, and researchers as tools to identify where foreign trade systems between countries are doing well as well as their shortcomings. This in turn helps take certain measures which improves or corrects problems in trade performance potentially benefitting local, regional or international standards.

International organizations and institutions have identified a set of Indices to measure the economic efficiency of foreign trade, and so often these Indices are referred to. The Index system includes the coverage rate index, the economic exposure index, the importance of exports index, the importance of imports index, the economic participation index and the average per capita share of foreign trade index. These Indices show the health of a country's economy and its competitiveness both regionally and globally (2018: 30 Krugman and others).

Second: Analysis of the economic efficiency Indices of foreign trade in Singapore

1. Coverage ratio index: It is one of the indexes used for analyzing the trade between countries. A ratio showing the value of exports relative to the value of imports, this index is used as an indicator of whether countries possess enough foreign exchange earned from their export sales to pay for their purchases on international markets. If the value of this index is less than one, it indicates that imports exceed exports. It means there is a negative trade gap. Conversely, if the index is greater than one, exports exceed imports and there is a positive trade gap. This index is also important in assessing the strength of the country's economy, as it shows whether the country depends heavily on imports or exports. In addition to its use in determining the independence of the country's economy and its ability to achieve trade balance (Al-Abdali and Rashid, 2016, 339) [2]. Figure (1) shows the coverage ratio index in Singapore.
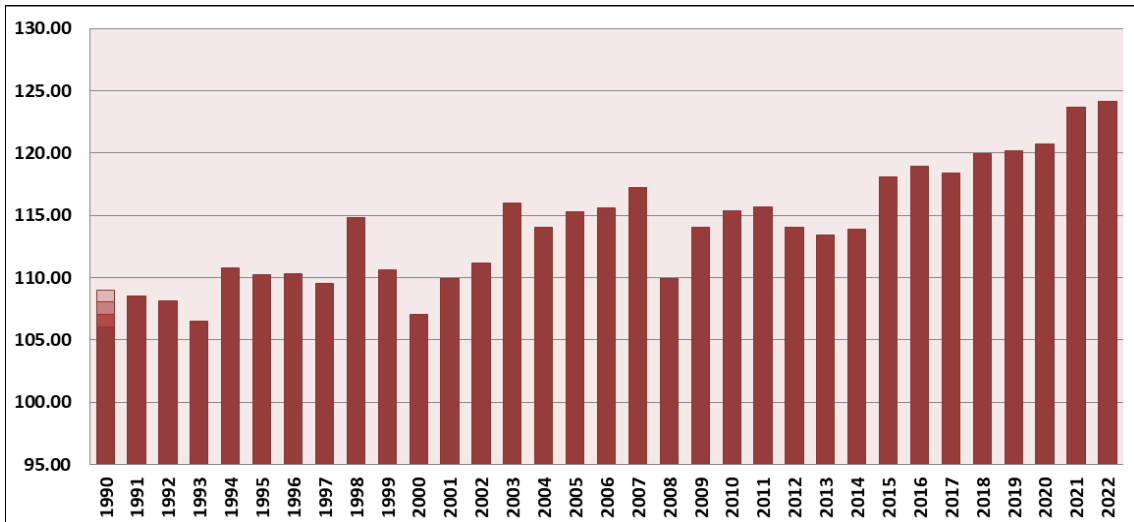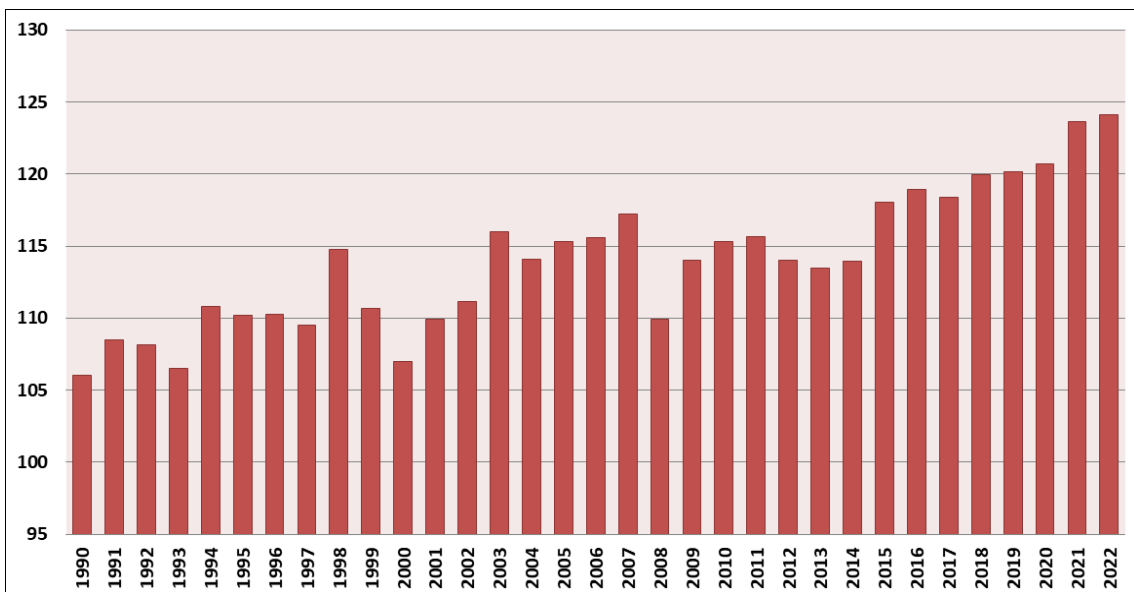
Source: Compiled via the researcher utilizing the World Bank free data

