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Macroeconomics Factors Affecting Net Exports of Oil Palm Industry in Malaysia

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Abstract: This quantitative study investigates the impact of oil palm production, oil palm pricing, inflation, and GDP growth rate on the net exports of Malaysia's oil palm industry. This research is aimed at analyzing how the net export of oil palm relates to certain macroeconomic variables. This study has employed multiple regression analysis through Ordinary Least Squares for 26 years of time series data from 1996 to 2020 in Malaysia. The findings from this study improve our understanding of the major factors contributing to net exports in the oil palm industry. Palm oil production, price, as well as GDP growth, drive net export of palm oil in Malaysia found during this research. An increase in production leads to the reduced amount of palm oil exported, all other things remaining constant. Conversely, inflation and GDP growth are major drivers behind the increased net export of palm oil.

Keywords: *Oil palm industry, net exports, macroeconomic factors, prices, production, inflation, economic growth.*

1. Introduction and Background

Malaysia's oil palm industry has shown remarkable progress. Initially grown as an ornamental plant in Malaysia, it has now transformed into a major industry. It has the highest growth rate for global demand for foodstuff, cosmetics, animal feed, bioenergy and other sectors (Abazue et al., 2015). The expansion of Malaysia's palm oil sector has created a global demand for exports among trade partners. As a result, Malaysia has established itself as the world's leading producer and exporter of palm oil around the globe. Crude palm oil production in 1990 was 6.09 million tonnes and increased to 10.84 million tonnes and 16.99 million tonnes in 2000 and 2010, respectively (Nambiappan et al., 2018). Palm oil cultivation in Malaysia is vast at more than 5.67 million hectares or 17% of the country's total land area with the export of palm oil products at 15.71 million tonnes or an equivalent value of RM86,472 million or roughly USD 18,662 million (Rajakal et al., 2024). The industry employs over 2 million people and contributes significantly to Malaysia's foreign exchange revenues (Nambiappan et al., 2018) Malaysian palm oil business contributes significantly to the country's economy by providing both money and job possibilities through exports. It was the fourth-largest contributor to Malaysia's economy in 2011, adding RM 53 billion (USD 16.8 billion) to the country's Gross National Income (Khamarudin et al., 2021 This business contributes 5% to 7% of Malaysia's GDP on average, with export earnings averaging RM 64.24 billion per year over the last five years (MPOB, 2023). As of 2021, the contribution of this industry to Malaysia's GDP was anticipated to be 2.5 percent (Ludin et al., 2022).

Malaysia is also currently leading the world in the production of biodiesel which uses palm oil as its primary input (Ziaei & Ali, 2021). The government is supporting the industry for its biodiesel contribution through the Biofuel Policy 2006, the Biofuel Industry Act 2007 and a supporting policy in 2011 (Ziaei & Ali, 2021). There are 22 biodiesel plants currently operating in Malaysia with a capacity of more than 2 million tonnes per year Mahayuddin et al., 2022). With the demand for sustainable energy rising amid climate change global issues, Malaysia's export of palm oil is gaining more significance. Malaysia's palm oil export markets have expanded to more than 200 markets throughout the world (Nambiappan et al., 2018). However, the sector is facing several challenges, including increased production costs, declining yields, and fierce competition from alternative vegetable oils. These problems are worsened by different macroeconomic factors including output, price, inflation rates as well as GDP growth rates. Although Malaysia has recently experienced an increase in oil palm production volumes, it is projected that the expansion will slow own because of problems like land constraints, labor shortages and environmental considerations. The fluctuations seen in palm oil prices over the short term though have mostly been upward trending driven by global demand and supply shifts along with

differing climatic conditions affecting agriculture. Sustainability concerns have gained increasing importance on the political agendas of governments, bought up by consumers' raise for sustainable goods and services and also become a major concern for businesses globally (Kumar et al., 2005).

Some of the major environmental issues connected with the production of palm oil are the emissions of greenhouse gases, wastewater production, poor waste disposal methods, and inefficiency in energy use (Zamri et al., 2022). This sector has labor-related problems like poor working conditions, low pay, labor shortages and lack of adequate training and skills development (Deli et al., 2023). Another key challenge to the domestic palm oil sector is its price volatility which affects not only pricing but also profitability (Ahmad et al., 2020). These elements of the macro economy are affecting the oil palm industry in Malaysia leading to rising production costs, reduced efficiency, and declining price trends. In this way, it becomes difficult for local producers of palm oil to compete amidst the unpredictable future of this industrial sector. Therefore, there is a need for regulators and industry players to come up with strategies that will address these issues so that the sector can remain viable in the long run. The purpose of this study is to investigate how four independent factors-oil palm production, oil palm price, inflation rate, and GDP growth rate affect the net export of palm oil in Malaysia. Thus, this research will provide knowledge about the factors influencing the overall performance of the Malaysian oil palm industry and recommendations to help the business thrive.

