Global Oil Price Transmission to Domestic Diesel Prices, and the Impact on Listed Firm's Profitability and Stock Market Returns Evidence from Thailand

Mr. Koravik Renuros

จุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY

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ความผันผวนของราคาน้ำมันโลกต่อราคาน้ำมันดีเซลในประเทศ ผลกระทบต่ออัตราการทำกำไรของบริษัทจดทะเบียนและผลตอบแทนในตลาดหุ้น กรณีศึกษาจากประเทศไทย

นายกรวิก เรณูรส

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By	Mr. Koravik Renuros
Field of Study	Finance
Thesis Advisor	Assistant Professor TANAKORN LIKITAPIWAT, Ph.D.

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INDEPENDENT STUDY COMMITTEE

..... Chairman
()

..... Advisor
(Assistant Professor TANAKORN LIKITAPIWAT, Ph.D.)

..... Examiner
(Associate Professor PORNANONG BUDSARATRAGOON, Ph.D.)

..... Examiner
(Assistant Professor RUTTACHAI SEELAJAROEN, Ph.D.)

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กรวิก เรณูรส : ความผันผวนของราคาน้ำมันโลกต่อราคาน้ำมันดีเซลในประเทศผลกระทบต่ออัตราการทำกำไรของบริษัทจดทะเบียนและผลตอบแทนในตลาดหุ้นกรณีศึกษาจากประเทศไทย. (Global Oil Price Transmission to Domestic Diesel Prices, andthe Impact on Listed Firm's Profitability andStock Market ReturnsEvidence from Thailand) อ.ที่ปรึกษาหลัก : ผศ. ดร.ธนากร ลิขิตาภิวัฒน์

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This research paper provides a comprehensive analysis of the dynamics of volatile oil prices over the past two decades, with a focus on the stock exchange of Thailand from the period of 2004 to 2022. Firstly, the study utilizes the Vector Autoregressive Model (VAR) technique to examine the impact of global oil price fluctuations on domestic fuel prices and the stock market in Thailand. The findings reveal that changes in global oil prices have a delayed and indirect effect on the Thai stock market. The transmission of volatility through domestic diesel prices is a crucial factor in this relationship. Notably, domestic diesel prices exhibit an immediate influence on the stock market, serving as a reliable indicator of economic growth. These insights shed light on the dynamic nature of the interactions between diesel prices, global oil prices, and the stock market in Thailand. Furthermore, the study investigates the impact of changes in domestic diesel prices on the accounting performance measures of energy sector firms. Through sub-sample analysis, the sample is divided into groups based on their association with energy prices. The results demonstrate a positive and significant effect of domestic diesel prices on accounting returns, particularly the return on assets (ROA), across the energy sector. The effect is more pronounced within the oil and gas companies. This highlights the dominant role of commodity prices, particularly diesel prices, as explanatory factors for accounting performance measures in the energy sector. Overall, this research contributes valuable insights into the temporal relationship between commodity prices, stock market performance, and accounting performance in the energy sector. By examining the dynamics of volatile oil prices and their impact on the stock exchange and accounting measures, this study enhances our understanding of the interconnections and dynamics within the energy sector and its relationship with the broader economy.

Field of Study:	Finance	Student's Signature .....
Academic Year:	2022	Advisor's Signature .....

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INTRODUCTION

Background and Significance of the Problem

The global oil market, recognized as a pivotal catalyst for economic expansion, is characterized by the indispensability of oil as a primary energy source. Its vital role in sustaining the foundational structure of nations, particularly in terms of energy utilization, fosters economic productivity and facilitates industrial growth. Nevertheless, in periods of high and volatile energy prices, this will inevitably exert severe pressure on the economic fundamentals, manifested through surging operational costs across various industries, shifts in consumer behavior, inflationary rate hikes, and staggered GDP growth patterns, which could potentially be amplified and transmitted to the stock market. With rising demand for energy consumption, especially amid the energy transition to a net-zero carbon economy, the world has set a net-zero target for the forthcoming decades. However, despite efforts to transition to alternative energy sources, crude oil will still remain a crucial component of the energy mix as the world continues to depend on these traditional sources to meet its energy needs.

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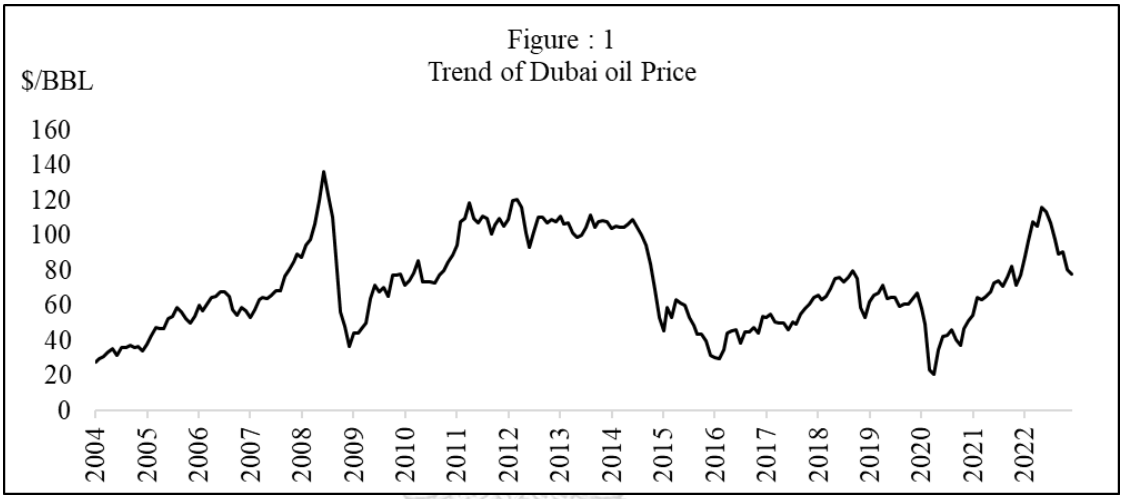
There has been a remarkable lack of stability in global oil prices over the past couple of decades, as shown in *Figure 1*. This volatility has attracted the attention of researchers who have explored the impact of energy prices on traditional stock returns. Several studies (Creti, Ftiti, & Guesmi, 2014; Jones & Kaul, 1996; Kilian & Park, 2009; Oberndorfer, 2009; Park & Ratti, 2008) discovered the impact of energy prices on traditional stock returns; that is, amplifying the volatility transmission of oil price shocks to the economy, which generally triggers the adverse relationship between petroleum prices and traditional stock returns. On the contrary, several

studies have concluded that the relationship is ambiguous. According to (Basher, Haug, & Sadorsky, 2018; Wang, Wu, & Yang, 2013) The interplay between petroleum prices and stock market dynamics can be contingent upon a nation's status as whether a country is a net importer or exporter, as well as by whether oil price fluctuations are caused by supply or aggregate demand shocks. According to the corresponding data in the literature, the effects of oil price volatility in exporting

Figure : 1
Trend of Dubai oil Price



nations are significantly stronger and have a substantial effect on stock returns.