Fig 1: Coverage rate index in Singapore

Figure (1) clearly demonstrates that the coverage rate surpassed one, signifying a positive trade gap, wherein the value of exports exceeded that of imports, so reflecting the robustness and autonomy of the Singaporean economy.

2. Economic Exposure Index: This index refers to the total foreign trade divided by the gross domestic product of a country, and is a measure used to measure the extent of the national economy's openness to foreign trade. It is also an important tool for measuring the level of economic integration of a country with the rest of the world, and it helps in understanding how trade affects the country's economy. The high degree of economic exposure reflects the dependence of the local economy on the outside world in selling its products (exports) or obtaining goods and services (imports). It also indicates the sensitivity of the local economy to external changes such as rising prices and the trade, financial and monetary policies of trading partners. Figure (2) shows the economic exposure index in Singapore.

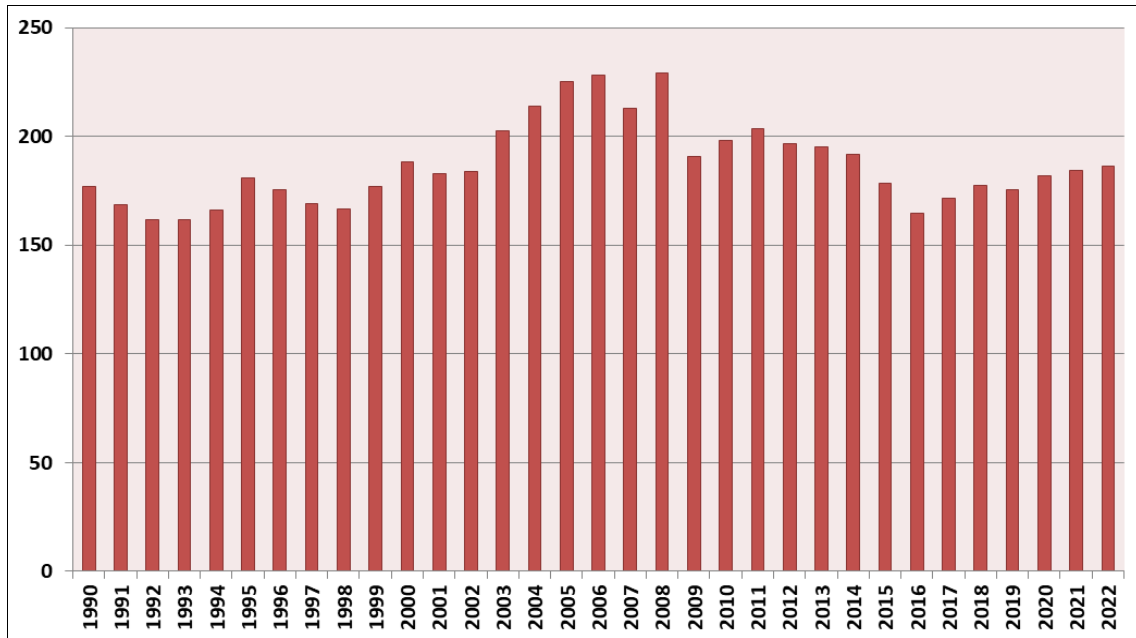*Source*: Compiled via the researcher utilizing the World Bank free data

Fig 2: Economic Exposure Index in Singapore

It is clear from Figure (2) that the degree of economic exposure in Singapore has taken an increasing trend during the study period despite its fluctuation in some years, as the degree of economic exposure exceeded (100%) throughout the study period, which indicates a high percentage of dependence of the Singapore economy on external variables, in other words, a high general percentage of foreign trade variables in the formation of the gross domestic product.

