Oil Shocks and Corporate Investment: Evidence from Stock Exchange of Thailand (SET)

Mr. Pakkawat Kitsirikarn

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ผลกระทบของน้ำมันและการลงทุนของบริษัท : กรณีศึกษาจากตลาดหลักทรัพย์แห่งประเทศไทย (ตลท.)

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By	Mr. Pakkawat Kitsirikarn
Field of Study	Finance
Thesis Advisor	Associate Professor VIMUT VANITCHAREARNTHUM, Ph.D.

Accepted by the FACULTY OF COMMERCE AND ACCOUNTANCY, Chulalongkorn University in Partial Fulfillment of the Requirement for the Master of Science

INDEPENDENT STUDY COMMITTEE

.... Chairman

()

.... Advisor

(Associate Professor VIMUT VANITCHAREARNTHUM, Ph.D.)

.... Examiner

(Boonlert Jitmaneeroj, Ph.D.)

.... Examiner

(Assistant Professor TANAKORN LIKITAPIWAT, Ph.D.)

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This special project empirically examines the impact from the different type of oil price shocks on corporate investment. This study follows the method proposed by Kilian (2009). He uses the structural vector autoregression model to decompose oil price shock into 3 type which comprised with oil supply shock, oil aggregate demand shock, and oil specific demand shock. Moreover, this work also incorporates industrial competition to investigate how it link to the impact of oil shock on corporate investment. The empirically examine period is Jan 2007 to Dec 2018. This study uses the firm-level data of companies listed in the stock exchange of Thailand. Also, this paper includes sub-sample analysis of two groups which are energy-related and non-energy related group.

This study finds that oil price shock from supply side has positive relationship with corporate investment. But oil price shock from the demand sides such as aggregate demand shock and specific demand shock have limited impact on corporate investment. For sub-sample analysis, The empirical finding still in line with all sample. While the existing of industrial competition of non-energy related industry help to mitigate the positive impact of supply shock and we can imply that it reduces overinvestment problem.

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Pakkawat Kitsirikarn

TABLE OF CONTENTS

Page

1. INTRODUCTION

It is essential to consider the impact of oil price shocks on corporate investments, as these shocks can have a negative impact on corporate investments, such as decreasing in extend capacity, investment project and output production (Elder and Serletis 2010). Global oil prices have been extremely volatile during the last decade, therefore using oil shocks to explain corporate investments is critical in an uncertain world.

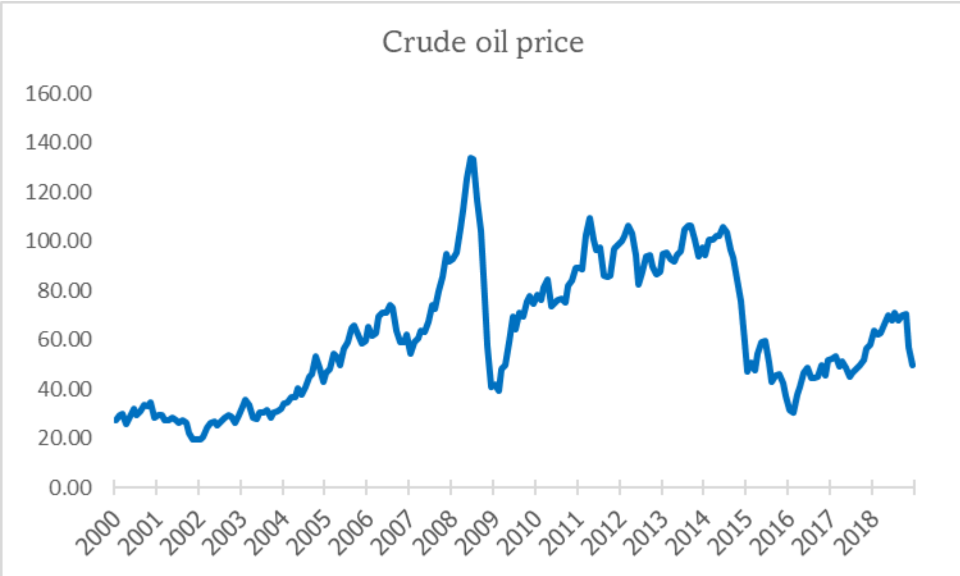


Figure 1: Monthly of WTI since 1 Jan 2000 – 31 Dec 2018.

Firm's decision on their investment projects is crucial part to create growth and sustain its ability to survive. Those decisions might be done for creating a cost efficiency, economy of scale or new innovations. This would lead to the ultimate goal of all firms which is the shareholders' wealth maximization which contributes to GDP directly. So, investigating the factor affecting firm's investment is worth to do so.

In corporate investment context, the oil supply-shortage cause oil price to rise then the companies that rely heavily on oil might boost their investments to improve the oil usage efficiency or shift to alternative source of energy. Thus, it might show positive relationship to corporate investment and adverse relationship would be expected for other firm in different industries. However, if the increase in price is due to economic demand, and enterprises have some successful projects, the negative effects of rising oil prices may be negated or even exceeded. So, it might show a weak positive relationship to corporate investment. Lastly, oil specific shock that come from uncertainty of oil market itself, such as sudden changes in prices from derivative speculation, might cause adversely effect to the corporate investment. Therefore, the different source of oil price shocks might result the differences in its relationships with the firms' investment. This draws my attention to investigate those relationships.

1.1) Overview of Thailand's oil market and its relationship with international oil market

Thailand is increasingly reliant on hydrocarbon imports to meet its rising fuel needs. Domestic crude oil reserves are depleting, and the country imports a large portion of its overall oil consumption.

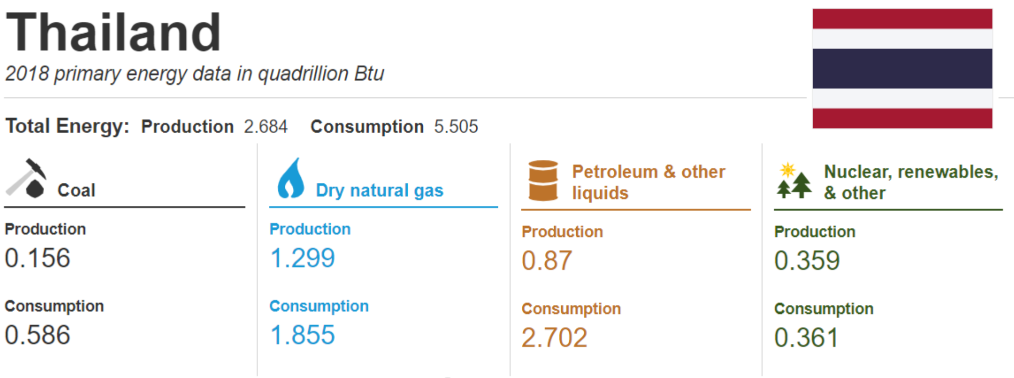


Figure 2: Thailand's oil summary data for 2018, the latest year with complete data in all categories from EIA.

As state in Figure 2, Thailand consumes around 2.702 quadrillion Btu of the petroleum product, but the production is only 0.87 quadrillion Btu. To meet demand and fill the supply gap, Thailand must import a very significant portion of its petroleum liquids.

In figure 3 and 4, Thailand had proven oil reserves of 404.89 million barrels. Thailand's total oil reserves are less than a year's consumption, making the country highly dependent on oil imports to keep its consumption levels stable.

	Barrels	Global Rank
Oil Reserves	**404,890,000**	**50th** in the world
	Barrels per Day	Global Rank
Oil Production	531,329	**29th** in the world
Oil Consumption	**1,302,000**	**17th** in the world
Daily Deficit	-770,671	
Oil Imports	875,446	
Oil Exports	33,237	
Net Imports	**842,209**	

Figure 3: Thailand's oil summary data from EIA.