2. Literature Review

Palm oil is an important commodity for export in Malaysia. A positive net export brings in trade surplus revenue for the country, contributing to higher GDP and stronger currency value for Malaysia. The study of how a net export can be improved is pertinent especially so for a country relying on a commodity such as oil palm for one of its important revenue generators. Palm oil net export has not been widely analyzed for its determinants. Tandra et al. (2022) however have analyzed the determinants of competitiveness of the global oil palm trade and found population and import of animal or vegetable oils to be positively affecting palm oil trade competitiveness, while GDP per capita and RSPO negatives affect it. Seng & Ahmad (2017) found Malaysian palm oil exports to be affected by world GDP. Jazuli & Kamu (2019) analyzed Malaysian palm oil export demand and found palm oil production, price of substitutes and palm oil-based products to be significantly affecting the export demand for palm oil. There is a lot more literature that discusses the determinants of palm oil exports.

Economic growth: Palm oil exports have been studied for impacts by macroeconomic variables including economic growth which is often represented by changes in GDP. In a study by Ridwannulloh & Sunaryati (2018), Indonesian crude palm oil export is examined and the study found the country's GDP and GDP of trading partners to be positively affecting Indonesia's crude palm oil export while the country's exchange rate and domestic consumption is found to be negatively affecting Indonesia's crude palm oil export. GDP has indeed been studied to determine its impact on production and export revenue. A higher GDP translates to more economic and business activities, thus triggering higher consumer expenditure. In the oil palm industry, GDP may shine as a stimulating factor for the demand for palm oil and its derivatives like cooking oil, biodiesel, and oleochemicals. Several studies show that there is an increase in the usage of palm oil products (biodiesel, food, cosmetics) with an increase in GDP development.

Empirical evidence indicates that economic expansion positively influences Malaysian domestic production of palm oils. Ahmad et al. (2019) found that the increase in GDP is one of the main drivers of the increased palm oil production level in Malaysia this enabling them to meet going years needs either within or beyond its borders. Also, it is important to know that the palm oil industry can benefit from higher GDP growth rates through increased export competitiveness. In international markets, a developing economy with a higher GDP frequently leads to increased demand for numerous items, including palm oil products. As one of the leading producers of palm oil globally, Malaysia will have increased production and export levels when there is strong GDP growth. For this reason, strong GDP growth can also create a conducive investment environment as well as support innovation within the palm oil sector. This will translate into higher investments meaning greater production efficiencies and yields alongside improved quality of palm oil products thereby making Malaysian ones more competitive internationally. Hence, the GDP growth rate could influence levels of investment in the palm oil industry. Empirical research has shown that more investments in the industry, including plantation expansion, infrastructure development and technology adoption happen when the country posts high GDP

growth rates (Kannan et al., 2018). Economic growth is strong which causes a good investment atmosphere and also makes money come into the business. The performance of the palm oil industry in the world market is affected by the GDP growth rate. As per various empirical studies, high GDP growth rates in Malaysia and other nations can stimulate many industries to use palm oil as an input including food processing and biodiesel production (Goh et al., 2021). A better export performance will enhance the expansion and competitiveness of the palm oil industry.

Inflation rate: One of the macroeconomic variables that are included in the study on determinants for exports is inflation. Inflation is positively affecting the exports of 5 ASEAN countries (Ilmas et al., 2022) and is negatively affecting palm oil export volume by Indonesia to its ten major destination countries (Widad, 2022). Inflation in a country will tend to make exports less desirable and thus may cause exports to fall. The impact of inflation on net exports is uncertain as it depends on both exports and imports. The impact of rising general prices may be easier to explain by looking at its impact on oil palm production instead. A rise in inflation rates may increase operating expenditures such as labor, fertilizer and fuel for palm oil producers, causing a smaller profit margin and reduced competitiveness (Isa et al., 2020).

Palm Oil Production: Palm oil production in Malaysia is marked by so many factors that affect the industry such as weather, land use policies, labor force and capital availability as well as technological advancements. The industry can only keep on being profitable and viable in the future if some policies and projects enhance sustainable practices, increase productivity levels and protect the environment. Regarding palm oil production in Malaysia, one of the most crucial factors is land accessibility. The establishment of palm oil plantations requires arable land. Land-use regulations such as land tenure systems and conversions have been shown to play a role in regulating the development of the palm oil sector (Azman-Saini et al., 2019). This can be seen as an array of factors that affect the rate of palm oil being expanded and produced, such as inadequate lands and environmental legislation. Hence, technological advancement serves a key purpose in improving the productivity and efficiency of the industry during these times. Research indicates that mechanization, genetic modifications and precision farming methods positively influence palm oil production (Parveez et al., 2022).

