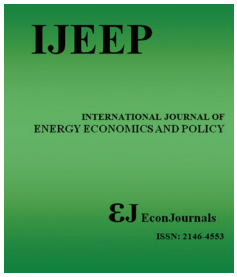

International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2015, 5(4), 926-933.

The Effect of Stock, Government Policy, and Monopoly on Asymmetric Price Transmission in Thailand

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ABSTRACT

The article studies of asymmetric price transmission (APT) of gasoline price and diesel price and their causes in Thailand. The study employs the monthly data of West Texas Instrument crude oil price, unleaded gasoline (ULG) price and high speed diesel (HSD) price, the oil fund, the stock of ULG and HSD inventories. The results show that APT exists for ULG but not for HSD. The oil fund does not influence on the price asymmetry. Whether the oil fund is levied, the price asymmetry always presents for ULG but not for HSD. Moreover, the marketing margins or firms' profits do not cause the asymmetric price for both. However, the oil fund and the marketing margins could make ULG prices adjust more quickly but HSD more slowly. The government is successful to use the oil fund directly to regulate the market gasoline and diesel price. The firms' monopoly power could also indirectly maintain those prices stable and make ULG price adjust more slowly and HSD more quickly. Finally, the stocks of ULG and HSD do not have the effects on the price asymmetry. The asymmetry is influenced mainly by the oil fund and the marketing margins. Firms do not need to adjust their price and their quantity.

Keywords: Asymmetric Price Transmission, Oil Fund, Marketing Margins, Stock of Inventories
JEL Classifications: C32, Q41, Q48

1. INTRODUCTION

Oil and their petroleum product industry in Thailand is one type of the supply chains. Based on their production process, the oil and their petroleum product industry have three stages: Upstream, intermediate, and downstream industry. First, the upstream industry focuses on sourcing crude oil from both domestic producers and imports. The products of this stage are crude oil, natural gas, condensate, and petroleum product. Second, the intermediate industry emphasizes on production process and business units. For production process, natural gas is transported by pipelines to ex-refineries. The business units cover imports, exports, and trading those oil products. Third, the downstream industry stresses on the distribution of those petroleum products – gasoline, diesel, liquefied-petroleum-gas, and so forth - to end consumers.

In Thailand, crude oil around 86% is imported and around 14% is produced domestically. Normally, the petroleum products are essential raw material for every industry sector, particularly transportation sector. Around 60% of petroleum products, such as gasoline and diesel, are used for transportation.

The structure of petroleum product prices in Thailand is based on the Singapore reference price, called Mean of Platts (MOPS). MOPS is the average oil price declared by the Platts in Singapore. The government uses the Singapore reference prices as a reference for the domestic prices in the country. There are several official committee established by the government cabinet and the government agency to regulate the domestic petroleum prices. The government claims are that Singapore is the center for trading products in Asia, the transportation costs are low, and Singapore prices are competitive prices and can prevent speculation.

Because the oil and their petroleum products are the fundamental raw materials, factors, or costs for every industry, their prices can affect every party and finally lead to people's costs of living. Most of crude oil and their petroleum products are imported from

the far eastern countries, the large producers in the world. The oil and their petroleum price usually move along with the world crude oil price. Figure 1 shows the movement of West Texas Instrument spot crude oil price and the announced domestic unleaded gasoline (ULG) and high speed diesel (HSD) prices. Normally, those gasoline and diesel prices move closely together with the world crude oil prices.

In Thailand, the government regulates the oil price and their petroleum product prices directly by the excise tax, the municipal tax, the conservation fund, and the oil fund. The excise tax is the government's instrument to control the consumption, while the municipal tax is the local tax that municipals collect in their communities. The conservation fund is collected for environment purpose. These three instruments are normally unchanged. It might need to correct the laws and the wills. On the contrary, the fund is the government instrument to directly regulate the country's oil prices and their petroleum prices. Figure 2 shows the oil fund levied on ULG95 and HSD. The ULG price is normally levied more oil fund than HSD, the oil fund charged on gasoline is more stable.

