ESTIMATING THE SHORT RUN ELASTICITY OF PETROLEUM IMPORT DEMAND FOR BANGLADESH

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Abstract

The petroleum import demand has significant impact on the economic development of the non-oil producing countries. Bangladesh is one of the petroleum hunger countries in the world. This paper has been progressed aiming to attain two major objectives. The prime objective is to examine the empirical literature on the petroleum import demand elasticity of Bangladesh. To meet this objective, this paper seeks to examine the relative responsiveness of Bangladesh petroleum import demand to the indigenous production capability and the price of petroleum in the international market for the period 2000 to 2010. Microeconomic technique of measuring elasticity has been used to estimate both production and price elasticity of petroleum import demand in the short run for Bangladesh. The estimation results reveal that the petroleum import demand is highly inelastic to the changes of both the international price and domestic petroleum production. This paper also assesses general state of Bangladesh petroleum import structure to identify the share of petroleum import cost on the cost of fiscal policy.

Keywords: Petroleum, Bangladesh, Import demand, Elasticity, Microeconomic technique.

1. Introduction

Petroleum is one of the most essential objects in the production process. Petroleum in one form or another has multidimensional uses ranging from households to the industry. Due to the technological advancement, the diversified aggregate demand relating to the up gradation of standard of living have, however, triggered the demand for petroleum products in the various sectors of the economy particularly in the production, communication and transportation. The expansion of economic activities and growth of household expenditure have led to a surge in demand for primary energy consumption, which gradually cannot be satisfied by domestic production since the 1990s (Zhao and Wu, 2007). This paper would mainly focus on Bangladesh explaining the relative sensitivity of its petroleum import demand. It is mentioned earlier that petroleum is one of the leading objects for industrialization. So, in developing countries like Bangladesh, the demand for petroleum is in rising trend as it is moving away from agriculture to industrial based economy. In raising productivity to agriculture and service sectors, the different petroleum products carry an equal importance. Now a days, it also turns to be a prime component in generating electricity to boost productivity in all sectors of the economy. Hence, since Bangladesh is characterized by oil dependent economy, a significant part of its total demand has to import from global oil market. Such dependency often impedes productivity due to the constant political complexities in the major oil exporting countries. It is a sad reflection that the price of oil is, therefore, dependent upon the behaviour of two groups of politicians who seem to

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exude either incompetence or unwarranted aggression, or both, compounded by indecision (Stevens and Hulbert, 2012)[1]. Thus, the political propaganda along with the cartelization in the oil augmented Middle East countries reflects constant uneven volatility in the supply channel. In this regard, over dependency on the international crude oil market undoubtedly reflects vulnerability over the import cost as it relates to the fiscal imbalance due to the uneven cost burden for the crude oil import. The possibility that higher oil prices impose secondary macroeconomic costs, in addition to the direct loss of income and welfare caused by the higher import bill and lower oil consumption, is frequently regarded as a second element of the demand component of the premium (Bohi and Montgomery, 1982).

In this back drop, it is tried in this paper to measure the degree of vulnerability of Bangladesh in the context of petroleum import. That is, this paper aims to find out the relative sensitivity of Bangladesh petroleum import demand due to the changes of oil prices in international market and also for the changes in domestic production of petroleum products.

The paper itself is divided into ten sections. Section one introduces while section two and three explains the objectives and literature review of the study. Section four provides the methodology of the study. Section five analyzes an overview of Bangladesh production capability of petroleum products and measures the responsiveness of Bangladesh petroleum import to the changes of indigenous production. Section six briefly outlines the import structure of different petroleum products and its consequences over the fiscal balance. Section seven focuses on the effects of volatility of crude oil price in the international market on the domestic petroleum market and this section also measures how Bangladesh petroleum import demand is sensitive to the changes of crude oil prices in the global market. Section eight provides a brief description of estimated results. Section nine deals with policy recommendations and at last the paper ends with the brief conclusion in section ten.