3. Export Importance Index: This index denotes the total exports relative to a country's gross domestic product and is regarded as a significant economic indicator for evaluating the robustness and sustainability of the nation's economy. It is utilized to assess the magnitude and influence of a nation's exports on its economic activity, as well as to evaluate the repercussions of these exports on global commerce and international relations. A higher score on this Index indicates a greater percentage of revenues derived from exports, their contribution to economic growth, and the

country's capacity to facilitate the flow of goods and services to foreign markets for profit and added value (Khader *et al.*, 2023, 82) [6]. Figure (3) illustrates the significance of exports in Singapore.
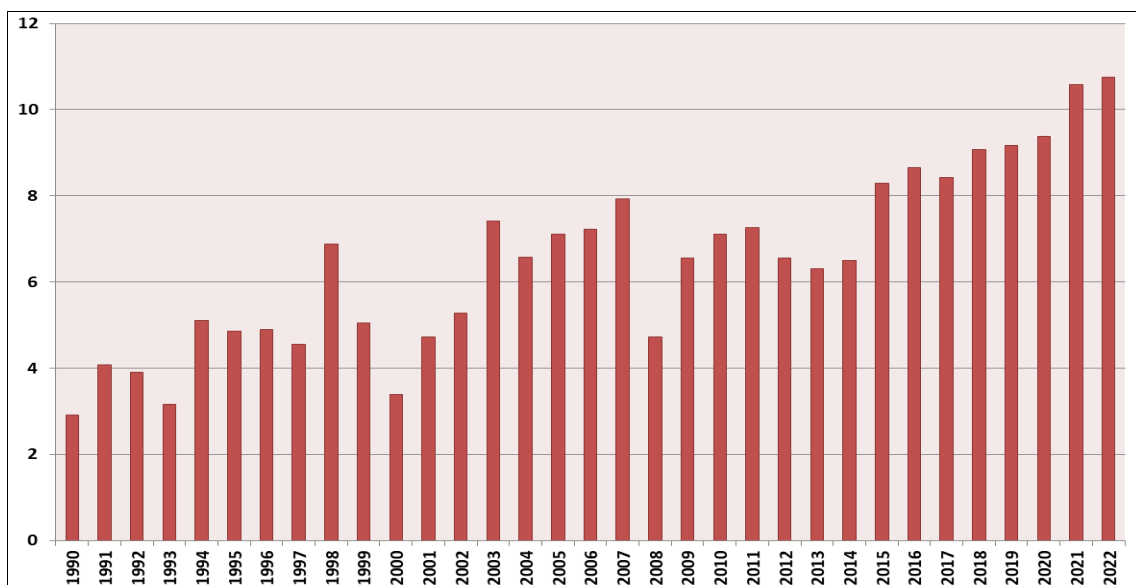

Source: Compiled via the researcher utilizing the World Bank free data

Fig 3: Importance of Exports Index in Singapore

Figure (3) clearly illustrates that the Importance of Exports Index percentages are elevated, ranging from 161% to 228%. These figures signify the robustness of the Singaporean economy and highlight the substantial influence of exports on economic activity through the augmentation of revenue derived from exports, which is utilized to foster economic growth.

4. Import Imports Index: This index is calculated by dividing total imports by a country's gross domestic product during a certain period, often one year. It serves as an indicator of the significance of the commodities and services that a nation acquires from foreign sources. Moreover, it is a principal economic index utilized to assess the vitality of a nation's economy. The increase in the import index has two implications: the first suggests economic expansion if the majority of imported goods are capital goods utilized for economic development, while the second indicates a structural imbalance in the production of the importing nation if most imported goods and services are consumer goods. Figure (4) illustrates the significance of imports in Singapore.

Source: Compiled via the researcher utilizing the World Bank free data

Fig 4: Import Importance Index in Singapore

Figure (4) illustrates the variation of the Import Importance Index in Singapore, ranging from its minimum value of 138.46% in 2016 to its maximum of 208.33% in 2008.

Overall, these elevated percentages signify the openness of the Singaporean economy to international trade and its importation of capital items to facilitate economic growth.

Nonetheless, it is observed that despite the elevated level of this index, when juxtaposed with the export importance index, the import importance index remains inferior to the export importance index throughout the research period, indicating a surplus in Singapore's trade balance.

