http://dx.doi.org/10.18623/rvd.v23.5618

DETERMINANTS OF EXPORT-ORIENTED PRODUCTION IN THAILAND'S REFINED PETROLEUM INDUSTRY

DETERMINANTES DA PRODUÇÃO ORIENTADA PARA EXPORTAÇÃO NA INDÚSTRIA DE REFINO DE PETRÓLEO NA TAILÂNDIA

Article received on: 12/11/2025
Article accepted on: 3/10/2026

Sittikorn Khamrod*
*Panyapiwat Institute of Management (PIM), Nonthaburi, Thailand
Orcid: https://orcid.org/0009-0003-8965-7964
sittikornkha@pim.ac.th

Nitdanee Tanyapornhirun*
*Panyapiwat Institute of Management (PIM), Nonthaburi, Thailand
Orcid: https://orcid.org/0009-0002-6155-5897
nitdaneetan@pim.ac.th

The authors declare that there is no conflict of interest

Abstract
This study aims to analyze the factors influencing export-oriented production within Thailand's refined petroleum product industry. The analysis is based on monthly time-series data covering the period from January 2021 to May 2025, totaling 53 observations. The empirical analysis employs a Multiple Linear Regression (MLR) model to examine the relationships between petroleum product export indices and overall export performance in the petroleum refining industry. The results indicate that several variables significantly influence the export index for the production of refined petroleum products in Thailand. These include the export indices of high-speed diesel, aviation fuel, kerosene, fuel oil, liquefied petroleum gas (LPG), and naphtha. The estimated model demonstrates a high level of explanatory power, with a coefficient of determination (R^2) of 98.9 percent and an adjusted R^2 of 98.8 percent. The findings suggest that major fuel products play a crucial role in determining the export capacity of Thailand's petroleum refining industry. In particular, variations in the production and export performance of key fuel products significantly contribute to the dynamics of petroleum export activity. These results highlight the importance of refinery product structure and production allocation in shaping export performance. The study also provides empirical insights that may support strategic planning for refinery operations and export development within Thailand's petroleum industry.

Keywords: Energy Industry. Petroleum Product Exports. Multiple Linear Regression Model.

Resumo
Este estudo tem como objetivo analisar os fatores que influenciam a produção orientada para exportação na indústria de produtos refinados de petróleo da Tailândia. A análise baseia-se em dados mensais de séries temporais que cobrem o período de janeiro de 2021 a maio de 2025, totalizando 53 observações. A análise empírica emprega um modelo de Regressão Linear Múltipla (MLR) para examinar as relações entre os índices de exportação de produtos petrolíferos e o desempenho geral das exportações na indústria de refino de petróleo. Os resultados indicam que várias variáveis influenciam significativamente o índice de exportação para a produção de produtos refinados de petróleo na Tailândia. Estas incluem os índices de exportação de diesel de alta velocidade, combustível de aviação, querosene, óleo combustível, gás liquefeito de petróleo (GLP) e nafta. O modelo estimado demonstra um elevado nível de poder explicativo, com um coeficiente de determinação (R^2) de 98,9 por cento e um R^2 ajustado de 98,8 por cento. Os resultados sugerem que os principais produtos combustíveis desempenham um papel crucial na determinação da capacidade de exportação da indústria de refino de petróleo da Tailândia. Em particular, as variações na produção e no desempenho das exportações dos principais produtos combustíveis contribuem significativamente para a dinâmica da atividade de exportação de produtos petrolíferos refinados. Estes resultados destacam a importância da estrutura dos produtos de refino e da alocação da produção na definição do desempenho das exportações. O

Petroleum Refining Industry. Asia-Pacific Energy Market.

estudo também fornece evidências empíricas que podem apoiar o planejamento estratégico das operações de refino e o desenvolvimento das exportações na indústria de refino de petróleo da Tailândia.

Palavras-chave: *Setor Energético. Exportações de Produtos Petrolíferos. Modelo de Regressão Linear Múltipla. Indústria de Refino de Petróleo. Mercado de Energia da Ásia-Pacífico.*

1 INTRODUCTION

The petroleum refining industry constitutes a fundamental component of the global energy system, as it involves the transformation of crude oil into a wide range of energy products and industrial feedstocks. These products include gasoline, diesel fuel, jet fuel, kerosene, fuel oil, liquefied petroleum gas (LPG), and various petrochemical inputs. Such products play a crucial role in supporting transportation systems, industrial activities, and broader economic operations across countries worldwide (Gary & Handwerk, 2007; Speight, 2014). In addition, the refining process significantly enhances the economic value of energy resources by converting crude oil into products that correspond to the structure of demand in the global energy market (U.S. Energy Information Administration, 2024). Over the past several decades, global energy demand has continued to rise in equivalent with economic expansion and population growth. As a result, the demand for petroleum products remains at a relatively high level. According to the International Energy Agency (2024), global oil demand is expected to continue increasing, with an estimated rise of approximately 850,000 barrels per day by 2026. Meanwhile, the total global demand for oil is projected to remain above 100 million barrels per day, reflecting the continuing importance of petroleum-based energy within the global economic system, particularly in the transportation and industrial sectors (BP, 2023). From an industrial perspective, petroleum refining is a technologically intensive and complex production process that requires advanced infrastructure and complex operational systems. Refineries around the world play an essential role in converting crude oil into diverse energy products, as well as essential feedstocks for the petrochemical industry. These include intermediate products such as naphtha and heavier

derivatives such as asphalt, both of which are closely associated with infrastructure development and industrial expansion (Speight, 2014). Nevertheless, the petroleum refining industry is also characterized by high levels of energy consumption and considerable environmental implications. Refining operations require substantial energy inputs throughout various processing stages, which in turn contribute significantly to greenhouse gas emissions. Consequently, environmental concerns associated with refining activities have increasingly attracted attention from policymakers, researchers, and industry stakeholders in recent years (Jia et al., 2020).