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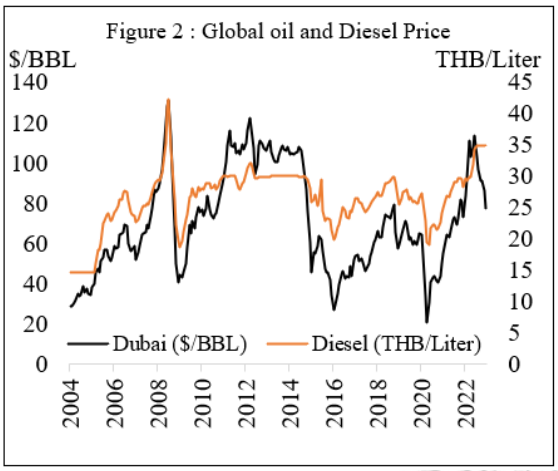
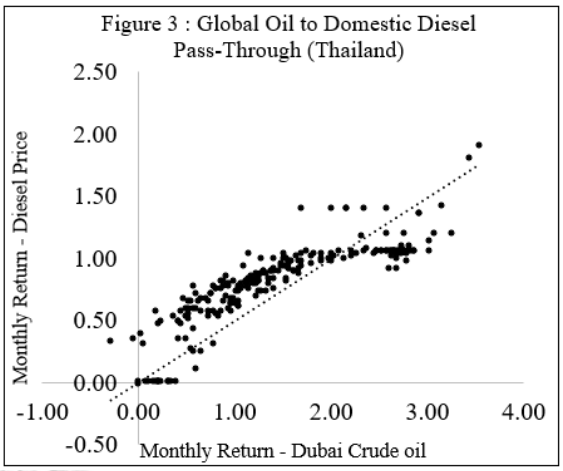
The correlation between of crude oil price and domestic fuel prices

The economic stability and energy security of Thailand are intricately tied to the influence exerted by crude oil prices on domestic fuel prices. Diesel, which constitutes approximately 45 percent of domestic fuel consumption, according to the Energy Policy and Planning Office (EPPO), is especially susceptible to fluctuations in crude oil prices. Due to the substantial amount of crude oil used in the production of refined products, a strong positive correlation exists between crude oil and domestic fuel prices as illustrated in *Figures 2 and 3*. Due to the reliance of transportation,

industrial sectors, households, and consumers on diesel for a variety of purposes, the volatile nature of oil prices swiftly translates into fluctuations in diesel prices.





The Thai government established the Oil Fuel Fund to stabilize domestic retail oil prices and implement additional energy policy initiatives in response to such market volatility. Despite the Fund's efforts, however, domestic diesel prices continue to move in the same direction as global oil prices but with varying magnitudes due to different tax and subsidy regimes. Thus, any disruptions in the global oil market will inevitably impact the Thai economy, even with the Oil Fuel Fund's existence.

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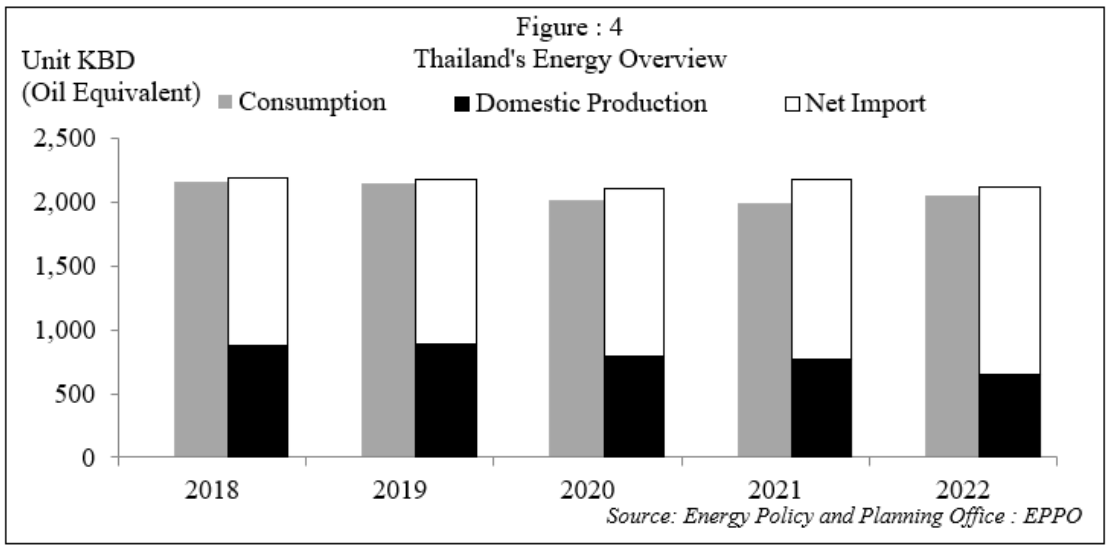
Implication on Thai's Market



EPPO's data *(Figure 4)* highlights a concerning insufficiency in Thailand's domestic energy resources, with more than fifty percent of the country's energy supply being reliant on imports. In periods of highly volatile commodity prices, the combination of the rising energy demand and dependence on foreign can create turbulence in the financial markets. This is particularly for countries that are import-dependent, as businesses in these nations must bear additional expenses, such as freight, insurance, and other premium-related costs, leading to cost-push inflation. The impact of these factors can have a detrimental effect on financial markets, highlighting the critical importance of closely monitoring price behavior and interconnectivity between global and domestic volatility transmission mechanisms for energy-related commodities, as well as their impact on the stock market.

From the point of view, the world is in the midst of the largest transition since the industrial revolution, and energy-related commodities will become even more vital than they have been in the past. Therefore, having a comprehensive understanding of the price behavior of energy-related commodities and the interconnectivity between global and domestic price volatility transmission mechanisms and the stock market is of utmost importance. Additionally, it is crucial to examine the effect of global oil price transmission on the profitability of listed firms, as fluctuations can significantly impact the financial performance of such firms in Thailand. This impact can have implications for the overall economy, making it vital for investors to be aware of the extent of such influence in order to make informed decisions and take appropriate actions.