Moreover, most market share of oil and petroleum products, around 73.8%, is held by the five producers and distributors: Petroleum Authority of Thailand (PTT) (37.5%), Esso (10.4%), Bangchak (9.3%), Shell (9.2%), and Chevron (7.4%). The remaining market share, around 33.8%, is held by the small or local entrepreneur. For the pumps or gas stations, PPT has around 1472 branches, Bangchak around 1065 branches, PTG around 772 branches, Esso around 519, and Shell around 517 (the data is upon June 2014). We find that only the five big firms hold most market share and do the related oil businesses. Therefore, in Thailand, the oil and their petroleum products are oligopolistic. PPT also has the highest market share and highest number of pump service. Furthermore, PTT do the whole business in the supply chain from the upstream to downstream. PTT's businesses starts from crude oil import, refinery, storage, wholesale, and retail as well as do another business in each of its business chain. Moreover, around a half of PTT's equity shares are held by the government. Based on a few large oil and petroleum products in Thailand, those firms might have a monopoly power, control the oil market, and influence the oil and petroleum product prices. Figure 3 shows the stock and Figure 4 shows the marketing margins of ULG and HSD. The stock of ULG is lower and more stable, while the marketing margins are higher.

From the oil fund, oligopolistic market, and stock of inventories, it might suspect that the gasoline and diesel price in Thailand are asymmetric price or sticky, especially when the upstream price increases. Those three factors might make the price unable to adjust immediately and completely, particularly in the short.

The asymmetric price transmission (APT) (Peltzman, 2000) can exists by several causes. The three main causes are monopoly (Borenstein and Shepard, 2002), adjustment cost (Borenstein, 1991), and political intervention, such as price support, imperfect and asymmetric information, and psychological pricing (Mayer and von Cramon – Taubadel, 2004). Most past researches are

