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Factors Affecting Domestic Price Differentials in the Petroleum Products

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Chapter 1 Introduction

The purpose of this research paper is to find out domestic price differentials of petroleum products and to examine factors affecting such price differentials. The research suggests some of the comparable product items in petroleum industry indicate more than two folded price differentials. In other words, domestic production prices of those products are more than two times higher than imported price.

As we discuss in the following part of this paper, we can attribute these price differentials, in some degree, to the final consumers' preference to the quality of product in these specific fields, rather than to institutional impediments such as tariffs and non tariff barriers. In addition to those final consumers' preference factors, however, we still indicate some possible features which have been establishing the price differentials.

We will discuss this issue in the following basic structure in this papers. First in Chapter 2, we will describe an outline of activities of Japanese petroleum industry, in order to obtain a preliminary base for further discussion. In Chapter 3, we will initially see some historical aspect of the industry. Some of the price differentials can be base on complicated trade form, which is believed to have been creating significant impediments for industrial entry by foreign enterprises, and they have historical characteristics. In Chapter 5, we will focus on domestic price differentials of petroleum products and examine the main factors affecting the differentials, especially with regard to items whose domestic price differentials are over two folds. The examination in this chapter will include traded form, distribution, existence of institutional impediment such as tariffs and non tariff barriers, and others. Finally in this paper, we will describe the conclusion and suggestion of future perspectives.

Chapter 2 Basic Characteristics of Petroleum Industry

1. Definition of Petroleum Industry in Japan

According to the Japanese Standard Industrial Group, petroleum industry has certain range of fields, including the following industrial sectors.

211 "petroleum refinery"

212 "grease manufacturing"

219 "miscellaneous petroleum- and coal-product manufacturing"

note: the sulfur produced in petroleum manufacturing process is defined by-product.

2. Processes of Manufacturing: out of Crude Petroleum into Petroleum Product

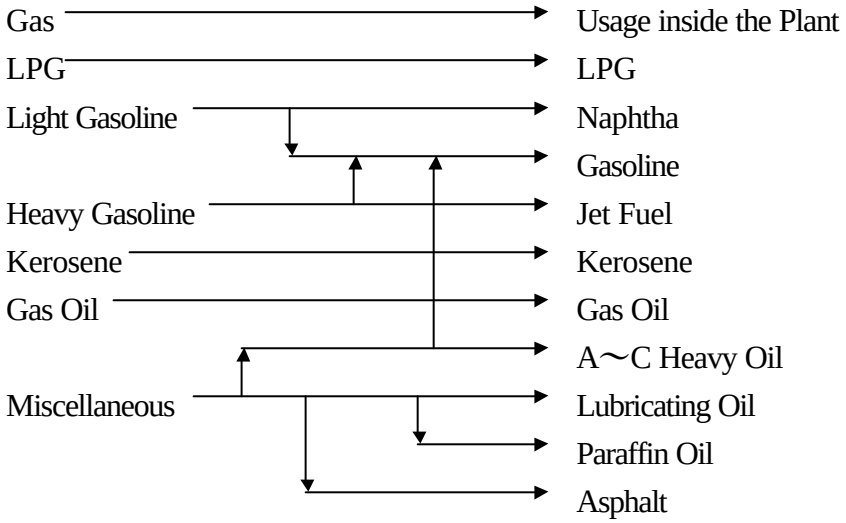
Petroleum products are categorized to several types: fuel petroleum, crude petroleum, lubricating oil, and other miscellaneous. Fuel petroleum includes LPG, gasoline, kerosene, jet fuel, gas oil, and heavy oil. Each of them are classified to industrial use, household use, and engine use in accordance with their main usage. Fuel petroleum consumption accounts for more than 80% of all petroleum product consumption. Crude petroleum includes naphtha, LPG, and crude oil. Naphtha is the raw material which is applied to petrochemistry. In lubricating oil, there are engine oil, cutting oil, operating oil, turbine oil, electric insulation oil, grease, and so forth. Other miscellaneous petroleum group includes asphalt, solvent, oil coke, and sulphur.