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Objective of the study

The central contribution of this study aims to uncover the connection between the uncertainty in global-domestic fuel price and the operational efficiency of listed companies in the SETENERG (SET energy sector), as indicated by the Return on Asset (ROA) ratio. The SETENERG (Resource) index was chosen for this research because the energy sector in the Thai market constitutes approximately 25% of the index. From *Figure 5*, it is evident that there exists a significant correlation among the variables, with the energy sector exhibiting the highest correlation with the index.

	AGRO	*CONSUMP*	*FINCIAL*	*INDUS*	*PROPCON*	*RESOURC*	*SERVICE*	*TECH*	*SET*
AGRO	1.0000								
CONSUMP	0.0222	1.0000							
FINCIAL	0.1911	0.6328	1.0000						
INDUS	0.3895	0.6554	0.8158	1.0000					
PROPCON	-0.0027	0.7449	0.9123	0.7136	1.0000				
RESOURC	0.3635	0.3931	0.8594	0.7222	0.7813	1.0000			
SERVICE	0.1820	0.4707	0.8583	0.6489	0.8884	0.8909	1.0000		
TECH	0.6895	-0.4422	0.0544	0.2524	-0.2202	0.2764	0.0772	1.0000	
SET	0.4334	0.4769	0.9240	0.8436	0.8226	**0.9476**	0.9046	0.3453	1.0000

Correlation Matrix of Industry Group in Stock Exchange of Thailand between 2018 – 2022

Consequently, the objectives of this study aim to investigate the following:

i. Do fluctuations in the prices of global oil has significant impact on domestic prices and stock market?

ii. To what extent can the domestic diesel price serve as a primary determinant in elucidating the financial profitability of listed energy sector companies in Thailand?

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LITERATURE REVIEW

Concept, Theory and Relevant Research

The debate regarding the effects of fluctuating energy prices has continued to generate considerable interest and has been a subject of significant concern in a number of recent publications. There is no doubt that the markets are interconnected; however, the strength, intensity, and correlation between commodity prices and the financial market can vary based on the region and time period studied. In examining the effects of oil price fluctuations on equity valuations, (Jones & Kaul, 1996) emerged as the pioneering contributor to comprehensively exploring the dynamic nexus between oil shocks and stock market reactions in four developed economies; Canada, Japan, the United Kingdom, and the United States. Their finding concluded the empirical evidence that oil price shocks influence corporate cash flows, depress profitability, and thus have a direct impact on the stock markets. (Sadorsky, 1999)**,** using the unrestricted VAR model, with monthly oil prices, S&P 500 stock returns, and short-term interest rates over the period 1947–1966, found that both changes in oil prices and volatility influence the performance of real stock returns in the U.S. market. In the same vein, (Diaz, Molero, & Pérez de Gracia, 2016) documented the relationship in the G7 economies using the VAR model. The research found that the stock market's performance deteriorated as volatility increased. (Park & Ratti, 2008) have documented empirical evidence using multivariate VAR analysis to test the volatility of petroleum prices in 13 European countries and the U.S. from January 1986 to December 2005, and have found a strong correlation between the two markets. In addition, it has been demonstrated that an increase in the volatility of oil prices is economically damaging and significantly depresses stock returns in the

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majority of European countries; however, this result also demonstrates a difference in the market's response to price volatility, as the impact has no effect on the real stock returns in the United States. Regarding the debate topic of the relationships between oil prices and financial markets, the majority of researchers confirmed the correlation between the two markets; thus, price shocks play a crucial role in elucidating the changes in stock-market returns. (Jones & Kaul, 1996; Sadorsky, 1999) (concluded the strong evidence between crude oil price change and emerging markets, but the precise relationship depends to a degree on the data frequency employed; daily, weekly, monthly). (Creti et al., 2014; Diaz et al., 2016; Fayyad & Daly, 2011; Kilian & Park, 2009; Oberndorfer, 2009; Park & Ratti, 2008) Although many scholars agree upon the correlation between oil prices and financial markets, the precise nature of this relationship are not so unanimous. According to (Cong, Wei, Jiao, & Fan, 2008) China's oil demand accounted for approximately 9 percent of global consumption in 2006, and the country's foreign dependence on the energy supply has surpassed 40 percent since 2004. Using monthly data from 1996 to 2007 and a standard multivariate vector auto regressive framework, the authors found no evidence of a statistically significant relationship between oil prices and Chinese financial market performance, despite China's substantial oil demand and foreign energy dependence. Consistent with some literatures documented that there is no evidence of the interaction between crude prices and equity markets. (Huang, Masulis, & Stoll, 1996) identified little evidence of such a link in the prices of stocks but only in the oil companies. (Apergis & Miller, 2009) scrutinized that although the interaction between the two exists, the magnitude of such effects turns out to be small; (Sukcharoen, Zohrabyan, Leatham, & Wu, 2014) in a study encompassing 18 countries between

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1982 and 2007, indicated weak dependence for most economies, except for Canada and the United States.

Several reports have investigated the impact of oil price fluctuations on the performance of the oil and gas company. Utilizing general accounting measures in the context of ROE, (Dayanandan & Donker, 2011) determined that oil price fluctuations had a significant impact on the earnings results of oil and gas companies based in North America during the period from 1990 to 2008. Additionally, they found that the performance of these companies was positively affected by high oil prices, but negatively impacted during the great economic and financial turmoil in 2007-2008. The authors further emphasized that commodity prices, particularly oil prices, were the most influential factor in determining the performance of resource-based industries like oil and gas. These conclusions are in line with other studies that have also highlighted a positive correlation between oil prices and oil company profitability (Pirog, Resources Science and Industry Division, & Library of Congress. Congressional Research Service, 2005; Wattanatorn & Kanchanapoom, 2012).

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- Literature gap and contribution -

The following contribution will be made to the existing literature. Although most studies in the literature have focused on the the interplay between crude oil price instability and the stock markets of developed countries such as the U.S. and Europe. However, only inadequate consideration has been dedicated to comprehending the transmission mechanism impact on domestic fuel prices due to global oil price fluctuations affect the performance of listed firms in Thailand. Existing studies predominantly concentrated on examining the influence of oil price turbulence on the

equity market, with less emphasis on firm-level profitability. This study will address this gap by examining the linkage between domestic oil prices and firm profitability, specifically measured through the return on assets (ROA), in Thailand. By examining this linkage, the research will provide valuable insights into the transmission mechanisms of global oil price fluctuations and their impact on the financial performance of listed firms. This analysis will offer insightful information and potentially enhance the predictive power of the research findings, benefiting the academic community and stakeholders involved in the Thai market.