Figure 1: Crude oil prices versus unleaded gasoline 95 and high speed diesel

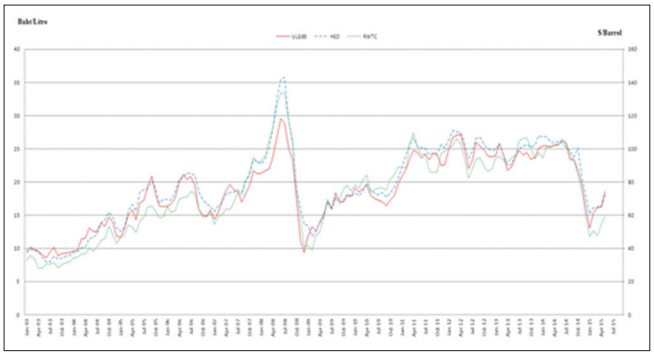


Figure 2: Oil fund levied on unleaded gasoline and high speed diesel

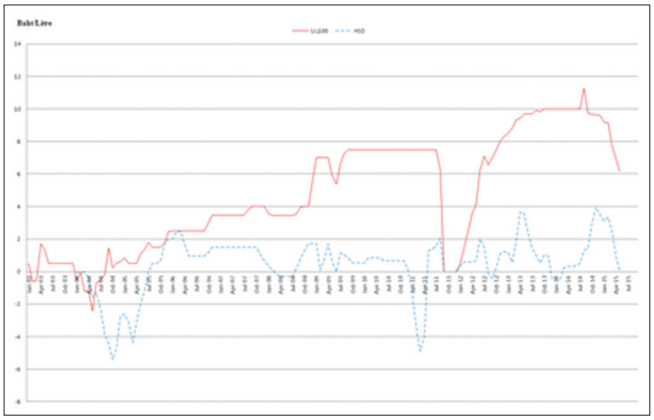


Figure 3: Stock of unleaded gasoline 95 and high speed diesel

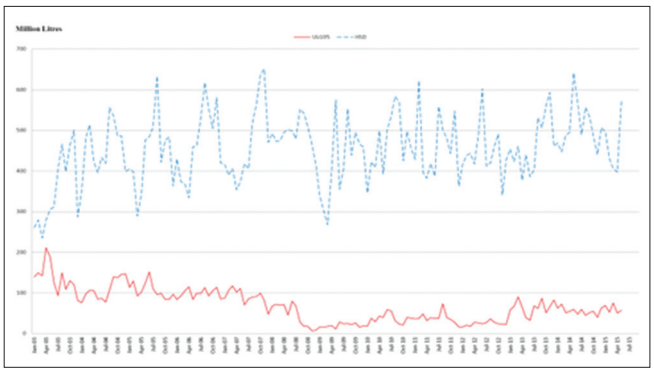
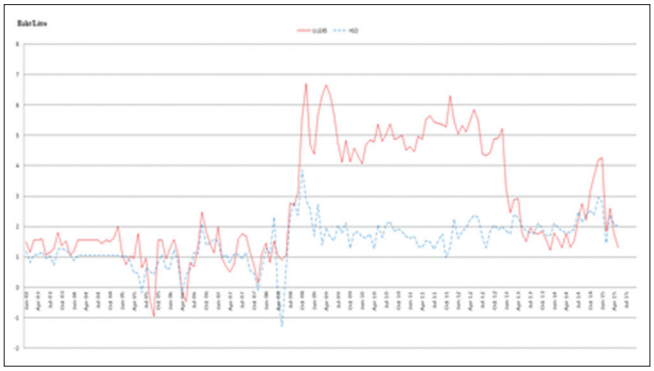


Figure 4: Marketing margins of unleaded gasoline 95 and high speed diesel



conducted the US market (Balke et al, 2002); only a few researches are the case of another country such as UK (Bacon, 1991), Netherland (Bettendorf et al, 2002), Canada (Godby et al, 2000), Germany, France, etc. Moreover, crude oil price and gasoline price are often studied for the asymmetric price transmission (Radchenko, 2004; 2005).

The positive asymmetric price exits from crude oil price to retail price. Imperfect information and competition could make firms maintain their retail price when the crude oil price decreases. Production and inventory also responds more to negative shocks than positive shocks (Borenstein and Shepard, 1996; Borenstein, Cameron, & Gilbert, 1997).

Moreover, the econometric models and the data frequency have influence on the results (Grasso and Manero, 2005). For example, Chen, Finney, and Lai (2005) use the threshold error correction models (Enders and Siklos, 2000) and find that the asymmetric price transmission for downstream price can occur not only through the spot markets of crude oil and refinery gasoline but also through the future markets. However, the weekly data presents the price asymmetry, not daily data (Bachmeier and Griffin, 2003).

People's expectation to oil prices could induce the asymmetric price. The retail gasoline prices respond much faster to anticipated changes in crude oil prices than to unanticipated changes. The positive shock of inventory, or the adjustment costs of the gasoline price, also causes the asymmetric price (Radchenko, 2004; 2005).

The market structure and currency also have the influence on the results. Most countries import crude oil by the US Dollar but sell the petroleum products such as gasoline in their local currency. The market structure in each country is also different. For the studies of France and Germany, L' Oeillet and Lantz (2009) find that no presence of price asymmetry for three petroleum products – gasoline, diesel, and heating oil, and for three transmission channels – refinery, distribution, and retail channel. Some researches study the diesel prices. or instance, Fosten (2012) discovers the asymmetric price transmission of diesel price in the United States.

Inventory plays the crucial role for price adjustment (Pindyck, 1994; Ye et al, 2002). Price responds to demand shocks more for lower stock than higher stock (Reagan, 1982). In addition, when demand shocks are high, firms adjust their prices rather than quantities to make more profits. On the other hand, when demand shocks are low, firms adjust their sales quantities or decrease their production instead of prices. This situation also leads to asymmetric price adjustment (Reagan and Weitzman, 1982). Moreover, several empirical studies employ the theory of storage model to various commodities (Pindyck, 2001; Pindyck, and Knittel, 2013). Byun (2013) shows that because crude oil inventories are positively related to convenience yield but negatively related to gasoline production, financial investors might anticipate the future prices from crude oil inventories. However, the studies do show no contribution from financial investors in the crude oil markets.

