Chapter 9

Economic Impacts of Subsidy Rationalization Malaysia

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August 2012

This chapter should be cited as
Hamid, K. A. and Z. A. Rashid (2012), 'Cambodia's Electricity Sector in the Context of Regional Electricity Market Integration' in Wu, Y., X. Shi, and F. Kimura (eds.), *Energy Market Integration in East Asia: Theories, Electricity Sector and Subsidies*, ERIA Research Project Report 2011-17, Jakarta: ERIA, pp.207-252.

CHAPTER 9

Economic Impacts of Subsidy Rationalization in Malaysia

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Subsidy rationalization efforts by governments remain constrained as many policy plans have been delayed based on argument that subsidy policies have objectives that go beyond economic rationale. This paper examines Malaysia's energy subsidy experience, in terms of the direct and indirect effects of subsidy distribution and reallocation, and considers whether the rationale for subsidy policy in the case of energy has been justified. Subsidy removal impacts how efficient an economy performs in terms: of energy product prices; cost of production; transportation services; government budget; household consumption: and general level of prices. As a subsidy row is non-existence in the 2005 published Malaysian input-output (I-O) table which would inform current policy, we create a subsidy row in the form of total fuel subsidy which has been constructed to assess the expected impacts of phasing out fuel subsidies in the short, medium and long run. This study employs Leontief's and a computable general equilibrium (CGE) model based on national and social accounts of the Malaysian economy, disaggregating and constructing a hybrid energy I-O matrix and partitioning the I-O table into energy and non-energy blocks. An explicit representation of the impacts of energy products; especially those which have received greater amounts of subsidy is embedded in this modelling. The modelling informs energy pricing, the domains of government intervention in energy markets, and the international experience in mitigating the negative impact of energy pricing reform. Features of the petroleum sector in the Malaysian economy and its interactions with the main economic variables are considered. I-O analysis is used to set a reallocation scheme using changes in wage levels and value added impacted by total fuel subsidy particularly on autonomous spending by households and growth. Finally, the CGE analysis, which is superior in substitution effects compared with I-O analysis, will explain the overall macroeconomic impacts of phasing out subsidies and the impacts of reallocation into related sectors using government expenditure. In conclusion, policy options reliant on cheap energy inputs and delays in subsidy rationalization pose a significant threat for Malaysia's continuing economic competitiveness in the region.

1. Introduction

The East Asian (EA) region's energy market integration was purposely mooted as an approach to achieve overall regional economic development and to narrow development gaps amongst EA member countries. Endowed with varied energy resources in terms of supply, demand and availability, the EA region needs a coordinated approach to harness and utilize the full potential of energy resources to fuel economic growth in the region. It is estimated that the region will spend USD 6-10 trillion of investment over the next couple of decades in the energy sector to meet future demand (UNEP 2004). This investment is expected to affect domestic and regional economies and will create distortion in the energy market; phasing out energy subsidies is amongst the most prevalent challenges of regional energy market integration. Despite these challenges, policy makers in Malaysia have justified delaying subsidy removal programmes with argument that subsidy removal policy goes beyond the economic rationale.

1.1. Background

Two key tasks for policy makers amongst various actions required for Energy Market Integration (EMI) is the removal of energy price distortions and the creation of an enabling environment for investment in the sector. Energy commodities across the region are taxed and subsidized at various levels. These taxes and subsidies engender huge market distortion and hinder harmonization of the EA energy market.

There are diverse energy and non-energy subsidies in Malaysia, most of which are intended to ease the conditions of poor groups particularly during crude oil price increase. Table 1 shows that the majority of energy subsidies are concentrated on petrol products and petroleum refinery. Total expenditure on fuel subsidy has been influenced by increased investment and the recent rise of crude oil prices. Table 1 further illustrates that Fuel subsidies are often offset by tax exemption and levies amounting to 10.4 % of total government expenditure in 2005. In the same year operating expenditure was recorded at RM10.9 billion and doubled to RM23.7 billion in 2011 as announced in the 2011 budget by the Ministry of Finance (Bernama, 2010). Remaining subsidies are becoming a relatively smaller share of total operating expenditure as compared to the increasing share attributed to fuel subsidy as shown in Table 1.

Energy subsidy is considered an effective policy tool which may assist poor groups in a population. However, fuel subsidy is indiscriminately employed in Malaysia and impacts all fuel consumers. This has led to queuing and blockades at petrol stations before announcements of fuel price increases. It has been argued that the unexpected timing and magnitude of fuel price increases have intensified public anger (Straits Times, 2006). For example, it has been suggested that a subsidy reduction of 1 cent for the retail price of petrol could represent a reduction of Government expenditure by as much as RM134 million (Malay Mail, July 2010). The negative economic effects resulting from transfer of payment through fuel subsidy depending on types, size and the structure of the economy and compelling evidence that subsidy causes large economic costs in the long run suggests that fuel subsidy rationalization is an important policy consideration.

Table 1 shows that petroleum subsidy alone amounted to almost RM18 billion in 2008. Total fuel subsidy is about 8.9% of total government expenditure or about 3.65% of gross domestic product (GDP). About RM15.9 billion worth of petrol and diesel subsidy is expected to be incurred in 2011 compared to RM9.6 billion that was spent in subsidising products in 2010. Direct fuel subsidies have increased significantly over the years placing growing pressure on government finances and exacerbating national deficit for over a decade. The fiscal ramifications of fuel subsidy impacts other parts of Malaysia's national accounts including the balance of payments, trade and others.

Subsidy budget is substantial and has grown annually at an exponential rate since the 1990s, the highest rate occurring in 2008. For example, in 2005 the total bill for fuel subsidy was about USD 3.66 billion[1] (RM10.9 billion), which amounted to USD 138 per capita fuel subsidy. This per capita subsidy value is higher than that of Malaysia's neighbouring country Indonesia, which spent in the same year USD 10.1 billion on total subsidy, but which has a lower fuel subsidy per capita of only USD 43.91.

[1] Sourced from the EIA 2011.

Table 1: Fuel Subsidy in Malaysia 1990 to 2010

Year	Total subsidies (RM million)	Of which: Fuel subsidies (RM million)	Total government expenditure (RM million)	Total government	
				Total subsidies	Fuel subsidies
1990	494	27	35,715	1.4	0.1
1991	965	401	37,861	2.5	1.1
1992	560	15	41,763	1.3	0
1993	589	23	42,341	1.4	0.1
1994	588	55	46,341	1.3	0.1
1995	612	123	50,624	1.2	0.2
1996	850	180	58,493	1.5	0.3
1997	958	228	60,415	1.6	0.4
1998	1,151	500	62,688	1.8	0.8
1999	1,136	458	69,313	1.6	0.7
2000	4,824	3,170	84,488	5.7	3.8
2001	4,552	2,881	98,992	4.6	2.9
2002	3,677	1,651	105,676	3.5	1.6
2003	2,679	1,006	114,577	2.3	0.9
2004	5,796	3,343	120,162	4.8	2.8
2005	13,387	10,984	128,278	10.4	8.6
2006	10,112	7,558	143,501	7	5.3
2007	10,481	7,473	163,649	6.4	4.6
2008	35,166	17,556	196,346	17.9	8.9
2009	20,345	6,190	206,582	9.8	3.0
2010	23,106	9,605	204,426	11.3	4.7