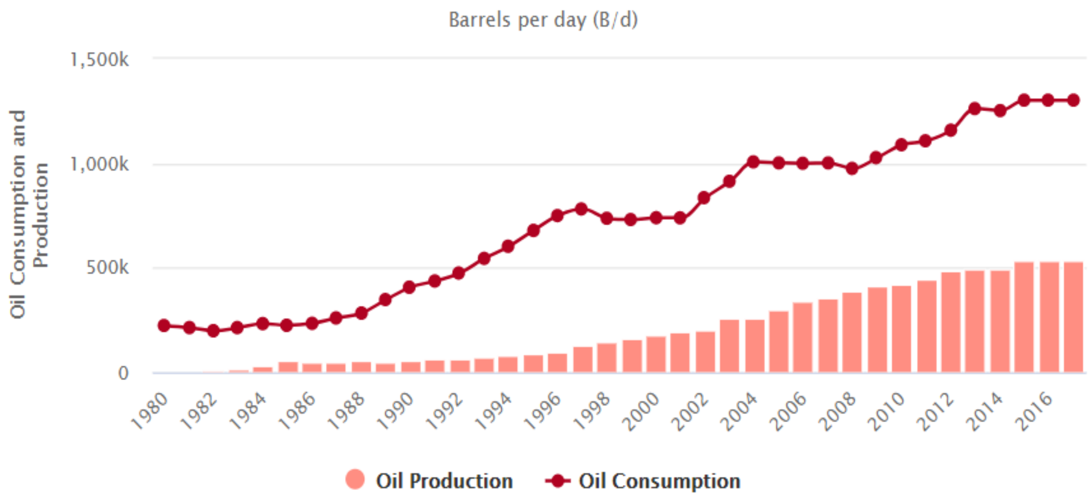


Figure 4: Thailand oil consumption and production (barrels per day) from EIA.

- <u>The correlation between of international crude price and domestic crude price</u>

Because Thailand has the oil fuel fund which was established to stabilize to keep domestic retail oil prices stable, and to carry out additional activities in accordance with government policies affecting the Energy Fund Administration. So, we find the correlations between international oil price (crude oil price) and domestic oil component price (diesel, fuel oil, gasohol and gasoline) to ensure that it still reacts in the same manner.

Correlation Probability	CRUDE_OIL	DIESEL	FUEL_OIL	GASOHOL	GASOLINE
CRUDE_OIL	1.000000				

DIESEL	0.902454	1.000000			
	0.0000	-----			
FUEL_OIL	0.848890	0.937593	1.000000		
	0.0000	0.0000	-----		
GASOHOL	0.865087	0.877778	0.917140	1.000000	
	0.0000	0.0000	0.0000	-----	
GASOLINE	0.849540	0.925132	0.967284	0.962615	1.000000
	0.0000	0.0000	0.0000	0.0000	-----

Figure 5: Correlation matrix of international crude price and domestic oil component price.

As state in figure 5, the correlation matrix shows a very significant statistic that the domestic oil component price has the same behavior with the world oil market price. The lowest correlation between world oil market price and domestic price is gasoline with a correlation of 0.84954 which is very high. And we also plot graphs to see the movement in each major domestic oil component. (see figure 6)

Crude oil price which is a proxy for global oil market is presented in USD per barrel. While the remaining products which are represented as domestic oil price in Thailand are showed in Bath per liter. The graphs show that all of products price move in the same direction but different magnitude. This is because oil fuel fund collects taxes and subsidies each product with different strategy. Gasoline and gasohol are clearly imposed with higher tax to subsidy diesel price so diesel price after 2009 showed lower volatility but diesel price still move in the same manner with international oil price.

According to above reason, we can say that Thailand's oil market has very close relationship with global oil market. So, the impact from global oil shock must inevitably affect Thailand's economy, even the existing of oil fuel fund.

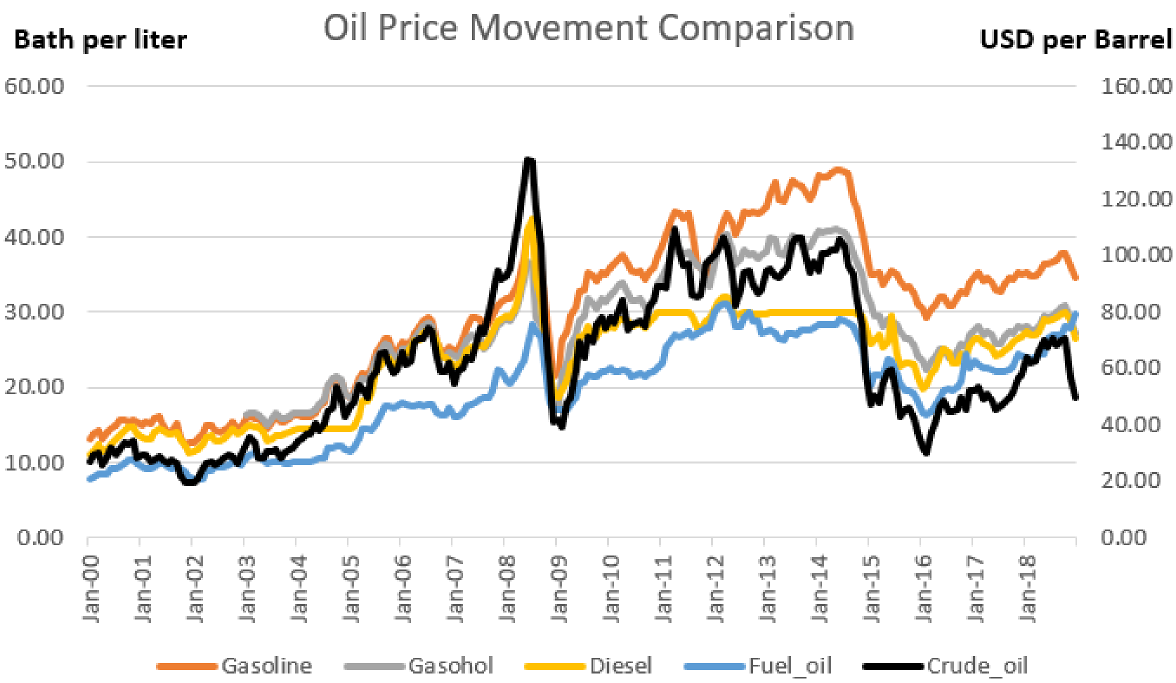


Figure 6: Oil movement comparison

Furthermore, industrial competition is thought to have some impact on firm performance, implying that industrial competition might contribute to the connection between oil price shocks and firms' investment. However, the previous literatures still do not have the exact consensus about how the industrial competitiveness affect other. As a result, this is also an interesting relationship. We'll also factor in the impact of industry competition in our analysis.

1.2) Objective of the study

1) To examine the relationship between the different types of oil price shocks and corporate investments. There are many papers finding about the impact of oil price volatility which was measured by oil standard deviation or oil price return. but it still little or no paper in Thailand assessing about how the different source of price shocks from oil affect corporate investment. The different type of oil price shocks would also have different effect on corporate investment decisions.

2) To examine whether the industrial competition relates to the relationship between oil price shocks and corporate investments or not. The impact of the industrial competition

on the firm's performance have been investigated intensively. But there are only few literatures considering about the essential of how industrial competition relate to the relationship of each oil price shocks and firms' investment.

1.3) Hypothesis of the study

The hypotheses are the different types of oil price shocks might have different relationship with corporate investments, and the industrial competition might contribute the significant influence in the relationship between oil price shocks and corporate investments.

Because The shocks from difference source such as supply, and demand channel should have heterogeneous effect due to its nature. Shocks from supply side come from oil production. This might be the result from oil producers' policy or conflict among them. Raising in oil price from supply shock come from shortage of supply. To cope with restricted oil supplies and sustain regular output, companies may decide to invest more in improving their energy efficiency, production, or as (Xu et al. 2019) state that firms might relocate to alternative energy businesses. Furthermore, (Kim et al. 2017) indicate that a decrease in oil production could result in a reduced interest rate due to an increase in oil prices. Because interest rate adjustment is a macro-level event, a lower interest rate may help various sorts of businesses by lowering their cost of financing. If the price of oil rises as a result of aggregated demand, it could be the result of a growing economy. As a result, there may be a larger demand for oil and energy. And it's possible that this will be accompanied by increased investment. However, a higher oil price may increase a company's production costs, lowering profits and negatively impacting investment. So, if aggregated demand shocks have a greater influence on the growing economy. It's possible that the company may invest less than in the past. Furthermore, oil aggregate demand shocks have a beneficial effect on inflation and interest rates at the macro level (Kim et al. 2017) and (Zhao et al. 2016). For specific demand shocks which is non-fundamental shock, this shock should lead to decreasing in investment. It is difficult to judge, and it will increase uncertainty. In corporate context, Because the firms' decision-making process cannot reversible since the projects start, Therefore, firms might amend or change their project decisions, then wait and see for new information (Jo 2014). As a result, the adverse effect might be the suitable result for the uncertainty that is captured in these specific shocks.