Nevertheless, it can be deduced that with the extravagant uptake of new technologies, yields will increase, harvesting techniques improved and resource management enhanced leading to an upsurge in production volumes overall. A trained labor force is very crucial for the smooth and effective working of the palm oil sector. Possibly this is why some scholars state that continued palm oil production requires readily available labor and constant skills upgrading (Rahman et al., 2016). For instance, migration patterns among workers or wage changes may influence labor markets affecting how much there exists for hiring hence influencing its price thus we may conclude that even if there are high costs; still people can produce again. A few key variables that influence palm oil production in Malaysia are weather patterns, availability of land, labor as well as capital. Since the productivity of oil palms depends greatly on appropriate rainfall and temperature, any change in these two factors will affect their performance significantly. Another big factor affecting Malaysian palm oil production is land. Because of the proliferation of oil palm trees, there are now problems like deforestation and the alienation of land use that might have adverse effects on the ecosystem. There is also a need for labor and money to produce palm oil.

High production costs may arise due to limited manpower leading to obstacles in expansion or improvement projects as a result of insufficient finances. The Government of Malaysia has implemented various policies and initiatives to address production issues, such as NKEA for Palm Oil, to enhance efficiency and promote green business practices. In addition, the authorities have fostered research and advancements in technology as well as productive manufacturing methods. According to empirical research carried out on palm oil in Malaysia, land availability is an important factor for Malaysian palm oil production. On the other hand, it was found from the study that larger land areas should be required for palm oil plantations (Hassan et al., 2018). As a result, increased productivity levels are dependent upon the availability of cultivable land. Moreover, a skilled workforce is essential for sustaining and improving productivity in the oil palm sector. Indeed, labor availability and skills play a crucial role in palm oil production in Malaysia as empirically shown by Isa et al., (2020). This is because access to skilled labor ensures efficiency as well as the introduction of new production methods within plantations.

Price of Palm Oil: The production and potentially the net exports of a product may be affected by its price. Concerning palm oil, an increase in its price can encourage further investment in the industry. This may lead to improved productivity, output and consequently profitability. Therefore, palm oil prices are influenced by worldwide supply and demand, weather conditions, costs of inputs as well as government policies (Sabariah & Rusmawati, 2014). According to Chong et al. (2017), a country's export earnings have a positive relationship with the global oil palm price. It plays a role in the growth of the palm oil industry and the economy as a whole. In addition to that, Sabariah & Rusmawati (2014) state that many factors affect palm oil prices such as global supply and demand weather changes production costs, etc. Rahman et al (2019) posited that the world price of palm oil has positive effects on Malaysia". When prices of inputs change, it may alter the cost structure in palm oil-producing areas like Malaysia hence affecting profitability level (Parveez et al., 2022).

3. Research Methodology

This study is a quantitative analysis that uses a deductive approach to data analysis. The data used for the study are time-series data for the period of 26 years from years 1996 to 2020. Some advantages of using quantitative research methods include the ability to generalize findings to a larger population, demonstrate cause-and-effect relationships, and replicate studies to establish reliability. However, there are some limitations to this method including the potential for researcher bias and the possibility of overlooking important nuances and contextual information. The study involves a multiple regression analysis using the Ordinary Least Square regression to examine the nature of the relationship between the net export of oil palm as the dependent variable and production of oil palm, prices of oil palm, inflation, and GDP growth rate as independent variables. Data for the study is obtained from various secondary data sources. Table 1 shows the variables used for the study and data sources.

Table 1: Variables and Data Source

VARIABLE	PROXY	DATA SOURCE
Net Export	EXP	Statista Trading Economics
Production of Oil Palm	PROD	Observatory of Economic Complexity (OEC) Economics & Industry, Dept of Statistics Malaysia (DOSM) Development Division, Malaysian Palm Oil Board (MPOB)
Price of Oil Palm	PRICE	Index Mundi
Inflation Rate	INF	Bank Negara Malaysia (BNM)
GDP Growth Rate	GDP	Bank Negara Malaysia (BNM)

The study is based on the following relationship among the variables:

$$NET\_EXP = f(PROD, PRICE, INF, GDP) \quad [1]$$

Where:

NET_EXP = Net Export of Oil Palm in Malaysia.
PROD = Production of Oil Palm.
PRICE = Price of Oil Palm.
INF = Inflation Rate.
GDP = GDP Growth Rate

In equation 1, the Net Export of Oil Palm in Malaysia (NET_EXP) is examined to be influenced by the production of oil palm (PROD), price of oil palm (PRICE), inflation rate (INF) and GDP growth rate (GDP). Increases in PROD, PRICE and GDP are expected to increase NET-EXP while an increase in INF is expected to reduce EXP. For the regression model (equation 2), PROD, PRICE and GDP coefficients are expected to be positive while the INF coefficient is expected to be negative in the estimated regression.