5. Economic participation index
This index is measured by dividing net foreign trade (trade balance) by total foreign trade. This index is used to measure the effectiveness of a country's foreign trade in achieving a positive or negative balance in its trade transactions with the outside world. If the value is positive, it indicates that the participation of exports in economic activity is greater than the participation of imports and vice versa (Al-Ghariri, 2022, 95) [3]. Figure (5) shows the trends of this index in Singapore.
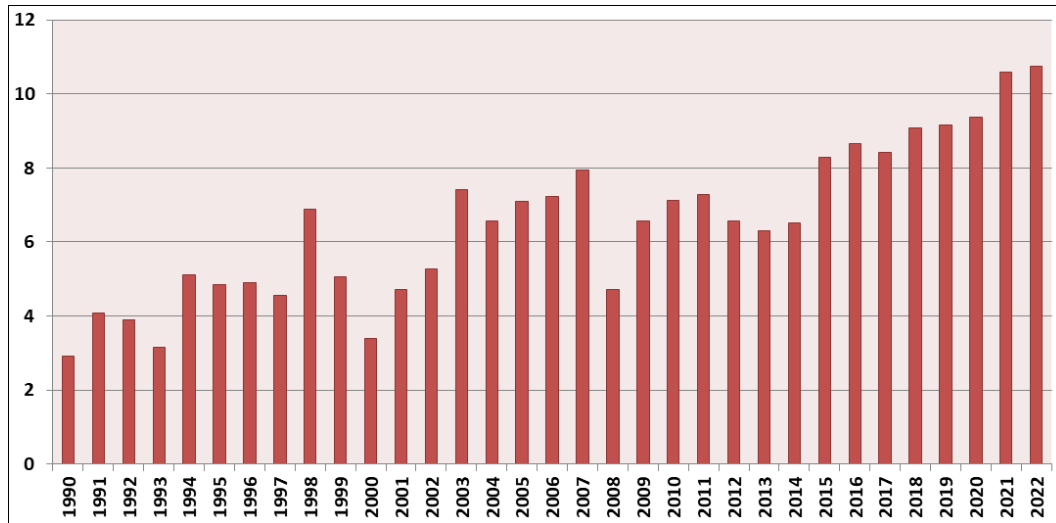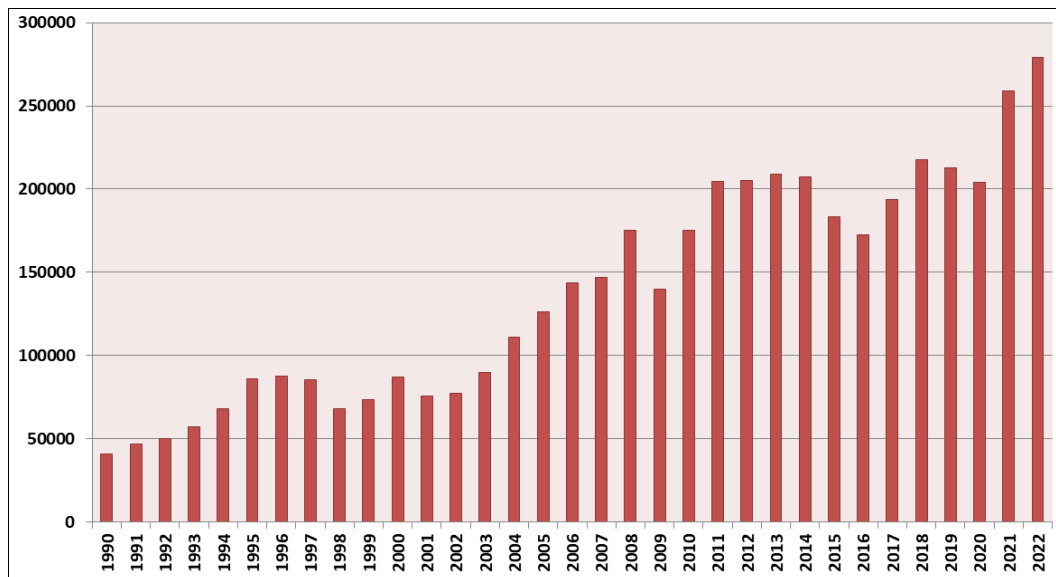

Source: Compiled via the researcher utilizing the World Bank free data

Fig 5: Economic Participation Index

It is clear from Figure (5) that all values of this index are positive, which indicates that the participation of exports in Singapore's economic activity was greater than the participation of imports. In other words, Singapore was able to achieve a positive balance in its foreign trade throughout the research period.

6. Average per capita share of foreign trade index: It is a measure used to measure the volume of foreign trade for each individual in a country. This index is usually calculated by dividing the total value of a country's foreign trade by its population. This index is one of the important Indices that indicate the level of per capita share of foreign trade and its impact on the individual economy in the country.

In addition, determining the average per capita share of foreign trade helps in estimating the level of the country's dependence on foreign trade and the efficiency of resource exploitation and local production, as well as determining the level of economic prosperity for the individual and society. This Index is also sometimes used as one of the Indices to measure the level of economic development and dependence on global markets (Mahmoud and Al-Kawaz, 2021, 106) [7], and Figure (6) shows the average per capita share of foreign trade in Singapore.

Source: Compiled via the researcher utilizing the World Bank free data

Fig 6: Average per capita share of foreign trade in Singapore

Figure (6) shows that the average per capita share of foreign trade tends to increase when comparing the beginning of the period with its end, which indicates that the growth rate of foreign trade was greater than the population growth rate in Singapore. This indicates that Singapore was able to achieve significant economic gains through foreign trade by providing job opportunities and improving the standard of living for the individual and society. In addition, the high score of this Index in Singapore indicates its ability to significantly influence the prices of goods and services at the global level, and thus its ability to achieve balance in its trade balance and ensure the sustainability of its economic prosperity.

Section Two: Concept and analysis of the economic growth index in Singapore

First - Economic growth: Economic growth denotes the augmentation of a nation's economic production over a certain duration, often one year. It also denotes the long-term growth in the actual output of products and services inside an economy over a certain timeframe. Economic growth is a crucial determinant of enhanced living standards and societal well-being, as it generates new work possibilities, decreases unemployment, elevates individual incomes, and improves overall quality of life (Al-Khaikani and Al-Sharifi, 2023, 15) [4].