In this paper, we will do the multivariate analysis model with fixed effect, which is popular in most literatures finding the impact of macro factors on firm-level data. The data in used is the annually data for 12 years of listed companies from 2007 to 2018, respecting the implementation of TFRS 9 & TFRS 16, from the Stock Exchange of Thailand.

This paper of mine contributes new evidence to the scarce literature about the effect of oil price shocks and firms' investment focusing on Thailand, which is oil-importing country, using the 3 types of oil price shock. This is a new scope of work using Thailand data to obtain deeper understanding about each effect of oil shocks to firm's investments. As we state earlier, each shock might have difference effect. So, identifying each effect separately will provide more useful understanding. Furthermore, by integrating industrial competition into the equation to see how it connect to the effect of 3 oil price shocks on corporate investment, additional findings supporting industrial competition's contentious influence mechanisms will be provided.

Another contribution of this paper is for policy makers who must implement policy when certain situations of oil shocks come in near future. they might easily find the most appropriate policy to run in those situations.

2. LITERATURE REVIEW

2.1) Oil Price Shock & Overall Market

The research of oil price shock on the financial market or overall economic activities has been investigated extensively and the previous results provide the strong evidence that oil price shock has a strong effect on both I mentioned above. (Hamilton 1983) state that oil price shock is the main driver leading to the U.S. recession after World War II. (Jones and Kaul 1996), (Sadorsky 1999) find that the stock market receives the effect from oil price shock. (Kilian 2009) use SVAR framework to decompose oil price shocks into 3 type which are oil supply shock, oil aggregate demand shock, and oil specific demand shock. The last shock is used to capture price changes resulting from cautious demand due to concerns about oil supplies in the future. The finding is that the oil price shocks was mainly driven by a combination of aggregate demand and specific demand shock rather than supply shock. The different type oil price shocks are not to be the same in its nature and it also has heterogeneous influence on the US economy. (Elder and Serletis 2010) indicate that oil price shock causes the reduction in aggregate investment in U.S. market. (Filis, Degiannakis, and Floros 2011) find a favorable connecting exists between oil prices and stock returns for oil exporting countries, but unfavorable results are true for oil-importing countries. (Zhao et al. 2016) indicate that the different type of oil price shocks has effect on inflation and output in China. (Basher, Haug, and Sadorsky 2016) find that oil supply shock has a weak relationship with exchange. (Kim et al. 2017) finds the negative link of interest rate to oil supply shock but positive to aggregate demand shocks. (Khandelwal, Miyajima, and Santos 2017) find that economic activities and oil price tend to critically affect the asset quality of the banks in the Gulf Cooperation Council (GCC) which is oil-exporting country. The reduction in oil prices could lead to an increase in the NPL ratio. (Huang et al. 2017) state that drastically increasing in world oil price could subpress national economies and this will be a cause of the economic recessions but there are limited findings or evidence to support and prove that a decreasing in oil-price will trigger or lead to economic booms. (Killins and Mollick 2020) find that the asset quality of

Canadian banks is improved with respect to the positive change in oil price. And Canadian banks are oil-exporting country's bank.

2.2) Oil Price Shock & Corporate Investment

Recently, there are many studies investigates the impact of oil price uncertainty on firm investment. Firms will be more likely to postpone their investment when surrounding by more uncertainty. (Bernanke 1983), (Pindyck 1990) suggest that uncertainty increase the option value for waiting new information. (Bloom, Bond, and Van Reenen 2007) suggest that firm's investment do not respond well to demand shocks from political stimulus in the period of high uncertainty. (Yoon and Ratti 2011) investigate the impact of energy price shock on firm investment of U.S. manufacturing firms and find that higher uncertainty causes the less responsiveness of investment to sales growth. (Henriques and Sadorsky 2011) state that after controlling the effect of Tobin's Q and cash flows, the U-shape relationship between oil price volatility and firm investment have been found. (An et al. 2016) investigate the impact of political stability and firm investment. The finding is that firm's investment reduces greatly during political turmoil. (Wang et al. 2017) find the negative impact of oil price uncertainty on firm investment. (Phan, Tran, and Nguyen 2019) state that firm's investment reduces when oil price uncertainty rises but the degree of impact varies across market, economy, and stock characteristic. (Chen et al. 2020) find that oil price shocks have heterogenous effect with corporate investment. Oil aggregate demand and specific demand shock have negative effect. However, oil supply shock has positive effect on firm investment in China. Moreover, a high intensity in industrial competition help to reduce the adverse effect of oil specific demand shock but only limited on other shocks.

2.3) Industrial competition Argument

According to various literatures, the level of industrial competition has a significant impact on business performance. Higher levels of competition can lower market power and profitability. It suggests that businesses in a low-competition industry have a greater ability to tolerate losses and pass the costs on to customers through pricing adjustments ((Gupta and Krishnamurti 2018); (Valta 2012); (Peress 2010)). According to some studies, firms in a greater competitive environment have a stronger incentive to get highest production or investment efficiency ((Nickell 1996); (Scherer and Ross 1990)), or industrial competition can be used as a powerful tool to monitor the economic agents to reduce information asymmetry and overinvestment incentive (Giroud and Mueller 2011). Industrial competition can minimize agency difficulties and increase company performance, according to (Laksmana and Yang 2015); (Jiang et al. 2015); (Lee, Byun, and Park 2019); and (Javeed, Latief, and Lefen 2020).

3. DATA & METHODOLOGY

The data for this paper come from Bloomberg database, Energy Information Administration, Lutz Kilian's personal website and Federal Reserve Bank of ST. LOUIS.

We obtain firm-level data of all listed companies in the stock exchange of Thailand (SET) from Bloomberg database. We exclude bank and other-financial listed companies from our sample because they have difference financial statement nature and format. And because of the implementation of TFRS9 and TFRS16, financial statements are not comparable in with the past format and need to be adjusted manually by users. Therefore, we decide to use the periods between 2007-2018 to cover relevance business cycle with respect to the limitation of TFRS 9&16.

Our firm-level data include corporate investment, industrial competition (SHHI), and the control variables which will be firm leverage ratios, cash flow, return on total assets, administrative expenses, Tobin's Q, sales growth rate, cash holding, debt capacity, firm size. (see appendix 1)

To obtain 3 types of oil price shock (Kilian 2009), which are oil supply shock, oil aggregate demand shock and oil specific demand shock, we get the spot prices of WTI & Brent crude oil to be represented as a benchmark for oil prices indicated by (Liu and Gong 2020) and (Su, Lu, and Yin 2018). For the real global economic activity index, the global oil production, and U.S. CPI, we will download from the website of Energy Information

Administration, Lutz Kilian's personal website, and the website of Federal Reserve Bank of ST. LOUIS, respectively.

3.1) SVAR model for decomposition of oil price shock

According to (Kilian 2009), the oil price shocks will be decomposed into three type based on the cause using SVAR framework, which can be written as follows:

$$A_0X_t = \alpha_0 + \sum_{i=1}^{p} A_iX_{t-i} + \varepsilon_t \tag{1}$$

In equation (1), X_t is a 3 × 1 vector of endogenous variables the percent change of global crude oil production (ΔPRO_t), the index of real economic activity (REA_t), and the real oil prices (ROP_t).

we obtain the data of crude oil production from EIA website and calculate the percent change (ΔPRO_t) in monthly interval. For the real economic activity (REA_t), we obtain this data from Lutz Kilian's personal website.it is the representative single-voyage freight rates available based on various cargoes consisting of grain, oilseeds, coal, iron ore, fertilizer. the level of global real economic activity relates to industrial commodity markets is proportionate to this index. The real oil price (ROP_t) will be calculated using US CPI to convert monthly nominal oil price to the real term.

ε_t is a 3 × 1 vector of structural innovation which is $\begin{pmatrix} \varepsilon_t^{supply\ shock} \\ \varepsilon_t^{aggregate\ demand\ shock} \\ \varepsilon_t^{specific\ demand\ shock} \end{pmatrix}$.