$$NET\_EXP = \alpha + \beta_1 PROD + \beta_2 PRICE + \beta_3 INF + \beta_4 GDP + \mu \quad [2]$$

Where:

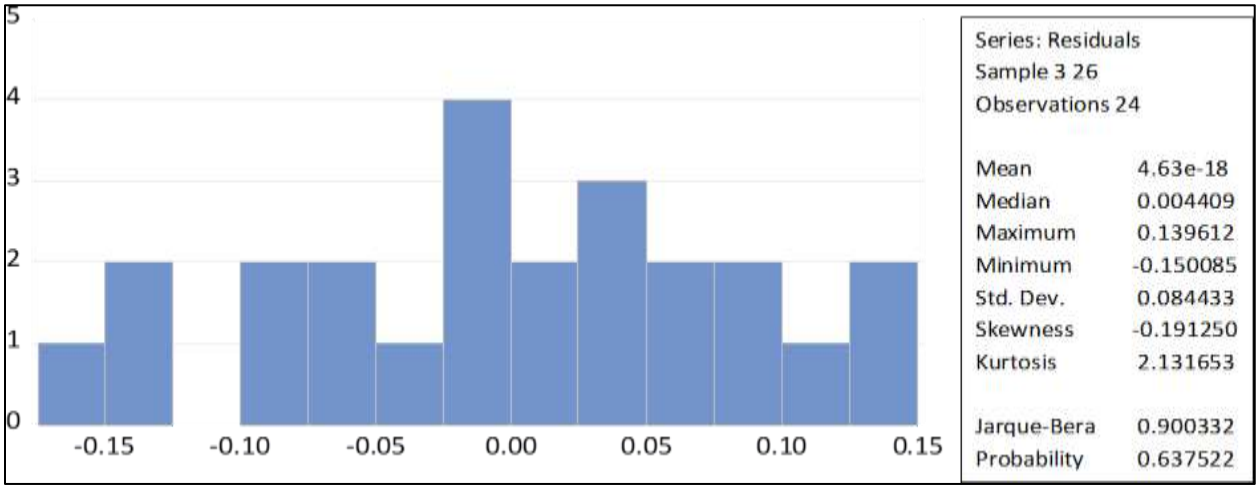
α = Constant
$\beta_1,\beta_2,\beta_3,\beta_4$ = Estimated coefficients
μ = Random error term

The study applies several diagnostic tests -- Normal Distribution (Jarque-Bera) Test, Serial Correlation (Durbin-Watson) Test and Multicollinearity Test (Variance Inflation Factor). The Jarque-Bera Test is used to determine if the sample used is taken from a normal population. When the data has a normal population, its distribution will form a bell-shaped curve when it is plotted on graphs, histograms, box plots, or frequency polygons. The shape of the curve will depend on the mean and standard deviation of the population. (Mohd Yusoff et al., 2022). To test if study data is normally distributed, the Jarque-Bera Test is tested for skewness and kurtosis of residuals.

4. Results

Using histogram, the Normal Distribution Test shows that the residual of the regression has almost a symmetrical bell-curved shape. Thus, we can conclude that the data is normally distributed (Figure 1).

Figure 1: Histogram



In this study, the variables apply log with difference form for all variables for the regression (Equation 3). The log net export of the oil palm industry (DLNET_EXP) is the dependent variable whereas log production of oil palm (DLPROD), log price of oil palm (DLPRICE), log inflation rate (DLINF), and log GDP growth rate (DLGDP) are the independent variables. DLNET_EXP only has a negative relationship with DLPROD whereas DLNET_EXP has positive relationships with the remaining independent variables, DLPRICE, DLINF, and DLGDP.

$$DLNET\_EXP = \alpha + \beta_1 PROD + \beta_2 PRICE + \beta_3 INF + \beta_4 GDP + \mu \quad [3]$$

Where:

DLNET_EXP	= Difference log net export of oil palm in Malaysia.
DLPROD	= Difference log production of oil palm.
DLPRICE	= Difference log price of oil palm.
DLINF	= Difference log inflation rate.
DLGDP	= Difference log GDP growth rate
α	= Constant
$\beta_1,\beta_2,\beta_3,\beta_4$	= Estimated coefficients
μ	= Random error term

Table 2 shows descriptive statistics of variables. There are 24 observations after data is transformed into a second difference form. In the descriptive analysis, skewness is a measure of symmetry. Skewness values are mostly close to zero, and the median and mean values are almost equal indicating that data used in general are normally distributed.

