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IMPACT OF TRADE OPENNESS, FOREIGN DIRECT INVESTMENT AND EXCHANGE RATE ON MANUFACTURING EXPORT IN MALAYSIA

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ABSTRACT

Despite recent changes in the capitalist financial system and global production, export manufacturing is one part of exports that maintain a productive structure and is a key component of economic growth that can create employment and income prospects. The export manufacturing value in Malaysia grew by 22.3 percent to RM 1,306.7 billion in 2022, with electrical and electronic products contributing 30.2 percent. In order to identify and assess the impact of trade openness, foreign direct investment (FDI) and the exchange rate on Malaysia's manufacturing exports, the present study uses empirical analytical methods. The study employed Autoregressive Distributed Lag (ARDL) regression analysis on annual time series data from year 1990 to 2021. The study's conclusions indicate that there is cointegration, or a long-term relationship, between Malaysia's manufacturing exports trade openness, FDI, and currency exchange rates. FDI positively and significantly affects the value of manufacturing exports. Trade openness is also significant and can contribute to higher economic growth and overall economic development. This study's findings may be valuable to the government in improving Malaysia's overall manufacturing export performance. However, governments must strike a balance between reaping trade gains and protecting domestic businesses from unfair competition or disruptions. Thus, Malaysia's trade openness and FDI growth policies can be strengthened and intensified to achieve these objectives.

***JEL classification**: J60, C10, I10*

***Keywords**: Autoregressive distributed lag, exchange rate, foreign direct investment, manufacturing exports, Malaysia, trade openness.*

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1. INTRODUCTION

Manufacturing exports are the international commerce of items produced in a country's manufacturing sector. Manufacturers create these items by converting raw materials and components into completed products, which are subsequently sold to clients in other nations. Manufacturing exports are an important component of a country's foreign commerce and may have a big economic effect. Malaysia's manufacturing industry is well-known for its export-oriented products, which range from electronics and electrical

items to machinery and equipment. The success of the industry is largely related to worldwide demand for these items. According to Krugman et al. (2018), the core notion of comparative advantage in trade operations is based on a country's productivity advantage in manufacturing a product when compared to other nations with lower opportunity costs. Due to an excellent transportation network, political stability, government regulations, and strong infrastructural facilities, Malaysia has a competitive advantage in the production of electrical and electronic-based products, and these commodities contribute the most to Malaysian exports.

Despite recent advancements in the capitalist financial and global production systems, manufacturing exports remain a productive structure and a key component of economic expansion that may provide employment and money. Manufacturing export time series data from 1990 to 2021 indicate a rising trend, with the exception of three years (2001, 2009, and 2020), which show a tiny drop. 2001 (the overall performance of the manufacturing sector output was affected by a slowdown in the main industrial countries as well as a decline in global electronic production), 2009 (the International Financial Crisis caused the Asian economy to be affected by a severe fall in world trade as a result of a sharp decline in demand from developed economies), and 2020 (the COVID-19 pandemic caused "the Great Lockdown" and a sharp decline in global growth).

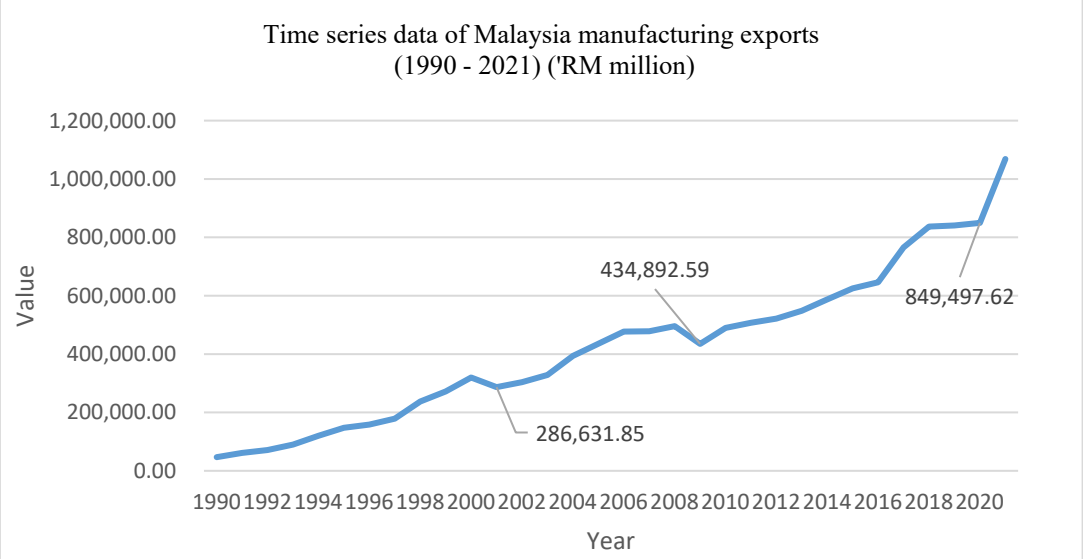

Figure 1: Time series data of Malaysian manufacturing exports (1990 – 2021) Source: Department of Statistics Malaysia (DOSM).

According to the 12th Malaysia Plan (RMKe-12), Malaysia's international trade performance is expected to improve in line with the expected recovery of global trade and strengthening of major commodity prices, with exports of manufactured goods expected to grow by 4.9 percent on average. The implementation of the ASEAN Economic Community (AEC) Action Plan 2025 and new free trade agreements (FTAs), such as the Regional Comprehensive Economic Partnership (RCEP), are expected to boost foreign trade growth, particularly for Malaysian manufacturing exports. According to the most recent 2023 Economic and Fiscal Outlook and Revenue Estimates report, manufactured goods exports would increase by 22.3 percent to RM 1,306.7 billion in 2022, driven by 30.2 percent greater demand for electrical and electronic items. Malaysia's manufacturing

exports have increased in other areas such as chemicals, processed foods, and machinery in recent years, in addition to the government's encouragement of high-tech industries such as biotechnology and aerospace in an effort to diversify the country's manufacturing exports.

The study's goal is to look at how factors including trade openness, foreign direct investment, and currency exchange rates affect Malaysian manufacturing exports. The purpose of this research is to address the question: What is the link between trade openness, foreign direct investment, and the currency exchange rate? and investigate the presence of cointegration (a long-term link) between Malaysian manufacturing exports, trade openness, foreign direct investment, and the currency exchange rate.

1.1 Research objectives

Among the objectives of this study is to:

a) Analyse the impact of trade openness, foreign direct investment, and the exchange rate on Malaysian manufacturing export performance.
b) Investigate the elements influencing Malaysian manufacturing export performance.
c) If the variables have a long-term link (co-integration);
d) Assess the effectiveness of government initiatives and policies targeted at encouraging industrial exports and increasing economic development.