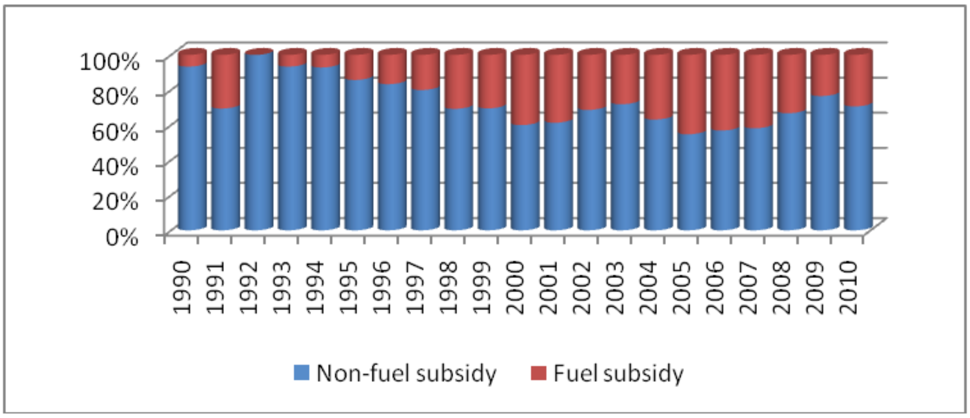
Source: Ministry of Finance, Malaysia (2010/2011) and various issues of Economic Reports.

Subsidy also comprises a significant part of electricity tariff determination in Malaysia. The national oil corporation, PETRONAS, subsidizes gas price pass-through to the National Power Corporation (TNB). However, the former has to import slightly more than one-third of its gas, which is priced at three and a half times that of the domestic price; the gas then has to be supplied to the latter. Any interruption or curtailment of gas supply experienced by the power corporation will result in rising operating costs and because the gas price is heavily subsidized, likely causes hikes in electricity tariffs. To protect low income households, special rebates were given for electricity units consumed during the recent electricity tariff hike. While commercial users are directly affected by having to pay higher tariff, other industries and consumers face a higher general price level indirectly.

One of the most pertinent issues related to energy security is the assurance of an uninterrupted electricity supply; fuel supply at power generation plants has to be made available. Pressures arising from increases in international coal prices have led the TNB to increase electricity tariffs. This situation will be further exacerbated in the future as although the corporation's generation mix currently comprises only one-third of coal while one-half is gas, the gas prices paid by the corporation are subsidized. In the future the corporation's generation mix will have to rely less on gas, and more on imported coal, implying that electricity prices will be higher.

Figure 1 illustrates a sharp increase in fuel subsidy as a percentage of total subsidy during 2005-2007. This increase is due to the rising crude oil prices in recent years. Therefore, although subsidies lower costs of production, they can also contribute to escalating expenditure on subsidy. Undesirable impacts of this feature include inefficient energy use, undermining returns on investments, and promoting reliance on outdated and dirtier technology that has negative environmental impacts.

Figure 1: Fuel Subsidy over Total Subsidy by Percentage, 1990-2010



Source: Ministry of Finance, Malaysia (2010/2011) and various issues of Economic Reports

The negative impacts of subsidy has recently led to a consideration of reform in energy subsidy in the 10th Malaysia Plan (2010 to 2015; EPU, 2010). The plan entails price liberalization to bring subsidized prices of fuel products closer to their market clearing level while remaining subsidies are targeted at the needy. The over-riding goal of subsidy rationalization is to address fiscal imbalances in order to improve, not only the production system's efficiency but also efficiency in allocation. The limitation of this rationale is that subsidy cannot be completely undertaken since some of these policies go beyond economic rationale. However, this negates the fact that direct effects are always more manageable than indirect effects based on varying consumption patterns which can be unpredictable.

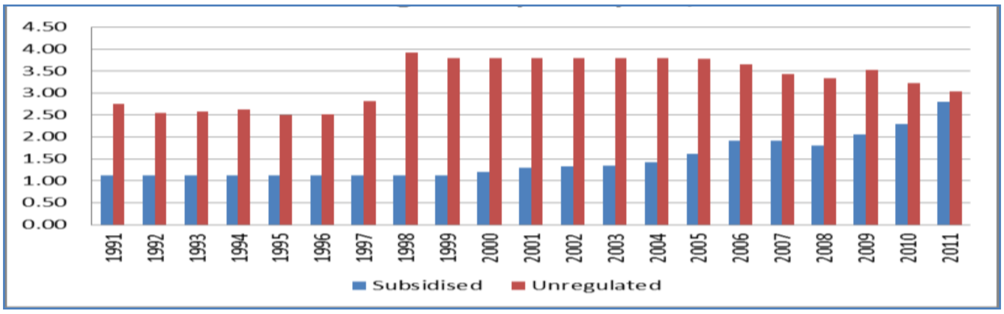
Key Reasons Why Subsidy Needs to Be Rationalized

Demand and supply of crude oil have a significant influence on total fuel subsidy. Total fuel subsidy surmounted an unsustainable trend since it is closely linked to world commodity prices, in particular the high side of crude oil prices. In addition, a recent study by the International Monetary Fund (IMF) revealed that some subsidies are not well targeted and largely benefit higher income groups. This study suggests that subsidized goods and services lead to over consumption and furthermore, do not encourage industry to upgrade and improve productivity where input costs are subsidized. The unintended consequences of subsidies, therefore, may contribute to long-term economic weakness.

Despite the Malaysian government's decades of effort to keep petrol price the lowest at the pump price compared to other ASEAN countries, especially for RON95, the cost of maintaining this strategy has had substantial impact on government expenditure and impact on the economy. Fuel subsidy intended to target on poor groups were widely accessible to all income groups.

Another stumbling block in Malaysian energy reform has been a dependency on the world price of imported products and all related direct and indirect costs, such as costs of refining, transportation, storing, import duties and taxes. Malaysia's petroleum pricing policy does not take into account the *foregone opportunity cost of production share* that is sold entirely in the domestic market under the subsidized price. Thus, the domestic prices of petroleum products were kept almost constant for a specified period, but demand for some of these products have fluctuated at different points of time. Figure 2 illustrates the irregular patterns of consumption of subsidized and unregulated petrol price since 1991 commencing from an initially large gap, but with the gap diminishing over time towards 2011.

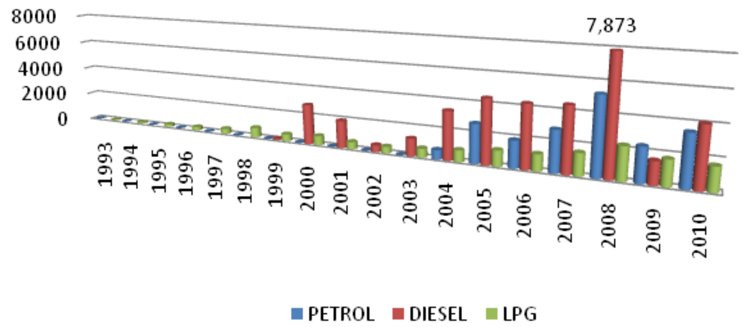
Figure 2: Subsidized and Unregulated Petrol Prices, 1991-2011



Source: Ministry of Domestic Trade and Consumers Affairs.