There are a number of reasons that make economic growth important in the economy, which can be identified as follows:

1. **Improving the standard of living:** Economic growth is a means of raising the standard of living for individuals by increasing employment opportunities and income, thus contributing to improving their quality of life.
2. **Creating job opportunities:** Economic growth contributes to increasing the volume of production and business, which in turn leads to creating new job opportunities and thus reducing unemployment rates.
3. **Increasing the country's ability to achieve sustainable development:** Economic growth enhances a nation's capacity to attain sustainable development by supplying essential resources for investment across diverse economic sectors.
4. **Improving the level of infrastructure:** Economic growth helps to enhance investments in infrastructure such as transportation, roads, bridges, and electricity, which contributes to accelerating economic development.
5. **Increasing the capabilities of economic institutions:** Economic growth contributes to encouraging the development of various sectors in the country, such as technology and innovation, and thus provides institutions with new opportunities for innovation, improving production art, and opening up to foreign markets.

Second - Economic growth Indices: There are several Indices used to measure economic growth, the most important of which can be identified as follows (Ali and Obaid, 2020, 192-195) [1]:

1. **Gross domestic product:** It is the aggregate value of products and services generated within a country's geographical boundaries within a designated time frame. This Index is among the most significant and often utilized indicators of economic development. The rise in economic growth signifies the advancement of its constituent sectors, including industry, agriculture, services, and others. This Index was used in this research to represent economic growth in Singapore due to its significance.
2. **Consumer spending:** It is a significant economic index utilized to assess economic growth. It is a significant determinant of the magnitude of economic growth in the nation. An escalation in consumer expenditure signifies a favorable indicator of economic expansion, since it denotes a rise in consumer consumption, subsequently leading to heightened output and revenues.
3. **Production of government sectors:** This Index represents the aggregate value of products and services utilized or invested by governmental sectors. It is a significant indicator of economic growth in any nation. It significantly contributes to economic growth and the enhancement of residents' quality of life.
4. **Net foreign trade Index:** It is an Index that measures the difference between a country's exports and imports. It is one of the Indices of economic growth, as net foreign trade shows the country's economic efficiency, as the increase in a country's exports over its imports indicates the strength of its economy and an increase in its production and revenues. If the opposite is true, this shows weakness in local production and an increase in dependence on the outside.

Third - Analysis of the Economic Growth Index in Singapore

The gross domestic product was selected to represent economic growth in Singapore as an indicator of the nation's capacity to efficiently generate goods and services. Furthermore, it indicates the magnitude of the nation's economic and industrial operations. During the research period, Singapore's gross domestic product experienced fluctuations, achieving positive growth rates for the majority of the time, except in 1998, when the financial crisis originating in Thailand adversely affected the Singaporean economy, leading to a slowdown, sectoral declines, and a depreciation of its currency exchange rate. In 2001, the economic crisis that originated in the United States and disseminated globally adversely impacted stock and bond valuations, heightened inflation and unemployment rates, and led to a contraction in the economic sectors contributing to Singapore's gross domestic product. In 2020, the COVID-19 pandemic and its associated measures affected industry and commerce, resulting in decreased output, revenues, and a contraction in gross domestic product. Overall, Singapore consistently attained positive growth rates for the most of the time. The rationale for this is the Singaporean government's implementation of a sustainable economic strategy, along with investments in education and scientific research, and the promotion of creativity and innovation, which fostered a technology renaissance that positively impacted all economic sectors. Furthermore, it experienced political stability and economic openness to external markets. Figure (7) illustrates the progression of Singapore's gross domestic output from 1990 to 2022.
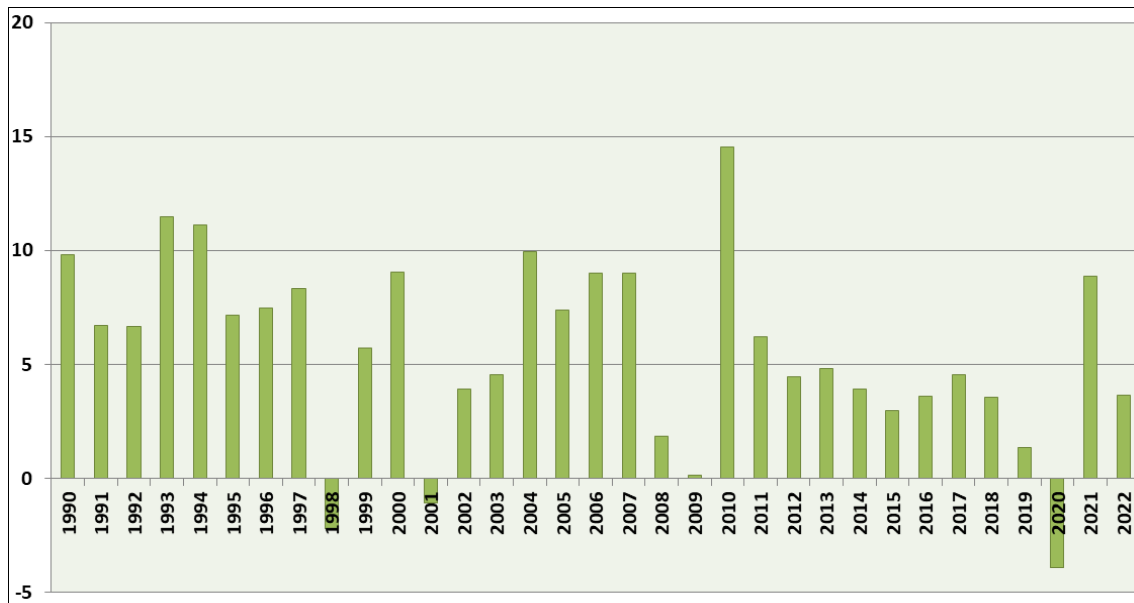
Source: Compiled by the researcher utilizing the World Bank's free data