The study's importance lies in its ability to provide a viewpoint that may significantly bolster Malaysia's total economic growth, especially for policymakers and other stakeholders focused on improving the performance of the country's manufacturing exports. It is crucial for the government to identify these decisive variables in order to implement effective measures for the sustained enhancement of manufacturing exports in Malaysia.

1.2 Overview of key terms

1.2.1 Manufacturing exports

The rationale for using manufacturing export statistics as the basis for this study is that Malaysia has constantly been positioned among the leading global exporters of manufactured products. Electronics and electrical items have significantly contributed to Malaysia's exports in the industrial sector. The range of goods include semiconductors, consumer electronics, and components. Additional notable manufacturing exports are palm oil and its derivatives, machinery, rubber goods, and textiles. The Final Foreign Trade Statistics 2021 report reveals that manufactured commodities make up 86.1 percent of total exports, with agricultural products accounting for 7.9 percent and mining products for 5.6 percent. Manufacturing exports have the potential to greatly enhance a country's economic development by capitalising on international demand, while a diverse industrial sector may enhance a country's economic ability to withstand external disruptions.

1.2.2 Trade openness and manufacturing exports

The amount to which a country actively participates in international commerce and enables the movement of goods, services, and investments across its borders is referred to as trade openness. It assesses a country's economic accessibility and connectedness with the global market. A country with a high level of trade openness participates actively

in international commerce, both in terms of acquiring goods and services from other nations and exporting its own products. This may result in a variety of economic advantages, including more access to international markets, higher efficiency via specialisation, technology transfer, and increased competition, all of which can contribute to increased productivity and economic development. Malaysia has signed a number of trade treaties in order to promote commercial openness. It is a member of the ASEAN and has signed free trade agreements (FTAs) with a number of nations and regions, including China, Japan, South Korea, India, and Australia. Malaysia has developed economic zones and free trade zones to tempt multinational corporations to establish operations in the country in order to attract foreign investment and strengthen export-oriented industries. This improves economic performance at all stages of development, produces new employment possibilities, benefits consumers and businesses worldwide, and assists in lifting a nation out of poverty. Because trade and capital mobility improve open economies, resulting in a better quality of life for its citizens, an open economy expands quicker, delivers more wealth, and helps foster greater stability and security for everyone. Trade openness (TO) is commonly measured by comparing a country's total trade (exports + imports) to its GDP, which provides an indicator of the importance of trade in proportion to the country's entire economic output as follows:

$$TO : \frac{Imp_{cur} + Exp_{cur}}{GDP_{cur}}$$

Countries that favour trade openness benefit from more access to financial flows, technology, lower imports, and larger export markets. Trade openness and capital mobility promote cross-border manufacturing activity, which boosts productivity and economic development. Trade openness is especially crucial in developing countries because each country transfers resources and aims to enhance exports that benefit the country's progress by broadening the market.

1.2.3 Foreign Direct Investment and manufacturing exports

Foreign direct investment (FDI) is the act of foreign companies or individuals investing in another country with the purpose of gaining a lasting stake or influence in the local economy (owning at least 10 percent of the company's equity holding in Malaysia). This investment can take the form of financial instruments. The portfolio comprises of equity and stock investment funds (including reinvested acquisitions) as well as debt instruments such as intercompany loans, trade credits, and other similar financial products. Foreign Direct Investment (FDI) will enhance capital-intensive sectors, stimulate the growth of manufacturing exports, and function as a metric for gauging economic prosperity. Foreign direct investment (FDI) refers to the process in which a country invests in another nation by acquiring existing firms, forming joint ventures, or establishing new enterprises. The citation is from Fernandez et al. (2020). Owusu-Nantwi and Erickson (2019) assert that foreign direct investment (FDI) may enhance economic development in the recipient nation via four distinct mechanisms: direct transmission of technology, demonstration impact, competitiveness effect, and labour mobility across companies. According to Asirvatham et al. (2017), their panel analysis research on ASEAN-5 nations from 1970 to 2015 found that FDI had a significant and beneficial impact on exports. This effect was particularly pronounced in the manufacturing sector, since foreign investment companies prioritised manufactured exports.

Recently, the Malaysian government has been actively offering opportunities for foreign direct investment (FDI) in the manufacturing and service industries. Additionally, they have been focusing on improving the country's digital infrastructure and introducing policies and initiatives to promote digital transformation and innovation. These efforts are aimed at attracting more FDIs in technology-oriented sectors.

1.2.4 Currency exchange rates and manufacturing exports

Ewubare and Merenini (2019) state that one of the most important macroeconomic factors impacting global competitiveness is currency exchange rates. Because local supply resources are limited, governments engage in international commerce to address this issue by exchanging goods and services. The general rule is that as a country's currency depreciates, its exports become more competitively priced and foreign buyers find them more affordable. This, in turn, may lead to a rise in demand for manufactured export items. Devaluation helps a country's exports grow, according to research by Semuel and Nurina (2015). Research shows that domestic exports may not necessarily grow in response to an increase in the exchange rate, which depreciates the local currency owing to market uncertainty. The economic performance of wood exports was impacted by the exchange rate when Bank Negara Malaysia (BNM) instituted a controlled floating exchange rate regime (Aini Zakaria et al., 2012). The research shows that the exchange rate isn't the only thing that affects Malaysian wood exports. In order to efficiently plan their manufacturing processes and manage their supply networks, manufacturers depend on stable currency rates. Uncertainty and problems in conducting foreign transactions might arise from sudden and considerable swings in currency rates. On the other hand, manufacturing exports are affected by things like product quality, availability of markets, and production costs.

1.2.5 Capital, labor and manufacturing exports

Capital and labour are two fundamental variables of production that might impact the success of manufacturing exports. Capital symbolises the physical and financial assets employed in the creation of commodities and services. Gross capital formation estimates the value of fixed assets and inventories added to the economy in a particular time, indicating the investment and accumulation of physical capital. Labour, the human resources that are engaged to run the capital, may be represented by a total labour force that shows the availability and involvement of human capital. Several studies have explored the link between capital, labour, and economic growth. The main results imply that capital and labour have impacts on manufacturing exports; these effects rely on the amount and quality of capital and labour, as well as their interaction with other variables such as trade openness, foreign direct investment, currency rate, economic development, etc. Mwinuka and Mwangoka (2023) investigated macroeconomic determinants that have substantial influence on the manufacturing sector’s development in Tanzania, which include the inflation rate, currency rate, trade openness, foreign direct investment, gross capital formation, and labour force participation rate. Hao (2023) revealed that trade openness, foreign direct investment, and capital creation favourably impact industrial economic development in China, whereas Sijabat (2022) concluded that foreign direct investment and gross capital formation are associated with economic growth in Indonesia. According to Onifade et al. (2022), trade openness and domestic investment have a favourable influence on economic development in the MENA area, which in turn may improve manufacturing exports.