Assuming subsidized and unregulated petrol prices are mainly influenced by world's crude oil prices, the amount of subsidy per liter of petrol products had reduced in this period of time despite increases in world's price of crude oil. The subsidy gap between subsidized and unregulated petrol prices had since narrowing probably due to serious subsidy rationalizing efforts. This is illustrated by subsidized and unregulated prices respectively represented by the blue and red bar in Figure 2. The existing pattern denotes that subsidized petrol experienced structural rigidities and a slow rate of replacement of energy capital stock. In contrast, unregulated petrol has very little demand in the short run because of structural rigidities, and this may be indicative of an influence of substitution of fuel to subsidized fuel. The closing gap between subsidized and unregulated petrol indicates an undermining of return on investment and consequently on the ability and incentive to invest in new infrastructure. This situation also encourages reliance on outdated and dirtier technology.

Figure 3: Fuel Subsidy, 1993-2010 (million RM)



Source: Ministry of Domestic Trade and Consumers Affairs.

Figure 3 shows that despite a record spike in the crude oil price of USD145 per barrel in 2008, fuel intake did not lower but led to a record consumption of diesel amounting RM7.8 billion. In addition, this does not include tax exemptions to oil producers when price of fuel is above the market price. Overall, total fuel subsidy increased to a record of RM15.4 billion in 2008, a trend being set with subsidy lowering the cost of production responding to the increase in demand for diesel and a corresponding record high in fuel consumption. This is believed to have raised informal and illegal activities such as fuel hoarding, siphoning and illegal trade particularly at the Malaysian borders and at sea. It has also undermined efficiency efforts in the productive system, lowering Malaysia's competitiveness amongst countries in the region.

Table 2 summarized the energy industry in the Malaysian economy that comprised of primary, secondary and tertiary energy production respectively represented by three main sectors i.e. Crude oil, natural gas and coal; Petroleum refinery; and Electricity and gas for 2000 and 2005. The main bulk of fuel subsidy is estimated to fall in the dimension of Petroleum refinery which valued at 72.9 % of total energy purchase in 2005 as shown in Table 3, with Electricity and gas constitutes another 20.7 %. Assuming the size of the energy bill influences the share of subsidy, then the bigger the value of energy purchased, the higher fuel subsidy is spent which could lead to a soaring expenditure bill if the trend of crude oil price remains rising. This situation would subsequently have adverse ramifications on Malaysia's output and GDP.

Table 2: Aggregate Energy Sectors and Their related Inputs by MSIC, 2000 and 2005

Energy Industry Commodity Group	Commodity Description
Crude oil, natural gas and coal	Petroleum oils, crude
	Natural gas, in gaseous state
	Coal
Petroleum production*	Diesel
	Petrol RON 97 below and above
	Furnace oil
	LPG
	Other Fuel
Electricity and gas	Electricity
	Gas

**Note*: The I-O Table 2005 termed Petroleum production as Petroleum Refinery
Source: I-O Table 2005, Department of Statistics

In terms of types and variation of subsidies, the 2005 I-O table clearly identifies energy inputs amounting to about RM53 billion, highlighted in Table 3. Most subsidies, especially fuel, are granted by the government to producers or distributors in energy industry to prevent a decline of that industry (e.g., as a result of continuous unprofitable operations) or an increase in the prices of its products or simply to encourage it to hire more labour (as in the case of a wage subsidy). Some of these subsidies were even used to encourage the sale of exports; subsidies on some foods to keep down cost of living, especially in urban areas; and subsidies to encourage the expansion of farm production, to achieve self-reliance in food production. Nevertheless, fuel subsidy is intended to ease the burden of the poorest group especially in times of oil price increase.

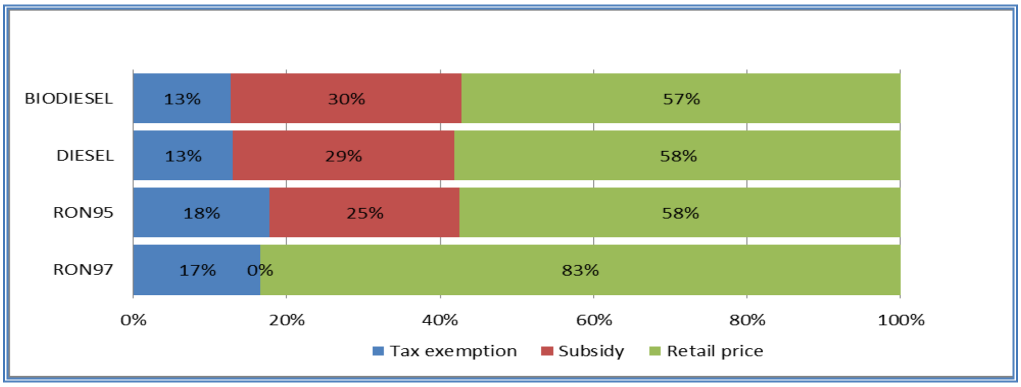
Table 3: Energy Purchased by Energy Sectors in Years 2000 and 2005, Domestic Production at *basic values*, RM'000

COMMODITY * COMMODITY (RM'000)	Crude petrol,		Petrol & coal products		Electricity & gas	
	2000	2005	2000	2005	2000	2005
Crude oil,	483,690	0	11,565,797	30,436,185	7	0
Petrol & coal	155,736	3,379,324	2,224,440	7,862,719	1,292,593	6,536,770
Electricity &	29,893	29,337	274,857	396,727	663,745	4,458,645
Total in 2005		3,379,324		38,695,631		10,995,415

Source: DOS I-O table 2000 and 2005

Energy dynamically works within a multi-complex, inter-industry environment, and subsidy only constitutes a small share of energy inputs; previous studies had proven the increasingly critical role of both energy inputs and subsidies. Since the combination of energy inputs and fuel subsidy have significant influence mainly on production system input material, subsidy escalates the risk of a country's susceptibility with the rising of crude oil prices.

Figure 4: Determination of Automatic Pricing Mechanism, 2011 (Prices in Terms of %)



Source: Ministry of Domestic Trade and Consumerism

Figure 4 shows different magnitudes in tax exemption, subsidy and retail price for different fuel products in 2011. Fuel subsidy on refined petroleum products were used to supply petrol pump stations' products such as diesel and gasoline since the 1970s, while others like LPG which emerged in the 1980s have no significant influence. Concurrently, subsidy on RON97 has been floated in the market in 2008 as an initial preparation to rationalize subsidy. However, as shown in Figure 4, RON97 fetches a high proportion of retail price (83%) and in terms of market control has less than 10 per cent consumed by motorist, thus, it does not significantly lowered the overall effect of subsidy. In terms of environmental effects, despite RON95 being considered pollution-free, it consists of benzene that acts as booster replacing lead (Bernama Auto News, 2010). RON97 has less impact in terms of pollution emissions, but is not widely consumed as it is marginally more expensive than RON95.