Fig 7: GDP growth rate in Singapore

Section Three: Measuring the impact of economic efficiency Indices of foreign trade on economic growth in Singapore

First - Research variables

1. **Dependent variable Y (Dependent Variable):** Economic growth expressed by the GDP growth rate.
2. **Independent variables (Independent Variable):** Six variables were identified to express the economic efficiency of foreign trade as follows:
- **Independent variable X1 (Independent Variable):** Expresses the coverage rate index.
- **Independent variable X2 (Independent Variable):** Expresses the degree of economic exposure index.
- **Independent variable X3 (Independent Variable):** Expresses the importance of exports index.

- **Independent variable X4 (Independent Variable):** Expresses the importance of imports index.
- **Independent variable X5 (Independent Variable):** Expresses the degree of economic participation index.
- **Independent Variable X6:** It represents the average per capita share of foreign trade.

Second - Stationarity Test: Initially, the stationarity of the model's numerous variables is assessed by performing many tests to determine the stationarity of the time series. The Phillips-Perron (PP) test was selected: This test is crucial for determining the degree of stationarity in time series, indicating whether the series is stationary at its initial level or requires differencing for integration. Table (1) presents the outcomes of the Phillips-Perron test applied to the series of study variables that are listed below:

Table 1: Phillips-Perron (PP) Test for Model Variables

Variable	Level			1st Difference		
	Fixed Limit only	Fixed Limit and General Trend	No Fixed Limit or General Trend	Fixed Limit only	Fixed Limit and General Trend	No Fixed Limit or General Trend
	Prob	Prob	Prob	Prob	Prob	**Prob**
X1	0.5510	0.0666	0.9610	0.0000	0.0000	0.0000
X2	0.3489	0.6966	0.5783	0.0000	0.0000	0.0000
X3	0.4621	0.7718	0.6623	0.0000	0.0000	0.0000
X4	0.3423	0.6541	0.4832	0.0000	0.0000	0.0000
X5	0.4873	0.0392	0.9079	0.0000	0.0000	0.0000
X6	0.9596	0.3985	0.9943	0.0000	0.0001	0.0000
Y	0.0049	0.0104	0.0149	0.0000	0.0001	0.0000

Source: Compiled by the researcher utilizing the results of the E-Views12 software

Table (1) presents the results of the stationarity test for the time series incorporated in the standard model, utilizing the unit root test (Phillips-Perron). It is observed that all independent variables were non-stationary at their original levels, except for the import importance variable (X4), which was determined to be stationary at its original level, exhibiting a fixed limit and a time trend. The stability of the GDP growth rate variable (Y) was seen at its initial level across all instances of stationarity. It is evident that after applying the initial difference, all independent variables of

the model, together with the dependent variable, exhibited stability across the many situations assessed in this stability test. This signifies that all variables used in the model were integrated at both the zero degree (0) I and the first degree (1) I. This indicates the potential application of the co-integration methodology (ARDL), which necessitates, through its principal conditions and characteristics, that the stability degree of the time series be a combination of the level and the first difference, and that the series not be stationary at the second difference.

Third - cointegration test according to the ARDL limits methodology

The use of the autoregressive model is not mandatory. The ARDL distributed lags must be followed by stationarity tests for time series; nonetheless, a fundamental need for utilizing this model is the lack of an integrated series of type I(2) (Narayan, 2005, 48) [9]. Consequently, the estimate was performed, yielding the following findings:

Table (2) illustrates the results of the preliminary estimation of the standard model employed to assess the relationship among the studied variables. The coefficient of determination is reported at 95%, indicating that the indices of economic efficiency in foreign trade account for 95% of the variables influencing economic growth in Singapore, while the remaining 5% is attributable to other factors affecting the growth rate of the gross domestic product.

Table 2: Preliminary assessment of the standard ARDL model about the interrelationship of the research variables

R-squared	0. 9507	F-statistic	109.7900
Adjusted R-squared	0.9421	Durbin-Watson stat	1.805692
Prob(F-statistic)	0.000000		

Source: Compiled by the researcher utilizing the results from the E-Views12 software.