2. LITERATURE REVIEW

In a study undertaken by Prasanna (2010), the focus was on analysing the performance of exports in India. In a study undertaken by Prasanna (2010), the objective was to evaluate the effect of foreign direct investment (FDI) on the export of manufactured products in India, specifically focusing on the impact on high-tech items produced in India over the period from 1991 to 2007. The study used ordinary least squares (OLS) analysis to investigate the impact of foreign direct investment (FDI) on both overall manufacturing exports and technologically advanced manufacturing exports. The study's results indicate that Foreign Direct Investment (FDI) had a significant role in boosting India's industrial exports from 1991 to 2017. In addition, Foreign Direct Investment (FDI) has a limited impact on the export of high-tech industrial goods.

Berulava (2012) uses a panel data modelling approach to analyse the export results of manufacturing firms. The objective of his study is to examine the effects of service-related inputs on the export results of manufacturing enterprises during the market transition. The objective of this research is to examine the impact of the service sector on the direction of industrial exports during a period of transition. The study findings provide a novel perspective on the impact of global trade liberalisation on the service industry. The service market's efficacy was shown to have a positive impact on manufacturers' export growth. The deregulation of information technology, electricity, roads and rail transportation, water distribution, and financial services will have the effect of promoting the growth of producer export activity.

Rahmaddi and Ichihashi (2013) examine the factors behind changes in Indonesia's manufacturing export pattern, which are mostly influenced by foreign direct investment (FDI). By using a distinct cross-sectional approach, this study utilises a dataset consisting of industry-level data from 1990 to 2008. The data is classified based on intensity factors. The research findings indicate that foreign direct investment (FDI), GDP growth, and currency exchange rates significantly influence the export performance of manufacturing products classified under SITC products 5 to 8, which include firms that are characterised as physical capital intensive (PCI), human capital intensive (HCI), and technology intensive (TI).

In a study conducted by Mwakanemela (2014), an examination was carried out on the exports of the Tanzanian manufacturing sector. This research investigates the influence of foreign direct investment (FDI), trade transparency, and inflation on manufacturing exports from 1980 to 2012. The analysis employs the Ordinary Least Squares (OLS) approach and Vector Error Correction Model (VECM) quantitative methodologies. The study's findings indicate that the influx of foreign direct investment (FDI) and the liberalisation of trade have a positive impact on Tanzanian manufacturing exports. However, inflation has a negative affect on these exports. Furthermore, Foreign Direct Investment (FDI), trade openness, and price inflation are crucial factors for comprehending the changes in manufacturing exports, both in the long and short term.

Darmadie and Handoyo (2020) utilised the Vector Error Correction Technique (VECM) to analyse the impact of foreign direct investment (FDI), trade openness, price inflation, and the exchange rate between the rupiah and USD on the long-term export of manufactured commodities in Indonesia from 2005 to 2013. The study findings demonstrate that trade openness does not have a lasting impact on manufacturing exports. Conversely, inflation, foreign direct investment, and the exchange rate between the rupiah and the USD have a long-term influence on manufacturing exports.

Sumiyati (2020) did a research study to examine the factors influencing Indonesian manufacturing exports from the first quarter of 2010 to the fourth quarter of 2019. This study highlights the importance of considering the gross domestic product (GDP) and inflation indicators when developing governmental strategies to improve exports in Indonesia, particularly in the manufacturing sector. Additionally, it reveals that inflation at lag 1 has a significant impact on manufacturing exports, both in the short and long term. The GDP has a positive influence on manufacturing exports in the short term, at both lag 1 and lag 2. However, in the long term, it only has a positive effect at lag 1. The currency proportion and FDI have little impact on manufacturing exports in both the short and long term.

The study conducted by Nafiu and Charlotte (2022) employs a trend analysis approach to evaluate the performance of industrial exports in Nigeria from 1970 to 2016. The OLS estimates indicate a statistically significant negative relationship between a rise in the average tariff rate and the exports of manufactured products. The correlation between capacity utilisation and industrial exports is negative and insignificant. The association between the currency rate and openness to trade significantly impacts the performance of Nigerian industrial exports in a positive and considerable manner.

Baharom et al. (2008) conducted a study in Malaysia using the boundary test approach to examine the relationship between trade openness, foreign direct investment (FDI), and Malaysia's overall economic performance. Empirical research have shown a positive and robust correlation between trade openness and economic growth, both in the short and long run. While there is a positive association between Foreign Direct Investment (FDI) and short-term economic development, there exists a negative correlation in the long run. In addition, Chandran and Munusamy (2009) assessed the long-term relationship between trade openness and the growth of the manufacturing sector in Malaysia by using the ARDL model's boundary analysis technique. The study findings indicate that trade openness, as a sustained economic strategy, positively impacts the expansion of the manufacturing sector in Malaysia. Ng and Chin (2021) used quarterly data from 2010 to 2021 to investigate the impact of exchange rate variations on the amount of items transferred between Malaysia and China. Research findings using the ARDL Model Technique indicate that exchange rate fluctuations have a negative impact on exports, however this impact is not statistically significant. Neoh and Lai (2021) used a dataset covering the years 1981 to 2016 to investigate how trade openness, together with microeconomic factors such as currency rates and average landing rates, as well as economic crisis events, affected the performance of Malaysia's manufacturing sector. The research used the ARDL theory and empirical evidence to demonstrate immediate dynamic effects, as well as a positive and significant improvement in trade transparency on the increase of industrial output. The research undertaken by J. Andersen et al. (2023) aimed to examine the determinants of manufactured goods exports in five ASEAN countries, namely Vietnam, Indonesia, Malaysia, Thailand, and the Philippines. The scholar utilised a random-effects framework to predict the value of manufacturing exports by employing panel data regression models, taking into account structural factors such as economic complexity and human capital, as well as macroeconomic factors such as the actual effective exchange rate, foreign direct investment, and inflation. The study revealed that foreign direct investment, human capital, the real effective exchange rate, and inflation had a positive and statistically significant influence on manufacturing exports in ASEAN. On the other hand, there is a positive correlation between the real effective exchange rate and manufacturing exports. This demonstrates that as a country's

currency strengthens, it may lead to an increase in export growth by reducing the cost of input commodities used in exporting. Moreover, a rise in consumption from outside nations might elucidate the advantageous influence of inflation on exports.