In this study, we will show the test results of Thailand. Moreover, we will fill the gaps of the past studies. A few studies show the case of Thailand and some petroleum products are no longer produced such as leaded gasoline (ULG91), low speed diesel, and Gasohol 91. Furthermore, the markets of petroleum products in Thailand are different from those of most developed countries. Government regulates the petroleum product prices through the excise tax, the municipal tax, the conservation fund, and the oil fund. Moreover, only a few large producers and distributors play the crucial role in the petroleum markets. Those firms might be monopolistic. Finally, we investigate the effect of the stock of petroleum inventories in this study.

2. CONCEPTUAL FRAMEWORKS

In this section, we will propose the conceptual framework for the studies. Since the gasoline and diesel prices are normally announced by the committee established by the government before the prices can be changed, this information is known in advance for most people. Therefore, the asymmetric and imperfect information is not possible. Therefore, we will not study the case of asymmetric and imperfect information. We will pay attention to the government intervention through the oil fund, the firms and producers' monopoly power through marketing margins, and the adjustment costs through stock of petroleum inventories.

2.1. Test for Government Policy

Figure 5 shows the movement of the oil fund for each petroleum product price, and Figure 6 shows the components of wholesale price. We see that the oil fund is one component of wholesale price and occasionally changes according to the government policy. Therefore, the oil fund might have influence on the wholesale price. Therefore, we will compare between the base and normal case for the usual wholesale price and the case of without the oil fund. We will exclude the oil fund and calculate the new hypothetical wholesale and then compare its results.

Figure 5: The components of wholesale price

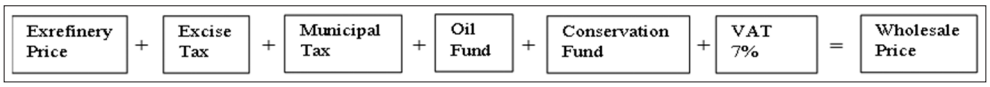
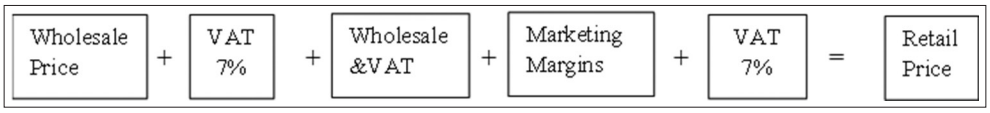


Figure 6: The components of retail price



2.2. Test for Monopoly

Figure 6 shows the component of retail price. The wholesale price in the Figure 5 that is added by and 7% value-added tax (VAT) is the officially announced wholesale price. With the marketing margins and 7% VAT, we have the retail price. Since a few large producers make the oil and their petroleum products the oligopolistic market. In fact, it might be monopolistic market, since PTT holds around 70% market share. We use the marketing margins for monopoly power proxy. Moreover, the marketing margins can reflect the profits that firms charge the final consumers and influence on the retail price. Thus, we compare the retail price in case of with and without the marketing margins.

2.3. Test for Stock of Petroleum Inventories

To test the stock effect of petroleum inventories on which producers, distributors, wholesalers, or retailers must hold, gasoline and diesel storages can be established on each chain, such as refinery storage, wholesale storage, or retail storage (pumps or gas stations) both in cities the refineries located (main storages) and distribution cities or provinces (sub-storages). Hence, we can test the stock effect on each stage of supply chains.

3. METHODOLOGY AND DATA

3.1. Data

For this study, the spot West Texas Instrument crude oil prices are obtained from the Energy Information Administration. For Thailand data, ULG and diesel prices are obtained from the Energy Planning and Policy Office and the stock of petroleum products are obtained from Ministry of Industry. All data are monthly. Furthermore, we employ the spot West Texas Instrument crude oil price as a proxy for the world crude oil price, and its unit is US Dollar/Barrel. Although the ex-refinery price is referred by the Singapore price, the Energy Planning and Policy Office data shows its unit in Baht/L after an exchange rate conversion. The other remaining data are expressed in local currency (Baht/L).