In the context of Thailand, the petroleum refining industry has developed steadily and demonstrates considerable capacity to produce energy products that serve both domestic consumption and export markets. Thailand's oil refineries are capable of producing a wide range of petroleum products and play a significant role in supporting the country's energy economy (Thai Oil Public Company Limited, 2024). International trade statistics further indicate that refined petroleum products represent one of Thailand's important export commodities. In 2023, the value of Thailand's petroleum product exports was approximately USD 8.87 billion (World Bank, 2024). Data from the Bank of Thailand also show that the monthly export value of petroleum products has, at certain periods, exceeded USD 800–900 million (Bank of Thailand, 2024). These figures highlight the economic importance of the petroleum refining sector within Thailand's export structure. A review of the literature suggests that products derived from petroleum refining are not produced independently but are closely interconnected in terms of production processes, market demand structures, and refinery product slate optimization. Various refined products—such as liquefied petroleum gas (LPG), naphtha, gasoline, kerosene, jet fuel, and diesel—originate from the same crude oil refining system and are generated through interconnected refining and conversion processes (Speight, 2014). Consequently, the output composition of refineries is shaped by both technological constraints and the evolving demand structure of energy markets. Within the broader energy market structure, several studies have emphasized the interdependence among fuel products within refinery production systems. For example, Karimu et al. (2021) found that fluctuations in oil demand and refinery output significantly influence the structure of automotive fuel markets. Similarly, Salimi et al. (2022) reported that economic and social factors directly affect both the demand and supply dynamics of gasoline. Furthermore,

Baek and Yoo (2022) demonstrated that refined fuel products play a crucial role in enhancing the export competitiveness of the petroleum refining industry. In refinery production processes, middle distillate products—particularly kerosene and jet fuel—are closely related because they originate from similar distillation ranges of crude oil. Wang et al. (2024) indicate that aviation fuel production continues to rely primarily on kerosene-based fractions. In addition, García-Maza and González-Delgado (2025) explain that hydrocracking technology enables the efficient conversion of heavy feedstocks into high-value products such as kerosene, diesel, LPG, and naphtha. Major fuel products, particularly diesel, also play a vital role in economic systems, especially in transportation and logistics sectors. Jiang et al. (2023) noted that fluctuations in diesel demand influence refinery production strategies and fuel blending decisions. Likewise, Raza and Siddiqui (2024) found that changes in the demand for refined petroleum products significantly affect production planning and investment decisions within the refining industry. For heavier products such as fuel oil and asphalt, previous research suggests that these outputs reflect the efficiency with which refineries utilize residual fractions of crude oil. Pipintakos et al. (2024) highlight the importance of bituminous materials in construction and infrastructure development. Meanwhile, Aitkaliyeva et al. (2025) explain that the quality of heavy petroleum products is closely associated with refinery conversion processes and product blending strategies. Taken together, the existing literature indicates that petroleum refining products are closely interconnected through production structures, refinery conversion processes, and the demand patterns of global energy markets. These interrelationships ultimately influence the export potential of refined petroleum products. Therefore, examining the factors that influence the export performance of refined petroleum products is essential for developing a deeper understanding of Thailand's energy industry structure and its role within the international energy market.

In this study, the researcher examines the factors influencing export-oriented production within Thailand's refined petroleum product sector. The analysis focuses on ten key product categories, namely octane-91 gasoline, octane-95 gasoline, high-speed diesel, aviation fuel, kerosene, fuel oil, liquefied petroleum gas (LPG), asphalt, naphtha, and engine lubricating oil. These products represent major outputs of Thailand's petroleum refining industry and collectively reflect the structural composition of refinery production in the country. To investigate the relationships among these variables, this

study employs a Multiple Linear Regression (MLR) model to analyze how the ten independent variables are associated with Thailand's exports of refined petroleum products. The MLR approach is particularly suitable for examining the simultaneous influence of multiple explanatory variables on a single dependent variable, thereby enabling a more comprehensive understanding of the combined effects of different petroleum product categories on export performance. Through this analytical framework, the study aims to provide empirical insights into how variations in refinery product outputs contribute to Thailand's petroleum export dynamics.

2 RESEARCH OBJECTIVES

1. To examine the relationship between the indices of refined petroleum products and export-oriented production within Thailand's refined petroleum product sector.
2. To analyze the influence of major refined petroleum products on export-oriented production in Thailand's refined petroleum product industry by employing a Multiple Linear Regression (MLR) model.