Figure 1

Crude Petroleum

→ Desalinization

→ Normal Pressure Distillation Equipment



The initial process of petroleum product manufacturing is refining of crude oil in refinery plant. In the plant, crude oil is turned into gas, LPG, gasoline, kerosene, and other substances by going through "normal pressure distillation equipment." After separation by the distillation, the gas is distributed to energy usage inside the plant, undergoing desulfurization and refinement by gas purification, together with gas from other process equipment. Propane and butane are manufactured out of LPG after going through purification and separation process by means of "LPG collecting equipment" also together with LPG coming out of other processes.

The figure 1 is an example of petroleum refining.

3. Characteristics of petroleum products

In this part, we see types and usage of main petroleum products.

(1) Gasoline (volatile oil)

In accordance with each usage, gasoline is classified to three types: for automobile

use, for industrial use, and for aircraft use. Aircraft use includes use for small airplane and certain types of helicopters. Since 99% of gasoline is for automobile use, however, we discuss gasoline for automobile use specifically, in this part of the paper.

Automobile gasoline (simply "gasoline" in the following part of this paper) is the fuel petroleum, which is applied to gasoline engine. There are two categories according to octane number rating, as follows:

- premium gasoline: octane number rating 98～100
  (equal to the standard of JIS-K-2202 number one)
- regular gasoline: octane number rating around 90
  (equal to the standard of JIS-K-2202 number two)

note: Octane number rating is a measure showing the degree of avoiding knocking.

In order to decrease the waste gas, several regulation on quality of gasoline were enforced. As a result, regular gasoline and premium gasoline have been required not to contain lead since February 1975 and October 1983 respectively.

(2) Jet fuel oil

Jet fuel oil is the fuel petroleum for jet engine. This is categorized to the following three group by their use.

- for long distance aircraft: JIS-K-2209 number one
- for middle short distance aircraft: JIS-K-2209 number two
- for general aircraft (especially in cold area): JIS-K-2209 number three

They are manufactured and their quality are controlled under strict standards. For example, the quality standards require high level of combustibility, sootlessness, and purity.

(3) Kerosene

Kerosene consists of the following two types. The two have different usage from each other.

- white kerosene: JIS-K-2203 number one
  mainly for air-conditioning or cookery use

・brown kerosene: JIS-K-2203 number two

mainly for oil motor and machine cleaning use

Especially used for oil stove, kerosene has strength in its high combustibility and creating less soot or less smoke. We can also point out its odorlessness as its merit. Since igniting temperature of kerosene is higher than 40 C, the possibility of its accidental ignition is fairly low; and this is another strength of kerosene. Highly refined kerosene contains less sulphur. Recently, therefore, they are often ordered for industrial fuel oil with waste gas abatement regulation getting strict.

(4) Gas oil

More than 90% of gas oil is used for diesel engine fuel, and the rest is used for heating fuel. Therefore, this type of petroleum is also called diesel fuel oil. By JIS standard, gas oil consists of five specific types in accordance with its seasonal and climate usage.

・JIS-K-2204 number one through three

(5) Heavy oil

Heavy oil is made up of the residual of distillation process or the mixture of the residual and gas oil. By its degree of mixture and its stickiness, heavy oil are classified to A ～C type.

・A heavy oil: one type in JIS-K-2205

for boiler in middle or small size plant, for air-conditioning in building, for diesel engine of small size vessel, and for air-conditioning in vinyl plastic hothouse.

・B heavy oil: two types in JIS-K-2205

for boiler in middle or small size plant and for ceramic industry fuel. Recently, the demand of B heavy oil is decreasing sharply.

・C heavy oil: two types in JIS-K-2205

for boilers in electric generation, chemical industry, and paper manufacturing. and for big size diesel vessel fuel.

In order to cope with air pollution, firms are recently working on strengthening less

sulphur quality.

(6) Naphtha

Naphtha is basically one type of fuel petroleum, and used for petrochemical transaction, for raw material of city gas manufacturing, and for ammonia production. Among these wide range applications, around 98% of naphtha is used for petrochemistry, where ethylene, propellent, benzene, and other products are produced undergoing separation process by high temperature.

Other usage of naphtha include production of city gas in separation plant. Because of the recent trend of diversification of gas raw material, however, demand of naphtha for gas production has been decreasing rapidly. Naphtha is also used in manufacturing of ammonia for fertilizer usage.