Malaysian researchers have undertaken studies on the growth of exported commodities, the characteristics that determine exports, and the importance of exports in the advancement of the nation's economy, as shown by previous study. The assessment of the pertinent research indicates that there is a scarcity of studies on the effects of manufacturing exports in Malaysia. Furthermore, the majority of these studies primarily concentrate on topics such as economic growth, productivity, manufacturing indices, and overall exports and imports. Nevertheless, academics no longer include the industrial export component as a dependent variable in their study. Prior research has shown a lack of explanation on the macroeconomic variables influencing industrial exports in Malaysia. This study aims to fill the existing gap by examining the relationship between trade openness, foreign direct investment (FDI), currency exchange rates, and manufacturing exports in Malaysia, a well-known developing nation. The study seeks to provide concrete evidence and draw important conclusions for future research.

3. RESEARCH METHODOLOGY

The association between Malaysian manufactured exports, trade openness, foreign direct investment (FDI), and the Malaysian ringgit (RM) per United States dollar (USD) is investigated using quantitative approaches in this paper. It also considers the effect of two more factors, namely gross capital creation and total labour force, which are expected to have a significant impact. To assure data availability, the researchers collected data yearly from the World Development Indicator (WDI), the World Bank, Bank Negara Malaysia, and the Department of Statistics Malaysia (DOSM) from 1990 to 2021. The autoregressive distributed lag model (ARDL) technique, as proposed by Pesaran & Shin (1999) and 103esara net al. (2001), was used to assess the variables influencing Malaysian manufacturing exports. ARDL is a model estimate test that does not need all variables to be integrated in the same sequence, according to Srinivasan and Kalaivani (2013). Unlike other tests that contain this limiting assumption, it is appropriate for small sample sizes.

3.1 Model formation

There are five independent variables that are expected to influence the structure of manufacturing exports in Malaysia: trade openness, foreign direct investment, currency exchange rate, gross capital formation, and total labour force. The table below is a summary of the variables:

Table 1: List of variables used in the study model.

Variables	Symbol	Variable types	Source
Manufacturing Export Value (RM million)	MfE	Dependent	Department of Statistics Malaysia (DOSM) and Bank Negara Malaysia
Trade Openness	TO	Independent	World Development Indicator (WDI)

Net inflow Foreign Direct Investment (% of GDP)	FDI	Independent	World Development Indicator (WDI)
Exchange rate	EXR	Independent	Bank Negara Malaysia
Gross capital formation	GCF	Independent	World Bank
Total labor force	TLF	Independent	World Bank

The model includes TO, FDI, EXR, GCF and TLF to estimate their impact on Malaysian manufacturing exports (the dependent variable). A functional time series data model is illustrated below:

$$MfE = f(TO,FDI,EXR,GCF,TLF) \quad (1)$$

All variables were log transformed to minimize their standard deviation before estimation. Therefore, the equation that can be formed in this model is as follows:

$$LmfE = \beta_0 + \beta_1 LTO_t + \beta_2 LFDI_t + \beta_3 LEXR_t + \beta_4 LGCF_t + \beta_5 LTLF_t + \mu_t \quad (2)$$

whereby

LmfE	=	log (manufacturing export value)
β0	=	Y intercept
β1, β2 β3, β4 dan β5	=	coefficient and elasticity to be estimated
LTO	=	log (trade openness based on the ratio of current import and export value to current Gross Domestic Product (GDP) for Malaysia)
LFDI	=	log (net inflows (% of GDP)
LEXR	=	log (exchange rate of RM per US dollar)
LGCF	=	log (gross capital formation value)
LTLF	=	log (total labor force)
μt	=	estimation error

3.2 Hypothesis formation

The null hypothesis indicates that there is no relationship between the independent variable and Malaysia's manufacturing exports. Meanwhile, the alternative hypothesis is that there is a significant relationship between the independent variable and manufacturing exports in Malaysia. The proposed hypothesis is as follows:

H1: There is a positive and significant relationship between trade openness and manufacturing exports in Malaysia.

H2: There is a positive and significant relationship between foreign direct investment and manufacturing exports in Malaysia.

H3: There is a negative and significant relationship between the foreign exchange rate and manufacturing exports in Malaysia.

H4: There is a positive and significant relationship between gross capital formation and manufacturing exports in Malaysia.
H5: There is a positive and significant relationship between the population growth rate and manufacturing exports in Malaysia.

The expected results of the variables are as in Table 2.

Table 2: Expected results of the regression model.

Variables	Explanation	Expected results
Manufacturing Export Value (RM million)	Manufacturing exports will increase if trade openness and foreign direct investment increase while the exchange rate depreciate	Positive
Trade Openness	If trade openness increases, it will increase manufacturing exports in Malaysia	Positive
Net inflow Foreign Direct Investment (% of GDP)	If foreign direct investment increases, it will increase manufacturing exports in Malaysia	Positive
Exchange Rate	If the foreign exchange rate increases, manufacturing exports in Malaysia will decerease	Negative
Gross Capital Formation	If gross capital formation increases, manufacturing exports in Malaysia will increase.	Positive
Total Labor Force	If total labor force increases, it will increases manufacturing exports in Malaysia.	Positive

3.3 Tests and procedures

To ensure that the model distribution is normal, we employ the Jarque-Bera procedure before proceeding with the empirical forecasting. The occurrence of a unit root in univariate analysis of variance is then discovered utilising the Augmented Dickey-Fuller (ADF) and Philip Perrons (PP) checking. The steps below outline how to run cointegration tests, model estimations, and diagnostic tests:

3.3.1 Augmented Dickey-Fuller (ADF) test

The researchers performed the Augmented Dickey-Fuller (ADF) test to determine the stationarity and level of integration of the variable data series. In order to resolve the serial correlation issue, Dickey and Fuller (1979) invented the ADF test with lag of the dependent variable, Δyt.

$$\Delta Yt = \beta 1 + \alpha t + \delta Yt{-}1 + \sum_{i=1}^{m} \theta i \Delta Yt - i + \varepsilon t \quad (3)$$

Δ is the first difference operator, εt is the stationary error term (white noise), and Yt is the variable time series. The hypothesis to be tested is

Ho: η1 = 0, There is a unit root exist (non-stationary time series)

H1: η1 < 0 No unit root exist (time series is stationary)

If the null hypothesis is opposed, then this indicates that the time series Yi has a mean value of zero and the data is stationary.

3.3.2 Philip Perrons (PP) test

Furthermore, Phillips and Perron, abbreviated as PP, developed a non-parametric approach for handling data with serial correlation while searching for the unit root. The PP approach solves the non-additive DF test equation and modifies the coefficient t-ratio such that serial correlation does not influence the asymptotic distribution of the test statistic. The asymptototic distribution of the modified PP t-ratio is equal to that of the ADF statistic.

3.3.3 Co-Integration test

The crucial value from Pesaran (2001) will be used to estimate the chance that each of the elements in the equation has a long-run cointegration, and the long-run cointegration between series will be checked using the F-test based on this hypothesis.