2. Objectives of the Study

In Bangladesh, the petroleum import cost is very significant in the total import cost. In fact, it is crucial in worsening the trade balance of Bangladesh. So, in turn, the government incurs additional cost burden to maintain fiscal balance and also to improve the balance of payment performance. In this back drop, to understand the degree of dependency on the petroleum import, this paper tries to measure the responsiveness of Bangladesh petroleum import for the changes of two most influencing factors such as price of petroleum in the global market and the domestic petroleum production capacity. Besides, this paper also investigates the effects on the prices of domestic petroleum products (kerosene, petrol, diesel etc.) for that of changes in international market. Moreover, the excess subsidy over the petroleum import squeezes the government capacity for the other crucial sectors of the economy. So, this paper analyzes the fiscal consequences for the rising petroleum cost. More specifically, the paper summarizes the following objectives:

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[1] For the details of the impacts of political upheavals to the crude oil price see Paul Stevens and Mathew Hulbert's "Oil Prices: Energy Investment, Political Stability in the Exporting Countries and OPEC'S Dilemma.

- To find out the elasticity of Bangladesh petroleum import demand to the changes of its indigenous production.
- To measure the sensitivity of Bangladesh petroleum import demand to the changes of crude oil prices in the international market.
- To measure the impact on the prices of domestic petroleum market due to the price changes of petroleum products in the international market.
- To scrutinize the overall production and consumption structure of different petroleum products of Bangladesh.
- To analyze the structure of Bangladesh petroleum import demand and this paper also seeks to identify the share of petroleum import cost in the cost of fiscal policy.

3. Literature Review

The purpose of this study is to estimate the relative sensitivity of Bangladesh petroleum import demand to domestic production and to the petroleum prices in international market. For the policy purpose, it is important to determine the level of vulnerability of Bangladesh petroleum import as the price of petroleum products experiences frequent ups and downs in the international market. It is necessary to mention here that it is hardly found any literature focusing on the estimation of elasticity for Bangladesh petroleum import demand. Numerous scholars have analyzed the behavior of petroleum import demand function for several decades in the different countries. Gately and Huntington (2001) estimates the effects on energy and oil demand of changes in income and oil prices for 96 of the world's largest countries categorizing as OECD and non-OECD countries using 1971-97 data in per capita terms. They found that the long run income elasticity of energy and oil demand is about 0.5 or 0.6 for the OECD countries, about 1.0 for non- OECD countries whose income is rising steadily and about 0.5 for non- OECD oil importers with slow and uneven income growth. They found that demand has responded more to increase in price than to decrease in price for both developed OECD countries and developing countries.

Tsirimokos (2011), estimates the short-run and long-run price and income elasticities of crude oil demand in ten IEA member-countries for the time period 1980-2009. He found that short run price elasticities range from -0.104 to -0.036 and long run price elasticities range from -0.275 to -0.066 but the short run income elasticities range from 0.355 to 0.662 and the long run income elasticities range from 0.726 to 2.473. He concluded that the price elasticities are highly inelastic both in the short run and long run, but the long run income elasticities are unit elastic and for some countries the income elasticities are elastic. Generally, because the petroleum exporting countries are limited and because it has no close substitutes, most of the countries either developed or developing depend entirely on the limited sources. Thus, for almost every country both the price and income elasticity of petroleum import demand become inelastic. Gutierrez (2010) examined the income and price elasticity of U.S crude oil import demand from Mexico based on time series from January 1990 to December 2010. He tested Augmented Dickey-Fuller (ADF), Phillips – Peron (PP), and Kwiatkowski- Phillips – Schmidt – Shin (KPSS) tests to determine their order of integration. He estimated the cointegrating import demand

regression using Dynamics of OLS procedure. He found that the U.S crude oil import demand from Mexico is income inelastic and perfect price inelastic.

Ziramba (2010) examined the elasticity of crude oil import demand as a function of real income and price for both short run and long run using the data of time period 1980-2006 of South Africa. He found that the long run income and price elasticity were -0.147 and 0.429 indicating that the import demand of crude oil is price and income inelastic. Altinay (2007) estimates the long run and short run elasticities for crude oil import demand in Turkey covering the period 1980 to 2005. He found that the crude oil import demand is inelastic to both income and price elasticities in both short run and long run.

4. Research Methodology

This paper has been conducted mainly on the basis of secondary data. For this study, the necessary information and the secondary data have been obtained from the various relevant journal publications, Bangladesh Petroleum Corporation (BPC), Bangladesh Bureau of Statistics (BBS), Bangladesh Economic Review, International Energy Statistics (IES), and from other national and international sources. In this paper, the microeconomic technique of measuring elasticity conducted by Mankiw (2006) has been applied to estimate price and production elasticity of Bangladesh petroleum import demand.

5. An Overview of the Production Capability and Consumption Structure of Petroleum Products in Bangladesh

Despite a natural resourceful country, Bangladesh has a tiny oil reserve. According to the Bangladesh economic review 2011, total storage capacity of oil in the country is about 0.9 million metric tons and the total demand for refined oil in the country is about 4.87 million metric tons which is increasing at about 5 percent per annum. The statistics of U.S. Energy Information Administration (EIA) shows the total crude oil distillation capacity of Bangladesh is 33 thousands of barrels per cal day and the total proven crude oil reserves is stagnant at 28 million since 2008 to 2011. However, with several indigenous oil companies like Bangladesh Petroleum Exploration and Production Company Limited (BAPEX) and Petrobangla, under the production sharing contracts, some foreign oil companies are also engaged in production and exploration of petroleum in Bangladesh. Under the 1993 national energy policy, the government has divided its territory and offshore sites into 23 blocks among which eight blocks were given to four foreign companies. In process, four additional blocks were awarded to three foreign oil companies during the second bidding round in 1997.

5.1 Consumption Scenario of Petroleum Products

In general, it seems, the rate of increase in the uses of petroleum products is positively related to the economic development of a country. Now, is this relationship exists in all countries? In fact, the balanced economic growth links the efficient progress of all key sectors of the economy. Thus, the countries likely to uplift efficient economic growth depend, however, on the efficient utilization of

scared energy resources as it is crucial for all sectors. In Bangladesh, agriculture is the most potential for the food security and for the rural employment. In the same vein, the manufacturing and service sectors are directly linked to the effective economic development. Needless to say, the sustainable growth of these two productive sectors is widely contingent upon the accessibility of sufficient energy resources. Moreover, excess supply of power and energy over the unproductive sectors (domestic uses, uncommercial communication etc.) should strictly be controlled. Otherwise, unplanned distribution of energies would lower the economic efficiency as the unproductive sectors would be prioritized in terms of getting energy supply. Thus, the planned and efficient distribution of petroleum energies listing the productivity obliges sustained growth as it raises production efficiency and technological knowhow.

Table- 1: Sector Wise Consumption of Petroleum Products (in metric ton)

Sector	2006-07	%	2007-08	%	2008-09	%	2009-10	%	2010-11	%
Agriculture	722829	20.23	702767	19.38	795639	23.92	909556	24.21	1004356	20.63
Industry	145334	4.07	153304	4.23	124988	3.76	177663	4.73	293948	6.04
Power	253729	7.10	264455	7.29	254950	7.66	216582	5.76	931877	19.14
Communication	1938644	54.24	2040026	56.26	1766848	53.11	2027509	53.96	2183790	44.86
Domestic &others	513394	14.36	465722	12.84	384230	11.55	425980	11.34	454053	9.33
Total	3573930	100	3626274	100	3326655	100	3757290	100	4868024	100

Source: Bangladesh Petroleum Corporation (BPC), 2006-07 to 2010-11

The petroleum consumption structure, as depicted in table -1, shows the domination of unproductive sector over the productive as the communication strictly dominants over the agriculture and industrial sector throughout the entire studied period. In 2006-07, the communication sector consumed more than 54% of the total petroleum consumption while agriculture and industry sector took only 20.23% and 4.07% respectively. However, from the table, the petroleum consumption is rising over the years as from 2006-07 to 2010-11, the growth of petroleum consumption recorded 36.21% at the annual rate of 7.24%. Moreover, the growth trend depicted in table-1 posits unplanned and inefficient distribution as the domestic sector consumed largely than the industry. Despite that, Bangladesh is one of the lowest in energy consumption countries. According to the Titi tudoracea bulletin (2010), Bangladesh consumes only 0.392% of Asia & Oceania and 0.117% of world petroleum consumption.

5.2 Production Consumption Gap and Import Demand Responsiveness of Petroleum Products to the Indigenous Production

The economic theory argues for negative relationship between the indigenous production of a commodity and its import demand. However, the influencing scale of

indigenous production over the import demand can be measured in explaining two factors: the gap between the aggregate demand and domestic supply and their rate of acceleration. As the product market is highly competitive, against the huge aggregate demand of a commodity, a tiny production capacity will not have any influence over its import. Furthermore, the sensitivity of import demand for an indigenous production remains zero if it has a dawdling rate of change than its demand counterparts. Now, in this section, it is tried to find out the sensitivity of Bangladesh petroleum import demand over the changes its domestic petroleum production. From the Table-2, it is discernible that Bangladesh petroleum production is very negligible in terms of its demand which is clearly notified by the gap of these tows. In 2000, against the consumption of 68.8 thousands of barrels per day the production was only 3.2 thousands of barrels. As the table shows, from year 2000 to 2010, the import of petroleum increased by 47.2 thousands of barrels per day on the other hand domestic production was increased only by 2.5 thousands of barrels per day. Now, to estimate the sensitivity of Bangladesh petroleum import demand to changes its production, quantitative technique of measuring elasticity developed by Mankiw (2006) has been applied:

Production elasticity of petroleum import demand:[2]

Percentage change in quantity import demanded ÷ Percentage change in production.

= % Δ in Q_{ID} ÷ % Δ in production

= Δ in Q_{ID}/Q_{ID} ÷ Δ in production∕production

Table-2: Production and Consumption Gap of Petroleum Products (thousands of barrels per day)

year	Indigenous Production	Total Consumption	Imports of refined petroleum products	Gap of production and consumption (% of total consumption)[3]
2000	3.2	68.8	37.338	65.6
2001	4.1	81.3	50.916	77.2
2002	6.8	82.8	54.211	76
2003	6.9	83.9	53.543	77
2004	6.7	84.6	56.037	77.9
2005	6.8	86.8	57.262	80
2006	6.7	90.8	62.605	84.1
2007	6.7	90.8	64.266	84.1

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[2] Mankiw (2006) defined price or income elasticity of demand as the responsiveness of the quantity demanded of a good to a change in its price or income. In the same vein, the production elasticity of import demand can be defined as the responsiveness of import demand to a change in its domestic production when all other factors remain constant. Since the acceleration production lowers the import, they will be negatively related.

[3.] In table -2, Total consumption ≠ Total production + Total import. This is due to the fact that, import constitutes only refined petroleum products where as consumption includes both refined and unrefined petroleum products.

2008	6.4	94.1	69.968	88
2009	5.7	100.7	77.294	90.3
2010	5.7	107.9	84.493	92.3

Source: International Energy Statistics. (U.S.A. Energy Information & Administration), (2000 to 2010) and author's calculation

Applying the elasticity measurement technique, from 2000 to 2010, the production elasticity to the import demand has been estimated at 1.62 with positive sign. That is, in this estimation, we found a positive correlation between the indigenous production and import demand which is, however, reversed of the conventional economic theories[4]. Since indigenous production and import demand is negatively related, the expected sign of the production elasticity of import demand must be negative. The estimated value with positive sign indicates the production elasticity of Bangladesh petroleum import demand is perfectly inelastic. This is because, compared to the demand, Bangladesh petroleum production is so insignificant that, at this stage, any changes of domestic production has no influence over its import demand.

6. Dynamics of Petroleum Import Structure.

This part of the study attempts to find out some crucial features of the Bangladesh petroleum import structure. First, since petroleum products differ in terms of its form of utilization and cost, this part investigates the nature of its import structure. Second, it is tried to find out the share of petroleum import cost in the economy. In this regard, this part compares petroleum import cost to the import cost of major primary goods and industrial goods to indicate its burden over the fiscal balance. However, from table-3, the petroleum import recorded a restorative tendency from the mid of the last decade in which the import of crude oil and refined petroleum products dominants over the other categories. From the year 2003-04 to 2010-11,as the table shows, the volume of refined petroleum imports was 2, 05, 45,804 metric ton (68.21%) while the shares of crude oil and lube base oil were 30% and 0.16% respectively of total oil import.

Table-3: Category Wise Petroleum import

| Year	Crude oil		Refined products		Lube base oil		HSFO		Total	
	Qnty in MT	Value (crore taka)	Qnty in MT	Value (crore taka)	Qnty in MT	Value (crore taka)	Qnty in MT	Value (crore taka)	Qnty in MT	Value (crore taka)
2003-04	1252424	1848.43	2262348	4015.81	6516	18.38	0.00	0.00	3521288	5882.62
2004-05	1063208	2261.98	2691750	7213.88	10189	38.14	39859	61.53	3805006	9575.53
2005-06	1253285	3750.69	2380533	9382.77	5137	35.53	0.00	0.00	3638955	13168.99

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[4] Since the domestic production and import demand of a particular commodity is negatively related, economic theory suggests the sign of production elasticity of import demand must be negative

2006-07	1211037	3985.02	2536535	10446.2	4287	25.13	0.00	0.00	3751959	14456.35
2007-08	1040084	5093.69	2273263	14343.04	5006	29.94	0.00	0.00	3318353	19466.67
2008-09	860877	3431.40	2507819	10945.24	4828	23.63	29920	60.38	3403444	14460.65
2009-10	1136567	4701.54	2634212	12028.18	7262	52.03	0.00	0.00	3778041	16781.75
2010-11	1409302	7037.00	3259344	20280.52	4745	43.75	230431	1123.17	4903822	28484.44
Total	9226784	32109.75	20545804	88655.64	47970	266.53	300210	1245.08	30120768	122277

Source: Bangladesh Petroleum Corporation (2003-04 to 2010-11)

The petroleum import cost is highly associated with the international market. Besides, for Bangladesh, consistent volatility in exchange rate and the government policy in launching petroleum based power plant also revamped the petroleum cost. It is discernible from table-3 that from the year 2003-04 to 2010-11, the total petroleum import cost was raised by 384.21% at 48% annually. During this period of time, the import cost of most vaunted refined petroleum and crude oil registered 405% and 281% growth respectively. In table-3, the volume of quantity import and the cost in the year 2010-11 is notified sky-scraping in the studied period. It is necessary to note that at the early 2010-11, the government started in launching petroleum based rented and quick rented power plant. Needless to say, such policies, however, put significant impact on the highly revamped petroleum import cost.

Figure-1: Comparison between Petroleum Import Cost and the Cost of Some Key Economic Sectors of Bangladesh
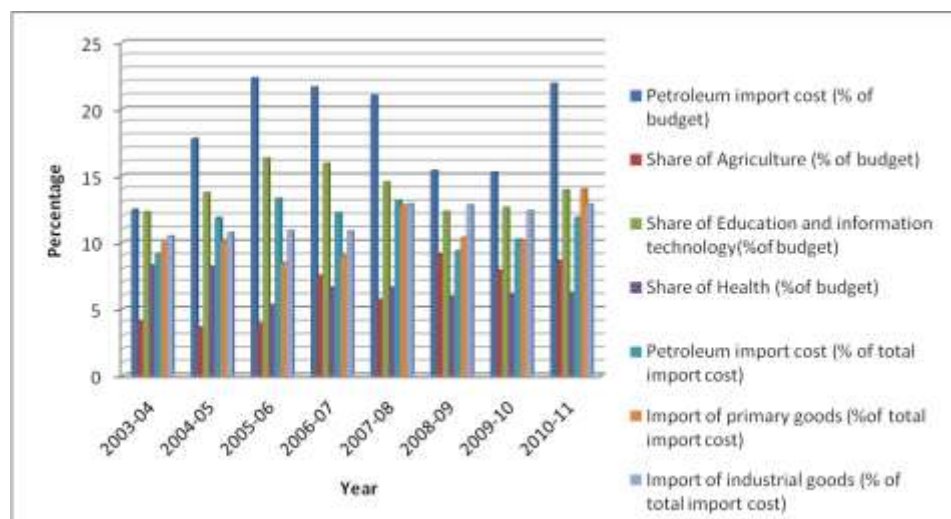
Source: Budget in Brief, MOF and authors calculation from Bangladesh Economic Review, Bangladesh Bank (various issues).

Various Significant Trends are Evident from Graph-1

- It is evident from the figure that the petroleum import cost of Bangladesh is increasing over the years. In the fiscal year 2003-04, as the figure shows, the total petroleum import cost was only 12.46% of its total budget and it is notified that it rose to 21.90% in the fiscal year 2010-11.

- From the figure, the petroleum import cost outweighs significantly the total expenditure on agriculture, health and education, the most crucial economic sectors of the economy. In 2003-04, in terms of total budget, the total petroleum import cost was 12.46% where as it was 4.04%, 12.28% and 8.27% respectively for the agriculture, education and health sectors. It is important to note here that such domination of petroleum import cost however, continued the whole decade. In 2010-11, as it is discernible from the figure, against a healthy petroleum import cost (21.9%) as a share of total budget, the agriculture, education and health sectors got only 8.6%,13.9% and 6.2% respectively.

- The cost burden for petroleum import on the fiscal balance can also be appraised by comparing it with that of the major primary goods and industrial goods. From the figure, the petroleum import cost was shown rising trend neck to neck with the essential importable of the economy. As the figure shows, from 2003-04 to 2010-11, in terms of total import cost of the country, the petroleum import cost registered 29.73% growth compared to 40% and 22.85% growth of major primary goods and industrial goods. It is important to note here that, in most of the cases during the last decade, the petroleum import cost dominated over the import cost of major primary goods and industrial goods. Against 12.61% annual growth rate of petroleum import cost from 2004-05 to 2008-09, the import cost of major primary products and industrial goods records 10% and 11.32% annual growth respectively.

The higher petroleum import demand, however, is associated with the higher import cost. Besides, some internal and external factors can be explained as additional influencing factors in accelerating the petroleum import cost of Bangladesh. Amongst the many, the volatility in the world crude oil market and also in the exchange rate regime can be regarded as the most influential external factors in tempting the oil price hike in the domestic market. Besides, in Bangladesh, the government policy in generating electricity from petroleum based power plant also played key role in mounting the petroleum cost. However, it is stated above that, this sky scraping petroleum import cost outweighs the cost for the most crucial sectors in the economy. Because of this additional cost burden, the government faces difficulties in maintaining fiscal balance and also stability in macroeconomic regime. Moreover, the excess subsidy on the petroleum import halts to expedite the productive activities as it relates to squeezes the fiscal capacity. With continued increase in price of crude oil and petroleum products in international market, government's response has been very slow and resulted in total subsidy of $170.5 and $445.4 million in 2004 and 2005, respectively (Alam, et al. 2013). Besides, due to this additional cost burden, the continuity in the development process is being slowed down as the government incurs liquidity shortages for the efficient allocation to the fundamental economic sectors.

7. The Elasticity of Bangladesh Crude Oil Import Demand and Domestic Crude Oil Price to the International Price

This section is divided into two main parts. In the first part, it has been tried to find out the relative responsiveness of the Bangladesh petroleum import demand to a change in the international prices by 2000-01 to 2010-11.The second part of this section provides an economic description of the behavior of local petroleum prices to the changes of crude oil price in the global market. That is, considering the same time period, it has been tried to estimate the percentage change of the petroleum prices in the Bangladesh local market for 1% change of the crude oil price in the international market.

Table-4: Comparative Statistics of Bangladesh Crude Oil Import Demand and the Price of Crude Oil in the International Market.

Fiscal year	Prices of crude oil in the international market.($ per barrel)	Bangladesh import of crude oil. (Metric ton)
2000-01	27.40	1337121
2001-02	20.50	1224707
2002-03	26.36	1331003
2003-04	30.27	1252424
2004-05	43.62	1063208
2005-06	57.00	1253285
2006-07	60.21	1211037
2007-08	94.12	1040084
2008-09	69.38	860877
2009-10	71.43	1136567
2010-11	87.39	1409302

Source: Bangladesh Petroleum Corporation (BPC), Statistical Year book 2010(BBS) & Authors Calculation from Monthly Data Available at www.ioga.com/crudeoil_Hist.com

As it is observed in section 5, because the production of petroleum is highly insignificant, the effect of indigenous production to the petroleum import is perfectly inelastic. Thus, Bangladesh depends almost hundred percent on the international market for domestic requirements. In this back drop, it is certainly to be expected that the responsiveness of petroleum import demand with respect to the changes of international prices also will be highly inelastic. Using the microeconomic tools of measuring elasticity developed by Mankiw, we will estimate the price elasticity of petroleum import demand:

Price elasticity of demand (PED) = Percentage change in quantity Import demanded / Percentage change in prices.

=   % Δ in Q$_D$ ÷ % Δ in Price [5]

= Δ in Q$_{ID}$ / Q$_{ID}$ ÷ Δ in P / P

Since the global oil market is highly politicized and the major portion of production and proven reserves are in government controlled, the global oil market performs unlikely to the perfectly competitive market. In addition to its dependence on the political decision making process in oil exporting nations, the world supply of oil is reduced by war, terrorism, and guerrilla activity that are the result of political instability or conflict (King, Deng and Metz 2012).

In table-4, from 2000-01 to 2010-11, against 219% increase of crude oil price in the international market, the petroleum import of Bangladesh has also increased by 5.98% which, however, is unlikely to the economic theory. In this back drop, according to the above equation, the price elasticity of petroleum import demand for Bangladesh is estimated as 0.03%. Here, the problem is, the sign of price elasticity of demand is positive. Against a substantial increase of crude oil price in the international market, remaining all other things constant, it is generally expected a massive reduction in the petroleum import demand. But, the estimated value 0.03% with positive sign indicates, without any reduction, the petroleum import demand soared up by 0.03% for 1% increase in international price.

During the last decade, Bangladesh petroleum market sows significant volatility. According to the research conducted by the Bangladesh Institute of Development Studies (BIDS), from December 1998 to November 2011, the domestic retail price of kerosene, diesel and furnace oil registered 353%, 318%, and about 1000% increase respectively. Moreover, as the table-5 shows, the local price of petroleum product was peaked in 2011. However, it is widely claimed that the policy of petroleum based power plant in generating electricity has triggered the prices in the domestic market.

Table -5: Domestic Retail Prices of Petroleum Products from May 2004 to December 2011 (Tk. per litre)

Time period	Kerosene	Diesel	Petrol	Octane
May 2004	20	20	33	35
December 2004	23	23	33	35
May 2005	25	26	35	35
September 2005	30	30	42	45
June 2006	33	33	56	58
April 2007	40	40	65	67
July 2008	55	55	87	90
December 2011	61	61	91	94

Source: Bangladesh Petroleum Corporation (BPC), Bangladesh Bank.

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[5] In the case, Δ in Price = change in international price of crude oil. That is, in calculating the price elasticity of Bangladesh petroleum import demand, only the change of international crude oil price will be considered.

Some significant evident can be found from table 4 and 5.

- It is evident that a positive relationship exists between the changes of petroleum prices in the international market and that of in the Bangladesh local market. The average price of crude oil in the global market has increased 20.59% during May2004 to May 2005. In reply, the price of different fuel oil such as kerosene, diesel and petrol has been raised by 25%, 30% and 6% respectively in the local market during the same period of time.

- The positive correlation between the domestic prices and international prices of petroleum products has been observed to have continued during the entire period contained in the table-4 and 5. From September 2005 to December 2011, the domestic price of kerosene, diesel, petrol, and octane was increased by 103%, 103%, 116.67% and 108% respectively. On the other hand, from 2005 to2011, the rate of increase of average crude oil price in the international market was estimated at 74.82%.

- Against 100.34%.increase of crude oil prices in the global oil market from 2004-05 to 2010-11, the average percentage increase of petroleum products (kerosene, diesel, petrol, and octane) in Bangladesh domestic market was estimated at 188.75 %. In this back drop, it has been calculated that, a 1% increase in the global petroleum prices caused 1.88 % increase in the average of petroleum prices in the Bangladesh local market.

8. Summary of the Estimated Results

Conventional economic theories argue that the import demand is negatively related to both world price and indigenous production of a particular commodity. In the same vein, for petroleum products, the increase in international prices or domestic production, the import demand will be slowed down ward and vice versa. Hence, the expected sign of both price and production elasticity of petroleum import demand should be negative.

Table-6: Estimated Values and both Expected and Estimated Signs of the Elasticites

Categories	Estimated values	Expected sign	Estimated sign
Petroleum import demand elasticity to the domestic Production.	1.62	–	+
Petroleum import demand elasticity to the international prices.	0.03	–	+
Elasticity of domestic petroleum prices to the international prices.	1.88	+	+

Source: Author's Calculation.

In this study, the value of Bangladesh petroleum import demand elasticity to both international price and indigenous production is estimated 0.03 and 1.01 with

positive sign. By the way of illustration, for 1% increase in both the domestic production and the price of petroleum in the global market, petroleum imports would increase by 0.03% and 1.01% respectively. In this back drop, Bangladesh can be interpreted as the most vulnerable on the fronts of price manipulation by the oil exporting alliance. On the contrary, the sensitivity of domestic petroleum prices to a change in the international price shows economically significant as it estimated with positive sign. The estimated results indicate Bangladesh petroleum prices highly elastic in the upward direction.[6]

9. Policy Recommendations of the Study

Bangladesh, like most of the developed and developing countries, is heavily reliant on international market for petroleum energy. On the other hand, the highly volatile international market along with the poor policy shifts relating to the production and utilization of petroleum energy intensify the additional cost burden for the economy. In this back drop, the paper proposes the following recommendations:

- Bangladesh should straight forward with long term plan to find additional oil mine as it got the only in the country with tiny production capacity. In this regard, in gaining technological proficiency, the government should emphasis on the research based vocational education and also on the efficient training program by hiring foreign technological experts to generate effective human capital.

- Since international crude oil market shows constant volatility, the government should improve the storage capacity to boost the requirements at the time of stability.

- Coal, along with petroleum and natural gas, is one of the leading energy components of the country. Despite the energy crisis, the country is failed to make the best use of it. So, the government should plans for the maximum extraction to add it in the national greed immediately.

- Rental and quick rental power plant, a measure of short run solution by the government, creating difficulties for the fiscal management. So, for the long run solution, the government needs to establish new electric power plant and also to renovate the inactive plants to release the pressure from petroleum.

- The government needs to ensure appropriate technical assistance and skilled human capital to improve the performance of Bangladesh Petroleum Exploration and Production Company Limited (BAPEX), Bangladesh Energy Regulatory Commission (BERC) and Bangladesh Petroleum Corporation (BPC).

- Corruption, in the entire system from import to consumption of petroleum products, is crucial to revamp the petroleum cost. In this backdrop, the effective accountability and accurate monitoring system through the entire system ranging from import to consumption of petroleum products should be

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[6] The estimated value for the sensitivity of Bangladesh petroleum prices in terms of international prices is 1.88. Since, during the studied time period, the prices in both the market moved in the upward direction, the value 1.88 is highly elastic in the upward direction. That is, for 1% increase in the international crude oil prices, the domestic crude oil prices rises by 1.88%.

executed to the petroleum cost burden.

10. Concluding Remarks

This paper investigates a number of important issues which are of great significance for the policy purposes. In this study, the elasticity of Bangladesh petroleum import demand is estimated in terms of both international price and indigenous production capability. The results, however, are observed perfectly inelastic for both the elasticities. For Bangladesh, the results actually confirm the bindings of petroleum import from the international market at any state of crude oil price and domestic production at the current production capability. On the other hand, the paper estimates the sensitivity of Bangladesh petroleum prices for the changes in the international prices. Since, the global crude oil market has constant volatility, the petroleum import cost however deepening the fiscal imbalance as the local crude oil market is estimated highly elastic to the international market. The article also shows the domination of petroleum import cost over the allocation of other essential sectors in explaining the degree of petroleum cost burden for the government in maintaining the economic stability.

However, the article further notices the inefficiency in the pattern of petroleum consumption. Despite a steady growth in the petroleum consumption pattern, the article analyzes, the domination of unproductive sector in terms of petroleum consumption might not be efficient for Bangladesh economic growth. Moreover, the paper reveals some policy options in explaining the improvement of petroleum production regime in an effort to lessen vulnerability in the context of foreign dependency. The paper also stresses on the necessity of efficient management system regarding distribution and consumption and also the paper argues for effective accountability through the entire system to lower the petroleum cost burden.

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