3 RESEARCH METHODOLOGY

This study was conducted based on a conceptual framework derived from a review of the relevant literature. The review indicates that the export index for production in Thailand's refined petroleum product sector is influenced by several key product indices. These include the export indices of octane-91 gasoline (unleaded), octane-95 gasoline (unleaded), high-speed diesel, aviation fuel, kerosene, fuel oil, liquefied petroleum gas (LPG), asphalt, naphtha, and engine lubricating oil. For the purpose of data analysis, the research procedure was organized into two main stages as follows:

Stage 1: The researcher conducted a preliminary analysis of the variables used in the study by employing descriptive statistics to summarize the basic characteristics of the dataset. This analysis included measures such as the mean and the standard deviation in order to describe the central tendency and dispersion of the data.

Stage 2: The researcher then examined the relationships and the influence of the explanatory variables on the export index for production in Thailand's refined petroleum product sector by applying Multiple Linear Regression Analysis (MLR). The dependent variable in the model is the export index for production in refined petroleum products in Thailand (Y). The independent variables consist of the export index of octane-91 gasoline (X_1), the export index of octane-95 gasoline (X_2), the export index of high-speed diesel (X_3), the export index of aviation fuel (X_4), the export index of kerosene (X_5), the export index of fuel oil (X_6), the export index of liquefied petroleum gas (X_7), the export index of asphalt (X_8), the export index of naphtha (X_9), and the export index of engine lubricating oil (X_{10}). The multiple linear regression model employed in this study can therefore be expressed in the following equation:

$$Y = \beta_0 + \sum_{i=1}^{10} \beta_i X_i + \varepsilon \qquad (1)$$

where

Y represents the export index for production in Thailand's refined petroleum product sector,

X_1 to X_{10} denote the indices of the selected refined petroleum products,

$\beta 0$ is the intercept term,

β_1 to β_{10} represent the regression coefficients of the independent variables, and ε denotes the error term.

For the estimation of the parameters in the multiple linear regression model, the researcher employed the Least Square Estimation method to estimate the parameters of the multiple linear regression model. The application of this method requires several important assumptions regarding the error terms to be satisfied. These assumptions consist of four main conditions: (1) The error terms must follow a normal distribution, which was examined using the Anderson–Darling statistic (Anderson and Darling, 1952). (2) The error terms must be independent of one another. This assumption was tested using the Durbin–Watson test (Durbin and Watson, 1950). (3) The error terms must have constant variance, which was assessed using the Modified Levene test. And (4) There

must be no multicollinearity among the independent variables. This condition was evaluated using the Variance Inflation Factor (VIF) (Khamrod and Srikhaetai, 2018).

4 RESEARCH RESULTS

The results of the data analysis on the factors influencing export-oriented production within Thailand's refined petroleum product sector are presented as follows. The dataset used in this study consists of monthly observations from January 2021 to May 2025, totaling 53 months. Descriptive statistics, including the mean and standard deviation, were calculated to summarize the characteristics of the variables. The results indicate that the export index for production in refined petroleum products in Thailand has a mean value of 116.36 with a standard deviation of 12.51. The analysis also includes ten independent variables. The export index of octane-91 gasoline has a mean of 111.45 and a standard deviation of 16.57. The export index of octane-95 gasoline has a mean of 112.38 and a standard deviation of 16.61. The export index of high-speed diesel has a mean of 104.34 and a standard deviation of 7.60. Furthermore, the export index of aviation fuel shows a mean of 237.40 with a standard deviation of 94.50, while the export index of kerosene has a mean of 132.30 and a standard deviation of 30.03. The export index of fuel oil has a mean of 99.83 and a standard deviation of 15.51. The export index of liquefied petroleum gas (LPG) has a mean of 105.75 with a standard deviation of 15.43. In addition, the export index of asphalt has a mean of 95.20 and a standard deviation of 13.38, while the export index of naphtha has a mean of 120.14 and a standard deviation of 43.36. Finally, the export index of engine lubricating oil has a mean of 111.24 with a standard deviation of 14.82, as shown in Table 1. For the analysis of the multiple linear regression model, the researcher examined the factors influencing the export index for production in refined petroleum products in Thailand. The relationships were investigated using the correlation coefficient and scatter plots between the export index for production in refined petroleum products in Thailand (Y) and the independent variables, namely the export index of octane-91 gasoline (X_1), the export index of octane-95 gasoline (X_2), the export index of high-speed diesel (X_3), the export index of aviation fuel (X_4), the export index of kerosene (X_5), the export index of fuel oil (X_6), the export index of liquefied

petroleum gas (X_7), the export index of asphalt (X_8), the export index of naphtha (X_9), and the export index of engine lubricating oil (X_{10}), as shown in Table 2.

Table 1

Mean and Standard Deviation of the Data

Variable	Mean	SD
Export Index for Production in Refined Petroleum Products in Thailand	116.36	12.51
Export Index of Octane-91 Gasoline	111.45	16.57
Export Index of Octane-95 Gasoline	112.38	16.61
Export Index of High-Speed Diesel	104.34	7.60
Export Index of Aviation Fuel	237.40	94.50
Export Index of Kerosene	132.30	30.03
Export Index of Fuel Oil	99.83	15.51
Export Index of Liquefied Petroleum Gas (LPG)	105.75	15.43
Export Index of Asphalt	95.20	13.38
Export Index of Naphtha	120.14	43.36
Export Index of Engine Lubricating Oil	111.24	14.82

From Table 2, when considering the linear relationships between the dependent variable and the independent variables, it was found that the export index for production in refined petroleum products in Thailand shows the strongest positive linear relationship with the export index of aviation fuel, with a correlation coefficient of 0.907. The second highest relationship is with the export index of octane-91 gasoline, which has a correlation coefficient of 0.682. In addition, strong relationships were also observed among some independent variables. For example, the export index of octane-91 gasoline and the export index of aviation fuel, as well as the export index of high-speed diesel and the export index of kerosene, have correlation coefficients of 0.659 and 0.610, respectively. These relationships are statistically significant at the 0.01 level. The scatter plots illustrating the relationships between the dependent variable and the independent variables are shown in Figure 1.