Ho: There is no cointegration between LmfE, LTO, LFDI, LEXR,LGCF,LTLF

[H_0: δ1 = δ2 = δ3 = δ4 = δ5 = δ6 = 0]

H1: There is cointegration between LmfE, LTO, LFDI,LEXR,LGCF dan LTLF

[H_1: δ1 ≠ δ2 ≠ δ3 ≠ δ4 ≠ δ5 ≠ δ6 ≠ 0]

If the expected F statistic value exceeds the upper threshold of the critical value, the null hypothesis (Ho) should be rejected. This is because it indicates the presence of a long-term correlation (cointegration) among the parameters of the time series. However, Ho is not rejected if the anticipated F statistic value is below the lower limit critical value. Moreover, in cases when the extent of integration of the explanatory variables is uncertain, it becomes unfeasible to determine the presence of cointegration if the estimated value of the F statistic falls within the range defined by the lower and higher limits. Pesaran, Shin, and Smith (2001) asserted that the null hypothesis is rejected when the F value exceeds the upper limit, while it is not rejected when the F statistic is below the lower limit.

3.3.4 Autoregressive Distributed Lag (ARDL) model

The ARDL approach was used in this work to estimate the long-term coefficients of the independent variables. Pesaran et al. (2001) and Pesaran and Shin (1999) state that ARDL provides benefits over traditional cointegration testing. Because of the limited sample size (42 observations), ARDL is the most suitable econometric model for this study's data analysis. Additionally, the ARDL method may first differentiate between trending and

stationary regressors, according to Sarmidi and Salleh (2011). Problems with non-stationary data are sidestepped by this method of modelling. We calculate the long-run coefficients for the variables in both models once we've established their long-run connection.

No prior variable definition is necessary for an ARDL model to approach cointegration between variables at I(0) or I(1), as shown by Pesaran and Shin (1998). In addition, the ARDL model may use less lag factors than previous cointegration estimation techniques without symmetric delays, according to Pesaran and Shin (1998). Cointegration, or long-term correlations, among variables, as well as the direction of both short- and long-term causation, may be found using the ARDL model. The next stage, after determining cointegration, is to estimate the long-run ARDL model with the help of the following equation:

$$\Delta LMfE_t=\alpha_0 + \delta_1 LmfE_{t-1} + \delta_2 LTO_{t-1} + \delta_3 LFDI_{t-1} + \delta_4 LEXR_{t-1} + \delta_5 LGCF_{t-1} + \delta_6 LTLF_{t-1} + \sum_{i=1}^{P} \beta 1 \Delta LmfE_{t-i} + \sum_{i=0}^{P} \beta 2 \Delta LTO_{t-i} + \sum_{i=0}^{P} \beta 3 \Delta LFDI_{t-i} + \sum_{i=0}^{P} \beta 4 \Delta LEXR_{t-i} + \sum_{i=0}^{P} \beta 5 \Delta LGCF_{t-i} + \sum_{i=0}^{P} \beta 6 \Delta LTLF_{t-i} + \varepsilon_t \quad (4)$$

The variables α, t, p, εt, and Δ stand for the intercept, lag sequence, error term, and first difference operator, respectively. Once the long-term equation is calculated, the following equation may be used to express the error correction terms (ECT) for the short-term model:

$$\Delta LMfe = c - \psi ECT_{t-1} + \gamma_{1,t} Lmfe_{t-i} + \gamma_{2,t} \Delta LTO_{t-i} + \gamma_{3,t} \Delta LFDIt-i + \gamma_{4,t} \Delta LEXRt-i + \gamma_{5,t} \Delta LGCFt-i + \gamma_{6,t} \Delta LTLFt-i + \varepsilon_t \quad (5)$$

One way to measure the rate of change in the explanatory variable or the long-term equilibrium is to look at the value of the ECT coefficient, which is -1/. In addition, ECT may clarify the direction of long-term causation by revealing which explanatory variables influence the dependent variable.

3.3.5 Diagnostic test

Some diagnostic evaluations will be performed to assess model reliability, including the Breusch Godfrey Serial Correlation LM Test, Autoregressive Conditional Heteroscedasticity (ARCH), and Cumulative Sum (CUSUM) stability tests.

4. EMPIRICAL RESULTS AND DISCUSSION

4.1 Matrix correlation coefficient analysis

The relationship between MfE and other independent variables (TO, FDI, EXR, GCF, and TLF) is depicted in a line graph of all the variables.