α_0 is the constant terms of the 3 × 1 vector, A_0 is the 3 × 3 contemporaneous matrixes. p is defined as the lag order, used in the equation, of X_t and it will be set to 24 lags following (Kilian 2009). Both sides of equation (1) were multiplied by A_0^{-1} to get the reduced-form of error δ_t as belows:

$$X_t = \beta_0 + \sum_{i=1}^{24} \beta_i X_{t-i} + \delta_t \tag{2}$$

In Eq. (2), $\delta_t = A_0^{-1}\varepsilon_t$. With respect to (Kilian 2009), the restriction matrix of A_0^{-1} assumes that the production of oil does not react to movement in the demand of oil within the immediately time frame. In addition, due to the sluggish nature of the adjustment in global real economic activity, we should expect global real economic activity to be slow to respond to specific demand shocks of oil. Lastly, it is reasonable to assume that real prices of oil will timely respond to movement in production of oil and global real economic activity. Based on the assumptions above, δ_t will be as follows:

$$\delta_t = (\delta_t^{APRO}, \delta_t^{REA}, \delta_t^{ROP}) = \begin{bmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & 0 \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{pmatrix} \varepsilon_t^{supply\ shock} \\ \varepsilon_t^{aggregate\ demand\ shock} \\ \varepsilon_t^{specific\ demand\ shock} \end{pmatrix} \quad (3)$$

In Equation (3), $\varepsilon_t^{supply\ shock}$, $\varepsilon_t^{aggregate\ demand\ shock}$, and $\varepsilon_t^{specific\ demand\ shock}$ is an the different type of oil price shocks which are the oil supply shocks, oil aggregate demand shocks, and oil specific demand shocks respectively.

The yearly corporate-level data will be used as a variable in this work. With respecting to (Kilian and Park 2009) and (Kilian, Rebucci, and Spatafora 2009), we will convert $\varepsilon_t^{supply\ shock}$, $\varepsilon_t^{aggregate\ demand\ shock}$, and $\varepsilon_t^{specific\ demand\ shock}$ as follows:

$$\hat{\sigma}_t^j = \frac{1}{12}\sum_{t=1}^{12} \hat{\varepsilon}_t^j \quad (4)$$

In equation (4), $\varepsilon_{i,t}$ is the monthly interval of oil price shocks (i) obtained from equation (3). $\hat{\sigma}_t^j$ denotes the yearly interval of oil price shocks.

Then we will obtain $\hat{\sigma}_t^{oil\ supply\ shock}$ (OSS), $\hat{\sigma}_t^{oil\ aggregate\ demand\ shock}$ (ADS), and $\hat{\sigma}_t^{oil\ specific\ demand\ shock}$ (SDS), respectively.

The definition for each oil price shocks are as follows

1. Oil supply shock: it is a shock to the amount of oil pumped out of the ground (oil production).

When oil production decreases, oil prices will rise. If the coefficient of oil supply shock is positive. It means that the increase in oil price from oil supply shock will cause firms to invest more whether for energy utilization, energy saving, refinery efficiency or moving to alternative energy.

2. Oil aggregate demand shock: it is a shock to the demand for all industrial commodities including crude oil as well.

The decomposition concept of oil price shocks states that real world economic activity responds to oil supply and aggregate demand shocks in real time. This can imply that aggregate demand shocks are calculated using some portion of global demand that is not affected by oil supply shocks. As a result, it's clear that oil aggregate demand shocks change in response to economic demand while the oil supply have flexible characteristic. If the overall economy or markets are in the period of a blooming/bull market. Then we can expect that people want to consume more and this leads to higher prices of goods such as oil and other commodities.

If the coefficient of oil aggregate demand shock is positive. It means that the blooming/bull market situations have a greater impact on corporate investment than that of the effect from the demand and supply channel of goods. If the coefficient is negative. The effect from the demand and supply channel is greater than the positive effect of the blooming/bull market.

3. Oil specific demand shock: it is a residual oil demand shock designed to capture precautionary and the global crude oil market shocks.

Referring to the how oil price shocks are decomposed, oil price volatility occurred from those specific demand shocks are caused by a number of complicated causes such as unanticipated oil price changes, unexpected disruption in production, and unknowable change in world activity (this type of oil price shocks represent the uncertainty in the oil market).

3.2) Proxy for the industrial competition

We follow previous literatures and use the Sales Herfindahl-Hirschman Index (SHHI) as our proxy for the industrial competition within each industry and consider only the listed firm in SET ((Hoberg and Phillips 2010); (Valta 2012); (Abdoh and Varela 2017); (Gupta and Krishnamurti 2018)).

$$SHHI_{j,t} = \sum_{i=1}^{N_j} S_{i,j,t}^{2} \quad (5)$$

In equation (5), $S_{i,j,t}$ is the market share of sales of the listed firm i in industry j, in year t. For high SHHI, it means a low competitive industry. While a low SHHI indicates a higher competitive market.

$SHHI_{j,t}$, which will be use in our analysis model, is stated as a dummy variable for the level of industrial competition in industry j in year t ((Chen et al. 2020); (Lee, Byun, and Park 2019)). The greatest benefit of dummy variable is to avoid the measurement problems and to present a more intuitive economic interpretation.

Over the sample period, the mean value of SHHI is lower than that of the SHHI of industry j at time t, then it will be set to one or zero otherwise. The value of one indicates that firms are in the concentrated market or low competition industry.

3.3) The regression models

For the first objective, the impact of 3 oil price shocks on corporate investment will be tested by the following equation:

$$CINV_{i,t} = \alpha_i + \gamma_t + \beta_1 OSS_t + \beta_2 ADS_t + \beta_3 SDS_t + \sum \beta_4 Control_{i,t} + \mu_{it} \quad (6)$$

In Equation. (6), $CINV_{i,t}$ is a proxy of the investment of corporate i in year t. It is calculated by the ratio of cash outflow for capital assets from the statement of cash flow divided by total asset. According to previous literature ((Maghyereh and Abdoh 2020); (Wang, Chen, and Huang 2014)), we choose this to be a proxy for corporate investment which is dependent variable.

For oil price shocks, OSS_t, ADS_t, and SDS_t are used as the proxies of oil supply shock, oil aggregate demand shock and oil specific demand shock of year t. And these shocks come from equation 4 and 5.

γ_t and α_i are time fixed effect and firm fixed effect ((Chen et al. 2020); (Phan, Tran, and Nguyen 2019)).

The corporate control variables are as follows: firm leverage ratio, cash flow, return on total assets, administrative expenses, Tobin's Q, sales growth rate, cash holding, debt capacity, firm Size.

For the second objective, we will investigate that how industrial competition link to the effect between oil price shocks and corporate investment using the following equation with interaction terms.

$$CINV_{i,t} = \alpha_i + \gamma_t + \beta_1 OSS_t + \beta_2 ADS_t + \beta_3 SDS_t + \beta_4 SHHI_{j,t} + \beta_5 OSS_t SHHI_{j,t} + \beta_6 ADS_t SHHI_{j,t} + \beta_7 SDS_t SHHI_{j,t} + \sum \beta_8 Control_{i,t} + \mu_{it} \quad (7)$$

In Equation. (7), $OSS_t xSHHI_{j,t}$, $ADS_t xSHHI_{j,t}$, $SDS_t xSHHI_{j,t}$ is proxy for the interaction terms between industrial competition and oil supply, aggregate demand and specific demand shock.

3.4) The sub-sample analysis

The impact of oil price shocks on corporate investments will also be investigated in-dept using the sub-sample analysis. The reason is that the impact from oil price shocks might not be the same across markets. In the scarcity situation, the energy-related company might have incentive to raise their investments to achieve the efficiency of their energy consumption or find other energy sources. While other firms in non-energy-related industries may have less intention to make their investment due to high cost. A total of 258 firms will be included with Energy, Utilities, Materials Consumer Discretionary and Industrials. All of this is the energy related industry. A total of 197 firms will be included with Information Technology, Health Care, Consumer Staples, Telecommunication Services and Real Estate. All of this is the non-energy related industry.