Table 2

Correlation Coefficients between the Dependent Variable and the Independent Variables

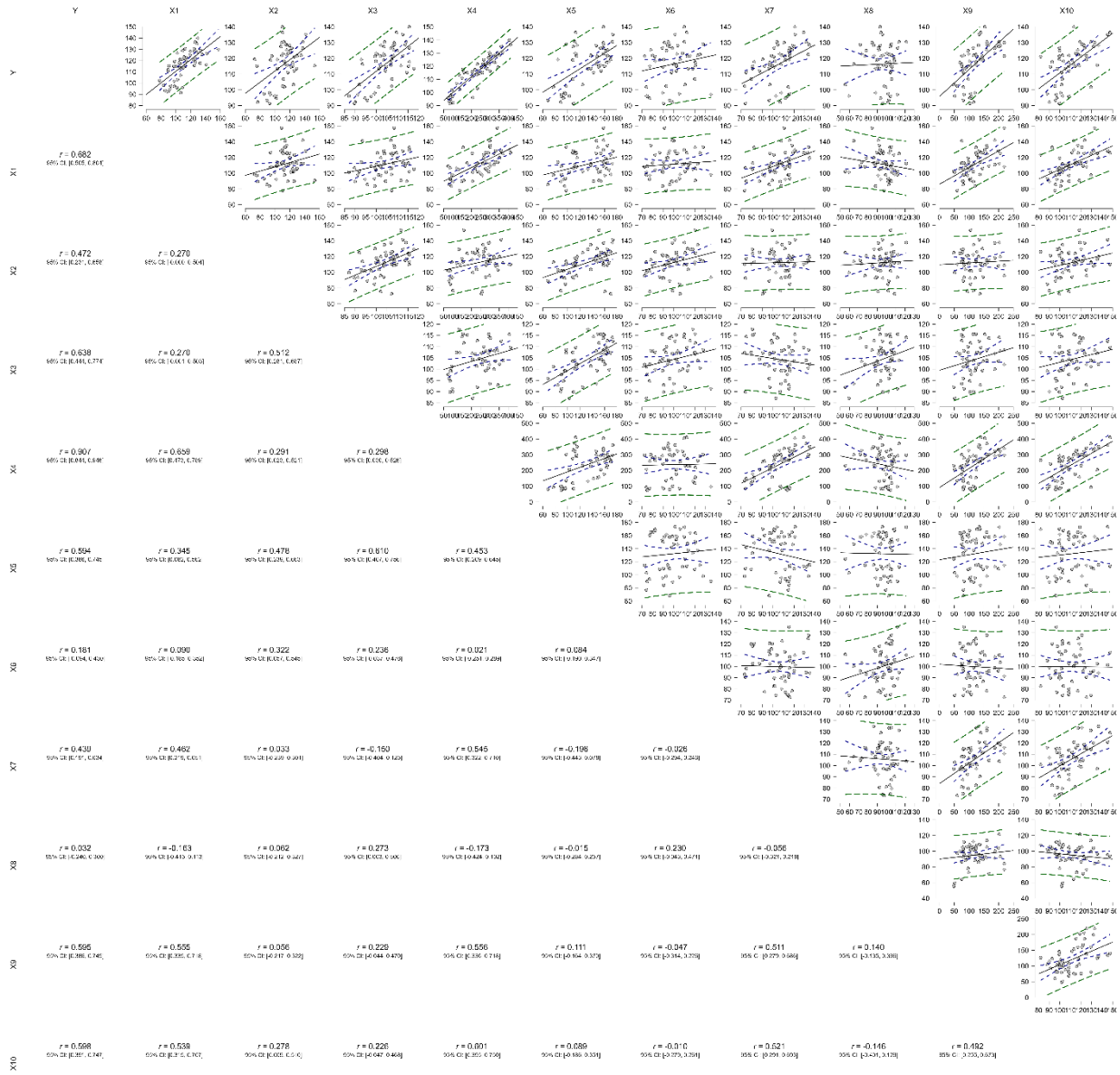
Variables	*Y*	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
X_1	0.682**									
X_2	0.472**	0.270*								
X_3	0.638**	0.270	0.512							
X_4	0.907**	0.659**	0.291*	0.298*						
X_5	0.594**	0.345*	0.478**	0.610**	0.453**					
X_6	0.181	0.090	0.322*	0.236	0.021	0.084				
X_7	0.439**	0.462**	0.033	-0.150	0.545**	-0.196	-0.026			
X_8	0.032	-0.163	0.062	0.273*	-0.173	-0.015	0.230	-0.056		
X_9	0.595**	0.555**	0.056	0.229	0.556**	0.111	-0.047	0.511**	0.140	
X_{10}	0.598**	0.539**	0.278*	0.226	0.601**	0.089	-0.010	0.521**	-0.146	0.492**

* Statistically significant at the 0.05 level, and ** Statistically significant at the 0.01 level.