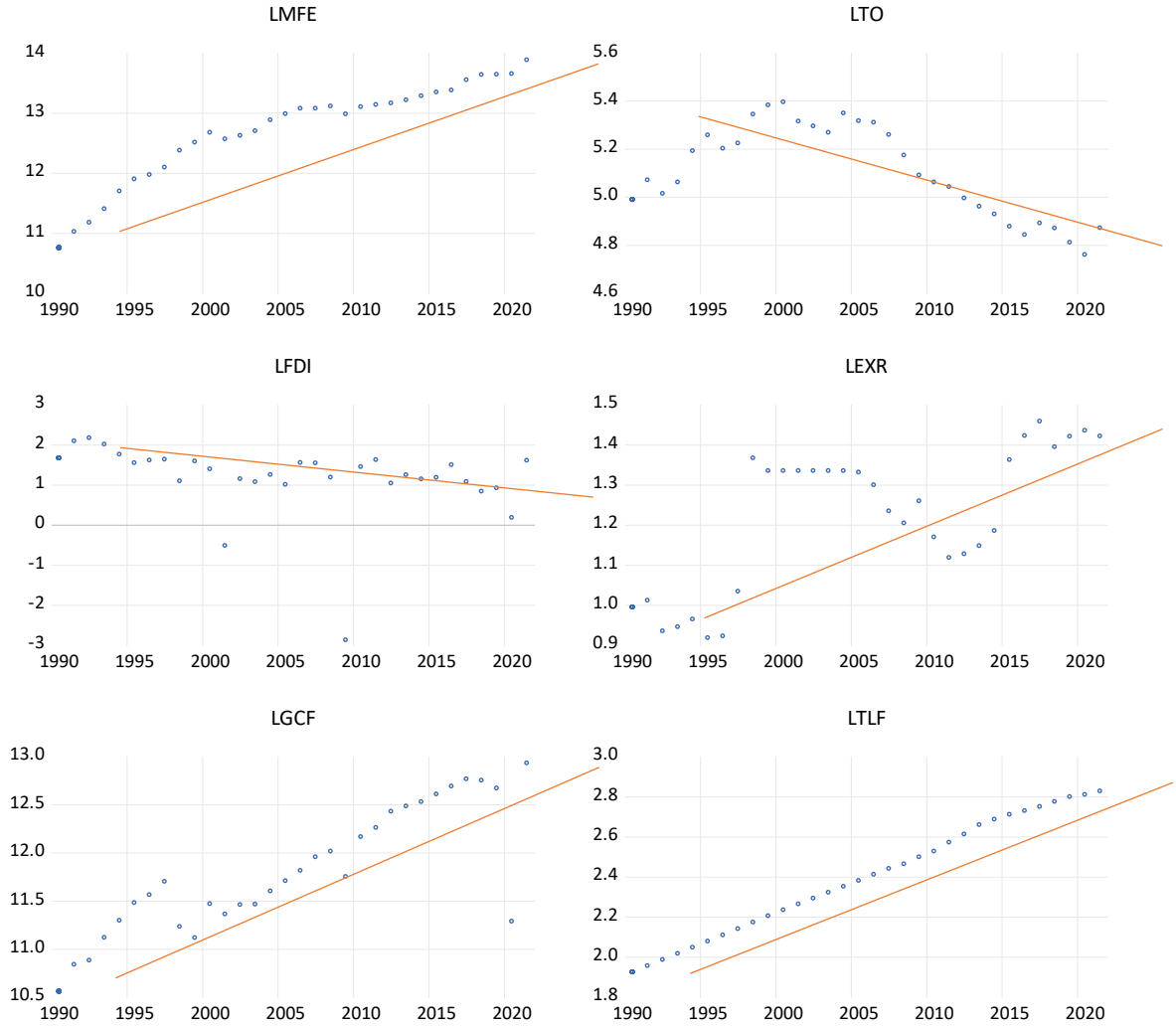

Figure 1: Correlation coefficient analysis.

From the graph, manufactured exports (MfE) have a significant beneficial correlation amongst those factors of exchange rate (EXR), gross capital foramtion (GCF) and total labor force (TLF), whereas trade openness (TO) and foreign direct investment (FDI) has a negative correlation, as indicated in the table below:

Table 3: Correlation coefficient analysis.

Correlation	LMFE	LTO	LFDI	LEXR	LGCF	LTLF
LMFE	1.000000					
LTO	-0.344143	1.000000				
LFDI	-0.344922	0.047176	1.000000			
LEXR	0.777200	-0.132445	-0.371452	1.000000		
LGCF	0.834980	-0.530052	-0.105902	0.473336	1.000000	

LTLF	0.947561	-0.618680	-0.310912	0.692413	0.877467	1.000000

4.2 Descriptive analysis

Table 4: Descriptive analysis of the study model.

VARIABLES	LMFE	LTO	LFDI	LEXR	LGCF	LTLF
Mean	12.7059	5.107479	1.181421	1.221925	11.81234	2.399317
Median	12.98373	5.080951	1.325433	1.279717	11.70618	2.396498
Maximum	13.8817	5.395475	2.17025	1.458718	12.93398	2.82825
Minimum	10.7545	4.76072	-2.870117	0.918051	10.55932	1.925078
Std. Dev.	0.818814	0.190846	0.901891	0.175607	0.646521	0.284511
Skewness	-0.843968	-0.130052	-3.092172	-0.472864	0.106711	-0.039998
Kurtosis	2.830476	1.70669	14.15776	1.839547	1.970857	1.733081
Jarque-Bera	3.837157	2.320408	216.9891	2.988072	1.472914	2.148643
Probability	0.146816	0.313422	0	0.224465	0.478807	0.341529
Sum	406.5887	163.4393	37.80546	39.10161	377.995	76.77814
Sum Sq. Dev.	20.78414	1.129088	25.21565	0.955977	12.95766	2.509337
Observations	32	32	32	32	32	32

Except for FDI, descriptive statistics revealed that the variables MFE, TO, EXR, GCF and TLF were all normally distributed. This is evidenced by a Jarque-Bera probability value greater than the 5% confidence level.

By applying descriptive statistics, we can see that all of the variables except FDI followed normal distributions: MFE, TO, EXR, GCF, and TLF. A probability value larger than the 5% confidence threshold, as determined by Jarque-Bera, indicates this.

4.3 Unit root test results

Table 5: Augmented Dickey Fuller (ADF) unit root test results.

Variables	At Level		First Difference		Results
	(Intercept)	*(Intercept & Trend)*	*(Intercept)*	*(Intercept & Trend)*	
LMFE	-3.755558	-3.185531	-4.013489	-4.253403	I (1)
	(0.0079)	(0.1058)	(0.0043)	(0.0111)	
LTO	-2.670745	-2.29467	-4.064939	-4.067724	I (1)
	(0.0936)	(0.4243)	(0.0038)	(0.0169)	
LFDI	-5.010298	-5.390874	-5.233049	-5.184186	I (0)
	(0.0003)	(0.0007)	(0.0002)	(0.0013)	
LEXR	-1.674104	-4.237562	-4.349150	-4.271581	I (1)
	(0.4337)	(0.0140)	(0.0018)	(0.0106)	
LGCF	-1.1821118	-4.723603	-8.167979	-8.147157	I (1)
	(0.3635)	(0.0035)	(0.0000)	(0.0000)	
LTLF	-1.551978	-4.549075	-3.756906	-3.505001	I (1)
	(0.4932)	(0.0072)	(0.0099)	(0.0625)	

Table 6: Philip Perrons (PP) unit root test results.

Variables	At Level		First Difference		Results
	(Intercept)	*(Intercept & Trend)*	*(Intercept)*	*(Intercept & Trend)*	
LMFE	-3.953564	-5.475730	-4.004284	-4.262291	I (0)
	(0.0048)	(0.0005)	(0.0044)	(0.0108)	
LTO	-0.720652	-2.714707	-4.146548	-3.871317	I (1)
	(0.8270)	(0.2379)	(0.0031)	(0.0262)	
LFDI	-5.010298	-5.385300	-23.245880	-26.34907	I (0)
	(0.0003)	(0.0007)	(0.0001)	(0.0000)	
LEXR	-1.346226	-1.744684	-4.290057	-4.204671	I (1)
	(0.5952)	(0.7067)	(0.0021)	(0.0124)	
LGCF	-1.507798	-4.723603	-8.250437	-8.229971	I (1)
	(0.5165)	(0.0035)	(0.0000)	(0.0000)	
LTLF	-1.583416	-0.550942	-2.621648	-2.948139	I (1)
	(0.4789)	(0.9751)	(0.0099)	(0.0627)	

Note: The table shows the unit root test results of ADF and PP. Values refer to t-statistics significance at the 5% level.

Based on the estimates, the ADF test shows that LFDI is stationary at the level of I (0), while, LMFE, LTO, LEXR, LGCF and LTLF are stationary at the first difference of I (1). As for the PP test, LMFE and LFDI is stationary at level I (0) while LTO, LEXR, LCF and LTLF are stationary at first difference I (1). The mixed results of I (0) and I (1) show that the ARDL approach can be used in this study.