DATA SOURCES, VARIABLES AND SUMMARY STATISTIC

This research paper aims to examine the effects of fluctuating global oil prices on firm performance at the Stock Exchange of Thailand. To conduct the analysis, we utilize data obtained from the Bloomberg Terminal database, which provides information on commodity prices and stock market dynamics. In addition, the domestic retail price of diesel, crucial for our investigation, is sourced from the Bank of Thailand (BOT). It is important to acknowledge that the collection of data on domestic diesel prices is subject to certain limitations. This is primarily due to the infrequent changes in the government-regulated announced price for diesel. As a result, we were only able to acquire monthly data instead of more frequent intervals such as daily or weekly. Furthermore, we gather the quarterly financial and accounting data from 2004 to 2022 for listed firms operating in the petroleum-related and energy sectors, as represented by the SET Energy sector index. This data is sourced from Eikon Refinitiv DataStream. The selected time frame encompasses significant events that have led to energy price volatility, including the global

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financial turmoil, Arab Uprisings, the COVID-19 pandemic, and the recent geopolitical tension between Russia and Ukraine.

The study employs a two-step methodology to comprehensively address our research questions. This approach allows us to thoroughly scrutinize the relationship between oil price fluctuations and firm performance, as well as returns in the Stock Exchange of Thailand.

Table 1	Domestic Diesel	Dubai	SET
Mean	0.499%	0.937%	0.451%
Median	0.117%	1.660%	0.858%
Maximum	16.571%	49.445%	18.214%
Minimum	-18.939%	-39.506%	-24.278%
Std. Dev.	4.733%	9.865%	4.753%
Skewness	-0.597	-0.236	-0.676
Kurtosis	4.232	4.666	4.950
Corr. With Global Oil Price (Dubai)	**0.669**	**1.000**	**0.418**
Corr. With Domestic Diesel Price	**1.000**	**0.669**	**0.281**
Observations	228	228	228

Descriptive statistics of monthly returns of Dubai crude oil, Domestic Diesel price and stock (SET) market index

The descriptive statistics of all three variables under the investigation period (Dubai, Diesel, and SET), transformed into changes in natural logarithm presented in Table 1, exhibit distributions that deviate slightly from a normal distribution, with negative skewness and heavier tails. Correlation coefficients were calculated to assess the relationships between crude oil prices, domestic diesel prices, and stock market returns. The results indicate a moderately positive correlation between Dubai oil prices and domestic diesel prices while there is a moderate positive correlation between both global and domestic fuel prices and the stock market, with correlation coefficients of 0.41 and 0.28, respectively. It is noteworthy to mention that the modest correlations among the independent variables indicate that the possibility of multicollinearity negatively impacting the estimation process is minimal. Therefore,

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we can infer that an increase in oil prices during the investigation period may have been perceived as an indicator of potential gains in stock market returns, although the strength of this relationship is not very strong.

Domestic Oil Price and Energy Sector Listed Firm's Data

The quarterly financial and accounting data for 66 energy sector firms listed on the Stock Exchange of Thailand were collected. Nonetheless, certain selection procedures were implemented to ensure the homogeneity and consistency of the data used in this study, a rigorous selection process was implemented to exclude companies that lacked essential financial information. Additionally, companies with a market capitalization below $10 billion were also excluded. The final sample consists of 25 publicly traded companies. This careful selection process aimed to enhance the quality and reliability of the data and ensure that the findings of the study were robust and representative of the energy sector in Thailand.

Taking into account the significance of synchronizing and aligning all series in this investigation in order to eliminate any potential biases that may result from using different data frequencies (Acaravci, Ozturk, & Kandir, 2012) This study computed the average monthly domestic fuel price on a quarterly basis to ensure that the analysis is based on consistent and comparable data, as the performance of these companies was publicly reported on a quarterly basis, and to align with the quarterly reporting frequency.

The primary indicator of financial performance utilized in this study is the Return on Assets (ROA), calculated by dividing net income by total assets. Additionally, several explanatory variables that have been widely employed in

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previous research were considered to assess the profitability of firms. These variables include Total Assets (Size) and the Leverage ratio, represented by the total debt divided by total equity (D/E). The inclusion of the Leverage ratio is crucial, as it is a significant factor for market practitioners to consider during periods of market volatility. While Liquidity and Asset Turnover ratios (A/O) can also be considered as potential explanatory variables for ROA; however, it is important to address the issue of variable redundancy and multicollinearity. The inclusion of too many variables in a regression model can lead to multicollinearity problems, where the variables become highly correlated with each other. In this case, liquidity and asset turnover measures may overlap with other variables already included in the analysis, such as total assets (size) and leverage ratio (D/E). The presence of redundant or highly correlated variables can introduce instability and ambiguity in the interpretation of the results. To maintain a more parsimonious and interpretable model, we has chosen to exclude Liquidity and Asset Turnover (A/O) variables. This decision is aimed at mitigating the potential issues associated with multicollinearity and ensuring a clearer understanding of the relationship between ROA and the selected explanatory variables.

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Given the complex nature of the market for energy-related commodities and the multitude of factors influencing price fluctuations, it is important to include relevant variables in the analysis. As such, the Thai baht/US dollar (THB/USD) exchange rate, obtained from the Bank of Thailand (BOT), was considered an important variable to incorporate into this study. This variable accounts for the impact of currency exchange rates on the energy market, particularly concerning crude oil,

which is relatively homogeneous and internationally traded based on the economic principle known as "the law of one price."

Furthermore, it has been suggested that when faced with rising oil prices, oil by-product distribution companies promptly and significantly increase their prices, while in the face of falling oil prices, they adjust their prices downward at a slower rate. Several studies have found evidence of asymmetric responses, indicating that companies and oil retailers tend to react more quickly to rising oil prices than to falling ones. This pattern of asymmetric responses has been documented in studies such as those conducted by (Apergis & Vouzavalis, 2018; Radchenko & Shapiro, 2011). To capture the distinct effects of domestic oil prices on firm performance, it is necessary to divide the sample into two groups: refineries and retailer businesses and energy businesses. Refineries and oil retailers have a more direct relationship with domestic oil prices, as their input costs (i.e., crude oil) are tied to changes in domestic oil prices. Consequently, they may swiftly increase their prices in response to rising oil prices and adjust their prices downward at a slower rate in response to falling oil prices. Energy companies, on the other hand, may have a more complicated relationship with domestic oil prices, as they may have multiple revenue streams and be involved in various stages of oil production. Hence, separating the sample into these two groups can assist in identifying and analyzing the distinct effects of domestic oil prices on firm performance within each group, thereby allowing for more precise and informative results.