From Figure 1, it was found that the export index for production in refined petroleum products in Thailand shows a linear relationship trend with most of the independent variables, except for the export index of asphalt, which has a correlation coefficient of 0.032 (Table 1). In selecting the multiple linear regression equation for estimating the export index for production in refined petroleum products in Thailand, the all possible subsets selection method was applied. In this approach, 2^k regression equations are generated, depending on the number of independent variables (k). The regression equation was then selected using the best subsets regression technique. In this study, the selection of the regression model was primarily based on the smallest Mallows' C_p value, which was 10.30, together with the standard error of the estimate, which was 1.252. The results indicate that the export index of engine lubricating oil (X_{10}) is not appropriate to be included in the regression equation for estimating the export index for production in refined petroleum products in Thailand. Subsequently, the model selection process was carried out step by step by considering the Mallows' C_p values and the standard error of the estimate values in the subsequent orders, as presented in Table 3.

Figure 1

Scatter Plots between the Dependent Variable and the Independent Variables



Based on Table 3, the analysis of variance using the F-test statistic yields a value of 721.28, with a p-value lower than the significance level of 0.05. This indicates that at least one independent variable can be used for estimation, as shown in Table 4. Subsequently, the independent variables—namely the export index of high-speed diesel (X_3), the export index of aviation fuel (X_4), the export index of kerosene (X_5), the export index of fuel oil (X_6), the export index of liquefied petroleum gas (X_7) and the export index

of naphtha (X_9)—were further examined using the t-test statistic. The results show that all independent variables have p-values lower than the significance level of 0.05. Therefore, these six independent variables are appropriate for estimating the export index for production in refined petroleum products in Thailand, as presented in Table 5.

Table 3

Regression Equations from the Best Subsets Regression

Vars	***R-Sq***	***R-Sq(adj)***	***C-p***	***S***	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
1	82.3	81.9	878.1	5.321				X						
1	46.5	45.5	2749.0	9.243	X									
2	97.1	97.0	104.7	2.174			X	X						
2	87.0	86.5	634.1	4.606		X		X						
3	97.9	97.8	63.0	1.853			X	X			X			
3	97.7	97.6	74.9	1.952			X	X					X	
4	98.4	98.2	41.7	1.658			X	X		X	X			
4	98.3	98.2	43.9	1.680			X	X		X			X	
5	98.7	98.6	26.7	1.498			X	X		X	X		X	
5	98.6	98.5	30.9	1.544	X		X	X		X	X			
6	**98.9**	**98.8**	**16.0**	**1.365**			**X**	**X**	**X**	**X**	**X**		**X**	
6	98.8	98.7	21.8	1.435	X		X	X		X	X		X	
7	99.0	98.9	14.0	1.329	X		X	X	X	X	X		X	
7	99.0	98.9	15.0	1.342		X	X	X	X	X	X		X	
8	99.1	99.0	11.2	1.279	X		X	X	X	X	X	X	X	
8	99.1	98.9	13.4	1.309	X	X	X	X	X	X	X		X	
9	**99.2**	**99.0**	**10.3**	**1.252**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	
9	99.2	99.0	11.0	1.262	X		X	X	X	X	X	X	X	X
10	99.2	99.0	11.0	1.248	X	X	X	X	X	X	X	X	X	X

Table 4

Analysis of Variance (ANOVA)

Source	**DF**	**SS**	**MS**	**F**	**P**
Regression	6	8058.60	1343.10	721.28	0.000
Residual Error	46	85.70	1.90		
Total	52	8144.30			

Table 5

Regression Coefficients and t-test Results

Predictor	Coef	SE Coef	T	P	VIF
Constant	7.640	3.699	2.07	0.045	
X_3	0.62131	0.03381	18.38	0.000	1.80
X_4	0.085796	0.003422	25.07	0.000	2.90
X_5	0.032242	0.009878	3.26	0.002	2.50

Predictor	Coef	SE Coef	T	P	VIF
X_6	0.06373	0.01271	5.02	0.000	1.10
X_7	0.09501	0.01893	5.02	0.000	2.40
X_9	0.024029	0.005741	4.19	0.000	1.70

For the multiple linear regression equation used to estimate the export index for production in refined petroleum products in Thailand, the results show that the coefficient of determination (R^2) is 98.9 percent, while the adjusted coefficient of determination (Adjusted R^2) is 98.8 percent. In addition, the standard error of the estimate for the export index for production in refined petroleum products in Thailand is 1.365 (Table 2).