Given this background, our research examines the economic impacts from the removal and reallocation of fuel subsidy on the Malaysian economy. This is undertaken by analysing economy-wide impact effects, sectorial and welfare ramifications, and suggests redistribution of fuel subsidy. We employ I-O and computable general equilibrium (CGE) models to estimate the economy-wide impacts of removing and reallocating fuel subsidy. The I-O model will be based on the Malaysian 2005 I-O table whereas the CGE model will be primarily constructed on the MIER-CGE database with necessary modification to accommodate the objectives of this study. Undertaking energy subsidy removal, the I-O model identifies and evaluates the amount of fuel subsidy purchased by sectors of the economy on selected fuel products including commodities like gasoline, LPG, kerosene, cooking gas, etc. In addition, the MIER-CGE database, also built based on the I-O table 2005, will capture fuel subsidy removal using an indirect tax on aggregate commodities such as Petroleum refinery as well as Electricity & gas. In considering the reallocating of subsidies we propose strategies aligned to recent economic issues and challenges in relation to welfare and growth.

1.2. Previous Study

Emerging in the literature on subsidy are empirical studies based on different countries in the world, for example, the Energy Sector Management Assistance

Program (ESMAP, 2004), Manzoor, *et al*. (2009), Aboulmein, *et al*. (2009) and Oktaviani, *et al*. (2005). ESMAP (2004) looks at global fossil fuel subsidy and how its negative impacts on economies and environment.

Manzoor, *et al*. (2009) use CGE/MPSG modeling based on Iranian data working with the assumption of an implicit rent payment to the specific government ownership of mineral resources in extraction of oil and gas. Their study shows that subsidy removal results in shrinking of output, reduction in urban and rural welfare of 13% and 12% respectively and also hyperinflation.

Aboulmein, *et al*. (2009) study the impact subsidy removal in Egypt over a 5-year period using a CGE model and found that without offsetting any policy actions, GDP growth would be reduced by 1.4 percentage points over the base year and depress welfare levels of households at all levels of income distribution. They found that inequality was reduced at the expense of the richest quintile.

Oktaviani, *et al*. (2005) employed a recursive CGE model and found that budget deficit, exchange rate fluctuation, and high fuel world price provide a burden on its budget capacity to stimulate the Indonesian economy. The Indonesian government has designed several fiscal policies which include reduction of fuel subsidy. Oktaviani, *et al*. (2005) analyze the impact of fuel subsidy reduction on macroeconomic variables, agricultural sector, and income distribution. Their results show that the *reduction in fuel price subsidy tends to increase prices of industrial outputs* highly dependent on fuel, such as the transportation and fishery sectors. In contrast, the change in fuel price does not influence prices in the paddy sector. They found that wage of skilled labour, land rent, and capital rent declined steadily in response to changes in fuel price. They also found households would incur income losses following the reduction in fuel subsidy, decreasing the overall welfare of households. Incomes are not evenly distributed within Indonesian society (household groups). An increased fuel price at consumer level reduces the Indonesian real GDP, and their paper suggests compensation by reducing fuel subsidy directly to the poor people as a possible policy measure. It is argued that compensation should be given indirectly to the poor people through the development of infrastructure, which mitigate supply side bottlenecks in the Indonesian economy.

The United Nations Environment Programme (UNEP, 2004) posits that implications of subsidy rationalization on production and imports will specifically influence "subsidies that are current unrequired payments that government units, including non-resident government units, make to enterprises on the basis of the levels of their production activities or the quantities or values of the goods or services which they produce, sell or import". Subsidies are not payable to final consumers and current transfers that government make directly to households as consumers are treated as social benefits. Subsidies also do not include grants that government may make to enterprises in order to finance their capital formation, or compensate them for damage to their capital assets, such grants being treated as capital transfers.

Considering the above definitions, it is critical for subsidies to be observed from the standpoint of a non-productive element encroaching into productive sectors especially in the energy sectors whereby the Malaysian economy is very dependent upon energy material inputs in sustaining growth. For that matter, a comprehensive examination on how subsidy removal may affect the economy is essentially a pre-requisite in the quest to raise economic growth.

2. Methodology

Since our main objective is to assess the expected impacts of phasing out subsidies of energy products in the short, medium and long runs, we must construct a fuel subsidy row and a hybrid energy I-O matrix partitioning it into energy and non-energy blocks. The structure of the matrices will enable an explicit presentation of the impacts of energy products; especially those receiving the greater amounts of subsidy. Households are also disaggregated according to expenditure level, so that impacts of different policies on poor households can be analyzed.

In the I-O analysis, the technical coefficients provide valuable information on the structure of input for a specific industry, i.e., oil or fuel industry purchase is used by other non-oil sectors in the production process and so on. The term input coefficient refers to the quantity of inputs required from each industry to produce one dollar's worth of a given industry's output. The proportions in which different inputs enter the production process of a particular industry are assumed to be constant over time. The input coefficient can be presented as a direct effect that is generally derived from the I-O table.

The construction of an I-O model originates from a cross-section of observed data for a particular economic area of a nation or region. Inside an economic system, every type of activity must be divisible into a number of producing sectors and has an impact on agents within the economy. The I-O analysis creates a picture of a regional economy describing flows to and from industries. In a practical sense, no one industry can survive in isolation from others since the expansion of exchange of goods between sectors raises the importance of interdependencies which results in a network of linkages between industries and those who depend on them for products and household income.

These impact studies are concerned with how one sector has three kinds of effects on the overall economy; direct effects, indirect effects and induced effects. As the two former effects have been defined earlier, we next define the induced effects as "economic activities from the consumption of goods and services using incomes generated from the direct and indirect effects" (Xu, 2002). The direct economic impact of a sector includes only its direct effects but the total impact includes all three effects generated by the oil sector. Nevertheless, the underlying assumptions are crucial in analyzing total impact.

An I-O model is the simplified representation of the production side of the economy where the set of producers of analogous goods and services from a homogenous industry interact with other industries in the economy. Each industry requires different combination of inputs to produce its output, procured from other domestic industries or from suppliers of intermediate inputs. To construct the I-O system, the following assumptions were used: where each industry in the economy produces only homogeneous products, production of each industry is based on fixed proportion between input and output ratios; production in each industry is subject to constant return to scale, so a change in one unit of input will result in an exact proportional change in output; prices are fixed and supply is perfectly elastic i.e. the model is demand-driven (O'Connor & Henry, 1975).