4. EMPIRICAL RESULT

4.1) Descriptive Statistics

Variable	Group	Mean	Std.	Min	Max	Obs.
CINV	ALL	0.0797	0.1840	0.0000	0.6897	3641
	ENERGY-RELATED	0.0751	0.2015	0.0000	0.6897	2099
	NON-ENERGY RELATED	0.0881	0.1617	0.0000	0.4795	1542
SHHI	ALL	0.3691	0.4826	0.0000	1.0000	3641
	ENERGY-RELATED	0.3900	0.4900	0.0000	1.0000	2099
	NON-ENERGY RELATED	0.3500	0.4800	0.0000	1.0000	1542
LEV	ALL	0.2651	0.1834	0.0003	0.7358	3641
	ENERGY-RELATED	0.2827	0.1887	0.0003	0.7358	2099
	NON-ENERGY RELATED	0.2408	0.1730	0.0003	0.7352	1542
CF	ALL	0.0708	0.0970	-0.2622	0.4081	3641
	ENERGY-RELATED	0.0877	0.0977	-0.2622	0.4009	2099
	NON-ENERGY RELATED	0.0580	0.0936	-0.2427	0.4081	1542
ROA	ALL	0.0491	0.0784	-0.6040	0.8423	3641
	ENERGY-RELATED	0.0463	0.0789	-0.5332	0.8423	2099
	NON-ENERGY RELATED	0.0528	0.0773	-0.6040	0.4958	1542
ADEX	ALL	0.1816	0.1627	0.0048	1.3227	3641
	ENERGY-RELATED	0.1598	0.1557	0.0048	1.3227	2099
	NON-ENERGY RELATED	0.2110	0.1667	0.0124	1.2912	1542
TQ	ALL	1.4326	0.8337	0.4294	6.2056	3641
	ENERGY-RELATED	1.2845	0.6587	0.4302	6.1449	2099
	NON-ENERGY RELATED	1.6321	0.9892	0.4294	6.2056	1542
SGR	ALL	0.0825	0.2903	-0.6576	2.4109	3641
	ENERGY-RELATED	0.0928	0.3236	-0.6576	2.4109	2099
	NON-ENERGY RELATED	0.0678	0.2373	-0.6480	2.1850	1542
CH	ALL	0.0921	0.1051	0.0001	0.8037	3641
	ENERGY-RELATED	0.0920	0.1030	0.0001	0.6537	2099
	NON-ENERGY RELATED	0.0920	0.1081	0.0001	0.8037	1542
DC	ALL	0.3897	0.2385	0.0011	0.9839	3641
	ENERGY-RELATED	0.3913	0.2404	0.0011	0.9839	2099
	NON-ENERGY RELATED	0.3886	0.2364	0.0050	0.9564	1542
SIZE	ALL	8.6383	1.4070	5.7860	14.6715	3641
	ENERGY-RELATED	8.7495	1.4707	5.7981	14.6715	2099
	NON-ENERGY RELATED	8.4907	1.3005	5.7860	12.6836	1542

Table 1: Descriptive Statistics of the firm's variable data and industrial competition.

We select all company in the stock exchange of Thailand (SET) in the period between 2007 – 2018 excluding all bank and financial listed companies. After that I minimize the influence of outliers by eliminating at top and bottom of 1% for data then I obtain 3,641 firm–year observations for 455 firms.

For corporate investment (CINV) the mean is 0.0797 for all observations during 2007-2018. The mean for subsample groups is 0.0751 for energy-related group and 0.0881 for non-energy-related group. The maximum value is 0.6897 for energy-related group and 0.4795 for non-energy-related group. And the energy-related group have its standard deviation of 0.2015 or 20.15% which is more than non-energy-related group.

The Mean of Sale-Herfindahl-Hirschman Index (SHHI) is 0.37 with the standard of 0.48. the standard deviation shows relatively high because SHHI is dummy variable. So, the value will be between 0 or 1. SHHI of energy-related group is 0.39 comparing to the 0.35 of the remaining group. Therefore, the competition in the energy-related group shows a bit more intense.

For control variable, cash flow (CF), and firm size (size) of energy-related group have a means value of 0.0877, and 8.75. These mean values show relatively higher than that of non-energy-related group which has a mean value of 0.0580, and 8.49. This is normally be a difference in nature of these 2 groups. Company in energy-related group are a capital-intensive business. So, the size of this group should be larger than other. For cash flow and return on asset, this is also normally nature for energy-related group. Energy-related group typically have a characteristic of cash-cow which generate higher cash flow.

Return on asset (ROA) of energy-related group shows a lower mean value of 0.0463 comparing to 0.0528 of non-energy-related group. The reason is that energy-related group are a capital-intensive business. So, they are bigger when compare to other. Furthermore, their products are energy or commodities related products. This group of products have thin margin comparing to other industries. So, when return on assets are calculated, ROA of energy-related group might be lower than other.

And as we stated earlier that energy-related group is cash cow business and have lower ROA. This represents lower growth opportunity. Investors will value businesses based on their growth opportunities and assets-in-place. So, when the growth opportunities in the investor views are limited comparing to other. The values should not be high in comparative term such as P/E, P/BV ratio. This led to lower mean of Tobin's Q ratio (TQ). A mean value of TQ for energy-related group is 1.2845 while it is 1.6321 for non-energy-related group.

Firm leverage (LEV) also shows some characteristic of 2 groups. Because The energy-related group has more assets than non-energy related group, on average. Thus, they have more collateral for loans. Therefore, energy-related group shows higher mean of leverage of 0.2827 comparing with 0.2408 of non-energy-related group. And This reason should be applied to the debt capacity (DC) as well.

For the remaining control variables, the mean for all sample of administrative expense ratio (ADEX), sale growth rate (SGR), and cash holding (CH) are 0.1816, 0.0825, and 0.0921, respectively.

Variance Inflation Factors (VIFs) are used to ensure that the model is not influenced by multicollinearity. All VIFs are less than 1.8, and the mean VIF is less than 1.5. As a result, multicollinearity issues should not be a problem.

4.2) Decomposition of the real price of crude oil into 3 components by structural model

We use the data cover the period from Jan 1991 to Dec 2018 of global crude oil production, real economic activity index, real WTI spot price and real Brent spot price. Our SVAR model follow the (Kilian 2009) method which set lag period to be 24 lags. The possible reasons of this used data set are as follow.

According to (Killins and Mollick 2020), They point out the flaws in estimating VAR models for the global oil market. The first is estimating the model using a sample size that is too small. There must be enough variance in the data produced by each shock for structural VAR models to be identified. We are less likely to experience such fluctuation if the estimating interval is shorter.

Another mistake is to rely on lag lengths that are substantially shorter than those indicated by (Kilian 2009) and other studies. The occurrence of long cycles in global commodity markets necessitates the inclusion of at least two years' worth of monthly lags in the VAR model, as explained by (Kilian and Lütkepohl 2017). Models with shorter lags will miss slow-building and slow-declining cycles, underestimating the relevance of flow demand shocks. Using traditional lag order selection criteria like the SIC or AIC is also not recommended. Therefore, we perform the SVAR model and then get the matrix of the estimated parameters showed in Appendix 2

Variable	Mean	Std.	Min	Max	Obs.
OSS_WTI	-0.0199	0.2089	-0.3976	0.3183	3641
ADS_WTI	0.0123	0.3541	-0.5886	0.5352	3641
SDS_WTI	-0.0043	0.2540	-0.4257	0.3869	3641
OSS_Brent	-0.0231	0.2135	-0.4220	0.3431	3641
ADS_Brent	0.0057	0.3545	-0.5566	0.5832	3641
SDS_Brent	0.0095	0.2786	-0.5510	0.4246	3641

Table 2: Descriptive Statistics of 3 oil price shock obtained from SVAR model.