4.4. Optimal model selection, ARDL cointegration test and long-term cointegration

With ARDL parameters (3,1,2,3,1,3), the best model for long-run relationship estimate is based on Akaike's Information Criterion (AIC).

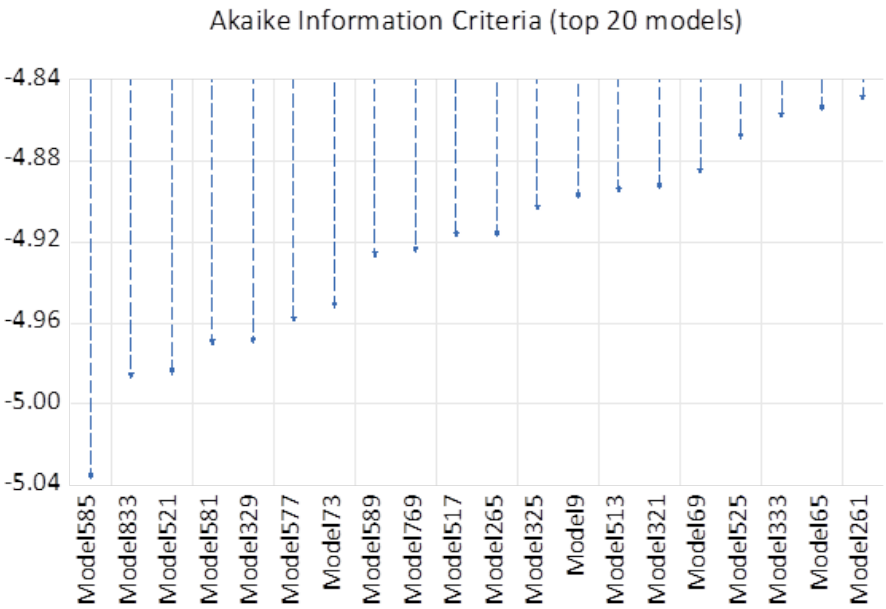

Figure 2: Akaike Information Criteria

Assuming that the optimal ARDL model does not exhibit any cointegration, we conduct tests for long-term cointegration and cointegration constraints (3,1,2,3,1,3). In this test, the critical region is indicated by the upper and lower limits at the 1%, 5%, and 10% levels, and the statistical F value, which was determined to be 8.828452, is higher than that. Exports of manufactured goods (LmfE) are shown to be cointegrated with other model variables such as trade openness, foreign direct investment (FDI), currency exchange rate, gross capital formation, and total labour force, suggesting the existence of a long-run link in this model. It is possible to estimate the variables' long-run equilibrium connection by using the best model.

4.5 F Bound test results

Null Hypothesis: No level relationship

Table 7: Results of the F Bound test.

Statistic test	Value	Significance	I (0)	I (1)
F-statistic	8.828452	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Following confirmation of the existence of cointegration, as reported by Pesaran et al. (2001), the equations computed in this study are as follows:

Cointeq = LMFE − (1.8362*LTO + 0.2182*LFDI_NET_INFLOWS − 0.9085*LEXR − 0.3215*LGCF + 4.1954*LTLF − 1.2433)

4.6 Results of long run coefficient estimates

Dependent variable: Manufacturing exports

Table 8: Results of long run coefficient estimates (Long run coefficients).

Variables	Coefficient	Std. Error	t-Statistic	Prob.
LTO	1.836246	0.166837	11.0062	0.0000**
LFDI_NET_INFLOWS	0.21818	0.114636	1.903232	0.0862*
LEXR	-0.90849	0.342259	-2.654394	0.0241**
LGCF	-0.321494	0.118406	-2.71518	0.0217**
LTLF	4.19545	0.330805	12.68254	0.0000**
C	-1.243267	1.302392	-0.954603	0.3623
ECT	-0.347299	0.034926	-9.943775	0.0000**

**, ** significant at the 1% and 5% confidence level*

Except for the gross capital formation (GCF) variable, the results of the study agree with the predictions of the regression model. The first table shows the long-term elasticity, which affects Malaysian policy. The findings of TO indicate that, over the long run, the value of manufacturing exports will rise by 1.84 percent for every 1% increase in TO. This finding is statistically significant at the 5% level of certainty. Imoisi (2018) found a favourable correlation between trade openness and Nigeria's manufacturing sector when utilising the ARDL technique, therefore our findings are in accordance with that. Meanwhile, research by Tahir et al. (2019) found that trade openness benefited some economic sectors at the expense of others. Specifically, it benefited the manufacturing and agricultural sectors. Since foreign direct investment (FDI) is crucial to the economic growth of developed countries, Jang (2011) argues that a free trade agreement between these nations has a negative impact on the economy.

The foreign direct investment (FDI) coefficient indicates that, with a ten percent confidence level, a one percent increase in FDI would lead to a long-term gain of 0.22 percent in the value of manufactured exports. This result is in line with what J. Andersen et al. (2023) found: that foreign direct investment (FDI) boosts the value of manufactured exports, which in turn allows the ASEAN area to experience quicker industrial progress within the global economic cluster. Additionally, FDI has a good effect on developing nations' industrial sectors, according to Amighini et al. (2017).

A 1% decline of the RM/USD would raise the value of manufactured exports by 0.91 percent in the long term, according to the anticipated result for the foreign currency exchange rate (RM/USD). This finding is significant at the 5% confidence level. Darmadie and Handoyo (2020) found that the IDR/USD exchange rate hurt Indonesia's manufacturing exports in the long run, and our results are in line with theirs. The central bank of Malaysia, Bank Negara Malaysia, has to try to keep the value of the ringgit stable so that businesses may operate in a way that helps the economy.

The negative GCF coefficient means that manufacturing export values will fall by 0.32% over time for every 1% rise in gross capital formation. An unanticipated trade-off

between manufacturing sector export-oriented output and domestic investment may have contributed to this unexpected outcome. The government's policy preference for domestic investment over export promotion, or vice versa, or a lack of resources necessary for both operations might cause this trade-off. Although TLF is statistically significant, it does show that a 1% increase to the total labour force would lead to a 4.20% rise in the value of manufacturing exports over the long term. Because manufacturing relies so heavily on human labour, this finding demonstrates a symbiotic relationship between supply of workers and manufacturing export success.

The most important part of ECT model estimating is getting a negative result, which means the test model is valid. In order to calculate the estimate of dynamic error correction, the long-run coefficients will be used. To no one's surprise, the error-correction coefficient is very significant and negative (-0.347299, p = 0.0000). A rather rapid adjustment process, as shown by the ECT coefficient, accounts for about 34.7% of the divergence from the long-run equilibrium every period.