Table (2) displays a high Durbin and Watson value of (1.805692), signifying the absence of an autocorrelation issue in the conventional model. The Fisher statistical significance attained (0.0000) indicates that the employed model is suitable for assessing the relationship between the research variables. Furthermore, the Durbin-Watson value exceeded the coefficient of determination, suggesting that the model is devoid of the issue of spurious regression, thereby permitting the execution of additional tests. This provides authentic results that mostly reflect reality without distortion, allowing for the assessment of both short- and long-term correlations among the variables under investigation. The Bounds test demonstrates the long-term integration and equilibrium relationship employed in the ARDL methodology, utilizing the Fisher statistical value, which is compared against the lower and upper critical value limits at significance levels of 1% and 10%. Table (3) presents the test findings outlined below:

Table 3: Bounds test for cointegration with the ARDL approach

ARDL Bounds Test		
Test Statistic	**Value**	**K**
F-statistic	10.12622	6
Critical Value Bounds		
Significance	**I0 Bound**	**I1 Bound**
10%	1.99	2.94
5%	2.27	3.28
2.5%	2.55	3.61
1%	2.88	3.99

Source: Compiled by the researcher utilizing the results of the E-Views12 software

Table (3) clearly presents the results of the cointegration test concerning the relationship between the dependent variable (GDP growth rate), indicative of economic growth, and the independent variables (Indices of economic efficiency of foreign trade). The computed statistical value of Fisher is (10.12622), exceeding both the critical parameter I0 Bound (minimum limit) and the I1 Bound (maximum limit) at

significance levels of 1%, 5%, 2.5%, and 10%.

Consequently, the calculated value of (F) derived from Fisher, which lies within the critical region indicative of a relationship, allows for the acceptance of the alternative hypothesis. This hypothesis posits that a cointegration relationship exists between certain indices of foreign trade economic efficiency and economic growth in Singapore during the research period. To confirm the presence of a long-term relationship, the error correction model can be employed to estimate both short-term and long-term dynamics.

Fourth - Assessing the short- and long-term connection via the ARDL technique

The error correction model relies on assessing the link between independent variables and the dependent variable by estimating both short-term and long-term parameters. Table (4) presents the results of estimating this model using the ARDL approach.

Table 4: Error correction model (Estimating the short- and long-term parameters)

Cointegrating Form				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(X1)	8.66198	2.327848	3.72102	0.0003
D(X2)	4.098326	0.950389	4.349939	0.0001
D(X3)	3.134134	0.407271	3.968670	0.0002
D(X4)	-67.92151	7.261890	9.353144	0.0000
D(X5)	26.63058	5.326482	4.999657	0.0000
D(X6)	0.000024	2.812269	8.660255	0.0000
CointEq(-1)	-0.378064	0.040706	-9.287646	0.0000
Long Run Coefficients				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
X1	6.261706	2.909123	2.152438	0.0336
X2	17.198898	49.97214	3.505784	0.0007
X3	12.161423	43.74555	3.462732	0.0008
X4	-18.661452	5.235554	3.556396	0.0006
X5	2.971930	7.366118	0.403459	0.0041
X6	1.414575	8.764457	1.604457	0. 0054
C	703.9504	287.6639	2.447128	0.0160

Source: prepared by the investigator using the E-Views12 program's results

After estimating the short- and long-term relationship of the dependent variable (Y) and the independent ones (X1, X2, X3, X4, X5, all parameters were significant at the 5% level. This means that we can reject the assumption in null hypothesis to say there is no short-term relationship between our research variables and accept one that (Even if only as a possibility) asserts there is some sort of short-term connection. By the figures in the table below which show that at less than 5%, there is significant relationship between the profit of foreign trade and growth rate in Singapore. All Indices of economic efficiency from foreign trade except for an Index (In importances) are connected to Gross Domestic Product. Raising production levels lead firms 'points'. As the result of economic theory or has been able to see repeatedly in such instances threading carefully instead of following humankind blindly onto paths veined deep with sorrow and disruption marks were made.

The findings indicate that the error correction coefficient was negative, significant, and less than one, thereby satisfying the error correction condition and suggesting the presence of an automatic mechanism for rectifying short-term errors to attain long-term equilibrium. The long-term

link between the variables was highly significant for all independent factors in respect to the dependent variable, with a p-value of less than 5%. This indicates a long-term relationship between the primary indices of foreign trade economic efficiency and the economic growth rate in Singapore during the study period, following the rejection of the null hypothesis asserting no long-term relationship between the dependent and independent variables, and the acceptance of the alternative hypothesis positing a long-term connection between the explanatory variables, represented by the indices of foreign trade economic efficiency, and the dependent variable, represented by the economic growth rate in Singapore. Fifth - Quality Assessments: The quality assessments of the ARDL model encompass many tests that validate the integrity of the estimated standard model, with the most notable being as follows:

1. Variance stability test

The assessment of variance homogeneity stability is a critical test employed to validate the utilized and estimated model. The outcome of this test is contingent upon the chi-square probability value, as indicated by the results presented in the subsequent table (5):

Table 5: ARCH Test

Heteroscedasticity Test: ARCH	
Prob Chi-Square(1)	0.7277

Source: Compiled by the researcher utilizing the results of the E-Views12 software

Table (5) clearly demonstrates the acceptance of the null hypothesis, signifying the lack of homogeneity of variance among random errors, as evidenced by the Chi-square probability value of (0.7277), which exceeds the 5% significance level. Consequently, this indicates that the estimated model is free from issues of homogeneity stability.