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Table 2	Mean	Maximum	Minimum	Std. Dev.	Observations
ROA for SETENERG (Energy)	6.43	14.15	-0.85	3.65	76
Domestic Diesel Price (THB/Liter)	26.41	36.14	14.58	4.69	76
Exchange Rate (USD/THB)	33.81	41.34	29.80	3.04	76
ROA for Oil and Gas Companies	*5.62*	*21.73*	*-19.78*	*6.30*	*473*
BCP	4.68	15.60	-4.18	3.86	76
ESSO	1.49	18.69	-19.78	8.29	57
IRPC	3.86	19.46	-16.10	6.47	76
PTG	6.13	11.13	1.49	2.55	39
PTT	8.77	19.56	-0.88	5.44	76
PTTEP	6.24	21.73	-8.06	8.46	45
SPRC	7.46	20.89	-11.91	8.86	28
TOP	7.54	19.03	-4.09	5.59	76
ROA for Others related Energy Sector Stock	*5.74*	*17.67*	*-4.18*	*3.38*	*722*
BANPU	6.43	14.15	-0.85	3.65	76
BCPG	5.38	7.99	3.66	1.22	24
BGRIM	2.98	9.83	-2.24	5.52	23
BPP	4.13	11.41	6.13	1.57	24
CKP	3.42	8.50	-4.18	3.23	37
EA	3.75	6.27	0.95	1.68	40
EGCO	6.36	16.41	1.06	3.68	76
GPSC	3.88	6.64	0.52	1.59	28
GULF	3.95	5.61	2.70	0.98	21
GUNKUL	6.43	14.74	1.39	3.23	48
RATCH	7.01	10.84	2.28	1.93	76
SGP	4.89	17.67	-1.86	2.84	59
SPCG	8.08	14.53	-0.51	4.46	65
SSP	3.99	6.91	4.46	0.63	21
TPIPP	10.73	6.13	1.57	2.28	22
TTW	5.77	13.20	-0.85	3.24	60
WHAUP	6.19	11.86	1.70	3.48	22

Table 2 reports basic descriptive statistic data used in the empirical investigate on of global oil price transmission to domestic diesel prices and the impact on listed firm's performance and stock market. The average domestic diesel price sold at the service stations was 26.41 THB/Liter. The results reveals that the mean ROA for SETENERG, an energy-related company, is 6.43, indicates that, on average, the company is generating a positive return on its assets. The maximum ROA of 21.73 and the minimum ROA of -19.78**,** indicate a wide range of performance among firms

that operate in the extraction of crude petroleum related business (Refineries, E&P and service station businesses) which are particularly sensitive to changes in fuel prices. However, the variability in performance, as reflected in the standard deviation and the wide range of ROA values for other energy related firms suggests that the effects of fuel price movement on firm's performance may vary.

Table 3	Oil and Gas Firms			Other Energy related Firms		
	Assets	D/E	Diesel	Assets	D/E	Diesel
Assets	1.00			1.00		
D/E	-0.10	1.00		0.43	1.00	
Diesel	0.48	-0.56	1.00	0.15	0.16	1.00

Correlation Matrix for independent variables

Table 3 presents the correlation matrix, which highlights the relationships between independent variables of oil and gas companies and other energy-related firms. It is notable that oil and gas companies exhibit a higher positive correlation between the logarithm of asset size (Size) and diesel prices. This suggests that as oil prices rise, these companies may have greater benefit from increased sales revenue, potentially leading to higher profits and increased assets. Conversely, a negative correlation is observed between the company's leverage (D/E) and assets, indicating that as oil prices increase and companies generate more revenue, they may have the opportunity to reduce their debt levels relative to equity. This trend is particularly evident in the case of oil and gas players in comparison to energy-related firms.

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METHODOLOGY AND EMPIRICAL MODELS

Analysis of Global-Domestic Petroleum Prices and Stock Performance

The Vector Autoregressive Model (VAR) is implemented to examine the relationship between multiple variables and to evaluate the precedence and information content between these variables in the time series. In general, the VAR model is utilized for forecasting the performance of interrelated time series and analyzing the complexities of the dynamic relationships resulting from random fluctuations in the investigated variables. By considering the lagged values of all observed variables in the system as endogenous, the VAR approach eliminates the need for structural modeling. Prior studies (Fayyad & Daly, 2011) have effectively demonstrated the efficacy of this model in analyzing the influence of petroleum prices on securities trading markets. Before employing the VAR model, it is imperative to verify the stationarity of all time series within the model, as non-stationary data may resulted in biased and inconsistent estimates, as well as inaccurate inferences. Thus, each series was tested for unit roots by utilizing the Augmented Dickey-Fuller test, and the lags in the test are optimally chosen using the Akaike information criterion (AIC), where the lags term was selected based on the first difference between raw and transformed data. The result of this process should indicate that all series exhibit stationarity.

The mathematical representation of VAR equations can be written as the following:

$$\begin{bmatrix} SET_t \\ Oil_t \\ DDiesel_t \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix} + \begin{bmatrix} \beta_{1,1} & \beta_{1,2} & \beta_{1,3} \\ \beta_{2,1} & \beta_{2,2} & \beta_{2,3} \\ \beta_{3,1} & \beta_{3,2} & \beta_{3,3} \end{bmatrix} \begin{bmatrix} SET_{t-i} \\ Oil_{t-i} \\ DDiesel_{t-i} \end{bmatrix} + \cdots + \begin{bmatrix} \mu_{1,t} \\ \mu_{2,t} \\ \mu_{3,t} \end{bmatrix}$$

$$SET_t = \alpha_1 + \sum_{i=1}^{p} \beta_{11,i} SET_{t-i} + \sum_{i=1}^{p} \beta_{12,i} Oil_{t-i} + \sum_{i=1}^{p} \beta_{13,i} DDiesel_{t-i} + \mu_{1t} \quad (1)$$

$$Oil_t = \alpha_2 + \sum_{i=1}^{p} \beta_{21,i} SET_{t-i} + \sum_{i=1}^{p} \beta_{22,i} Oil_{t-i} + \sum_{i=1}^{p} \beta_{23,i} DDiesel_{t-i} + \mu_{2t} \quad (2)$$

$$DDiesel_t = \alpha_3 + \sum_{i=1}^{p} \beta_{31,i} SET_{t-i} + \sum_{i=1}^{p} \beta_{32,i} Oil_{t-i} + \sum_{i=1}^{p} \beta_{33,i} DDiesel_{t-i} + \mu_{3t} \quad (3)$$