(7) LPG (Liquefied Petroleum Gas)

LPG is generally familiar to people in the name of Propane and Butane. The main usage structure is in the following table (1992 statistics).

for household fuel	35 %
for automobile fuel	10 %
for city gas production	12 %
for electric generation	5 %
for industry	38 %

In Japan, LPG made the first appearance in the market in 1955. From that time on, its demand has been growing considerably in comparison with other fuel oil because of the following reasons. The waste gas after burning is less contaminated, and it occupies smaller space because of its liquidity formation (one 250th of its gas form).

Chapter 3 Historical Aspect of Petroleum Industry in Japan

At the end of World War, Japan's refinery capacity of petroleum was less than 20% of that in pre War period. In addition, in 1946 the General Headquarters of the Allies (GHQ) forbade operation of all petroleum refinery plants located on Pacific Ocean shore. Japanese petroleum industry, as a result, was almost in ruin.

In order to reconstruct it, consequently, Japanese firms emphasized on establishment of intimate partnership with foreign capital, since they thought that foreign capital would activate the industrial activity in Japan. Especially since 1949, they started foreign capital oriented practices. We can observe it by the following series of cooperation by holding capital by Japanese firms.

1948	Feb.	Toa Nenryo Kogyo (now Tonen) - Stanbuck (US)
	Mar.	Mitsubishi Sekiyu - Tidewater (US)
		Nippon Sekiyu - Caltex (US)
	Jun.	Showa Sekiyu (now Showa Shell Sekiyu) - Shell (UK, Holland)
	Jul.	Kowa Sekiyu - Caltex (US)
		Maruzen Sekiyu (now Cosmo Sekiyu) - Union (US)

In 1950, with this movement of cooperation with foreign firms peaking out, operations of pan-Pacific refinery plant was started in January. In June, Korean War occurred and demand of miscellaneous goods, especially heavy oil related items, skyrocketed compared with the demand in ordinary period. Since 1951, therefore, sales of petroleum products increased at a rate of 60% p.a.. In 1953, the yearly total amount of sale of petroleum product was more than two folds of that in pre War average year.

From the end of World War until 1950s, Japan's primary source of energy was coal. With the above stated development of petroleum industry, however, national energy policy by government changed to liquefied energy oriented, and eventually Japan entered to "Petroleum Era" since 1960.

In those days, at the same time, Japan succeeded in getting an IMF 8th clause country title. Therefore, Japan was required to promote free foreign exchange policies, which had strong influences on petroleum industry. One typical example of the practices of these policies is an act on petroleum related business enforced in July 1962. The main goal of this act was the establishment of a consistent supply system of petroleum products in order to prepare for the expected fluctuating economy caused by free trade. In this act, official permission procedures for petroleum refinery and new installation or enlargement of refinery plant were regulated.

Afterwards, however, Japan experienced the "First Petroleum Crisis" in 1973 and the second in 1979. In those critical terms, Japanese petroleum industry faced oil price skyrocketing and extreme depression of demand for petroleum products. Under this circumstance, structural innovation of the industry was strongly advocated, gradually. After 1980, Japanese government suggested several plans for the industrial restructuring. They included the following details:

(1) Settlement of excessive plants.

Caused by the rapid depression of oil products demand, considerable number of plants became excessive, and the utilization rate of equipment in this industry lowered abruptly. The rate of refinery in 1981 was 59.5%.

(2) Concentration of oil whole sale business.

To eliminate the sentiment of excessive competition in the industry, concentration of whole sale sector was suggested.

(3) Restructuring of distribution sector of petroleum products.

In addition to the (2) plan above, more efficient distributing system was tried to be established by restructuring distributing system by small firms.

As a result of practices on these plans, number of whole sale companies decreased up to 7 groups and 11 companies, and systematization of enterprises in the distributing sector was highly extended. Japanese government feared the excessive systematization and intensiveness, and enforced a temporary act on import of particular petroleum products in January 1986. By this act, the government permitted crude oil refining firms to import

petroleum products.

Chapter 4 Demand and Supply of Petroleum Products in Japan

Now We see demand and supply in Japan.