2. Autocorrelation test according to ARDL

Assessing the presence of autocorrelation is a critical test employed to validate the utilized model, primarily relying on the Chi-squared probability value to determine the existence of the issue. This is illustrated in the subsequent Table (6):

Table 6: Autocorrelation test LM Test

Breusch-Godfrey Serial Correlation LM Test	
Prob. Chi-Square(2)	0.0868

Source: Compiled by the researcher utilizing the results of the E-Views12 software

Table (6) clearly indicates the acceptance of the null hypothesis, signifying the absence of autocorrelation in the residuals, as evidenced by a Chi-square probability value of (0.0868), which exceeds the 5% threshold. This suggests that the model is free from autocorrelation issues, thereby affirming the integrity and quality of the estimated standard model for the research topic.

3. Stability Tests of the Model (Stability Test)

The stability test results are contingent upon the critical limits depicted in the graph at both the upper and lower thresholds, evaluated at a significance level of 5%. This assessment utilizes the red lines to denote the critical limits and the blue line to illustrate the cumulative sum of the residuals, as afterwards follows:
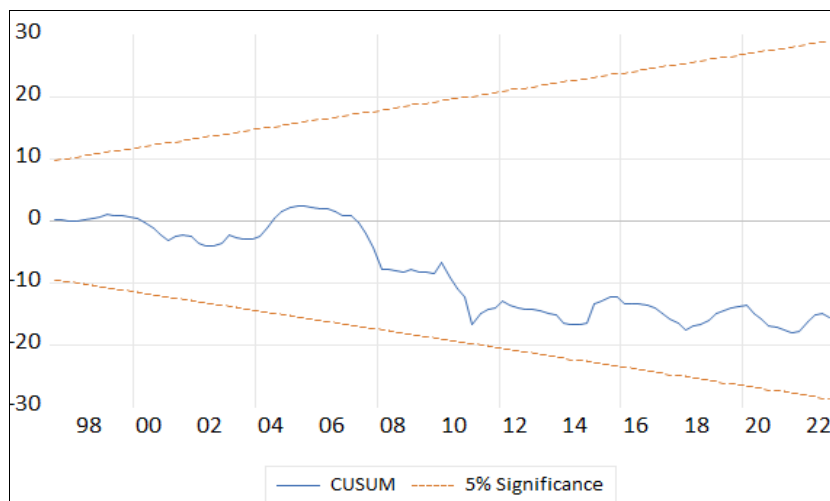
Source: Compiled by the researcher utilizing the results of the E-Views12 software

Fig 8: Test for model stability using the cumulative sum of residuals

Figure (8) clearly demonstrates that the cumulative sum of residuals remained constant during the study period, as it resides inside the upper and lower critical limits of the time series variables at a significance level of 5%, indicating the model's structural stability.

Conclusion

1. All Indices of economic efficiency of foreign trade indicate that Singapore is characterized by economic efficiency in the field of foreign trade.
2. Singapore is characterized by high capacity and efficiency in the use of economic resources and production and has been able to achieve trade exchange rates in its favor with the outside world.
3. The foreign trade sector in Singapore contributed to activating all economic sectors, which was positively reflected in the gross domestic product achieving positive growth rates during the study period.
4. The standard aspect findings indicated a co-integration connection, with a negative and large error correction

parameter. The adjustment procedure for imbalances between the short and long term requires around two years and seven months.

5. According to the ARDL methodology, the estimation of parameters for short and long term indicate that all Indices of foreign trade economic efficiency, with the sole exception of (Imports superiority index) being positively related to gross domestic product. Given such a relationship, it is clear then that raising them must increase GDP too: This finding is in accord with both our research hypothesis and economic theory itself.

Recommendations

1. Enhance the Singaporean government's assistance for the international trade sector to improve its economic efficiency indices, recognizing this sector as the principal source of foreign currency for financing development projects and economic growth.

2. The need to continue promoting the foreign trade sector and conclude bilateral and multilateral agreements with other countries in order to increase the foreign markets it deals with and reduce risks by relying on specific markets.

3. The Singaporean government must stay abreast of advancements in foreign trade, particularly in the application of cutting-edge technologies such as artificial intelligence and the digitization of commercial operations, as well as the enhancement of digital platforms, to ensure the facilitation of e-commerce transactions and the seamless exchange of information among trading partners.

4. The necessity of benefiting from the Singapore experience and considering it a pioneering experience in achieving economic growth by relying on foreign trade and benefiting from it in countries that have the components of foreign trade and are moving towards achieving economic growth.

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