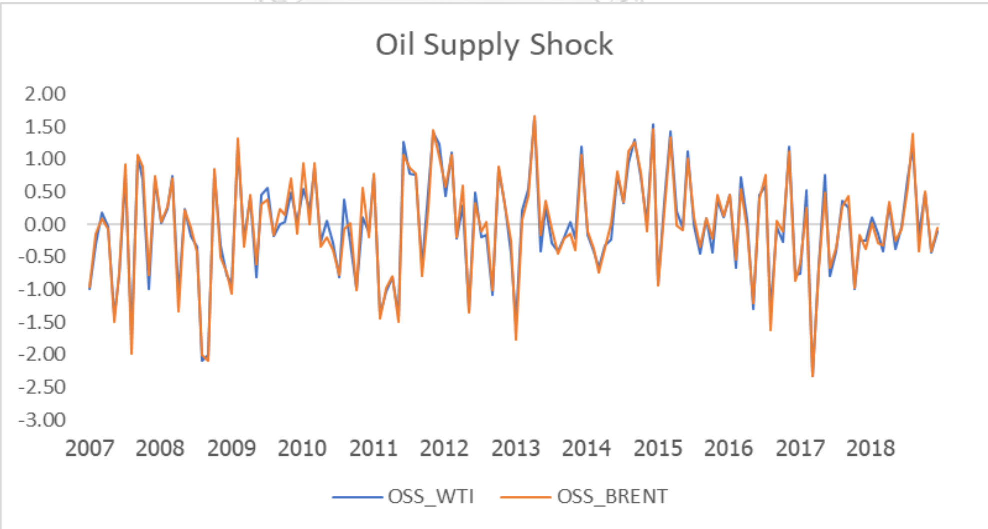
We present the mean, min, max, and standard deviation of oil price shocks in Table 2. The mean value of the price shock from supply side derived from real WTI price and real Brent price are -0.0199 and -0.0231, respectively. The standard deviations are 0.2089 and 0.2135, respectively

While the mean of aggregate demand shock from real WTI price and real Brent price are 0.0123 and 0.0057, respectively. The standard deviations are 0.3541 and 0.3545, respectively

The mean of specific demand shock from real WTI price and real Brent price are -0.0043 and 0.0095, respectively. This difference in sign might come from the specific nature of each oil market such as WTI for drilled oil from US and Brent for drilled oil from North Sea. The standard deviations are 0.2540 and 0.2786, respectively

The data show that oil price shock of both demand and supply side from real Brent price present slightly more volatility than shocks derived from real WTI price.

Figure 7 indicates that the 3 oil price shocks obtained from SVAR calculated from WTI and Brent are significantly connected. We can see a clear reduction in both of demand shocks during 2008, which is in line with the real situation. Because the 2008 financial crisis significantly impact to the demand in oil market, international oil prices have fallen sharply. In 2014, however, there was a lot of volatility in the oil demand shock. This is owing to the fact that, in the late 2014, international oil prices sharply decrease due to the strong US currency, unexpected increase in supply from the rapid oil production in the US, the Iranian conflict, and other factors.



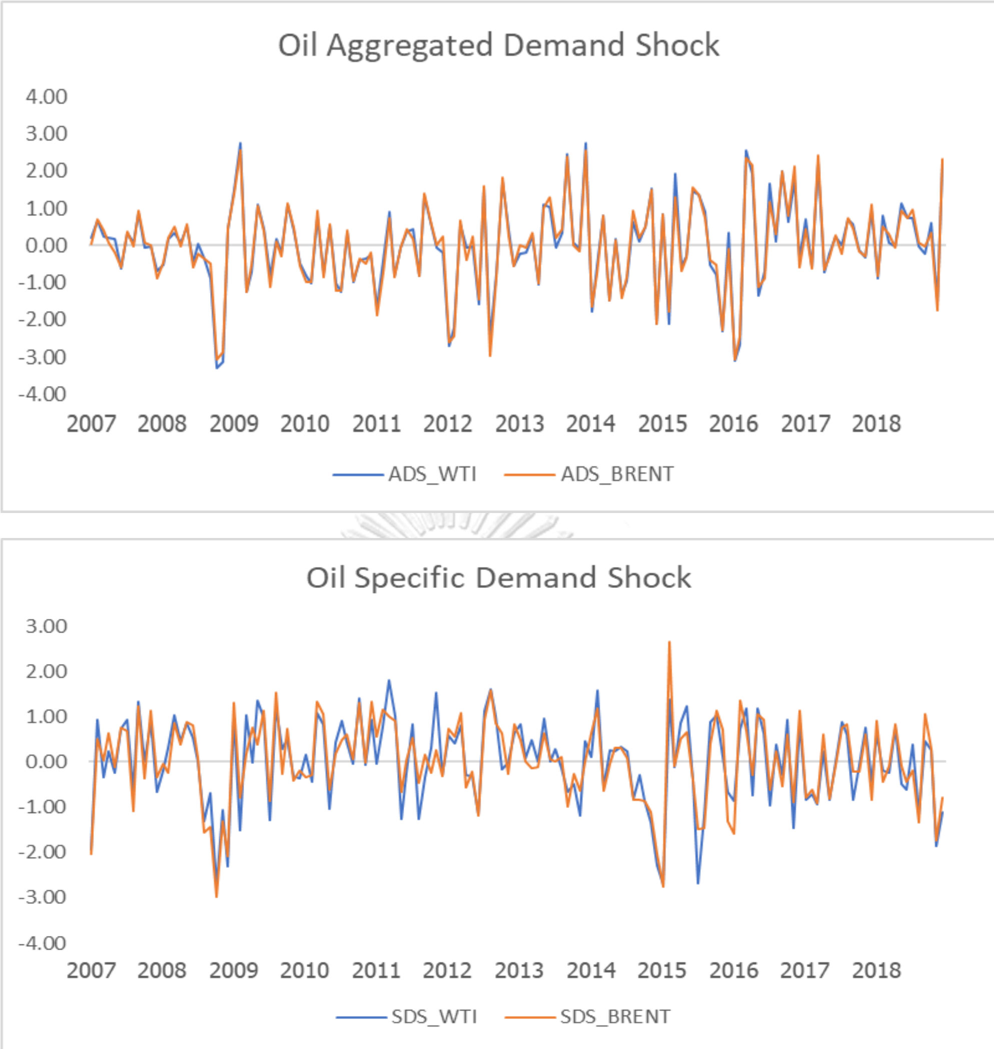


Figure 7: Three type of oil price shocks calculated from real WTI and Brent price using SVAR.

4.3) Impact of each oil price shocks on firms' investment

I use the panel regression model to test the impact of oil price shock. I perform the Hausman test to verify that the fixed effect is suitable for my empirical analysis. Then we perform a modified Wald statistic for groupwise heteroskedasticity in the residuals of a fixed effect regression model and it suggest that there are heteroskedasticity problem. So, we decide to use robust standard error to deal with heteroskedasticity to get all regression results in this paper.

VARIABLES	Whole Sample			
	(A) WTI CINV		(B) BRENT CINV	
OSS	0.0399***	(0.0123)	0.0403***	(0.0124)
ADS	-0.0102	(0.0119)	-0.00668	(0.0115)
SDS	-0.00936	(0.0100)	-0.00299	(0.0104)
LEV	0.0216	(0.0355)	0.0258	(0.0352)
CF	-0.169***	(0.0358)	-0.168***	(0.0358)
ROA	0.256**	(0.105)	0.263**	(0.105)
ADEX	0.268	(0.203)	0.268	(0.203)
TQ	0.0314	(0.0228)	0.0315	(0.0229)
SGR	0.0808***	(0.0175)	0.0818***	(0.0175)
CH	0.197***	(0.0643)	0.197***	(0.0643)
DC	0.608***	(0.126)	0.605***	(0.126)
SIZE	0.00892	(0.0147)	0.00658	(0.0145)
Constant	-0.358*	(0.200)	-0.339*	(0.199)
Observations	3,641		3,641	
Number of c_id	455		455	
R-squared	0.131		0.131	
Model	FE		FE	

Notes: (A) WTI is the result from the shock calculated by WTI price. BRENT (B) is the result from the shock calculated by Brent price. The standard error show in the parentheses. The significant level of the coefficient at the 1%, 5% and 10% will be show as ***, **, and *, respectively

Table 3: The regression results of the impact of 3 oil price shocks on corporate investment.

Table 3 report the regression results based on the shocks calculated from real WTI and real Brent price on the firms' investment. the coefficients of oil price shocks which is supply, aggregate demand, and specific demand shock from real WTI spot price are 0.0399, -0.0102, -0.00936, respectively. While the coefficients of shocks from real Brent spot price are 0.0403, -0.00668, -0.00299, respectively.

Only oil supply shock (OSS) from WTI and Brent are significantly positive at the 1% level. We can explain the results that oil price shock from supply side has a positive effect on the corporate investment. On the other hand, oil price shock from both demand sides have negatively affect the corporate investment. But the effect price shock of demand side has no significant relationship with corporate investment in Thailand.