4.7 ARDL model diagnostic test results

Table 9: Diagnostic Test Results

Type of test	**F-statistic (p value)**
Serial Correlation (Breush–Godfrey Serial Correlation LM Test)	4.419191 [0.0527] **
Heteroscedasticity Test (Breusch–Pagan–Godfrey)	0.757987 [0.7078]***

*Note: p-values for diagnostic tests in parentheses […].**,*** are significant at the 5%, and 10% confidence levels*

According to Pesaran's (2001) diagnostic tests, serial correlation and heteroscedasticity have no effect on the model. The p-value generated from the BG serial correlation LM test is greater than the probability level at 5%, and the p-value derived from the heteroscedasticity test is higher than the chance level at 5% and 10%, as shown in Table 9. As a result, the null hypothesis should be accepted, and there are no problems with heteroscedasticity or autocorrelation.

4.8 ARDL Model Stability

Researchers looked at the stability of long-run coefficients as well as short-run dynamics. If the cumulative sum of the recursive residual (CUSUM) statistic stays within the essential restrictions of the 5% confidence level, the null hypothesis that all coefficients in the error correction model are stable cannot be rejected. The cumulative sum of squares of recursive residuals (CUSUMQ) test, which is based on squared recursive residuals, was performed using a similar approach. Figures 2 and 3 show that there is no structural instability when the AIC criteria is used, since neither the CUSUM nor the CUSUMQ lines exceed the critical limits.

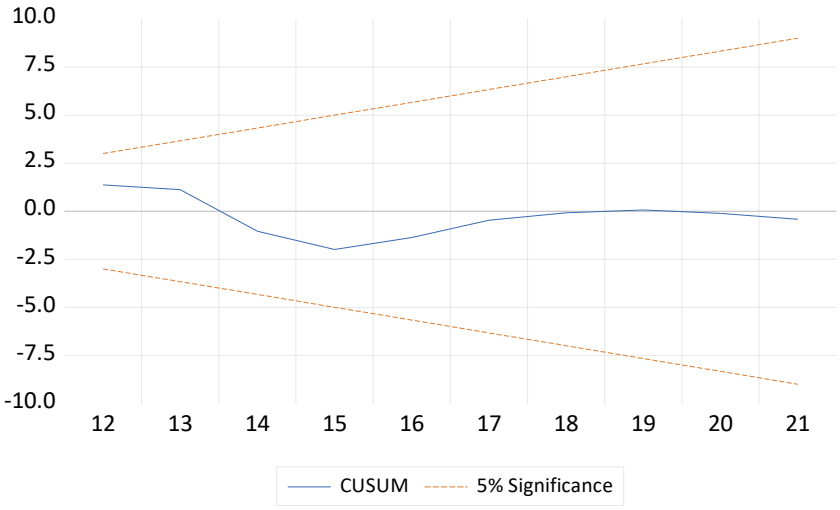

Figure 3: CUSUM test.

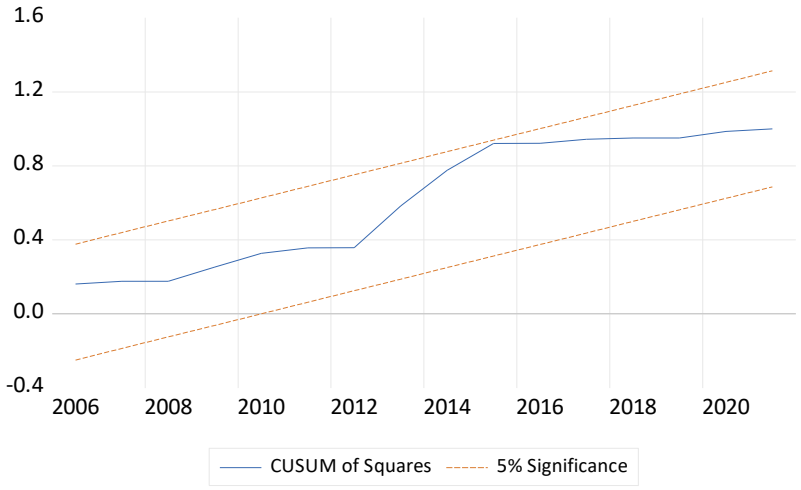

Figure 4 : CUSUM of squares test.

5. CONCLUSIONS

The investigation establishes a durable correlation between trade openness, foreign direct investment, the exchange rate of Malaysian Ringgit per US Dollar, capital creation, the labour force, and the export performance of the Malaysian manufacturing sector. The analysis reveals that trade openness, foreign direct investment (FDI), and labour force exert positive and substantial impacts on manufacturing exports, but exchange rate and capital creation exert negative and substantial impacts. These findings suggest that Malaysia can improve its manufacturing export performance by bolstering its integration with the global market, attracting greater foreign investment, and ensuring a continuous expansion of its labour supply. Additionally, it should maintain a stable and competitive exchange rate while avoiding excessive domestic investment that could hinder export production.

Foreign direct investment (FDI) contributes a crucial role in Malaysia's economic growth by bolstering capital-intensive industries and boosting the value of manufacturing exports. To further stimulate FDI, particularly in high-value-added and technology-intensive sectors, the government must actively promote investment strategies such as acquisitions, joint ventures, and the establishment of new companies. These measures will enhance the productivity, efficiency, and competitiveness of the manufacturing sector. Studies have shown a strong and significant correlation between the export of manufactured goods from Malaysia and trade openness, which quantifies the level of economic integration with international trading partners. Hence, it is imperative for the government to persist in implementing trade liberalisation policies aimed at diminishing trade barriers, expanding export markets, and fostering regional collaboration, particularly in light of the COVID-19 pandemic's disruption of world commerce. In addition, it is important for the government to oversee the exchange rate policies in order to maintain a steady level of the ringgit per US dollar exchange rate, hence diminishing the unpredictability and fluctuation of export profits and expenses. The Malaysian Investment Development Board (MIDA), as the primary investment promotion body in Malaysia, must dedicate itself to cultivating a favourable atmosphere for enterprises and investors, so guaranteeing sustained development and prosperity. This involves encouraging fresh investment into the Malaysian economy, particularly in the manufacturing sector, which plays a significant role in Malaysia's export performance. In addition, policymakers should thoroughly evaluate the trade policies that impact the development of the manufacturing sector, including the decision to implement import substitution programmes or export promotion policies. Import substitution policies seek to diminish imports and enhance local production via the implementation of tariffs, quotas, or subsidies. Conversely, export promotion policies strive to augment exports and foreign currency revenues by offering incentives, improving infrastructure, or facilitating market access. The selection of trade policy is contingent upon the country's comparative advantage, factor endowments, and development objectives.

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