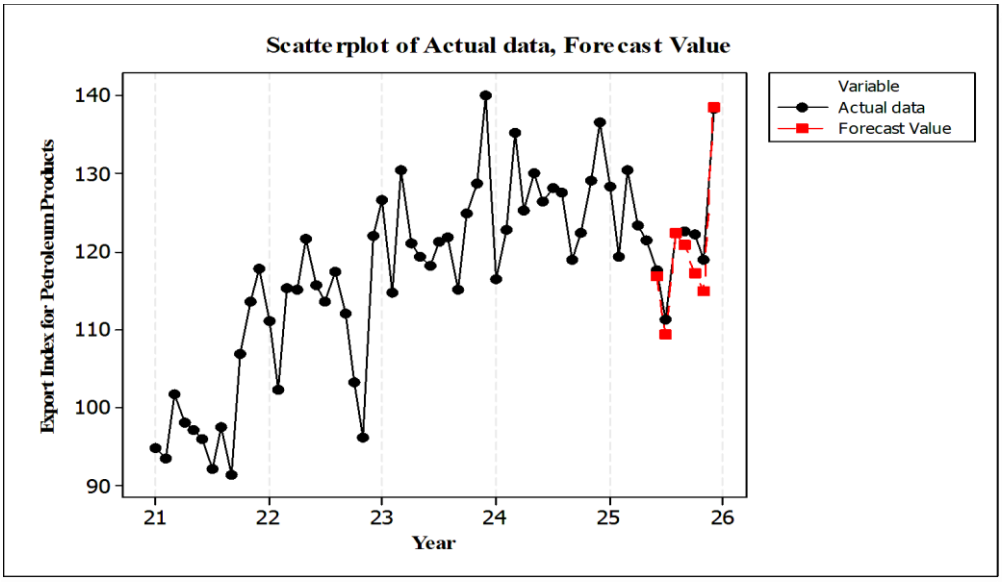
Therefore, the multiple linear regression equation used to estimate the export index for production in refined petroleum products in Thailand can be expressed as follows:

$$\hat{Y} = 7.640 + 0.62131X_3 + 0.085796X_4 + 0.032242X_5 + 0.06373X_6 + 0.09501X_7 + 0.024029X_9 \quad (2)$$

From Equation (2), the preliminary assumptions for the error terms were examined. First, the normality of the error terms was tested using the Anderson–Darling test, which yielded an AD statistic of 0.340 with a p-value of 0.484, indicating that the error terms are normally distributed. Next, the independence of the error terms was examined using the Durbin–Watson test, which produced a value of 2.037 with a p-value of 0.782, indicating that the error terms are independent. Furthermore, the homogeneity of the error variance was tested using the Modified Levene Test, which yielded a t-test statistic of 0.290 with a p-value of 0.774. This result indicates that the variance of the error terms is constant at the 0.05 significance level. Finally, the issue of multicollinearity among the independent variables was examined using the Variance Inflation Factor (VIF). The results show that the VIF values for all independent variables range between 1.10 and 2.90 (VIF < 5), indicating that the independent variables exhibit only a slight degree of correlation with one another.

Figure 2

Comparison between the Actual Values and the Predicted Values of the Export Index for Production in Refined Petroleum Products in Thailand



From Figure 2, the comparison between the actual values (black line) and the predicted values (red line) of the export index for production in refined petroleum products in Thailand is presented. The predicted values were calculated using Equation (2). The results indicate that the predicted values are close to the actual values and exhibit a similar trend of movement. The predicted values used for comparison correspond to the period from June to December 2025. These results reflect that the model is capable of appropriately estimating the changes in the export index for production in refined petroleum products in Thailand.

5 CONCLUSION AND DISCUSSION

The research findings indicate that the export index for production in refined petroleum products in Thailand is significantly influenced by six types of petroleum products, namely high-speed diesel, aviation fuel, kerosene, fuel oil, liquefied petroleum gas, and naphtha. These results reflect that the export structure of Thailand's petroleum refining industry depends largely on the allocation of output among major fuel products and co-products derived from deep conversion processes. In particular, middle distillate

products and products obtained from hydrocracking processes play an important role, as they represent key mechanisms for increasing the value added of modern petroleum refineries.

For the high-speed diesel index, the results indicate that it has a significant positive influence on exports. This finding is consistent with the study of Jiang et al. (2023), which suggests that the properties of diesel fuel blends affect both the economic value and operational constraints of refineries. Similarly, Raza and Siddiqui (2024) found that demand patterns for refined petroleum products influence refinery production planning and investment decisions. In addition, Coruh et al. (2025) confirmed that diesel demand remains closely linked to the transportation sector and changes in overall energy demand. Therefore, when the diesel index increases, it reflects both refinery production capacity and the overall potential for expanding exports of refined petroleum products. Regarding the aviation fuel index and the kerosene index, the study found that both variables significantly influence exports. This result is consistent with the production structure of refineries, as both products belong to the middle distillate fraction of crude oil refining. Wang et al. (2024) reported that commercial aviation fuels still rely primarily on kerosene-based fuels. Meanwhile, Kittel et al. (2023) demonstrated that kerosene produced through hydrocracking processes can be used for aviation fuel production when the aromatic content is maintained at an appropriate level. Furthermore, García-Maza and González-Delgado (2025) indicated that hydrocracking processes can efficiently convert heavy feedstocks into kerosene, diesel, liquefied petroleum gas, and naphtha. Thus, increases in the aviation fuel and kerosene indices reflect greater flexibility in refinery product structures and greater opportunities for generating export revenue. For the fuel oil index, the findings also show a significant influence on exports. This result is consistent with the literature that views heavy petroleum products as indicators of the efficiency of utilizing crude oil residues. Baek and Yoo (2022) found that heavy petroleum products exhibit different competitive dynamics in export markets compared with lighter petroleum products. Stratiev et al. (2023) presented a systematic model of heavy petroleum product production in refineries, covering several grades of fuel oil. In addition, Sotirov et al. (2025) found that the quality of fuel oil depends directly on blending composition and the level of conversion of residual feedstocks. Therefore, fuel oil should not be considered merely a residual output of the refining process but also a