All these assumptions are less realistic since prices are not free from inflation and in fact do fluctuate due to substitution effects through either input use or final consumption. Apart from that, in economies of scale supply is inelastic. However, these assumptions are less restrictive and are outweighed by the fact that I-O analysis can show interdependencies between sectors and is accepted worldwide in economic impact analysis. The basic inter-industry relationship in the I-O model can further be simplified, using the following notations: X_i for total output of sector j, then X_{ij} for output in sector i used in sector j, and Y_i for total final demand for sector i's product. This relationship is summarized as in Table 4 as follows:

Table 4: Inter-industry Matrix Representation of An I-O model

Item	Purchasing sector	Total	Final Demand	Total
Producing sector	1 x_{11} $x_{12}...x_{1n}$	W_1	Y_1	X_1
	2 x_{21} $x_{22}...x_{2n}$	W_2	Y_2	X_2
	3 x_{31} $x_{32}...x_{3n}$	W_3	Y_3	X_3
	...	...	...	...
	N x_{n1} $x_{n2}...x_{nn}$	W_n	Y_n	X_n
Total Inputs	U_1 U_2 $U_3...U_n$			
Primary Inputs	V_1 V_2 $V_3...V_n$	V	V	
Total Production	X_1 X_2 $X_3...X_n$	Y	X	

Source: Miller & Blair (1985)

Table 4 indicates that if there are n sectors, then we read each producing sector in the left hand corner as purchasing sector and sales to final demand (first row) as follows:

$$X_1 = x_{11} + x_{12} + x_{13} \ldots\ldots\ldots\ldots\ldots x_{1n} + Y_1 \qquad \ldots(1)$$

This equation (1) is summarized in the following equation (2),

$$X_i = \sum_{j=1}^{n} x_{ij} + Y_i \qquad i = 1\ldots..n \qquad \ldots(2)$$

If all sectors are arranged accordingly, they could be interpreted as an accounting identity. Under equilibrium conditions, the quantity of output supplied equals the quantity of input demanded. In this form the demand of any sector's input is proportional to the output sector j's demand, for the output sector i is proportional to the total output of industry j. It could then be written as follows:

$$X_{ij} = a_{ij}X_j \qquad \ldots(3)$$

Where a_{ij} = coefficient of proportionality of I-O coefficient.

This coefficient value could be zero if sector *j* does not consume any input from other sector *i*. This value must be positive and lies between one and zero. Substituting (3) in (2), we obtained the following equation (4);

$$X_{ij} \quad = \quad \sum a_{ij}X_j + Y_j \qquad (\, i = 1 \ldots. n\,) \qquad \ldots (4)$$

Rewriting equation (4) in matrix form we have the following equations:

$X_1 \;=\; - a_{11}X_1 - a_{12}X_2 - a_{13}X_3 \ldots\ldots\ldots\ldots\ldots. a_{1n}X_n = Y_1$

$$X_2 - a_{21}X_1 - a_{22}X_2 - a_{23}X_3 \ldots\ldots\ldots\ldots\ldots. a_{2n}X_n = Y_2 \qquad \ldots\ (5)$$

$$X_n - a_{n1}X_1 - a_{n2}X_2 - a_{n3}X_3 \ldots\ldots\ldots\ldots\ldots. a_{2m}X_n = Y_n$$

Based on (5) we can rewrite in diagrammatic matrix form as follows:

$$\begin{pmatrix} 1 - a_{11} & -a_{12} & \ldots. & -a_{1n} \\ -a_{22} & 1\text{-}a_{22} & \ldots. & -a_{2n} \\ \ldots. & \ldots. & \ldots. & \ldots. \end{pmatrix} \quad \text{x} \quad \begin{pmatrix} X_1 \\ X_2 \\ \ldots. \end{pmatrix} = \begin{pmatrix} Y_1 \\ Y_2 \\ \ldots. \end{pmatrix}$$

$$-a_{n1} \qquad -a_{n2} \qquad \ldots. \qquad 1\text{-}a_{nm} \qquad\qquad X_n \qquad\qquad Y_m \qquad \ldots (6)$$

The following matrix *A* is defined as the matrix of I-O coefficient, and we can rewrite equation (6) as follows:

$$A = \begin{pmatrix} a_{11} & a_{12} & \ldots. & a_{1n} \\ a_{21} & a_{22} & \ldots. & a_{2n} \\ \ldots. & \ldots. & \ldots. & \ldots. \\ a_{n1} & a_{n2} & \ldots. & a_{nm} \end{pmatrix} \qquad \ldots (7)$$

In equations (7), the first term on the left-hand side is equal to the identity matrix of I-O coefficient. This product is multiplied by the output *nx1* matrix (or column vector); it can be denoted as *X* which is equal to the final demand *nx1* matrix (or column vector) termed as Y. The I-O system can be rewritten as follows:

$$(I - A)_{\text{nxn}} X_{nx1} = Y_{\text{nx1}} \qquad \ldots (8)$$

If equation (8) is multiplied on both sides by the inverse matrix we obtained:

$$(\, I - A\,)^{-1}(\, I - A\,)\, X \;=\; (\, I - A\,)^{-1} Y \qquad \ldots\ (9)$$

Since $(I - A)^{-1}(I - A) = I$, the identity, is then

$$IX = (I - A)^{-1}Y \qquad \dots (10)$$

Finally, we will derive the following equation (11);

$$X = (I - A)^{-1}Y \qquad \dots (11)$$

Equation (11) holds the condition that matrix $(I - A)$ has an inverse matrix in the form of $(I - A)^{-1}$ which is popularly known as Leontief's inverse matrix. This concept is used to calculate impact analysis in this study. Given X as the total output, we can solve the impact as this is equal to the inverse matrix multiplied by the final demand. Hence, any change in the final demand, when multiplied by the inverse matrix, will change the total output. The inverse matrix is also in a table produced by the DOS and can be derived by the spread sheet using appropriate computer functions.

The proposed study starts with a brief overview of the main approaches to energy pricing; the domains of government intervention in energy markets, and the international experience in mitigating the negative impact of energy pricing reform. This is then followed by description of the features of the petroleum sector in the Malaysian economy and its interactions with the main economic variables. Next, an I-O analysis will be conducted to measure the direct impact of raising prices of petroleum products on costs of production of different sectors in the economy. The analysis shows the relative effect of each petroleum product under different scenarios of various levels of increases in energy prices.

2.1. Construction of I-O Framework

Since subsidy row is not yet available in the I-O table 2005, we construct our own subsidy row to simulate the impact of subsidy removal. Fuel subsidy matrix is computed from the I-O table 2005 in relation to energy commodities i.e. Crude oil, natural gas & coal, Petroleum refinery and Electricity & gas. The constructed fuel subsidy matrix from purchases of fuel input excludes Crude oil, natural gas & coal as it does not have a direct relation to fuel subsidy since it is mainly for exports. Both the Petroleum refinery and Electricity & gas rows were first treated outside the I-O table in computing fuel inputs and subsidy portion in these commodities deriving the following diagrammatic description of total fuel subsidies.

$$\underset{\text{Crude oil, natural gas \& coal}}{\begin{bmatrix} \\ \\ \\ \end{bmatrix}_{120x1}} + \underset{\text{Petroleum refinery}}{\begin{bmatrix} \\ \\ \\ \end{bmatrix}_{120x1}} + \underset{\text{Electricity \& gas}}{\begin{bmatrix} \\ \\ \\ \end{bmatrix}_{120x1}} = \underset{\text{Total fuel subsidy}}{\begin{bmatrix} \\ \\ \\ \end{bmatrix}_{120x1}}$$

The vector of total fuel subsidy is then moved into the row-wise primary quadrant to be placed just below the domestic tax row as diagrammatically shown in Table 4. Then, we create three new rows of subsidies with these following transactions:

i. Domestic tax (including fuel subsidy)

ii. Domestic tax (excluding fuel subsidy); and

iii. Total fuel subsidy.