Table 1. Domestic Demand on Petroleum Products in Japan

C. Y.	1989	1994	94/89 Annualalized rate of change	Share of components (%) 89	94
Gasoline	42,740	50,378	3.3		
	20.2	21.0			
Jet fuel oil	3,469	4,331	4.5		
	1.6	1.8			
Kerosene	26,996	28,268	0.9		
	12.8	11.8			
Gas oil	34,828	44,317	4.9		
	16.5	18.5			
A heavy oil	26,348	27,858	1.1		
	12.4	11.6			
B, C heavy oil	45,763	43,977	-3.9		
	21.7	18.4			
Naphtha	31,530	40,252	5.0		
	14.9	16.8			
TOTAL	211,674	239,381	2.5		
	100.0	100.0			
LPG	18,324	19,011	0.7		

Unit; 1,000kl, 1,000t (LPG)

Table 2. Supply of Petroleum Products in Japan

C. Y.	1994		
	Production	Import	Import/Supply
Gasoline	50,204	1,502	2.9 (%)

Jet fuel oil	7,394	—	—
Kerosene	26,988	2,032	7.0
Gas oil	45,073	1,252	2.7
A heavy oil	28,363	1,047	3.6
B, C heavy oil	49,616	3,537	6.7
Naphtha	17,770	22,876	56.3
TOTAL	225,408	32,247	12.5

Unit; 1,000kl

Table 3. Consumption Share of Petroleum Products in Major Countries

(1993, %)

	Japan	U.S.A.	U.K.	Germany	Italy
Gasoline	14.6	42.7	28.5	24.0	19.0
Jet fuel•Kerosene•Gas oil	40.2	35.7	45.4	55.3	34.5
Heavy oil	15.1	4.3	13.3	5.7	31.8
Naphtha	8.6	1.0	3.8	6.5	3.9
LPG	8.3	7.1	3.6	2.3	3.8

Source; OECD,"Quarterly Oil Statistics and Energy Balances." 1,Quarter,1994.

Table 4. Tariff Rate of Crude Petroleum and Petroleum Products in Japan

－ Effective Tariff Rate － (Unit;Yen/kl)

		1989.4	1992.4	1994.4
Crude petroleum				
for refining		350	315	
for others		350	315	
for petrochemistry		Free		
Gasoline		1,480	1,430	
Jet fuel				
specific gravity	～0.8017	2,180	2,130	
	0.8017～	2,450	2,400	
Kerosene		630	580	
Gas oil		1,330	1,290	
A heavy oil				
for aguriculture	Free			
low sulfur		2,790	2,770	
high sulfur		3,780	3,750	
B heavy oil				
low sulfur		2,600	2,580	
high sulfur		3,780	3,750	
C heavy oil				
low sulfur		2,540	2,520	
high sulfur		3,780	3,750	
Naphtha				
for petrochemistry		32	31	25
for electric Power		780	760	
LPG		Free		

Table 5. Taxes of Petroleum Products in Japan

Gasoline	Gasoline tax	53,800	(Yen/kl)
Jet fuel oil	Airplane fuel tax	26,000	
Gas oil	Gas oil trade tax	32,100	
LPG	Pertorium gas tax	9,800	

Chapter 5 Domestic Price Differentials － The Results －

1. Other Survey on Domestic Price Differentials

Table 6 ,7 ,8 are recent surveys on domestic price differentials.

Table 6. "Survey on Domestic Price Differentials in Consumer Goods"

Ministry of International Trade and Industry, June 1994

(Tokyo＝100)

	Tokyo	NewYork	Los Angels	London	Paris
Gasoline	100	24	37	76	80
Oil for heating	100	55	55	43	78

Price incruding taxes.
Oil for heating is white kerosene inTokyo , oil gas for heating in other cities.
Exchnage rate is an average rate within periods of survey.
$1＝￥108.81, £1＝￥163.82 , F.1＝￥18.68.

Table 7. "Survey on Domestic Price Differentials in Living Expense"

Economic Planning Agency, September 1994

(Tokyo＝100)

	Tokyo	NewYork	London	Paris	Berlin
Gasoline	100	31	65	81	72
Oil for heating	100	42	77	59	73
LPG	100	47	－	－	55

Oil for heating is white kerosene in Tokyo, oil gas for heating in other cities.
Exchnage rate is a average rate of 1993.
$1＝￥111.20, £1＝￥166.87, F.1＝￥19.64, D.M.1＝￥67.26.