3.2. Econometric Model

In this study, we use the asymmetric error correction model to test the price asymmetry. The model is as follows:

$$\Delta P_{D,t} = \nu^{+}\left(P_{Up,t-1} - \delta_0 - \delta_1 P_{D,t-1}\right)^{+} + \sum_{j=1}^{k^{+}} \lambda_s^{+}\left(\Delta P_{Up,t-s}\right)^{+} + \sum_{j=0}^{m^{+}} \mu_s^{+}\left(\Delta P_{D,t-s}\right)^{+}$$

$$+\nu^{-}\left(P_{D,t-1} - \delta_0 - \delta_1 P_{Up,t-1}\right)^{-} + \sum_{j=1}^{k^{-}} \lambda_s^{-}\left(\Delta P_{Up,t-s}\right)^{-} + \sum_{j=0}^{m^{-}} \mu_s^{-}\left(\Delta P_{D,t-s}\right)^{-} + \varepsilon_t$$

Where, $x^{+} = \max(x, 0)$ and $x^{-} = \min(x, 0)$, the subscript *Up* means upstream price and *D* means downstream price, the subscript *t* indicates time index, *k* and *m* mean the highest lag.

Moreover, the model has the following explanation and interpretation.

1. The error correction terms can be separated as follows:

$$EC^{+} = \left(P_{D,t-1} - \delta_0 - \delta_1 P_{Up,t-1}\right)^{+} = \max\left(P_{D,t-1} - \delta_0 - \delta_1 P_{Up,t-1}, 0\right)$$

And $EC^{-} = \left(P_{D,t-1} - \delta_0 - \delta_1 P_{Up,t-1}\right)^{-} = \min\left(P_{D,t-1} - \delta_0 - \delta_1 P_{Up,t-1}, 0\right)$,

Where, the coefficients in the error correction term $\left(P_{D,t-1} - \delta_0 - \delta_1 P_{Up,t-1}\right)$, δ_0 and δ_1, are the co-integrating factor.

2. The coefficients of the error correction terms ν^{+} and ν^{-} represent the speed of adjustment back to equilibrium. Moreover, we can test for the long run adjustment of price transmission by testing the hypothesis that $\nu^{+} = \nu^{-}$
3. The coefficients on the changes in downstream prices λ_s^{+} and λ_s^{-} represent the short run marginal effects
4. This study uses the level data for this econometric model.

4. RESULTS

In this section, we will show the test results. The test results will be separated for each petroleum product.

4.1. ULG95 Price

Tables 1-3 shows the test for government policy (the oil fund), monopoly (marketing margins), and adjustment cost (the stock of ULG and HSD inventories). For the base case, the results indicate that APT exists in ULG95 price. The price asymmetry occurs on each stage of supply chains: From crude oil price to ex-refinery price, from ex-refinery price to wholesale price, and from wholesale price to retail price. The positive price asymmetry happens both in the long run and in the short run. In the short run, the increasing upstream price transmits faster to the downstream price than does the decreasing upstream price. In the long run, the speeds of adjustment of the upstream prices are less than those of the downstream prices. The market adjusts very slowly. Only for the case of decreasing upstream price of the ex-refinery – Wholesale chain, the speed of adjustment magnitude is greater than one, so the system is unstable. Moreover, for the case that we remove the oil fund and the marketing margins from the price structure, the results expresses that the price asymmetry of the chain from ex-refinery price to wholesale price is still exchanged. Therefore, the oil fund does not have an effect on the price asymmetry. In addition, for the cases that we remove the oil fund from the chain and compare the outcomes between with and without marketing margins, we see that marketing margins have no influence on the price asymmetry. Either with marketing margins or not, the price asymmetry would not exist. The short run effects are not much different when the oil fund and the marketing margins are removed. However, the long run adjustments for decreasing upstream price are faster or unstable than those of the increasing upstream price. Finally, for the oil stock, price asymmetry does not exist in the long run for all chains. However, it might occur slightly for falling price on wholesale and retail price in the short run.