Table 4: Augmented Input-Output Table 2005

Item	**Purchasing sector**	**Total**	**Final Demand**	**Total**
Producing	$1 \quad x_{11} \quad x_{12} \ldots x_{1n}$	W_1	Y_1	X_1
Total Inputs	$U_1 \quad U_2 \quad U_3 \ldots U_n$			
Primary Inputs	$V_1 \quad V_2 \quad V_3 \ldots V_n$	V	V	
Domestic tax (incl. fuel subsidy)	***(existing row)***			
Domestic tax (excl. fuel subsidy)	***(constructed row)***			
Total fuel subsidy	***(new row constructed)***			
Total	$X_1 \quad X_2 \quad X_3 \ldots X_n$	Y	X	

Source: Fuel subsidy data from Economic Report 2010/2011 and I-O Table 2005

The improved total fuel subsidy row is later computed into the intermediate quadrant by multiplying and introducing the proportion of subsidy in each sector. Having this new structure, the normal process of direct and indirect effect of Leontief's model can be performed. Firstly, we divide each intermediate input with its total to produce technical coefficient which represents direct effects. If the subsidy is phased out, technical coefficients in the intermediate demand will be higher values in terms of its proportion. This technical coefficient expansion is similar to the one in developed countries. Contrarily, the primary quadrant becomes less in terms of share than previously. Table 5 shows the proportion of petroleum product's input in the intermediate input of the economy and the total product mix of fuel located at the total intermediate input as used by all sectors in the economy amounted to RM53.9 billion.

Table 5: Preliminary Data on Intermediate Input for Petroleum Refinery in 2005

Aggregate value	Basic price (in RM billion)	Sectoral share of total output
Total fuel subsidy	24.8	1.55%
Total fuel product mix	53.9	3.36%
Total intermediate input	729.6	45.49%
Total output	1,603.9	100.00%

Source: Estimated from the I-O Table 2005

2.2. Construction of MIER-CGE Model

Classified as an applied general equilibrium (AGE) model, the MIER-CGE model was adopted from Orani-G[2]. The model has a wide potential to be used as a tool for practical policy analysis particularly in examining fuel subsidy in terms of substitution effects that the I-O model falls short on. Although this initial version was static, with applications confined to comparative-static analysis, it is possible to upgrade the model containing dynamic elements, arising from stock/flow accumulation relations: between capital stocks and investment, and between foreign debt and trade deficits. Other extensions to the basic model can include systems of government accounts, and regional breakdowns of model results. We use Gempack as the main software to solve AGE models and process the translation of model specification into a model solution program. The Gempack user needs no programming skills; instead, by creating a text file, a list of the equations of the model can be derived. Another solution program, Tablo, then translates this text file into a model-specific program which solves the model.

2.2.1. Model Structure

Typical to a static AGE model, the model consists of equations describing, for some time period, producers' demands for produced inputs and primary factors; producers' supplies of commodities; demands for inputs to capital formation;

[2] The MIER-CGE is constructed under research collaboration between the Malaysian Institute of Economic Research (MIER) and Department of Economics, Faculty of Economics and Management, Bogor Agricultural University (IPB), Indonesia.

household demands; export demands; government demands; the relationship of basic values to production costs and to purchasers' prices; market-clearing conditions for commodities and primary factors; and numerous macroeconomic variables and price indices.

Demand and supply equations for private-sector agents are derived from solutions of optimization problems (cost minimisation, utility maximisation, etc.) which are assumed to underlie the behaviour of the agents in conventional neo-classical microeconomics. The agents are assumed to be price-takers, with producers operating in competitive markets which prevent the earning of pure profits. Like the majority of AGE models, MIER-CGE is designed for comparative-static simulations and replicates the equation system of Orani-G Model of Australian Economy (Horridge, *et al*. 1998). The detailed data structure of MIER-CGE is diagrammatically shown in Figure 5.

Classification is also made based on sources of commodities (domestic or imported), type of labour, and other factor inputs. In the final step, the database constructed must be balanced as required by any CGE model. The column headings in the main part of the figure (an absorption matrix) identify the following demanders: domestic producers divided into I industries; investors divided into I industries; a single representative household; an aggregate foreign purchaser of exports; government demands; and changes in inventories.

Entries in each column exhibit the structure of purchases made by agents identified in the column heading. Each of the C commodity types identified can be obtained locally or imported from overseas. The source-specific commodities used by industries as inputs to current production and capital formation consumed by households and governments, are exported, or are added to or subtracted from inventories. Only domestically produced goods appear in the export column. M of the domestically produced goods are used as margins services (wholesale and retail trade, and transport) which are required to transfer commodities from their sources to their users. Commodity taxes are payable on purchases. As well as intermediate inputs, current production requires inputs of three categories of primary factors: labour (divided into O occupations), fixed capital, and agricultural land. Production taxes include output taxes or subsidies that are not user-specific. The 'other costs' category covers various miscellaneous taxes, e.g. municipal taxes or charges.

Figure 5: MIER-CGE Database flows

		Absorption Matrix					
		1	2	3	4	5	6
		Producers	Investors	Household	Export	Government	Change in Inventories
	Size	← I →	← I →	← 1 →	← 1 →	← 1 →	← 1 →
Basic Flows	↑ C×S ↓	V1BAS	V2BAS	V3BAS	V4BAS	V5BAS	V6BAS
Margins	↑ C×S×M ↓	V1MAR	V2MAR	V3MAR	V4MAR	V5MAR	n/a
Taxes	↑ C×S ↓	V1TAX	V2TAX	V3TAX	V4TAX	V5TAX	n/a
Labour	↑ O ↓	V1LAB					
Capital	↑ 1 ↓	V1CAP					
Land	↑ 1 ↓	V1LND					
Production Tax	↑ 1 ↓	V1PTX					
Other Costs	↑ 1 ↓	V1OCT					

C = Number of Commodities
I = Number of Industries
S = 2: Domestic, Imported,
O = Number of Occupation Types
M = Number of Commodities used as Margins

	Joint Production Matrix
Size	← I →
↑ C ↓	MAKE

	Import Duty
Size	← 1 →
↑ C ↓	V0TAR

Source: MIER_CGE model

Each cell in the illustrative absorption matrix in Figure 5 contains the name of the corresponding data matrix. For example, V2MAR is a 4-dimensional array showing the cost of M margins services on the flows of C goods, both domestically produced and imported (S), to I investors. In principle, each industry is capable of producing any of the C commodity types. The MAKE matrix at the bottom of Figure 5 shows the value of output of each commodity by each industry. Finally, tariffs on imports are assumed to be levied at rates which vary by commodity but not by user. The revenue obtained is represented by the tax vector, V1TAX.