Table 8. "Survey on Domestic Price Differentials in Intermediate Goods"

Ministry of International Trade and Industry, June 1994

(Tokyo＝100)

	Tokyo	U.S.A.	Germany	Korea	China
Regular gasoline	100	29	49	63	21
Premium gasoline	100	28	46	71	20
Naphtha	100	112	106	96	195
Gas oil	100	43	97	44	32
A heavy oil	100	64	39	68	29
C heavy oil	100	52	49	95	107

Price without tax (Japan , U.S.A. , Germany) , incruding tax (Korea , China). Quarity is not necessary same.

Exchnage rate is a average rate within periods of survey.

$1＝¥101.19, D.M.1＝¥62.80, 1＝¥18.68.

2. The result

We compare the following 9 items. Domestic Price Differentials were 1.321 on simple average (with the exception of LPG and), with the highest of 2.478 (gasoline) and the lowest of 0.832 (jet fuel). Frequency distribution shows Table 9.

Table 9. Domestic Price Differentials

	Price Differential	Industrial Classification (Middle-Stage)
Gasoline	2.478	2111011
Jet Fuel	0.832	1012
Kerosene	0.955	1013
Gas Oil	1.843	1014
A Heavy Oil	0.990	1015
B and C Heavy Oil	1.172	1016
Naphtha	0.980	1017
LPG	1.210	1018
Miscellaneous Petroleum Product	1.128	1019

Chapter 6 Factors of Domestic Price Differentials

1. Institutional Regulation

(1) In accordance with Petroleum Act, permission by the minister of MITI is required for the enterprise entry into petroleum refinery, and for building or enlarging refinery plants. For consistent supply of petroleum, there are administrative governmental guidance occasionally.

(2) The temporary act on import of particular petroleum products permits only refining firms to import gasoline, gas oil, and kerosene. There is no regulation, on the other hand, regulating importing naphtha.

(3) Several laws related to foreign exchange administration and export, export of petroleum products restricted within specific range. Because of this regulation, domestic demand structure of petroleum products depends highly on domestic manufacturing structure. It follows that domestic industry have lost sensitivity to information on international market, and are unable to penetrate into it.

(4) Gas stations have to be registered on official procedure according to regulations in an act on sales of volatile oil.

(5) The law on fire prevention have several strict regulations on high safety standard of gas station structure.

(6) From a standpoint of environmental protection, high quality standards are required to petroleum products.

(7) LPG Act regulates several standards of security or safety on LPG related business activities, and governmental permission is required for new entry by enterprises into the fields.

(8) When enlargement of supply area of city gas is attempted, coordination with LPG industry in the area is required.

2. Distribution Form

(1) Distribution system of petroleum products is consists of direct sale and sales on special

contract. As for heavy oil and naphtha, which are consumed in a great bulk, primary distribution is done by direct sale. As for the rest, special contract sale is the main channel.

	sales on special contract	direct sales
heavy oil	50 %	50 %
gas oil	91 %	9 %
kerosene	95 %	5 %
gasoline	98 %	2 %

(2) Since the weight of direct sales is lower, the profit of whole sale company depends highly on margin incurred by refinery process.

(3) As for gasoline, there are many gas stations; therefore, sales per station is one fourth of those in the US. Costs of both equipment depreciation and labor are comparably high, and the high weight of retail margin is characteristic. Other factors affecting costly structure of distribution is high price of real estate and construction service. Additionally, excessive customary services is an important factors.

(4) Some aspects of wholesale firms' trade practices could be significant factors. They include a) subsidies to retail firms for equipment or leasing to keep certain wholesale share, b) payment of rebate for retail promotion. The latter practice is strongly associated to ambiguity in sales price decision process.

(5) For products competing with imported goods, such as naphtha, and products with lots of substitute energy source, price raising is quite difficult. In those cases, cost push is apt to bring about price raise of gasoline price.

(6) As for kerosene, many of the distributing retail stations are small. Usual sales by them are in small amount. Such trade form has made up inefficient distributing system and costly structure.

(7) LPG distribution system are made up of small size retail operators and of many processes. Therefore, the same systematic problems with kerosene can be pointed out. The rate of

distribution margin of LPG is typically high. Another important factor is interior plumbery of LPG. They are usually done by retail operator without charge to consumers (free plumbery). This customary trade form makes it difficult to change retail operators for final consumers.

(8) In Japan, petroleum pipelines have not been much developed, and the primary conveying means are domestic tankers and tank trucks. Both of them have rather small capacity, and inefficient means of transportation, compared with European or US system, which have advanced pipeline network.

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