4.4) Sub-sample analysis

VARIABLES	(A) WTI				(B) BRENT			
	energy-related		non energy-related		energy-related		non energy-related	
	CINV				CINV			
OSS	0.0425**	(0.0181)	0.0386**	(0.0149)	0.0424**	(0.0180)	0.0404**	(0.0156)
ADS	-0.0213	(0.0171)	-0.00595	(0.0132)	-0.0179	(0.0165)	-0.00973	(0.0129)
SDS	-0.00526	(0.0146)	-0.0226	(0.0149)	-0.0183	(0.0163)	-0.0118	(0.0130)
LEV	0.0164	(0.0421)	0.0586	(0.0632)	0.0207	(0.0419)	0.0620	(0.0631)
CF	-0.184***	(0.0550)	-0.0979*	(0.0561)	-0.184***	(0.0551)	-0.0966*	(0.0562)
ROA	0.431***	(0.155)	0.0722	(0.133)	0.439***	(0.155)	0.0770	(0.131)
ADEX	0.437	(0.317)	0.0324	(0.0591)	0.437	(0.317)	0.0320	(0.0584)
TQ	0.0581	(0.0454)	0.00588	(0.00784)	0.0585	(0.0456)	0.00579	(0.00795)
SGR	0.0632***	(0.0165)	0.126***	(0.0437)	0.0637***	(0.0164)	0.128***	(0.0438)
CH	0.238***	(0.0876)	0.178**	(0.0875)	0.237***	(0.0873)	0.178**	(0.0880)
DC	0.713***	(0.165)	0.430***	(0.0787)	0.711***	(0.164)	0.428***	(0.0792)
SIZE	-0.00800	(0.0157)	0.0244	(0.0212)	-0.00970	(0.0157)	0.0214	(0.0207)
Constant	-0.320	(0.259)	-0.336**	(0.162)	-0.306	(0.259)	-0.311*	(0.158)
Observations	2,099		1,542		2,099		1,542	
Number of c_id	258		197		258		197	
R-squared	0.187		0.091		0.187		0.091	
Model	FE		FE		FE		FE	

Notes: (A) WTI is the result from the shock calculated by WTI price. BRENT (B) is the result from the shock calculated by Brent price. The standard error show in the parentheses. The sub-sample group will be show seperately using energy-related and non-energy related. The significant level of the coefficient at the 1%, 5% and 10% will be show as ***, **, and *, respectively.

Table 4: The regression results of the impact of 3 oil price shocks on firm investment based on sub-samples.

For **Table 4**, we try to examine whether the oil price shocks have different impacts on the corporate investment with respect to sub-sample or not. **Table 4** reports the regression results of the impact of oil price shocks based on the shocks calculated from real WTI and real Brent price on the firms' investment for energy related and non-energy related group.

For the shock calculated from real WTI price. The coefficients of oil supply shocks are 0.0425 for energy related group and 0.0386 for non-energy related group, and both are significantly positive at 5% level.

For the shock calculated from real Brent price. The coefficients of oil supply shocks for each group are 0.0424 for energy related group and 0.0404 for non-energy related group, and both are significantly positive at 5% level.

These findings suggest that oil price shocks calculated from various sources can have varying effects on business investment in Thailand's as a whole and also be true when we perform sub-sample analysis as well. Furthermore, the impact of oil supply shocks, when we perform the sub-samples analysis, is still in line with the all sample. However, based on the coefficient values, oil supply shocks, which are merely statistically significant, appear to have a higher degree of impact on corporate investment in the energy related business. We'll look at why oil supply shocks have a favorable influence on corporate investment in Thailand, which is an oil-importing country.

Our finding about the impact of oil price shock from supply-side is supported by the work of (Broadstock and Filis 2014). Their finding is that the relationship between Chinese stock market and supply shocks return is positive. This finding could be explained by the fact that Thailand has been in the process of transitioning from a developing to a developed economy for several decades. Thailand is in a period of increasing oil consumption. However, as a result of supply shocks, oil prices have risen, world oil output has decreased. agents may decide, in the name of the firm, to make an investment to improve energy efficiency or create new technologies to deal with limited of oil supply and maintain their competitiveness. Firms that consume massive energy have a bigger incentive to invent eco-energy devices or move to the renewable business.

According to (Xu et al. 2019), oil-importing countries such as China have prioritized the research and application of energy-usage efficiency technologies and renewable energy. On the other side, (Kim et al. 2017) state that an increase in oil prices due to decreasing oil production could result in a lower rate of interest. The reason is that interest rate movement is a major event in macro-level, by lowering interest rate, most economic agents would receive benefit such as reducing in cost of financing.

The finding from (Huang, Li, and Wu 2021) indicate that oil supply shock is more relevance in driving industry returns when comparing with oil demand shock. While (Baumeister and Hamilton 2019) find that the disruption in oil supply is the greatest factor of oil price movement since the past. This is also in line with our result that oil supply shock is statistically significant.

the greater impact of oil supply shocks that we find in this paper for the energy related group is very reasonable. Because the firms in this group are depend on oil and commodity product as indispensable cost for their production. And Thailand's oil dependence has been increasing year by year so it is rational to imply that oil supply will affect Thailand's corporate investment.

Then we give the explanations for our findings of non-energy related group. the recent analyses show that an oil supply shock can have a considerable impact on China's non-energy-related industry (Zhao et al. 2016). Furthermore, oil supply shocks might affect interest rates and inflation (Kim et al. 2017), affecting non-energy-related industries as well. According to (Elder and Serletis 2010), macro-level cyclical variations can be caused by the oil market shock that spread to corporate decision. The reason is that the macro-economy cannot be sufficiently dispersed from particular significant industries so it will lead industry-level volatility.

4.5) Testing the role of industrial competition

VARIABLES	(A) WTI				(B) BRENT			
	energy-related		non energy-related		energy-related		non energy-related	
	CINV				CINV			
OSS	0.0635**	(0.0291)	0.0207*	(0.0127)	0.0610**	(0.0287)	0.0230*	(0.0132)
ADS	-0.0367	(0.0255)	-0.00588	(0.00990)	-0.0324	(0.0239)	-0.00843	(0.0101)
SDS	-0.00764	(0.0183)	-0.0339**	(0.0147)	-0.0222	(0.0206)	-0.0225*	(0.0117)
SHHI	0.0213	(0.0353)	-0.00588	(0.0158)	0.0179	(0.0351)	-0.00835	(0.0151)
OSSxSHHI	-0.0617	(0.0433)	0.0634**	(0.0305)	-0.0569	(0.0429)	0.0575*	(0.0318)
ADSxSHHI	0.0405	(0.0299)	0.00990	(0.0297)	0.0376	(0.0288)	0.0133	(0.0281)
SDSxSHHI	0.0107	(0.0230)	-0.0274	(0.0402)	0.0155	(0.0229)	-0.0285	(0.0365)
LEV	0.0174	(0.0427)	0.0619	(0.0641)	0.0220	(0.0425)	0.0648	(0.0643)
CF	-0.183***	(0.0552)	-0.0956*	(0.0550)	-0.183***	(0.0555)	-0.0934*	(0.0553)
ROA	0.421***	(0.155)	0.0742	(0.131)	0.430***	(0.155)	0.0800	(0.129)
ADEX	0.437	(0.315)	0.0363	(0.0593)	0.437	(0.315)	0.0370	(0.0589)
TQ	0.0587	(0.0457)	0.00580	(0.00776)	0.0590	(0.0457)	0.00575	(0.00789)
SGR	0.0633***	(0.0166)	0.126***	(0.0445)	0.0637***	(0.0166)	0.128***	(0.0448)
CH	0.233***	(0.0871)	0.183**	(0.0862)	0.232***	(0.0869)	0.182**	(0.0869)
DC	0.713***	(0.166)	0.434***	(0.0802)	0.710***	(0.165)	0.432***	(0.0809)
SIZE	-0.00557	(0.0148)	0.0256	(0.0228)	-0.00750	(0.0146)	0.0231	(0.0224)
Constant	-0.349	(0.256)	-0.349**	(0.172)	-0.332	(0.253)	-0.327*	(0.168)
Observations	2,099		1,542		2,099		1,542	
Number of c_id	258		197		258		197	
R-squared	0.189		0.093		0.189		0.093	
Model	FE		FE		FE		FE	

Notes: (A) WTI is the result from the shock calculated by WTI price. BRENT (B) is the result from the shock calculated by Brent price. The standard error show in the parentheses. The sub-sample group will be show seperately using energy-related and non-energy related. The significant level of the coefficient at the 1%, 5% and 10% will be show as ***, **, and *, respectively.