Where the mathematical notation for a VAR equation includes a vector of jointly determined, SET_t , Oil_t and $DDiesel_t$ representing for monthly logarithmic return of the Stock Exchange of Thailand, global oil price and domestic diesel price respectively. The estimated parameters α denote a vector of constants, a matrix of coefficients [$\beta_{11,i}$,…, $\beta_{33,i}$] where *'i'th* component reveals the *i-th* market's impulse response to a unit of random shock in the (stock, oil and domestic diesel) market after a certain period. A vector of stochastic error terms represented by μ_t which captures any remaining variation in the current value of each variable that is not explained by the past values of itself and the other two variables. Choosing an appropriate lag order selection in the system is crucial for VAR. For this reason, the AIC was applied in order to determine the optimal lag order for the model. These criteria aid in balancing the trade-off between goodness of fit and parsimony by penalizing models with excessive parameters (lags). The final number of lags selected for the VAR model is typically determined by choosing the lag structure with the lowest AIC value.

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Domestic Oil Price and Firm Profitability Performance (ROA)

This study's primary objective is to determine the impact of domestic oil prices on the profits of various energy sector companies listed on the Stock Exchange of Thailand. To efficiently capture the dynamics of these effects, a panel data estimation framework is utilized. Given that panel data, incorporates both time series and cross-sectional information, it is prone to encountering problems with heteroscedasticity, endogeneity, and autocorrelation. Regarding empirical methodological frameworks, a number of estimation strategies are provided to alleviate such constraints, such as generalized least squares (GLS), fixed effects, and random effects estimations, which (Wattanatorn & Kanchanapoom, 2012) successfully implemented to examine the relationship between petroleum prices and firm profitability.

The panel data regression to capture the relation between domestic diesel price, exchange rate, firm's size, and the leverage ratio as the dependent variable.

$$ROA_{it} = \omega_1 + \omega_2 DDiesel_t + \omega_3 FX_t + \omega_4 Size_{it} + \omega_5 Leverage_{it} + \varepsilon_{it}$$

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Fixed effects model

$$ROA_{it} = \omega_{1i} + \omega_2 DDiesel_t + \omega_3 FX_t + \omega_4 Size_{it} + \omega_5 Leverage_{it} + \varepsilon_{it} \quad (4)$$

Random effects model:

$$ROA_{it} = \omega_1 + \omega_2 DDiesel_t + \omega_3 FX_t + \omega_4 Size_{it} + \omega_5 Leverage_{it} + \gamma_i + \varepsilon_{it} \quad (5)$$

where ω_{1i} represents fixed effects and γ_i represent firm's random effects.

Empirical Results

In order to investigate the interconnection between global crude petroleum prices, local diesel prices, stock market returns, and the key financial indicator of energy-related listed companies in Thailand, the analysis is segmented into two stages. The initial stage entails the evaluation of a VAR model, which serves to thoroughly scrutinize the intricate relationship among Dubai prices, domestic fuel prices, and the stock market. This rigorous analysis aims to uncover the directional or indirect impact of commodity prices on stock trading market returns.

Subsequently, panel least squares, fixed effects, and random effects models are employed to scrutinize the implication of domestic fuel price changes on the financial earning of energy-listed companies. These models allow for the exploration of the long-term relationship between oil price fluctuations and the key profitability indicator of energy-related companies.

By conducting the analysis in these two stages, the study aims to gain insights into the interplay between oil prices, diesel prices, securities trading market performance, and the profitability results of energy-listed firms in Thailand. This approach enables a comprehensive examination of the various factors and their effects on the dynamics of the energy sector.

Global-Domestic Petroleum Co-Price movement and Stock Returns

Vector Autoregressive Model (VAR) estimates

Table 4 : Results of Unit Root Test

	ADF Test Statistic	1% Critical Value
Dubai	-10.851***	-3.468
Dubai (-1)	-9.730***	-3.468
Dubai (-2)	-9.150***	-3.468
Diesel	-9.783***	-3.468
Diesel (-1)	-8.910***	-3.468
Diesel (-2)	-7.562***	-3.468
SET	-11.535 ***	-3.468
SET (-1)	-10.965***	-3.468
SET (-2)	-7.119 ***	-3.468

Note: The optimal lag length, presented in brackets, for the ADF unit roots tests were based on the AIC criterion
**** indicates statistical significance at 1% level*

The hypothesis of non-stationary variables is tested against the alternative hypothesis of stationary variables by utilizing the Augmented Dickey-Fuller (ADF) statistic. To determine the appropriate lag length from the ADF test, we implement the Akaike information criteria (AIC) for selection purposes. Table 4 exhibits the results obtained from conducting the Augmented Dickey-Fuller unit root test, which was executed with the intention to confirm the stationarity of the monthly dataset (2004-2022), verifying the non-existence of unit root, and thereby affirming the data's stationarity. In our study, the results indicate that we are able to reject the null hypothesis that all variables contain a unit root at all 1%, 5% and 10% level of significance. This implies that the natural logarithm of all variables under consideration display characteristics of stationarity.

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Table 5 : Results of Vector Autoregressive Estimate

	Dubai	Diesel	SET
Dubai (-1)	0.243***	0.183***	-0.013
	(2.960)	(4.808)	(-0.248)
Dubai (-2)	-0.058	-0.009	-0.117**
	(-0.704)	(-0.244)	(-2.278)
Diesel (-1)	0.081	0.127	0.191*
	(0.458)	(1.551)	(1.720)
Diesel (-2)	-0.1141	-0.0507	0.161
	(-0.717)	(-0.689)	(1.608)
SET (-1)	0.805***	0.225***	0.111*
	(7.606)	(4.583)	(1.685)
SET (-2)	-0.0722	0.029	-0.127*
	(-0.611)	(0.529)	(-1.718)
Constant	0.004	0.002	0.005
	(0.706)	(0.609)	(1.343)
R^2	0.2356	0.3171	0.1183

Note that the values in parentheses are the corresponding t-statistics.
****, **, * indicates statistical significance at 1%, 5% and 10% respectively (two-sided tested)*

Furthermore, Table 5 presents an investigation into the impact of variations in commodity prices on the stock market. The analysis was conducted utilizing the Vector Autoregressive Model (VAR) technique. The objective is to assess the influence of global crude prices and domestic diesel prices on the stock market. An in-depth analysis of these findings reveals several noteworthy results.