The MIER-CGE model employed in this paper analyses the impacts of energy price changes on economic growth and income distribution. The MIER-CGE model is a non-linear simultaneous equation model which accommodates price and quantity variables adjustment as input factor market equalizer or commodity market equalizer in economic simulation. In other words, MIER-CGE model simulates the optimal condition of consumers and producers in an economy. In addition, the CGE model also simulates government role as an economic actor. Generally, this model comprehends all transactions in money cycle, commodity cycle and services cycle in economic mechanism (Lewis, 1991). If we add some dynamic equations which represent a time factor, the equations will change from I-O model to MIER-CGE model.

Table 6: Sets, Subsets, and Disaggregation of MIER-CGE Model

Sets	Subsets	Disaggregation
Institutions		Producers, investors, households, aggregate foreign purchaser of exports; government.
Household		One representative household
Industries/Commodities		120 industries based on 2005 Malaysian I-O Table
Production Factors	Labour	Unskilled and Skilled Labour
	Capital	
	Land	
Source	Domestic	120 industries based on 2005 Malaysian I-O Table
	Import	120 industries based on 2005 Malaysian I-O Table
Margin		11 Industries

Source: MIER-CGE model.

2.2.2. Advantage using MIER-CGE Model

The MIER-CGE model is employed for several reasons; (i) it accommodates price variable adjustment fall-short by other models, such as I-O and SAM; (ii) the CGE model has good ability to accommodate structural changes in the economies; and (iii) Dynamic CGE which uses Malaysia's SAM data can provide possibilities to substitute energy input factor with capital and labour more accurately. As such, it can identify economic impacts of price changes due to subsidy removal, and compensation of reducing the fuel subsidy or escalation of energy price. Structurally the MIER-CGE model utilizes efficiency of economic growth and household incomes. The MIER-CGE model for Malaysia is constructed from seven blocks, namely: Production, Household, Government, Investment and Capital, Export-Import, Market Clearing, and Inter-temporal with equations portraying the dynamic that connects the economy of the current year with past years.

Table 7: Database Component of MIER-CGE

N	Head	Ty	Dimension	Coeff	Total	Name
1	1BAS	RE	COM*SRC*IND	V1BAS	1.08E+	Intermediate Basic
2	2BAS	RE	COM*SRC*IND	V2BAS	1.16E+	Investment Basic
3	3BAS	RE	COM*SRC	V3BAS	2.33E+	Households Basic
4	4BAS	RE	COM	V4BAS	5.77E+	Exports
5	5BAS	RE	COM*SRC	V5BAS	634746	Government Basic
6	6BAS	RE	COM*SRC	V6BAS	602642	Inventory Changes
7	1-	RE	COM*SRC*IND*	V1MAR	0	Intermediate Margins
8	2-	RE	COM*SRC*IND*	V2MAR	0	Investment Margins
9	3-	RE	COM*SRC*MAR	V3MAR	0	Households Margins
1	4-	RE	COM*MAR	V4MAR	0	Exports Margins
1	5-	RE	COM*SRC*MAR	V5MAR	0	Government Margins
1	1TA	RE	COM*SRC*IND	V1TAX	121601	Intermediate Tax
1	2TA	RE	COM*SRC*IND	V2TAX	198308	Investment Tax
1	3TA	RE	COM*SRC	V3TAX	134166	Households Tax
1	4TA	RE	COM	V4TAX	159231	Exports Tax
1	5TA	RE	COM*SRC	V5TAX	771710	Government Tax
1	1LA	RE	IND*OCC	V1LAB	1.46E+	Labour
1	1CAP	RE	IND	V1CAP	3.52E+	Capital
1	1LN	RE	IND	V1LND	115460	Land
2	1-Oct	RE	IND	V1OCT	-28	Other Costs
2	MAK	RE	COM*IND	MAKE	1.6E+0	Multiproduct Matrix
2	0TA	RE	COM	V0TAR	0	Tariff Revenue
2	SLA	RE	IND	SIGMA1LA	60	Labour Sigma
2	P028	RE	IND	SIGMA1PRI	112.7	Primary Factor Sigma
2	1AR	RE	COM	SIGMA1	353.1	Intermediate Armington
2	SCET	RE	IND	SIGMA1OU	0.4	Output Sigma
2	2AR	RE	COM	SIGMA2	240	Investment Armington
2	3AR	RE	COM	SIGMA3	240	Households Armington
2	P021	RE	1	FRISCH	-2.88	Frisch Parameter
3	XPE	RE	COM	EPS	107.03	Household Expenditure
3	P018	RE	COM	EXP_ELAST	-649.45	Traditional Export
3 2	EXN T	RE	1	EXP_ELAST _NT	-10	Non-Traditional Export Elasticities

Source: MIER-CGE model 2012.

2.2.3. Balancing the MIER-CGE Database

The Gempack program has produced two documents, namely MIER.har (database) and summary.har (check for database balancing). Before the next process is carried out, checking the database is crucial. At the sector level, balancing its level is indicated by the similarity of total input and total value of sales in each industry (Dixon, *et al.* 1992). At the aggregate level the balance is shown by the equal value of GDP from the expenditure side and revenue side. This refers to the concept of balance, i.e. a database is called balanced if: (1) the aggregate GDP as the expenditure to GDP income side, and (2) the total cost equal to the total value of sales and profits in each sector or industry to be zero (Warr, 1998).

The result of CGE analysis, which measures overall impacts of phasing out subsidies subject to alternative scenarios in the medium-run is then considered. This includes estimation of the effects of raising prices of various energy products on relevant macroeconomic variables, namely, prices, investment, growth rates of GDP and of sectoral value added, deficit in government budget, resource gap and welfare of different groups of urban and rural households.

GDP from expenditure and revenue side as well as the total value of sales and costs in each industry is shown in Table 8. In this table, the expenditure side of GDP is the sum of expenditure components of each economic agent, such as household consumption, private investment, government's spending, and net exports amounting to RM 539.2 million. This value is equal to the value of the GDP that is the sum of revenues and earned income of owners of production factors (land, labour, capital, subsidies and indirect taxes). The sales value for each sector is also in the summary.har. The sales value is the sum of the components of the sales of each sector as intermediate and investment goods, sales to households abroad (exports), and the government. The sectoral total sales have to be equal with the cost of each sector. Total costs in each sector is the sum of several components, which include the purchase of domestic goods, intermediate goods imports, spending on the margin, the payment of indirect taxes, labour costs (wages), capital costs (interest), land rent and tax payments on production (value added tax). The CGE model assumes identical value of sales and production costs in each sector and implies a zero rate of return in accordance with the properties of perfect competition. Once the database consisting 120 sectors is believed to be balanced on aggregate and sectoral level, the data processing can be utilized in the policy simulation process. The final constructed database (mier.har) is readily available for policy simulation as shown in Table 8.

Table 8: Malaysia GDP from Expenditure and Income Side, 2005 (RM'000)

No	Expenditure	Value	No	Income	Value
1	Consumption	246,838,400	1	Land	11,546,087
2	Investment	118,295,632	2	Labour	145,723,024
3	Government	64,246,340	3	Capital	352,003,072
4	Stocks	602,642	4	Other Cost	-28
5	Exports	578,133,888	5	Indirect Taxes	29,923,882
6	Imports	-468,920,864			
	Total	539,196,037		Total	539,196,037

Source: MIER-CGE model.