Table 2: Descriptive Statistics

	DLNET_EXP	DLPROD	DLPRICE	DLINF	DLGDP
Mean	0.012866	0.003055	0.009890	0.070412	0.064813
Median	0.055104	-0.010490	0.090381	0.133559	-0.026871
Maximum	0.562850	0.193854	0.433433	2.560014	5.426535
Minimum	-0.723604	-0.156512	-0.999249	-1.622478	-2.594598
Std. Dev.	0.293250	0.100736	0.329634	0.855053	1.597597
Skewness	-0.439957	0.270665	-1.161422	0.688542	1.518587
Kurtosis	3.173715	2.132136	4.696547	4.569090	6.949405
Jarque-Bera	0.804426	1.046226	8.273878	4.358404	24.82222
Probability	0.668838	0.592673	0.015972	0.113132	0.000004
Sum	0.308784	0.073326	0.237365	1.689888	1.555501
Sum Sq. Dev.	1.977893	0.233396	2.499155	16.81564	58.70331
Observations	24	24	24	24	24

A test of autocorrelation, also known as serial correlation, is performed to assess the degree of connection between a variable and its previous values over several observations or time intervals. The Durbin-Watson test can be used to evaluate any serial correlation between variables in a regression equation with the test consistently assigned a value between 0 and 4. When the range is 0 to less than 2, positive autocorrelation is indicated while range between 2 and 4 indicates negative autocorrelation. In Table 3, the Durbin-Watson statistics is 2.1783, indicating the Durbin-Watson test to be statistically significant at a 5% level with no first-order serial correlation.

Table 3: Test of Autocorrelation

Dependent Variable: DLNET_EXP
Method: Least Squares
Date: 06/06/23 Time: 23:41
Sample (adjusted): 3 26
Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLPROD	-0.655981	0.205404	-3.193607	0.0048
DLPRICE	0.964436	0.087077	11.07573	0.0000
DLINF	0.016127	0.029026	0.555607	0.5850
DLGDP	0.097923	0.015426	6.348077	0.0000
C	-0.002150	0.019046	-0.112906	0.9113

R-squared	0.917100	Mean dependent var	0.012866
Adjusted R-squared	0.899648	S.D. dependent var	0.293250
S.E. of regression	0.092897	Akaike info criterion	-1.731602
Sum squared resid	0.163967	Schwarz criterion	-1.486174
Log likelihood	25.77922	Hannan-Quinn criter.	-1.666490
F-statistic	52.54814	Durbin-Watson stat	2.178441
Prob(F-statistic)	0.000000		

Multicollinearity occurs when a perfect linear function of one or more additional independent variables exists although there is no independent variable. Although multicollinearity is rare, it can be detrimental as it becomes more challenging to precisely estimate the true model's coefficients the more highly correlated two (or more) independent variables are (Studenmund, 2011). The variance inflation factor (VIF) is a tool that determines the severity degree of multicollinearity. If the VIF of a variable is bigger than 5, the multicollinearity is considered to be severe. Based on the figure above, the VIF for variables production of oil palm (DLPROD), price of oil palm (DLPRICE), inflation rate (DLINF), and GDP growth rate (DLGDP) are all do not exceed 5 hence the variables have little correlation with one another, and the degree of multicollinearity is not severe.

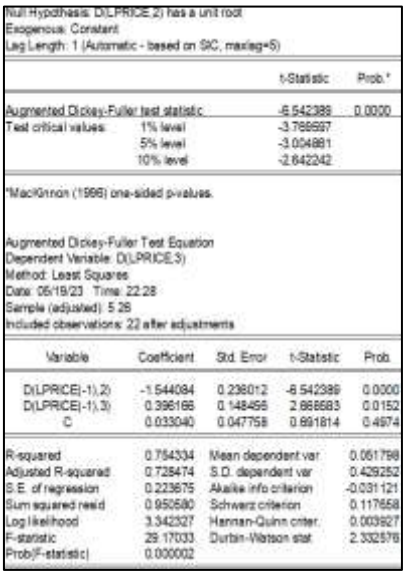
Table 4: Multicollinearity Test

Variance Inflation Factors
Date: 06/06/23 Time: 23:45
Sample: 1 26
Included observations: 24

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
DLPROD	0.042191	1.142160	1.141065
DLPRICE	0.007582	2.197867	2.195804
DLINF	0.000842	1.653260	1.641644
DLGDP	0.000238	1.621408	1.618628
C	0.000363	1.008876	NA

An integration analysis via the Augmented Dickey-Fuller Test or Unit Root Test is performed for this study. The Augmented Dickey-Fuller Test or unit root test, is set for 2nd difference, trend, and intercept to obtain significance and ensure that our data is normally distributed. All of the independent variables in this study show that there is no multicollinearity with a low degree of multicollinearity since the VIF for all the independent variables does not exceed 5. After running the Augmented Dickey-Fuller test at the 2nd level of difference, all the independent variables appear to be significant. This suggests that the independent factors have a long-term impact on Malaysia's net export of oil palm.