4.2. HSD

Tables 4-6 shows the test results of HSD, which can be interpreted similarly. The results show that for the base case, the APT does not exist in the long run but exist only in the short run. In the short run, the price asymmetry occurs particularly on the decreasing upstream price on each stage of supply chains: From crude oil

Table 1: Base case (ULG95)

Independent variables	Variable - Relationship		
	P_{Up}=Crude oil price P_D=Ex-refinery price	P_{Up}=Ex-refinery price P_D=Wholesale price	P_{Up}=Wholesale price P_D=Retail price
	$\Delta P_{D,t}$	$\Delta P_{D,t}$	$\Delta P_{D,t}$
EC^{+}_{t-1}	0.033930*** (0.008691)	0.018964 (0.017998)	0.015543 (0.017667)
$\Delta P^{+}_{Up,t}$	0.101043*** (0.024724)	0.948047*** (0.086989)	0.858231*** (0.054828)
$\Delta P^{+}_{D,t-1}$	-	-	-
EC^{-}_{t-1}	0.279256** (0.138748)	4.701162 (5.271410)	0.606211** (0.312453)
$\Delta P^{-}_{Up,t}$	0.246891*** (0.018329)	1.009640*** (0.066772)	0.760176*** (0.043655)
$\Delta P^{-}_{D,t-1}$	-	-	-
Number of observations	144	144	144
R^2	0.683328	0.784406	0.852553
Long run asymmetry $v^{+}=v^{-}$	−0.245326** (0.141532)	−4.682199*** (5.283875)	−0.590668* (0.314329)

***1% significant, **5% significant, *10% significant, ULG: Unleaded gasoline

Table 2: Test for oil fund and marketing margins

Independent variables	Variable - Relationship		
	P_{Up}=Ex-refinery price P_D=Wholesale price w/o oil fund	P_{Up}=Ex-refinery price P_D=Retail price w/o oil fund	P_{Up}=Ex-refinery price P_D=Retail price w/o oil fund and marketing margins
	$\Delta P_{D,t}$	$\Delta P_{D,t}$	$\Delta P_{D,t}$
EC^{+}_{t-1}	0.026369* (0.016057)	0.013731 (0.012190)	0.025798* (0.015893)
$\Delta P^{+}_{Up,t}$	1.038589*** (0.047772)	0.784357*** (0.091546)	0.970005*** (0.045071)
$\Delta P^{+}_{D,t-1}$	-	-	-
EC^{-}_{t-1}	1.274345*** (0.506026)	0.937798 (1.151144)	2.586357 (6.728108)
$\Delta P^{-}_{Up,t}$	1.104392*** (0.035487)	0.852579*** (0.059996)	1.035000*** (0.034174)
$\Delta P^{-}_{D,t-1}$	-	-	-
Number of observations	144	144	144
R^2	0.934912	0.764798	0.934068
Long run asymmetry $v^{+}=v^{-}$	−1.247976*** (0.506349)	−0.924067 (1.151731)	−2.560559 (6.729984)

***1% significant, **5% significant, *10% significant, ULG: Unleaded gasoline

price to ex-refinery price, from ex-refinery price to wholesale price, and from wholesale price to retail price. Similar to ULG price, the positive price asymmetry happens both in the long run and in the short run. In the short run, the increasing upstream price transmits faster to the downstream price than does the decreasing upstream price. In the long run, the speeds of adjustment of the upstream prices are less than those of the downstream prices. For the decreasing upstream price of the crude oil – ex-refinery and the ex-refinery – wholesale chain, the speeds of adjustment magnitude are greater than one, so the system is unstable. Furthermore, the oil fund does not affect the price asymmetry. Either with or without the oil fund, the price asymmetry does not exist in the long run. The short run effects are not much different whether the oil fund is imposed or the marketing margins are removed. However, the long run adjustments for decreasing upstream price are faster or unstable than those of the increasing upstream price. For the marketing margins, price asymmetry would not appear either with or without it. Finally, the oil stock does not have any effect on price asymmetry on all price levels both in the long run and the short run.