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The analysis uncovers significant findings. Firstly, the lagged values of Dubai prices display a negative impact on the stock market, as indicated by the VAR estimate. The coefficient for Dubai (-1) is not statistically significant at conventional levels, suggesting that a one-unit increase in the lagged value of Dubai does not have a substantial effect on the stock market. However, the coefficient for Dubai (-2) is both negative and statistically significant at the 5% level. This negative coefficient implies a potential inverse relationship between Dubai prices and the stock market in the medium term. In other words, changes in Dubai prices, with a lag of two periods,

exert a significant negative effect on the stock market, indicating that previous movements in Dubai prices can influence the stock market after a certain time lag.

Conversely, the impact of domestic diesel prices on the stock market exhibits more nuanced dynamics. The coefficient for Diesel (-1) is positive and statistically significant at the 10% level, indicating a positive short-term relationship between domestic diesel prices and the stock market. This suggests that fluctuations in domestic diesel prices can lead to an immediate positive effect on the Thai stock market during the examined period. In contrast, changes in global crude prices, represented by Dubai prices, demonstrate a negatively delayed effect on the stock market throughout the investigated period. This could be attributed to the fact that diesel prices are closely linked to the domestic economy, as reflected by the stock market, whereas Dubai prices are influenced by global factors such as international supply and demand.

Importantly, the empirical findings also indicate a statistically significant relationship between global oil prices (Dubai) and domestic diesel prices, as evidenced by the significant coefficient for Dubai (-1) at the 1% level. However, the direct impact of these fluctuations on the stock market is less definitive and subject to contingencies in the timing of the fluctuations, suggesting that the transmission mechanism linking global oil price movements to the stock market operates over a non-immediate time horizon. It is noteworthy that the indirect influence of global oil price fluctuations on the stock market manifests through their impact on domestic diesel prices.

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Overall, the results suggest that fluctuations in global oil prices, as represented by Dubai prices, have a delayed impact on the stock market. This could be attributed to the fact that Dubai prices are influenced by international factors such as global supply and demand. In contrast, the linkage between alterations in domestic diesel prices and the stock market is considerably stronger, stemming from their inherent association with the domestic economy. Thus, domestic diesel prices serve as a reliable gauge of economic growth and exert an immediate positive influence on the stock market.

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Panel estimation results – SET Energy's listed firms

Table 7	GLS with Hetero	Fixed Effects	Random Effects
ROA for Oil and Gas Companies			
Constant	-30.832***	- 34.773***	-36.186***
	(-6.998)	(-7.727)	(-7.841)
DDiesel	0.317***	0.460***	0.435***
	(5.033)	(7.034)	(6.562)
FX	0.887***	0.934***	0.978***
	(9.087)	(9.122)	(9.421)
Size	0.00	-0.00***	-0.00***
	(0.392)	(-6.872)	(-5.284)
Leverage	-1.486***	-1.048***	-1.194***
	(-5.509)	(-3.671)	(-4.193)
Observations	473	473	473
Number of Stocks	8	8	8
R^2		0.0964	0.0917
ROA for Others related Energy Sector Stock			
Constant	-4.414***	-2.976*	-3.237*
	(-2.630)	(-1.667)	(-1.755)
DDiesel	0.033**	0.054**	0.052**
	(2.425)	(2.032)	(1.963)
FX	0.316***	0.283***	0.285***
	(7.487)	(6.414)	(6.445)
Size	-0.00***	-0.00***	-0.00***
	(-4.873)	(-7.310)	(-7.228)
Leverage	-0.283**	-0.948***	-0.941***
	(-2.421)	(-6.659)	(-6.657)
Observations	722	722	722
Number of Stocks	17	17	17
R^2		0.1428	0.1445

****, **, * indicates statistical significance at 1%, 5% and 10% respectively (two-sided tested)*

Table 7 presents the results of the generalized least squares (GLS), fixed effects, and random effects estimations for the listed SET Energy Sector Oil & Gas companies and other related Energy Sector Stocks. The sample used in the analysis includes 25 firms, and the quarterly data covers the period from 2004 to 2022. Return on Assets (ROA), which is calculated as the ratio of net income to total assets. FX refers to Thai baht/US dollar (THB/USD) exchange rate. SIZE, which represents the natural logarithm of total assets, and Leverage, defined as the ratio of total debt to total equity. Additionally, DDiesel represents the domestic retail price of diesel in Thailand throughout the investigated period.

Empirical Result for Oil & Gas Companies

The empirical results for oil and gas companies indicate a positive and significant relationship between the domestic price of diesel (DDiesel) and the financial performance of oil and gas companies. This relationship is consistently observed across all three models (GLS, Fixed Effects, and Random Effects), with statistical significance at the 1% level. The results indicate that an increase in the price of domestic diesel is associated with an increase in the financial performance of oil and gas companies. This positive relationship can be explained by the behavior of refineries when oil prices rise. In response to higher oil prices, refineries tend to increase their level of investment in production to produce more refined-products. Consequently, firms have the ability to pass on the additional production costs to their customers through enhanced pricing flexibility and profit maximization strategies, which ultimately leads to an increase in their profits. This finding aligns with the previous research conducted by (Dayanandan & Donker, 2011) on listed oil and gas firms in North America.

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Moreover, the coefficient for Size exhibit statistical significant at 5% and 10% levels for both Fixed and Random effect models with a negative sign, implying that an increase in size affects the return on asset negatively for listed oil and gas firms. Additionally, the coefficients related to foreign exchange (FX) are statistically significant at the 1% level and exhibit the expected sign, indicating that baht appreciation benefits the profitability performance of the firms under consideration. Furthermore, the study identifies that the positive influence of foreign exchange on Return on Assets (ROA) is more pronounced compared to the impact of diesel prices. This disparity can be attributed to the unique characteristics of oil-distribution related

firms that engage in importing crude feedstock in USD and subsequently selling it domestically in THB. As a result, when the THB appreciates, these firms experience an increase in the mark-to-market value of their oil inventories. Consequently, this appreciation in FX contributes to a higher positive ROA.

The coefficient estimate for Leverage is also statistically significant and aligns with expectations. Similar to the findings of (Dayanandan & Donker, 2011), the negative and statistically significant coefficient estimate for Leverage indicates that higher levels of debt financing have an adverse impact on the return on assets (ROA) for oil and gas firms. This suggests that excessive reliance on debt can hinder the financial performance of these companies.