reflection of a refinery's ability to convert heavy feedstocks into products that can compete in export markets. In terms of the liquefied petroleum gas (LPG) index, the results show that it also has a significant influence on exports. Coruh et al. (2025) found that the demand for LPG is related to the demand for gasoline and diesel fuel. Meanwhile, Stratiev et al. (2024) indicated that LPG is one of the important co-products of the refining process. In addition, Eirinakis et al. (2024) suggested that improving the efficiency of LPG production processes under quality specifications can enhance refinery operational performance. Therefore, LPG serves both as an indicator of refinery conversion efficiency and as a product that supports the export potential of the petroleum refining industry. Finally, the naphtha index was found to significantly influence exports. This finding is consistent with the role of naphtha as a linking product between the petroleum refining industry and the petrochemical industry. Baek and Yoo (2022) identified naphtha as one of the petroleum products with strong competitive potential in international trade markets. Meanwhile, García-Maza and González-Delgado (2025) confirmed that hydrocracking processes can increase naphtha yields from heavy feedstocks. Furthermore, Stratiev et al. (2024) explained that naphtha forms an integral part of refinery product structures and is directly associated with refinery process design. Consequently, naphtha represents an important variable in value creation and industrial linkage, which ultimately contributes to the export potential of Thailand's petroleum refining industry.

The findings of this study provide important insights into the dynamics of the petroleum refining industry in regions where the sector continues to play a crucial role in energy security, fuel trade, and industrial expansion. This is particularly relevant for the Asia–Pacific region, where demand for crude oil and refined petroleum products remains closely associated with economic growth, transportation activities, and industrial development. Such relationships are especially evident in developing and emerging Asian economies, which continue to serve as major drivers of global oil demand in the near term. At the same time, future trends in the refining industry suggest that the growth of refined petroleum products will increasingly depend on certain product groups rather than traditional transportation fuels. In particular, products such as naphtha and aviation fuel are expected to play a more significant role than gasoline and diesel in the long term. Therefore, the findings of this study—highlighting the roles of diesel, aviation fuel,

kerosene, liquefied petroleum gas, naphtha, and fuel oil in influencing export performance—can provide useful information for supporting decisions related to production structure planning, refinery product slate allocation, and the development of competitive capabilities within the refining industry. These insights are particularly valuable for countries in the Asia–Pacific region, especially those that rely heavily on the trade of fuel products and petrochemical feedstocks, as they can help inform strategic planning aimed at enhancing the competitiveness and sustainability of the petroleum refining sector. These findings may provide useful implications for refinery production planning and export strategy development in Thailand.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to Panyapiwat Institute of Management, Thailand, for providing financial support for this research. This support has been instrumental in facilitating the completion of the study, including data collection, analysis, and the preparation of the manuscript. The authors also appreciate the institutional support that contributed to the successful publication of this research.

REFERENCES

Aitkaliyeva, A., S. Ashimova, I. Baidullayev, Y. Merkibayev, M. Yelubay, G. Toleutay, and C. Oliviero Rossi. 2025. Oil sludge as a rejuvenator for aged bitumen: Structural and thermal effect. *Applied Sciences* 15 (12): 6757. https://doi.org/10.3390/app15126757.

Aitkaliyeva, A., et al. 2025. Asphalt binder performance and durability. *Fuel* 364: 131023. https://doi.org/10.1016/j.fuel.2024.131023.

Anderson, T. W., and D. A. Darling. 1952. Asymptotic theory of certain goodness-of-fit criteria based on stochastic processes. *Annals of Mathematical Statistics* 23: 193–212.

Baek, C., and S.-H. Yoo. 2022. Dynamic changes in the export competitiveness of the South Korean oil refining industry. *Applied Sciences* 12 (6): 2789. https://doi.org/10.3390/app12062789.

Bank of Thailand. 2024. Foreign trade statistics of Thailand. https://app.bot.or.th/BTWS_STAT/statistics.

BP. 2023. *Statistical Review of World Energy 2023*. https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html.

Coruh, E., M. S. Yıldız, F. Urak, A. Bilgic, and V. Cengiz. 2025. Motivating green transition: Analyzing fuel demands in Turkiye amidst the climate crisis and economic impact. *Sustainability* 17 (11): 4851. https://doi.org/10.3390/su17114851.

Durbin, J., and G. S. Watson. 1950. Testing for serial correlation in least squares regression: I. *Biometrika* 37 (3–4): 409–428.

Eirinakis, P., G. Koronakos, S. Lounis, and J. Kallrath. 2024. Optimizing LPG production under quality specifications by preprocessing MILP with Pareto dominance and DEA. *International Journal of Production Research*. https://doi.org/10.1080/00207543.2024.2346185.

García-Maza, C., and A. González-Delgado. 2025. Hydrocracking performance for conversion of heavy feedstocks. *Applied Energy* 362: 121813. https://doi.org/10.1016/j.apenergy.2024.121813.