Table 3: Test for inventory (ULG95)

Independent variables	Variable - Relationship		
	P_D=Ex-refinery price INV=Inventory	P_D=Wholesale price INV=Inventory	P_D=Retail price INV=Inventory
	$\Delta P_{D,t}$	$\Delta P_{D,t}$	$\Delta P_{D,t}$
EC^{+}_{t-1}	0.000799	0.002803	0.005353
	(0.001435)	(0.005378)	(0.004179)
ΔINV^{+}_{t}	0.009141	0.000296	−0.001519
	(0.012184)	(0.014828)	(0.011749)
$\Delta P^{+}_{D,t-1}$	-	-	-
EC^{-}_{t-1}	0.007877	−94.19522	−0.032436
	(0.014718)	(1491349)	(0.047261)
ΔINV^{-}_{t}	0.010486	0.025405*	0.020895*
	(0.011724)	(0.015196)	(0.012506)
$\Delta P^{-}_{D,t-1}$	-	-	-
Number of observations			
R^2	0.060984	0.036912	0.035404
Hypothesis test	−0.007078	94.19802	0.037790
$v^{+}=v^{-}$	(0.013649)	(1491349)	(0.045659)

***1% significant, **5% significant, *10% significant, ULG: Unleaded gasoline

Table 4: Base case (HSD)

Independent variables	Variable - Relationship		
	P_{Up}=Crude oil price P_D=Ex-refinery price	P_{Up}=Ex-refinery price P_D=Wholesale price	P_{Up}=Wholesale price P_D=Retail price
	$\Delta P_{D,t}$	$\Delta P_{D,t}$	$\Delta P_{D,t}$
EC^{+}_{t-1}	0.014658***	0.026994	0.490373***
	(0.005953)	(0.018992)	(0.065275)
$\Delta P^{+}_{Up,t}$	0.155604***	0.553727***	0.648217***
	(0.020425)	(0.099065)	(0.043871)
$\Delta P^{+}_{D,t-1}$	-	-	-
EC^{-}_{t-1}	1.656256	11.00439	0.494555***
	(2.621399)	(193.0523)	(0.117492)
$\Delta P^{-}_{Up,t}$	0.198039***	0.616553***	0.868878***
	(0.015732)	(0.082712)	(0.034256)
$\Delta P^{-}_{D,t-1}$	-	-	-
Number of observations	144	144	144
R^2	0.743264	0.619198	0.916462
Hypothesis test	−1.641597	−10.97740	−0.004182
$v^{+}=v^{-}$	(2.623415)	(193.0580)	(0.150143)

***1% significant, **5% significant, *10% significant, HSD: High speed diesel

5. CONCLUSION AND DISCUSSION

In this section, we will discuss the main results and their causes. First, for the base case, the APT exists on each chain of ULG95: Crude oil – ex-refinery, ex-refinery – wholesale, and wholesale – retail chain, but does not exist on all chains of HSD.

Second, the oil fund does not have influence for asymmetric price on ULG95, HSD. However, the situations are different. The asymmetric price of ULG price always exists whether there is the oil fund or not. On the other hand, the asymmetric price of HSD does not exist whether the oil fund is included or excluded from the price structure. However, the oil fund could maintain the gasoline and diesel prices stable, achieving the government objectives to keep the prices not fluctuate very much. Without the oil fund, the petroleum product price could fluctuate very much, probably reaching the peak immediately if the upstream price goes up significantly.

Third, the firms' profit (the marketing margins) that might reflect their monopoly does not have any influence on the price asymmetry for ULG and HSD. That is, whether the marketing margins are added to the price structure or not, the asymmetric price would not occur from the marketing margins. Although the marketing margins could be monopoly power that firms control the petroleum markets, the marketing margins could help indirectly

Table 5: Test for oil fund and marketing margins (HSD)