Table 5: The regression results of the impact of 3 oil price shocks on firm investment based on SHHI.

For **Table 5**, we perform the tests to investigate how industrial competition relate to the impact of oil price shocks on corporate investment in Thailand. We select Sales-Herfindahl-Hirschman Index (SHHI) to be a proxy for the industrial competition level.

The tested results are reported in **Table 5** by including SHHI to our equation. We get the coefficients of oil supply shocks derived from real WTI and real Brent price for energy-related company. And the values are 0.0635 and 0.0610, respectively, and significantly positive at 5% level. While the coefficients of oil supply shocks derived from real WTI and Brent spot price for non-energy-related company are 0.0207 and 0.0230, respectively, and significantly positive at 10%. This represents the in-line result as before including the role of industrial competition.

Furthermore, we find that the coefficients of oil specific demand shock from real WTI and real Brent spot price of non-energy-related group are -0.0339 and -0.0225, respectively, and significantly negative at 5% level for the shock derived from real WTI spot price. While the coefficient from the shock derived from real Brent spot price is significantly negative at 10% level.

The unfavorable impact of oil price shock from specific causes or events on non-energy-related company investment can be linked to these reasons. According to the method of decomposition of oil price shocks, the movement of oil price caused by specific events are the result of a complex set of factors, including unexpected oil price changes, speculative intent, unexpected production disruptions, and unknowable change in activity of commodity around the world (Broadstock and Filis 2014). To put it another way, it is hard to determine the source of this shock. And this shock might come with unfavorable situation on overall market. So, non-energy related company might also be affected by unfavorable condition/uncertainty. In corporate context, managers, on behave of the firm, might not decide to invest when they face high uncertainty (Jo 2014). Therefore, this might lead to the result that the negative effect of oil specific demand shocks on the corporate investment. The coefficient is significantly negative for non-energy related group. While energy related group is a capital-intensive business. They plan to invest in long term. So, they may not consider those non-fundamental shock.

For the insignificant results of oil aggregated demand shock in all regression results, the possible reasons might be the following. As Thailand is oil-importing country, normally the level of consumption of oil depends on the level economic activities. In the situation of blooming economy, the level of oil demand will be high and thus lead to higher oil price. This should lead to lower consumption of oil. However, because of blooming situation, companies get more benefit from investing than that shock in price come from demand side. But Thailand has internal uncertainty within country which might affect corporate investment (An et al. 2016). An increasing in uncertainty causes the value of option to increase and thus it might lead manager to decide to postpone firm investment ((Bernanke 1983), (Pindyck 1990)). Furthermore, (Phan, Tran, and Nguyen 2019) states that the impact of oil price uncertainty varies across market, economy, and stock characteristic. So, the mixed situation between blooming/glooming in world economic activity and internal uncertainty in Thailand might be the most reasonable answer for this insignificant result of oil aggregated demand shock (Bloom, Bond, and Van Reenen 2007).

For energy-related group, most of them are capital intensive businesses. Their decision to make an investment is plan for long term for example 5-10 year. Therefore, shock from demand side might not be the relevance reason to adjust their investment planning to future technology. And the previous literature finds that oil supply shock is more importance than oil demand size shock (Baumeister and Hamilton 2019); (Huang, Li, and Wu 2021) which is in-line with our finding.

Next, we will explain the regression results when we include industrial competition. Based on real WTI and Brent price, it can be found that the coefficient of the interaction term between industrial competition and oil supply shocks (OSSxSHHI) is 0.0634 and 0.0575 and it is significantly positive at 5% and 10% level, respectively, for non-energy-related industry. This means that higher level of competition can weaken the positive impact of oil supply on the corporate investment of non-energy-related group. While all remaining coefficients of interaction terms show limited result, and it is not statistical significance for both of sub-sample and real spot price.

Our result that high level of competition reduced the positive impact from oil supply shocks might come from the following reasons: In the oil market, there is a lot of information friction, which might make economic actors confused about what's driving the price of oil

(Byrne, Lorusso, and Xu 2019). Because a high level of industry competition is beneficial for mitigating information asymmetry and improving firm performance ((Boubaker, Saffar, and Sassi 2018); (Lee, Byun, and Park 2019)). Industrial competition can improve the investment efficiency by more intentionally investing effectively to avoid an overinvestment problem. Thus, the positive effect of oil supply shocks on corporate investment is mitigate.

5. Conclusions

This paper tries to examine the impact of different sources of oil price shocks on the corporate investment of firms listed in the Stock Exchange of Thailand (SET). Specifically, following Kilian's SVAR framework (Kilian 2009), oil price shocks are decomposed into oil supply shocks, oil aggregate demand shocks, and oil specific demand shocks. After that, using a panel regression model, the different effect of oil price shocks on Thailand's firm investment is estimated. In addition, we examine whether industrial competition influences the link of the relationship we state above. Using 3,641 firm-year observations in the covering the period from 2007 to 2018, our regression results suggest that oil price shock from supply side has positive effect on corporate investments.

Then, we perform sub-sample analysis by dividing the all sample into two groups based on how it relates to the energy price. Our findings show that oil price shock from supply side still in line with we mentioned above. while the investment of energy-related group shows more vulnerable to the supply shocks. On the contrary, the impact from specific demand side on corporate investment show significantly negative for non-energy-related industry. While oil aggregated demand shock shows no significant impact to corporate investment in Thailand for all regression results.

Finally, the empirical results find that a high level of industrial competition in non-energy related group weaken the positive relationship of oil supply shocks on corporate investment which is reduce an overinvestment problem. while industrial competition shows limited or no relationship with others.

Our findings are useful to the policy makers. Rather than relying solely on oil price changes, they have a clear picture of what oil shock drive the economy in which ways. Policymakers and regulators should support technological advancements that enhance energy utilization efficiency Furthermore, they should promote the level of competition to mitigate the overinvestment problem.

APPENDIX

Appendix 1: Variable Definition

Corporate Investment **(CINV)**	cash outflow from cash flow statement for capital assets scaled by total assets from balance sheet
Oil supply shock **(OSS)**	a shock related to the oil production and obtained from the SVAR framework
Oil aggregate demand shock **(ADS)**	a shock related to the fundamental demand and obtained from the SVAR framework
Oil specific demand shock **(SDS)**	a shock related to the unexpected adverse event in demand and obtained from the SVAR framework
Sales Herfindahl-Hirschman Index **(HHI)**	sum of the square of sale market share for each firm in each industry.
Firm Size **(SIZE)**	convert the firm total asset to the natural logarithm form
Firm leverage ratio **(LEV)**	total debt from balance sheet devided by total assets from balance sheet
The Tobin's Q ratio **(TQ)**	total value by market capitalization devided by firm's whole assets from balance sheet
Return on assets **(ROA)**	net profit from income statement devided by average total assets calculated from balance sheet
Cash holding **(CH)**	Selling and administrative expenses from income statement devided by gross revenue from income statement
Selling and administrative expenses **(ADEX)**	operating cash flow from cash flow statement devided by total assets from balance sheet
Firm's cash flow **(CF)**	total sale in year T minus total sale in the year before then devided by total sale in year T
Sales growth rate **(SGR)**	cash and cash equivalent plus tradable securities (from balance sheet) devided by total assets from balance sheet
Debt capacity **(DC)**	net fixed assets from balance sheet devided by total assets from balance sheet

Appendix 2: The matrix of the estimated parameters from SVAR

1	0	0
-0.6023	1	0
0.1314	-0.1129	1

the matrix of the estimated parameters from SVAR based on WTI spot price.

1	0	0
-0.5440	1	0
0.2971	-0.1243	1

the matrix of the estimated parameters from SVAR based on Brent spot price

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VITA

NAME	Pakkawat Kitsirikarn
DATE OF BIRTH	31 January 1994
PLACE OF BIRTH	Bangkok
INSTITUTIONS ATTENDED	Master of Science in Finance, Chulalongkorn University Bachelor of Accountancy, Thammasat University
HOME ADDRESS	Nonthaburi 11000