García-Maza, S., and Á. D. González-Delgado. 2025. Technical–economic assessment and FP²O technical–economic resilience analysis of the gas oil hydrocracking process at large scale. *Sci* 7 (1): 17. https://doi.org/10.3390/sci7010017.

Gary, J. H., and G. E. Handwerk. 2007. *Petroleum Refining: Technology and Economics*. 5th ed. Boca Raton, FL: CRC Press.

International Energy Agency. 2024. *Oil Market Report*. https://www.iea.org/reports/oil-market-report.

Jiang, H., X. Li, and Y. Zhang. 2023. Market dynamics of diesel fuel and refinery blending strategies. *Energy Policy* 179: 113662. https://doi.org/10.1016/j.enpol.2023.113662.

Jiang, Y., G. G. Zaimes, S. Li, T. R. Hawkins, A. Singh, N. Carlson, M. Talmadge, D. J. Gaspar, M. M. Ramirez-Corredores, A. W. Beck, B. Young, L. Sittler, and A. Brooker. 2023. Economic and environmental analysis to evaluate the potential value of Co-Optima diesel bioblendstocks to petroleum refiners. *Fuel* 333: 126233. https://doi.org/10.1016/j.fuel.2022.126233.

Karimu, A., S. Salia, and J. J. Hussain. 2021. The impact of refinery and oil demand shocks on the motor fuel market in Sweden. *International Journal of Finance & Economics* 26 (4): 4862–4878. https://doi.org/10.1002/ijfe.1995.

Khamrod, S., and K. Srikhaetai. 2018. The multiple regression model for learning achievement in science and mathematics of undergraduate Y students. *Apheit Journal* 7 (1): 92–103. [in Thai].

Kittel, H., P. Straka, P. Simáček, and D. Kadleček. 2023. Kerosene from hydrocracking for JET fuel with reduced aromatic content. *Petroleum Science and Technology* 41 (5): 507–523. https://doi.org/10.1080/10916466.2022.2061000.

Pipintakos, G., et al. 2024. Bitumen aging and performance in road pavements. *Construction and Building Materials* 418: 134567. https://doi.org/10.1016/j.conbuildmat.2023.134567.

Pipintakos, G., A. Sreeram, J. Mirwald, and A. Bhasin. 2024. Engineering bitumen for future asphalt pavements: A review of chemistry, structure and rheology. *Materials & Design* 244: 113157. https://doi.org/10.1016/j.matdes.2024.113157.

Raza, S. A., and A. W. Siddiqui. 2024. Exploring temporal demand patterns of refined petroleum products: Implications of the COVID-19 pandemic as a black swan event. *The Extractive Industries and Society* 17: 101388. https://doi.org/10.1016/j.exis.2023.101388.

Raza, S. A., and M. N. Siddiqui. 2024. Demand structure and investment decisions in refined petroleum markets. *Energy Economics* 118: 106453. https://doi.org/10.1016/j.eneco.2023.106453.

Salimi, M., M. A. Moradi, and M. Amidpour. 2022. Modeling and outlook analysis of gasoline supply and demand. *Energy* 256: 124686. https://doi.org/10.1016/j.energy.2022.124686.

Sotirov, S., I. Shishkova, D. Stratiev, and K. Atanassov. 2025. Heavy fuel oil quality dependence on blend composition, hydrocracker conversion and petroleum basket. *ChemEngineering* 6 (2): 43. https://doi.org/10.3390/chemengineering6020043.

Speight, J. G. 2014. *The Chemistry and Technology of Petroleum*. 5th ed. Boca Raton, FL: CRC Press.

Stratiev, D., A. Dimitriev, D. Stratiev, and K. Atanassov. 2023. Generalized net model of heavy oil products' manufacturing in petroleum refinery. *Mathematics* 11 (23): 4753. https://doi.org/10.3390/math11234753.

Stratiev, D., I. Shishkova, N. Angelova, D. D. Stratiev, and K. Atanassov. 2024. Generalized net model of the processes in a petroleum refinery—Part I: Theoretical study. *Mathematics* 12 (19): 3017. https://doi.org/10.3390/math12193017.

U.S. Energy Information Administration. 2024. *International Energy Outlook*. https://www.eia.gov/outlooks/ieo/.

Wang, B., Z. J. Ting, and M. Zhao. 2024. Sustainable aviation fuels: Key opportunities and challenges in lowering carbon emissions for aviation industry. *Carbon Capture Science & Technology* 13: 100263. https://doi.org/10.1016/j.ccst.2024.100263.

Wang, L., Y. Chen, and H. Liu. 2024. Market prospects of kerosene-based aviation fuels. *Energy Reports* 10: 2145–2154. https://doi.org/10.1016/j.egyr.2024.02.012.

World Bank. 2024. *World Integrated Trade Solution Database*. https://wits.worldbank.org.

Authors' Contribution

All authors contributed equally to the development of this article.

Data availability

All datasets relevant to this study's findings are fully available within the article.

How to cite this article (APA)

Khamrod, S., & Tanyapornhirun, N. (2026). DETERMINANTS OF EXPORT-ORIENTED PRODUCTION IN THAILAND'S REFINED PETROLEUM INDUSTRY. *Veredas Do Direito*, 23(6), e235618. https://doi.org/10.18623/rvd.v23.5618