Table 5: Unit Root Test



Null Hypothesis: D(LPRICE,2) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=5)

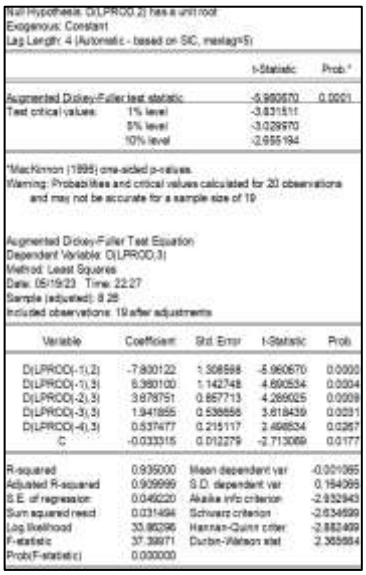
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.542389	0.0000
Test critical values:	1% level	-3.788697	
	5% level	-3.004861	
	10% level	-2.642242	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPRICE,3)
Method: Least Squares
Date: 05/19/23 Time: 22:28
Sample (adjusted): 5 26
Included observations: 22 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPRICE(-1),2)	-1.544084	0.236012	-6.542389	0.0000
D(LPRICE(-1),3)	0.396188	0.148466	2.668683	0.0152
C	0.033040	0.047758	0.691814	0.4974

R-squared	0.754334	Mean dependent var	0.061798
Adjusted R-squared	0.728474	S.D. dependent var	0.429252
S.E. of regression	0.223675	Akaike info criterion	-0.031121
Sum squared resid	0.950580	Schwarz criterion	0.117658
Log likelihood	3.342327	Hannan-Quinn criter.	0.003927
F-statistic	29.17033	Durbin-Watson stat	2.332576
Prob(F-statistic)	0.000002		



Null Hypothesis: D(LPROD,2) has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=5)

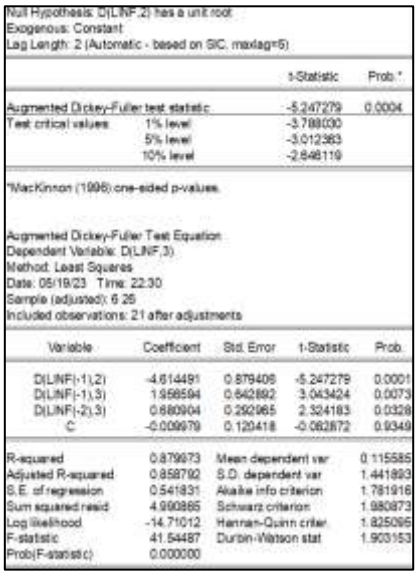
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.960670	0.0001
Test critical values:	1% level	-3.831511	
	5% level	-3.029970	
	10% level	-2.655194	

*MacKinnon (1996) one-sided p-values.
Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 19

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LPROD,3)
Method: Least Squares
Date: 05/19/23 Time: 22:27
Sample (adjusted): 8 26
Included observations: 19 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LPROD(-1),2)	-7.800122	1.308598	-5.960670	0.0000
D(LPROD(-1),3)	5.380100	1.142748	4.690534	0.0004
D(LPROD(-2),3)	3.878751	0.857713	4.289025	0.0009
D(LPROD(-3),3)	1.941855	0.538656	3.618439	0.0031
D(LPROD(-4),3)	0.837477	0.215117	3.468834	0.0047
C	-0.033315	0.012279	-2.713089	0.0177

R-squared	0.935000	Mean dependent var	-0.001085
Adjusted R-squared	0.909999	S.D. dependent var	0.184095
S.E. of regression	0.046220	Akaike info criterion	-2.932943
Sum squared resid	0.031494	Schwarz criterion	-2.634599
Log likelihood	33.86296	Hannan-Quinn criter.	-2.882499
F-statistic	37.39971	Durbin-Watson stat	2.365884
Prob(F-statistic)	0.000000		



Null Hypothesis: D(LINF,2) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.247279	0.0004
Test critical values:	1% level	-3.788030	
	5% level	-3.012363	
	10% level	-2.646119	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LINF,3)
Method: Least Squares
Date: 05/19/23 Time: 22:30
Sample (adjusted): 6 26
Included observations: 21 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LINF(-1),2)	-4.614491	0.879406	-5.247279	0.0001
D(LINF(-1),3)	1.956594	0.642892	3.043424	0.0073
D(LINF(-2),3)	0.680904	0.292965	2.324183	0.0328
C	-0.009979	0.120418	-0.082872	0.9349

R-squared	0.879973	Mean dependent var	0.115585
Adjusted R-squared	0.858792	S.D. dependent var	1.441893
S.E. of regression	0.541831	Akaike info criterion	1.781916
Sum squared resid	4.990885	Schwarz criterion	1.980873
Log likelihood	-14.71012	Hannan-Quinn criter.	1.825095
F-statistic	41.54487	Durbin-Watson stat	1.903153
Prob(F-statistic)	0.000000		

A multiple regression is performed on data using a second difference log form for all variables resulting in regression estimates as shown in Table 6. The goodness of fit measure, R^2 exhibits a value of 0.9171, showing that 91.71 percent of variations in net export for oil palm in the second difference log (DLNET_EXP) is explained by the production of oil palm, price, inflation and GDP, all of which are in second difference log form (DLPROD, DLPRICE, DLINF, DLGDP).