Empirical Result for Others related Energy Sector Companies

For other energy sector companies, the results are also generally consistent across the three models. The relationship between Domestic Diesel price and ROA is positive and statistically significant across all three models, albeit at different levels of significance. The coefficient estimates are statistically significant at the 5% level in the GLS with Hetero model and at the 1% level in the Fixed Effects and Random Effects models. The coefficient estimates for Size and Leverage in these companies are also negative, aligning with the findings for oil and gas firms.

Overall, the empirical results suggest that the domestic price of oil, as measured by the price of diesel, has a significant positive effect on the financial performance of both oil and gas companies and other energy-related companies in Thailand. However, the impact is stronger for oil and gas companies compared to other energy-related companies, suggesting that the commodity price plays a

predominant role in driving the performance of listed oil and gas firms. Moreover, the findings indicate that rising diesel prices and favorable foreign exchange rates contribute to higher Return on Assets (ROA). Conversely, larger firm size and increased leverage negatively affect ROA within the broader energy sector.

Though the empirical findings suggest that foreign exchange (FX) has a stronger impact on firm performance than the price of diesel, although both factors are significant in explaining positive performance. The appreciation of the local currency (THB) has a pronounced positive effect on Return on Assets (ROA) for the firms under consideration. While diesel prices also play a crucial role in explaining firm performance, the impact of FX is found to be more influential. Thus, foreign exchange dynamics should be carefully considered alongside diesel prices when analyzing and predicting the financial performance of these firms.

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Conclusion

This study undertakes a comprehensive analysis of the dynamics of volatile oil prices over the past two decades, with the aim of achieving two primary objectives. Firstly, the investigation employs the Vector Autoregressive Model (VAR) technique to delve into the significant impact of fluctuations in global oil prices on both domestic prices and the stock market in Thailand. By utilizing these advanced statistical methods, we are able to explore the complex and dynamic structures as well as the inter-relationships between commodity prices and the stock market within the Thai context. The empirical findings reveal that changes in global oil prices exhibit a delayed effect on the Thai stock market, while domestic diesel prices exert an immediate influence. Consequently, domestic diesel prices serve as a reliable indicator of economic growth and have an immediate positive impact on the stock market. The study demonstrates that domestic diesel prices can serve as a reliable gauge of economic growth and exert an immediate positive influence on the stock market. The proactive measures taken by the government to stabilize domestic retail oil prices further highlight the direct relationship between diesel prices and the Thai stock market. Conversely, the observed delayed effect of Dubai prices supports the notion that changes in global crude prices impact the stock market with a certain time lag, following adjustments in domestic diesel prices and the transmission of global economic conditions. These insights significantly enhance our understanding of the temporal relationship between commodity prices and the Thai stock market, thereby providing valuable insights into the dynamic nature of their interactions.

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Secondly, the study examines further into the impact of changes in domestic diesel prices on the accounting performance measures of energy sector firms. To

facilitate a more in-depth analysis, the sample is divided into two groups based on their association with energy prices for sub-sample analysis. The findings indicate a positive and significant effect of domestic diesel prices on the accounting returns, particularly the return on assets (ROA), for energy sector firms, with a more pronounced effect observed within the oil and gas companies. The primary contribution of this research lies in its ability to shed light on the dominant role played by commodity prices as explanatory factors for accounting performance measures in resource-based industries. Therefore, while the study primarily focuses on the impact of diesel prices, it acknowledges the significant role of FX and emphasizes the need to consider both factors in understanding and managing the financial performance of energy sector firms.

In conclusion, this study makes a substantial contribution to our understanding of the intricate dynamics among global oil prices, domestic prices, stock market performance, and the accounting performance of energy sector firms. The findings derived from this research hold significant relevance and should capture the attention of market participants. The findings offer valuable insights into the immediate and delayed effects of diesel and global oil prices on the stock market, as well as the substantial impact of domestic diesel prices and the impact of FX on accounting performance measures, particularly within the oil and gas companies. The identification of the sensitivity of individual and institutional investors towards commodities and currencies markets, including diesel, global oil market and FX, implies that these markets offer diversification opportunities during periods of price fluctuations, irrespective of their direction. Consequently, these results can be

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effectively utilized to formulate efficient and profitable investment strategies while considering the presence of risks associated with oil price variations.

Moreover, an enhanced understanding of the interconnections between accounting measures (ROA), domestic diesel prices, firm size, and leverage ratios by risk managers in energy firms can contribute to the development of effective risk management strategies. By addressing concerns associated with oil price risk, these strategies have the potential to improve the financial performance of the firms.

Furthermore, corporate entities can leverage this information to evaluate the potential impact of diesel price and FX fluctuations on their own financial performance. Armed with this knowledge, they can make informed strategic decisions aligned with their financial objectives and mitigate any adverse consequences arising from diesel price as well as currencies volatility.

Additionally, the findings shed light on the direct influence of diesel prices on the stock market and their significant impact on the return on assets (ROA) of energy firms. This raises a crucial question for regulators: whether to stabilize diesel prices through government intervention, utilizing mechanisms such as the oil fuel fund, or allow domestic prices to freely adjust in accordance with the global market. Empirical evidence suggests that considering the advantages of allowing domestic diesel prices to adapt to the global market without government intervention might be beneficial. This approach recognizes the positive impact of diesel price increases on higher ROA and encourages market forces to drive efficiency and competitiveness in the energy sector. Ultimately, the decision regarding price stabilization or market-driven

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adjustments requires careful evaluation of the overall economic and financial landscape, considering the potential benefits and drawbacks of each approach.

Further analysis investigating the performance of each firm in different sectors may provide more information on the mechanisms through which firms generate profits or experience losses. By examining the performance of individual firms within specific sectors, we can gain insights into the factors that drive their financial outcomes and identify sector-specific dynamics. Additionally, it would be beneficial to consider additional relevant factors that may influence firm performance. For instance, technological advancements, in conjunction with government regulations, as well as macroeconomic conditions have a significant impact and play a vital role in establishing the linkages between energy-related commodities and firm performance. By integrating these variables into the analysis, a more comprehensive understanding of the determinants of firm performance within different sectors, as well as their collective influence on the stock market, can be attained.

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จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University

VITA

NAME	Koravik Renuros
DATE OF BIRTH	12 Apr 1995
PLACE OF BIRTH	Bangkok
INSTITUTIONS ATTENDED	Chulalongkorn University
HOME ADDRESS	58/1 Soi. Wachirathum Sathit 53 Sukhumvit 101/1 Rd. Bangchak Prakanong Bangkok 10260

จุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY