The Effects of Fuel Subsidy Removal on Input Costs of Productions: Leontief Input-Output Price Model

Mukaramah Harun[#1], Siti Hadijah Che Mat[#2], Wan Roshidah Fadzim[#3], Shazida Jan Mohd Khan[#4], Mohd Saifoul Zamzuri Noor[#5]

[#]*School of Economics, Finance and Banking, Universiti Utara Malaysia, 06010 Sintok, Kedah*
[1]mukaramah@uum.edu.my
[2]hadijah@uum.edu.my

***Abstract*— The study analyzes the impact of fuel subsidy removal policy on input costs of production sectors in Malaysia by applying the Input-output Price Model using Malaysia Input-output Table 2010. The elimination of subsidy on fuels such as RON95, RON97 and Diesel led to the increase in fuel prices by 32% on average. The increase in fuel prices led to an increase in production input costs for all 66 sectors, where the increase in the input costs of each sector exceeded the hike in fuel prices. There are 4 sectors whose production input costs are higher than the fuel subsidy removal policy namely fishing and aquaculture; transportation and storage; utilities; crops, animal production and hunting; and food products. Input-output price model application is an approach less commonly used in previous studies in Malaysia even though it is the most appropriate model for analyzing the impact of fuel subsidy removal on sectoral input costs. This study shows that the elimination of fuel subsidies has a major impact on the country's inflation and drastic global oil price changes can challenge the Malaysian economic sustainability.**

***Keywords*—** *Fuel Subsidy, Sectoral Price Effect, Sectoral Analysis, Input cost of production, Input-Output Price Model.*

1. Introduction

Subsidies are important policy instrument adopted by governments to attain economic, social and environmental objectives. For example, energy resources are one of the areas that have witnessed active intervention of governments all over the world, especially in developing countries through comprehensive subsidization of energy consumption. According to the International Energy Agency [1], the value of fossil fuel subsidies amounted to about US$500 billion globally in 2014. In Malaysia, energy consumption is largely driven by the relatively low energy prices due to its previous energy subsidy policy on transport fuel (gasoline and transport diesel) and electricity. Its total energy consumption increased by 2% per year for 14 years from 1210.39 kg of oil equivalent per capita in year 1990 to 2967.54 kg of oil equivalent per capita in year 2014 compared to other ASEAN members such as Singapore (1%), Indonesia (1%) and the Philippines (0.1%) (World Bank Data, 2018).

In Malaysia as the other developing countries, subsidies is utilize to promote its development, particularly the fuel subsidies which constitutes the second largest amount of subsidy in the country at RM23.5 billion in 2014. The fuel subsidies increased significantly over the years as indicated in Figure 1 adding pressure on government finance. The share of fuel subsidies in total government expenditure rose drastically since 2009, reached the highest rate at about 12 percent of total government expenditure in year 2013. The higher share on fuel subsidies contributing to a larger fiscal deficit. In 2012, Malaysian government spent over RM25 billion on fuel subsidies, contributing to a large deficit amounting to 4.5% of Gross Domestic Product (GDP). This deficit of 4.5 % of GDP was the second highest among Asia's emerging economies, right after India [2].

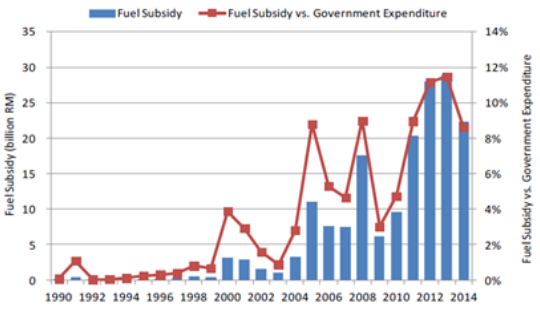

Figure 1. Fuel Subsidies from the Government

Source: Economic Planning Unit (2004-10), Hamid and Rashid (2012),
Maybank IB Research (2014)

Note: *in September 2009 Ron97 was substituted by Ron95. Ron 97 will continue will be sold but its price will be increased by 20 cent. It means government already started the fuel subsidy rationalization in September 2009.

The government spent on fuel subsidy that consists of gasoline, NGV- non-gasoline vehicles (gas), and diesel to keep price low compared with the actual prices fetched internationally. Therefore, Malaysia's budget capacity could turn unsustainable if there is an increase in the fuel price, if the subsidy to keep low fuel price constitutes a huge portion of government annual budget. Figure 1 shows that, when the crude oil price shot in 2008, the total fuel subsidy borne by the government was more than RM15 billion. In normal circumstances when crude oil price hovers in between USD65 to USD85 per barrel, the estimated fuel subsidy is in between RM9 billion to RM11 billion annually.

Amidst a global rise in fuel prices in 2008 the Malaysian government has been struggling with its budget deficit as it has tried to balance its revenues and expenditures. The government has cited the ever increasing subsidy bill as the main cause of its perennial budget deficit. The fiscal deficit which was about 2.7% of GDP in 2007 climbed very rapidly to 7% in 2008 due to rising fuel prices, and the consequent increase in subsidies and public expenditure. This reason cause reduction of fuel subsidy be a national mission. In the Tenth Malaysia Plan (2011-2015), the government plans to rationalised subsidies. The government introduced a subsidy rationalization plan in July 2010 and proceeded to raise fuel prices in December, 2010 and then has entirely removed the fuel subsidy in December 2014. Following the implementation of its subsidy rationalizing programme in the second half of 2010, the government managed to narrow its fiscal deficit to 5.6 percent of GDP at the end 2010 and 3.7 percent in 2014. Besides fuel subsidies that strain nation budgets, it is said that fuel subsidies could divert funds away from productive spending, discourage fuel efficiency, boost demand for fossil fuels, and benefited wealthy than poor Malaysians.

The reduce fuel subsidies resulted in a jump in inflation. Almost instantly after the government hiked the fuel price from RM1.92 a liter to RM2.70 a liter in 2008 the prices of electricity, food, transportation and raw materials spiked thereafter. Inflation reached about 5.5% in 2008 which was above the threshold. The price never came down thereafter, even though the fuel price had been reduced the lowest.

This study intent to examine the impact of phasing out fuel subsidy on the price, specifically, to see the burden of the fuel price increases on industrial and commercial users as production cost increase. In other words to see how much the increase in the price of fuel trigger the increase in production cost, in turn increase price of goods and service of various sectors. This study employed Leontief input-output price model.

The findings of this study are expected to provide an important input in the debate on the impact of removing fuel subsidies on the prices of output produced by various sector. As to our knowledge, there is a lack of studies on the sectoral effects of fuel subsidies removal in Malaysia by employing Leontief input-output price model. This research provides valuable information for policy decision makers in considering appropriate policies related to the removal of fuel subsidies.

2. Significance of The Study on Consumption Subsidy, Removal of Subsidy and Input-Output Analysis

Energy consumption subsidy is common in developing countries. Energy subsidy is defined as "any government action that lowers the cost of energy production, raises the revenue of energy producers, or lowers the price paid by the energy consumers" [3]. This kind of government support allows the energy to be purchased below the current market rate, hence, resulting in a saving to the public. According to [4] and [1], energy consumption subsidy is any policy by the government that is aimed at reducing the price of energy consumed by citizens relative to what the price would have been in the absence of such policy. The regulated price will reduce the consumer price index (CPI) and thus make it easy for the government to regulate the level of inflation.

Scholars such as [4]-[6] and many others have advocated energy subsidy removal because subsidies distort the true market price by failing to reflect the true market cost, which always lead to inefficient consumption and production of the subsidized goods. Reducing the price of a product below its cost price causes consumers to place less value on the product, which leads to an increase in demand, over use, waste and creating unnecessary shortage. Those who take a more benign view argue that subsidies can serve as instrument for redistribution goals, or can help to correct market failures. However, the public-finance economist Ronald Gerritse has warned that subsides defended

on such grounds "may have externalities that we did not bargain for".

[7] studied the effects of oil producing countries' fuel subsidies removal on the oil market and the world economy. They identified the producing countries with fuel subsidies where retail fuel prices are about 34 percent of the world price and found that removal of subsidies would reduce the world price of oil by six percent. They also showed that removal of subsidy unambiguously enhance welfare in the oil-producing countries. Other studies examined the effect of fuel subsidy on prices in other sectors. [8] studied the impact of subsidy removal on the transport sector development in Nigeria. The result shows that subsidy has a positive and significant relationship with the transport sector which implies that removing gasoline subsidies can increase the operational cost of the transportation sector and reduce the GDP of the country. However, [9] obtained different result for the transportation sector. They also provided evidence that a complete or one-shot removal of fuel subsidy is more favorable in terms of a better performance of the agricultural sector.

Meanwhile, [10] conducted a research to analyze the effect of a fuel subsidy removal on selected food prices in Port Harcourt (2001-2012). They examined the impact of subsidy removal on the prices of rice, garri, yam, beef and fish, by examining the prices of the different food items before and after the subsidy removal to determine if subsidy removal causes inflation. They showed that from 1966 to 2012 (56 years), Nigeria had removed the fuel subsidy 24 times, and the prices of most food items increased astronomically from 2001 to 2012 especially for beef and fish.

In Malaysia, by employing energy intensity and input-output quantity model, [11] estimated the effects of an increase in oil price on food prices. Their results reveal that energy intensity and higher oil price leads to an increase in the consumer price index (CPI) on food. The study by [21] using a computable general equilibrium (CGE) model highlights that households experience a significant decline in their welfare due to the increase in the price of transportation. Meanwhile, [12] expected that the removal of subsidy to raise the fuel price by approximately 50%. Their result shows that out of the household consumption in 12 sectors, the prices most affected by the fuel subsidy removal are for food and non-alcoholic beverages (23.48%), housing, water, electricity (27.73%), and transportation (26.53%).

This study intends to examine the impact of fuel subsidies removal on the cost of production in the various economic sectors in Malaysia. Although there are studies on fuel subsidy rationalization related to prices in Malaysia as indicated earlier, to our knowledge, none of the studies focuses on the sectoral cost of production effects of fuel subsidies removal has employed an Input-Output Price model using the latest Malaysian Input-output Table for year 2010. In addition, this study produces results at a highly disaggregated level, comprising 67 production sectors in Malaysia.

3. Quantification Of Sectoral Input Cost

In this study, Malaysia's Input-output Table 2010 is used to carry out an analysis using the Input-output (I-O) Leontief price model in estimating the economy effects of fuel subsidies removal in Malaysia. Specifically, the model estimates how cost of productions in the various sectors would respond to the implementation of the fuel subsidies removal.

The I-O Leontief price model or also called the supply driven I-O is a dual model for conventional Leontief quantity I-O model. The I-O Leontief price model has been developed and used to deal with the direct and indirect effects of input activities [13]-[18] as the conventional Leontief I-O model [19] which depends on the assumptions of fixed technical coefficients and a perfectly elastic supply of inputs focuses on analyzing the impacts stemming from the final demand or output orientation of activities. The I-O Leontief price model shows the total effects or the general equilibrium relationship between the prices of each of the primary inputs and the input cost indices for the industries.

The I-O approach is a well-established and most transparent methodology appropriate to analyze the short term impacts of one-shot policy shocks like the subsidies reduction. One important advantage of the I-O model is that it allows explicit examination of industry interdependency, how the elimination of subsidies in fuel sectors through its direct and indirect effects triggers changes in other sectors. The underlying presumption of this model is that fuel subsidies rationalization increases the prices of fuel goods, thereby leading to an increase in the prices of other goods and services, which subsequently increase the price of private consumption, decrease consumer welfare and increase public revenue.

Fuel subsidy removal may have significant impacts on the cost of production of other sectors given that fuels are essential inputs for production for other sectors. The model is a linear production function formulated on two basic assumptions: fixed proportions of inputs, under the assumptions

of constant returns-to-scale, and no consumer's utility functions. The first assumption underlines that each sector produces a single product and there is a fixed relationship between each sector's output and all its inputs, or in others words ignores the possibility of economies of scale in the production system. The second assumption means that the consumer's utility functions are ignored, so the final demand does not take part in the price definition.

The study uses Malaysia's Input-output Table for year 2010, dealing with 67 production sectors.

Assuming that the sectoral prices are equal to the average cost of production, the price for sector j can be expressed as the average cost of production (modified from [17]). Thus, if j=1,….,67, are the production activities considered, the price of the each production activity is as follows:

$$p_j = \left(1+\tau_j\right)\left[\sum_{i=1}^{67} p_i\, a_{ij} + \left(1+s_j\right)wl_j + rk_j + \left(1+t_j{}^m\right)p_j{}^m m_j\right] \quad (1)$$

where is the price of production in sector j; is the input-output technical coefficients; are respectively, the price of labor (wage), the price of capital and the price of imports; and are espectively, the coefficient of labor, the coefficient of capital and the coefficient of import and are respectively, the taxes by the government, the tax rate of social security paid by sector j, and the tariff rate of imported goods.

The simulation analysis introduces a fuel subsidy removal. This means that the basic model (equation 1) needs to be redefined. Let j = 67 be the activity of petroleum refinery products. When the fuel subsidy removal is introduced, we can evaluate the effects on prices through the following expression:

$$p_j = \left(1+\ \tau_j\right)\left[\sum_{i=1}^{66} p_i\, a_{ij} + p_{67}a_{67j}\left(1+f_j\right) + \left(1+s_j\right)wl_j + rk_j + \left(1 + t_j{}^m\right)p_j{}^m m_j\right] \quad (2)$$

Where is the rate of reduction in the fuel subsidy. In this case, a fuel subsidy removal is represented by the increase in the price of petroleum products by 32 % (refers to an average increase in petroleum product price; RON95, RON97 and diesel from May 2009 to December 2014).

The simulation results show the percentage variation in prices with the assumptions that all the benchmark prices are equal to unity.

4. The Increase In Sectoral Production Costs

Overall, the sectors in Malaysia experienced an increase in production input costs as a result of the implementation of the fuel subsidy rationalization which started from September 2009 until being completely eliminated in 2014 as shown in Figure 2. and Table 1. All major sectors were affected by the elimination of fuel subsidies where in aggregates the average input costs for agricultural production increased by 54.59 %, services 50.73 %, mining and quarrying 50.15 %, manufacturing 49.91 %, and construction 49.82 %. The findings of this study are similar to the previous studies which found an increase in input costs due to fuel subsidy removal (see for example [7-10]).

Looking at the sector specifics, it was found that sectoral production input costs have increased between 48.08% to 60.71%. The sectors with significant increases in production input costs were fishing and aquaculture (60.71 %) followed by transportation and storage (54.6 %), utilities (52.20 %), crop production, animal production and hunting (52.09 %) and food products (51.92%). The results of this study are consistent with those of [8], [20], [10] who found that removing petroleum products such as fuel and gasoline subsidies can increase the operational cost of the transportation and agriculture sectors. These results indicate that both sectors are consuming more fuel compared to others sectors.

Meanwhile, there are four sub-sectors that were less affected by the impact of fuel subsidy removal namely textiles, apparels and leather products; transport equipment; other manufacturing; specialized construction activities; and health, with the percentages increase in input costs less than 50%, at between 49.16% and 49.21%. The reason is because these sectors are less dependent on fuel use. Other sectors such as forestry and logging, mining of coal and lignite, chemical, rubber products, metal and other non-metallic mineral products, food products, utilities and rental and leasing have experienced an increase in production input costs of between 50.09% to 51.86%.

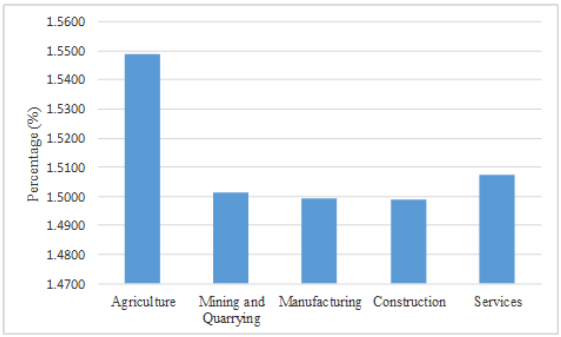

Figure 2. The Simulation Results of Changes in Input Costs of Production of Main Sectors after the Removal of Fuel Subsidy

Table 1. The Simulation Results of Changes in Input Costs of Production Sectors after the Removal of Fuel Subsidy

Sectors	Sub-sector	Simulation Result
Agriculture	Crops, animal production and hunting	1.5209
	Forestry and logging	1.5186
	Fishing and aquaculture	1.6071
Mining and Quarrying	Extraction of crude petroleum & natural gas	1.5046
	Mining of metal ores	1.5009
	Mining of coal and lignite	1.5001
	Other mining and quarrying	1.5004
Manufacturing	Food products	1.5192
	Beverages and tobacco products	1.5001
	Textiles, wearing apparel and leather products	1.4916
	Wood, furniture, paper products and printing	1.4987
	Chemical, rubber products, metal and other non-metallic mineral products	1.4969
	Electrical, electronic and optical products	1.4953
	Transport equipment and other manufacturing	1.4921
Construction	Construction of buildings	1.4951
	Civil engineering	1.5082
	Specialised construction activities	1.4933
Services	Utilities	1.5220
	Wholesale and retail trade	1.4976
	Food & beverage and accommodation	1.5117
	Transportation and storage	1.5416
	Information and communication	1.5062
	Finance	1.5080
	Real estate	1.5084
	Rental and leasing	1.5156
	Research and development	1.5023
	Business services	1.5039
	Education	1.5009
	Health	1.4808
	Government Services	1.5014
	NPISHs	1.5084
	Other services activities	1.5012

5. Conclusions and Policy Recommendations

This study analyzes the effects of fuel subsidy removal policy on the input costs of production sectors in Malaysia. Fuel is a very important source of energy in the production process for all sectors and therefore any change in fuel prices affects the country's productivity and output. Hence to generate economic growth the government has implemented fuel subsidies to ensure low fuel prices and low production costs. However, fuel subsidies provided by the government can no longer be continued due to the federal government's financial constraints, volatility in world oil prices and the leakage of subsidies to non-target groups, which is a fuel subsidy distribution to high-income households. Consequently, the impact of the fuel subsidy removal policy led to an increase in fuel prices by 32 % on average. This fuel price increase has led to a rise in the cost of production for the other 66 sectors in this study. The production costs of fishing and aquaculture sector; transportation and storage; utilities; crops production, animal production and hunting; and food products, have the highest increased due to the fuel subsidy

removal policy.

Hence, in aggregate term, the agriculture and aquaculture which is contain of fishing and aquaculture and crop production and animal production is badly affected by the fuel subsidy removal policy and this is in line with the findings by [11] and [10] who argued that fuel subsidy removal could lead to an increase food prices and the consumer price index (CPI) of foods. Nonetheless, in terms of the magnitude of the increase in the costs of production of other sectors which can be translated into the rise in the prices of goods in other sectors due to the rise in fuel prices as a result of fuel subsidy removal, our result is quite different from the findings by [12]. This study found that the increase in the prices of goods was higher than the fuel price hike while [12] found that the rise in the prices goods in other sectors was lower than the fuel price hike caused by the fuel subsidy removal. In conclusion, the removal of fuel subsidies exposed the product prices in every sector to changes in the world oil prices. Therefore, policymakers should anticipate possible oil price hikes to avoid a possible economic disturbance.

References

[1] IEA "*World Energy Outlook, Paris"*. http://www.worldenergyoutlook.org/media/weowebsite/2008-1994/weo1999.pdf

[2] IISD *"Lessons Learned: Malaysia's 2013 Fuel Subsidy Reform. Geneva: Global Subsidies Initiative of International Institute for Sustainable Development"* (March), 1–17. Retrieved from https://www.iisd.org/GSI/sites/default/files/ffs_malaysia_lessonslearned.pdf\nhttps://www.iisd.org/gsi/sites/default/files/ffs_malaysia_lessonslearned.pdf. 2014.

[3] Dartanto, Teguh. *"Reducing fuel subsidies and the implication on fiscal balance and poverty in Indonesia: A simulation analysis."* Energy Policy, No 58, pp. 117-134, 2013.

[4] Heggie, Ian G., and Piers Vickers. *Commercial management and financing of roads*. The World Bank, 1998.

[5] Burniaux, Jean-Marc, John P. Martin, and Joaquim Oliveira-Martins. *"The effect of existing distortions in energy markets on the costs of policies to reduce CO2 emissions: evidence from GREEN."* The Economic Costs of Reducing Co2 Emissions, Oecd Economic Studies, No 19, 1992.

[6] Schneider, Karen, and Matthew Saunders. *"Removing energy subsidies in developing and transition economies."* International Conference, Sydney. Vol. 7, 2000.

[7] Balke, Nathan S., Michael Plante, and Mine Yücel. *"Fuel subsidies, the oil market and the world economy."* The Energy Journal 36.Adelman Special Issue, 2015.

[8] Soile, Ismail, Hezekiah Tsaku, and Bilikisu Musa-Yar'Adua. *"The impact of gasoline subsidy removal on the transportation sector in Nigeria"*, 2014.

[9] Oktaviani, Rina, et al. *"Impact of a lower oil subsidy on Indonesian macroeconomic performance, agricultural sector and poverty incidences: a recursive dynamic computable general equilibrium analysis."* , 2007.

[10] Ekine, D. I., and I. A. Okidim. *"Analysis of the Effect of Fuel Subsidy Removal on Selected Food Prices in Port Harcourt, Rivers State Nigeria (2001-2012)."* Analysis Vol 5, No 4, 2013.

[11] Hamid, Khalid Abdul. "*Integrated Input-Output Analysis of the Economic Impact of Higher Oil Price in Malaysia"*. Diss. Universiti Putra Malaysia, 2010.

[12] Razak, Nor Azam Abdul, Russayani Ismail, and Roslan Abdul Hakim. *"Is There a Case for Fuel Subsidy Removal in Malaysia?."* Journal of Economic & Financial Studies, Vol 2, No 04, pp. 01-13, 2014.

[13] Miller, Ronald E., and Peter D. Blair. "*Input-output analysis: foundations and extensions"*. Cambridge university press, 2009.

[14] Kehoe, Timothy J., et al. *"A general equilibrium analysis of the 1986 tax reform in Spain."* European Economic Review Vol 32, No 2-3, pp. 334-342, 1988.

[15] McKean, John R., and R. Garth Taylor. *"Sensitivity of the Pakistan economy to changes in import prices and profits, taxes or subsidies."* Economic Systems Research Vol 3, No 2, pp. 187-204, 1991.

[16] Han, Sang-Yong, Seung-Hoon Yoo, and Seung-Jun Kwak. *"The role of the four electric power sectors in the Korean national economy: an input–output analysis."* Energy policy Vol 32, No 13, pp. 1531-1543, 2004.

[17] Llop, Maria, and Laia Pié. *"Input–output analysis of alternative policies implemented on the energy activities: an application for Catalonia."* Energy policy Vol 36, No 5, pp. 1642-1648, 2008.

[18] Khanh, Nguyen Quoc. *"Study on the Impacts of Electricity Tariff Increase on the National Economy of Vietnam."* Energy Market Integration in East Asia: Theories, Electricity Sector and Subsidies, ERIA Research Project Report 2011, No 17, pp. 253-67, 2012.

[19] Leontief, Wassily. *"More pitfalls in demand and supply curve analysis: a final word."* The Quarterly Journal of Economics Vol 48, No 4, pp. 755-759, 1934.

[20] Akinyemi, Ayodele Jacob, et al. *"Curcumin administration suppress acetylcholinesterase gene expression in cadmium treated rats."* Neurotoxicology, No 62, pp. 75-79, 2017.

[21] Solaymani, S., & Kari, F. *"Impacts of energy subsidy reform on the Malaysian economy and transportation sector"*. Energy Policy, No 70, pp. 115-125, 2014.