AN F-test analysis is also conducted to detect the overall fit of the regression equation between the dependent variable, DLNET_EXP and the independent variables, DLPROD, DLPRICE, DLINF, and DLGDP at a 5% level of significance. The value of F-statistics which is 52.5418 is higher than the critical value of F-statistics, 2.84 and the probability value of F-statistics at less than 5% shows that the regression equation is statistically significant at 5% and has a good overall fit.

Table 6: Regression analysis

Variables	Coefficients	Probability
Constant	-0.0022	0.9113
DLPROD*	-0.6560	0.0048
DLPRICE*	0.9644	0.0000
DLINF	0.0161	0.5850
DLGDP*	0.0979	0.0000
F-statistics	52.5481	0.0000
R^2	0.9171	
Adjusted R^2	0.8996	
Durbin-Watson Statistic	2.1784	

*Significant at a 5% level of significance

The regression output can be explained as a regression equation as shown in equation 4:

$$DLNET_{EXP} = -0.0022 - 0.6560DLPROD + 0.9644DLPRICE + 0.0161DLINF + 0.0969DLGDP \quad [4]$$

Discussion

Based on the regression equation, an increase in production of oil palm (in difference log) by 1000 metric tons results in a drop in n the difference log net export of oil palm industry by RM0.6560 billion. This shows that DLNET_EXP and DLPROD have a negative relationship. An increase in the price of oil palm (in difference log) by RM1 per metric ton, results in the net export of the oil palm industry (in difference log) increase by RM0.9644 billion. This shows that DLNET_EXP and DLPRICE have a positive relationship. An increase in the inflation rate (in the differences log) by 1%, results in the net export of oil palm (in the difference log) increasing by RM0.0161 billion. This shows that DLNET_EXP and DLINF have a positive relationship. An increase in GDP growth rate (in difference log) by 1% results in net export of oil palm (in difference log) increase by RM0.0979 billion. This shows that DLNET_EXP and DLGDP have a positive relationship. In general, the regression has a good fit. From all independent variables, DLPROD, DLPRICE and DLGDP are significant variables in explaining DLNET_EXP at a 5% significance level. In terms of signs of relationship, DLPRICE and DLGDP show an expected positive relationship with DLNET_EXP.

5. Managerial Implications and Recommendations

In this study, researchers found that an increase in the oil palm price leads to a rise in Malaysia's net export of oil palm. This relationship is seen in the literature. The supply elasticities help explain why higher palm oil prices increase Malaysia's net exports of palm oil. Malaysia is known as one of the biggest producers and has so much infrastructure and the ability to meet demand whenever prices go up. Producers in Malaysia tend to produce more when prices rise, thus having a surplus for exportation. Thus, exports from Malaysia can increase as a result of this ability to adapt quickly and boost supply within a short time such that when prices are high, they command a big share of the world's palm oil market. Another reason is the global demand dynamics of palm oil. Even if the price of palm oil goes higher, importing countries may still need large quantities because there are no substitutes that are readily available or cheap. This kind of product serves various purposes in different sectors like food, cosmetics and biofuels. With an increase in prices, Malaysia has become a more appealing destination for importing countries due to its established supply chains and image as a trustworthy exporter. Therefore, Malaysian exports have also risen to sustain this level of demand despite the price increase maintaining or even increasing its market share hence resulting in higher net exports.

The findings of this research show that there is a relationship between the economic growth of Malaysia and the net export of palm oil. Thus, an increase in GDP growth rate leads to generally better economic conditions, resulting in more investments into main sectors such as oil palm production. Higher GDP growth provides conditions for both the government and private sector to invest more resources in the modernization of palm plantations, refinement of process units and improvement of transport networks. This enhances productivity and reduces costs of producing palm oil among other benefits, thereby making Malaysia one of the world's most competitive producers. As a result, due to increased international demand, it has enhanced its palm oil shipments around the globe resulting in greater foreign earnings from these agricultural exports. In addition,

Malaysia's development of strong commercial relations and worldwide marketplace assist the country in achieving economic growth.

Malaysia's oil palm business is an important economic engine, contributing considerably to the country's GDP and employing millions of people. With Malaysia being the world's second-largest producer of palm oil, the business is also a significant source of export earnings. A positive net export of oil palm brings prosperity to the country, thus the factors affecting it must be examined. Furthermore, the macroeconomic aspects that impact the oil palm business are pertinent to secure the industry's long-term survival. Production of oil palm is found to be significant and negatively related to the net export of oil palm. Higher production is not followed by higher net export in the empirical study even though the literature expects the relationship to be positive. This scenario may be due to international business and political disputes that relate to Malaysia's palm oil production and export.