Independent variables	Variable - Relationship		
	P_{Up}=Exrefinery price P_D=Wholesale price w/o oil fund	P_{Up}=Exrefinery price P_D=Retail price w/o oil fund	P_{Up}=Exrefinery price P_D=Retail price w/o oil fund and marketing margins
	$\Delta P_{D,t}$	$\Delta P_{D,t}$	$\Delta P_{D,t}$
EC^{+}_{t-1}	0.034886	0.028154	0.024563
	(0.036706)	(0.018357)	(0.031900)
$\Delta P^{+}_{Up,t}$	0.792835***	0.955211***	0.885719***
	(0.099224)	(0.080756)	(0.086508)
$\Delta P^{+}_{D,t-1}$	-	-	-
EC^{-}_{t-1}	10.10926	3.827136	2.692933
	(416.4026)	(2.538561)	(33.06327)
$\Delta P^{-}_{Up,t}$	0.994974***	1.089904***	1.020442***
	(0.074215)	(0.065132)	(0.063737)
$\Delta P^{+}_{D,t-1}$	-	-	-
Number of observations	144	144	144
R^2	0.732285	0.802244	0.802878
Hypothesis test	−10.07437	−3.798982	−2.668370
$v^{+}=v^{-}$	(416.4255)	(2.537751)	(33.08264)

***1% significant, **5% significant, *10% significant, HSD: High speed diesel

Table 6: Test for inventory (HSD)

Independent variables	Variable - Relationship		
	P_D=Exrefinery price INV=Inventory	P_D=Wholesale price INV=Inventory	P_D=Retail price INV=Inventory
	$\Delta P_{D,t}$	$\Delta P_{D,t}$	$\Delta P_{D,t}$
EC^{+}_{t-1}	−0.003153	−0.004348	−0.000192
	(0.003520)	(0.004333)	(0.002605)
ΔINV^{+}_{t}	0.001247	0.000601	0.002289
	(0.002757)	(0.002545)	(0.004553)
$\Delta P^{+}_{D,t-1}$	-	-	-
EC^{-}_{t-1}	−0.000242	−0.000475	4.700408
	(0.000492)	(0.000560)	(319420.2)
ΔINV^{-}_{t}	−0.002672	−0.001858	−0.002065
	(0.002619)	(0.002520)	(0.003426)
$\Delta P^{-}_{D,t-1}$	-	-	-
Number of observations	144	144	144
R^2	0.053667	0.067397	0.004975
Hypothesis test	−0.002911	−0.003873	−4.700599
$v^{+}=v^{-}$	(0.003394)	(0.004077)	(319420.2)

***1% significant, **5% significant, *10% significant. HSD: High speed diesel

to maintain those gasoline and diesel prices in the country stable, not fluctuating very much.

Finally, the stocks of ULG and HSD inventories, rarely contributes to the price asymmetry for any petroleum product. From the test results, only the wholesale price of fuel oil could be affected by the amount of its stock. However, the stock effect is small (10% significance). Therefore, we can conclude the petroleum stock (inventory) could not influence on the price asymmetry. In other words, the APT should, if occurs, be caused by another cause. Therefore, because the petroleum prices in Thailand are regulated both directly through the oil fund and indirectly through a few large producers and distributors, those large producers and distributors might not need the stock of petroleum inventories to adjust their production and sales.

In conclusion, in the long run, the oil fund and the marketing margins make the effect of the decreasing upstream prices on the downstream prices adjust faster for ULG price but slower for HSD price. In other words, without the oil fund and the marketing

margins, the downstream price responds to the upstream price faster for ULG but slower for HSD. Nevertheless, the magnitude for diesel is not changed very much. Thus, those oil fund and marketing margins expedite the downstream price adjusts more quickly especially for ULG but more slowly for HSD. In the short run, the oil fund and the marketing margins make the downstream price is sticky. However, the oil fund directly makes the retail price adjust more quickly and keep it stable, fulfilling the government policy. Moreover, the marketing margins indirectly make the ULG adjust more slowly but does the HSD adjust more quickly. The downstream price adjustment is not much different whether with or without the oil fund and the marketing margins. The stock of petroleum products does not have considerable effect on the price asymmetry. It can infer that firms, producers, and distributors would not be difficult to adjust their prices and their quantities, probably from the oil fund and the marketing margins.

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