Malaysian government can provide subsidies or tax benefits to such Roundtable of Sustainable Palm Oil (RSPO) certification-compliant palm oil growers, to stimulate sustainable agriculture practices among them to improve their net export for palm oil. Thus through promotion and support of sustainability initiatives, the palm oil industry players can improve their brand image as an environmentally friendly producer of palm oil which could attract green-minded consumers and consequently command higher prices on the overseas market. This would not only increase demand for Malaysian palm oil but also differentiate its product from less sustainably produced competitors thereby increasing net export. Additionally, the government may as well think of bargaining advantageous arrangements with key importers to make Malaysian palm oil cheap through lower duties and other barriers to international trade. It may also create or expand export promotion programs that are directed towards buoyant markets with growing demand for palm oil such as Africa or the Middle East. This will help to improve access to inward markets while at the same time advocating for Malaysian palm oils abroad leading to an increase in levels of exports thus raising net palm oil exports from Malaysia.

An increase in Gross Domestic Product (GDP) is normally linked with a stable and booming economy, hence enhancing Malaysia's reliability as well as making it more appealing for international trade. With the rates of increased economic growth, Malaysia can have favorable trade agreements, abolish export constraints and expand its reach to new markets. Consequently, by having more palm oil exports along with increased production capacity due to expanded market access, Malaysia can have greater net exports of this commodity. The roles played by the Malaysian Government and society in supporting – and aiding the palm oil industry in Malaysia are crucial. Farming will thus increase their output but reduce input costs due to direct subsidies, low-interest loans or tax breaks offered to farmers by the government. To boost productivity while reducing the chances of crop failure, the government could also fund R&D to develop new varieties of palm oil trees that are resistant to diseases and pests. The scheme promotes sustainable approaches within the oil palm sector through the Malaysian Sustainable Palm Oil certification program. Production of environment-friendly oil palm is what is defined under MSPO whereas any company conforming to those specifications will receive an MSPO certificate. In this way, through advertisements, it can protect nature whilst at the same time promoting lasting practices within the sector.

The palm oil business is heavily scrutinized in the international arena as this industry has issues related to deforestation and the sustainability of forest and palm oil plantation practices. For Malaysia to ensure higher exports of its palm oil, the government and local industry players should play their part in promoting the country's production of palm oil in the international market. Campaigning to raise awareness of Malaysia's sustainable practices for palm oil production and the health benefits of palm oil in food consumption should be a priority for government agencies that assist in marketing Malaysia's oil as well as for other relevant stakeholders. Efforts to increase awareness include education initiatives and continuous encouragement towards implementing and improving sustainable production practices in the business. The government might also reinforce sustainable production standards, like the Malaysian Sustainable Palm Oil (MSPO) certification program. These criteria would assist in guaranteeing that the oil palm business operates responsibly and with little environmental damage.

The oil palm industry in Malaysia may also receive help from the community. They can utilize items made from palm oil for cooking, soaps and body lotion to raise awareness and demand. Besides, the community should

always consider supporting companies that are into sustainability to help with sustainable practices within the palm oil belt. A letter to a local member of parliament or joining a protest against unsustainable practices is another way the community can support this industry. This helps raise awareness on why oil palm sustainability must stop its depletion. To support farmers in Malaysia with inputs like fertilizers or pesticides, we can provide them with subsidies. We can also fund research and development through the Malaysian Palm Oil Board, encourage sustainable practices with the Malaysian Sustainable Palm Oil certification scheme and participate in lobbying activities by writing letters to lawmakers. Moreover, Malaysian palm oil suppliers can also perform their functions. The palm oil industry may focus on embracing sustainable practices, investing in research and development (R&D) and enhancing its branding efforts as avenues for boosting the competitiveness of Malaysia's palm oil exports. In this way, Malaysian palm oil becomes attractive to environmentally conscious consumers and markets through methods of production that are eco-friendly together with sustainability certifications. Investment in research and development may improve yields, higher quality products and creation of additional value through novel applications of palm oil. Moreover, strategic marketing and branding initiatives that are centered on quality and sustainability could further enhance Malaysian palm oil's position in the global market making it a more appealing choice for all international buyers.

Conclusion

This study on the net export of palm oil for Malaysia has identified price of the palm oil and GDP growth rate to be positively affecting the net export of palm oil while the production of palm oil is negatively affecting palm oil net export. With the net export of oil palm as one of the biggest contributors to Malaysia's GDP for the past decade, efforts to increase it via understanding the impacts of these macroeconomic variables would improve the competitiveness of this industry in the global market.

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