2.3. Final closure

Considering the first issue of energy subsidy removal, the I-O model identifies and evaluates the amount of fuel subsidy purchased by sectors of the economy on selected fuel products including commodities like gasoline, LPG, kerosene, cooking gas, etc. In addition, the MIER-CGE database built, also based on the I-O table 2005, captures fuel subsidy using simulations on indirect tax on aggregate commodities such as petroleum, coal products and electricity and gas. Reallocating subsidy will consider three optional strategies in what manner government would opt spending on pro-poor, pro-wage, and/or pro-growth. For both models, we compare simulations of baseline and post removal of subsidy which is expected to provide some insights on economy-wide, sectoral and welfare impacts of fuel subsidy reduction (and/or removal) on the economy, environment and society as a whole. Although it is widely presumed in the real world, that energy subsidy removal will negatively affect the economy as the access to energy will be restricted due to price increase, in the long run, it is expected that the subsidy free economy will reduce distortion and encourage efficiency and thus, lower the cost of production.

3. Results and Findings

3.1. Direct Effect

In terms of the first phase of country-wide impact, the direct effect of subsidy share of the whole output of the economy is approximately estimating the requirement for direct inputs in various level of input and output. Directly, fuel subsidy comprises 3.40 % of total intermediate input and only 1.55 % of total output of the economy as shown in the following Table 9.

Table 9: Fuel Subsidy Share in the Economy

Dimension	**Value (‘000)**	**Subsidy value* (‘000)**	**Subsidy over share of intermediate input and total output (in per cent)**
Total Intermediate input	729,583,619.47	24,806,023.95	3.40
Total output	1,603,906,678.89	24,806,023.95	1.55

Note: *estimated subsidy value from I-O model
Source: I-O Table 2005

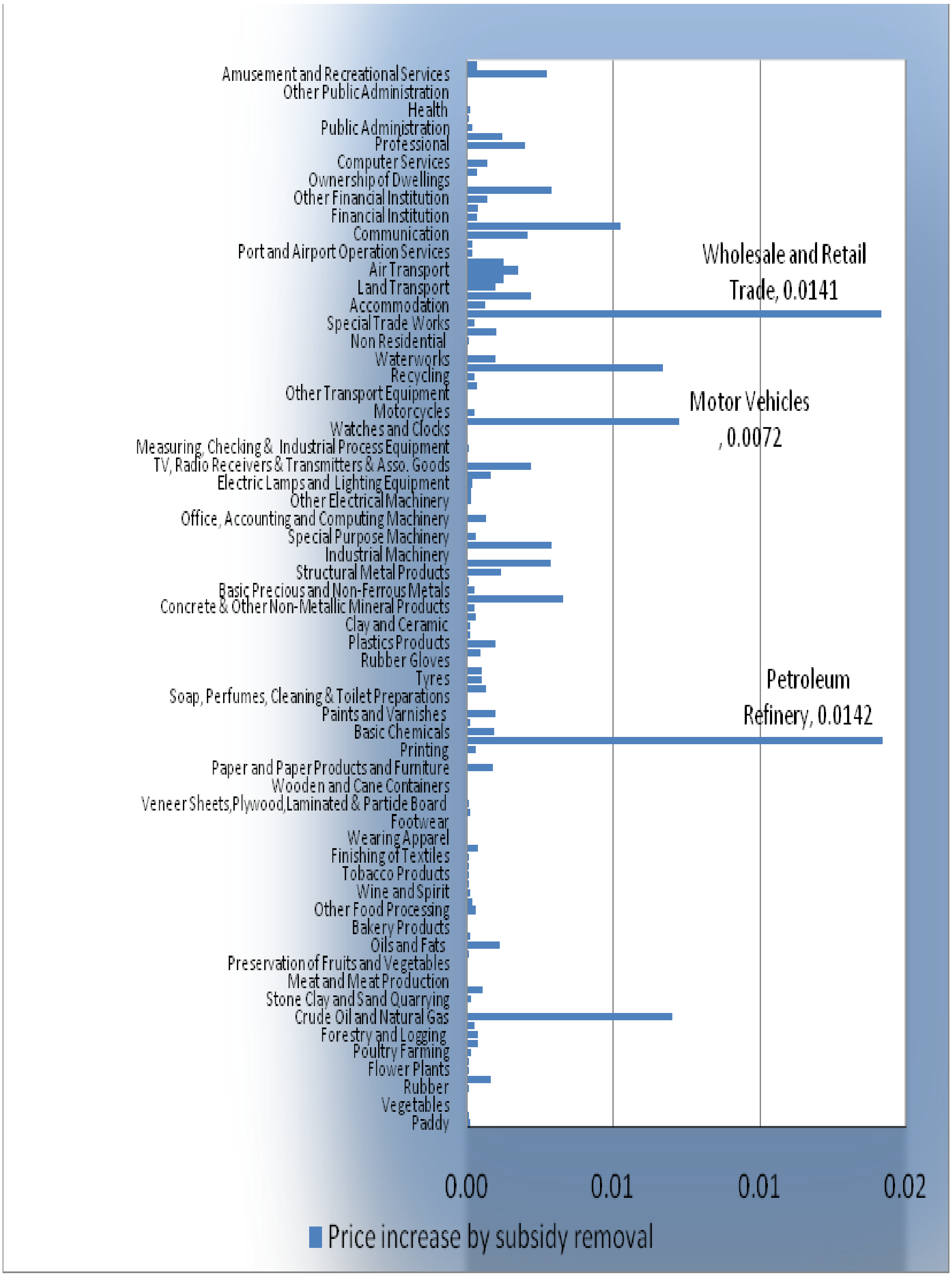
In trying to simplify and make sense of these numbers; considering fuel subsidy removal comprises about 3.40 % of intermediate input, in other words, for every ringgit spent for the purchase of energy input, subsidy will comprise of about 3.40 cents of the total costs of intermediate inputs. Similarly, in terms of total output, for every ringgit of output produced in the economy, subsidy will cost about 1.55 cents of output.

The direct effect of removing fuel subsidy in the economy suggests that initially there will be an inflationary pressure in the market that will especially affect the heavily depended oil sectors such as Petroleum refinery (0.0142), Wholesale and retail trade (0.0141), and Motor vehicles (0.0072), since their input costs will increase subsequent to subsidy removal as shown in the following Figure 6.

Ranked Sectors by Direct Effects of Post-subsidy

The following Figure 7 shows sectors in the economy ranked from the highest effects after subsidy removal. The initial or direct effect of oil subsidy removal has the effect of generating an increase in domestic fuel products. Oil subsidy removal computed into the intermediate input quadrant of the I-O table affects the technical coefficient that connotes increases in price. In the long-run it will encourage lowering of costs in producing goods due to the increase in price. Similarly, the phasing out of gas subsidy will initially generate an increase in domestic prices for gas inputs.

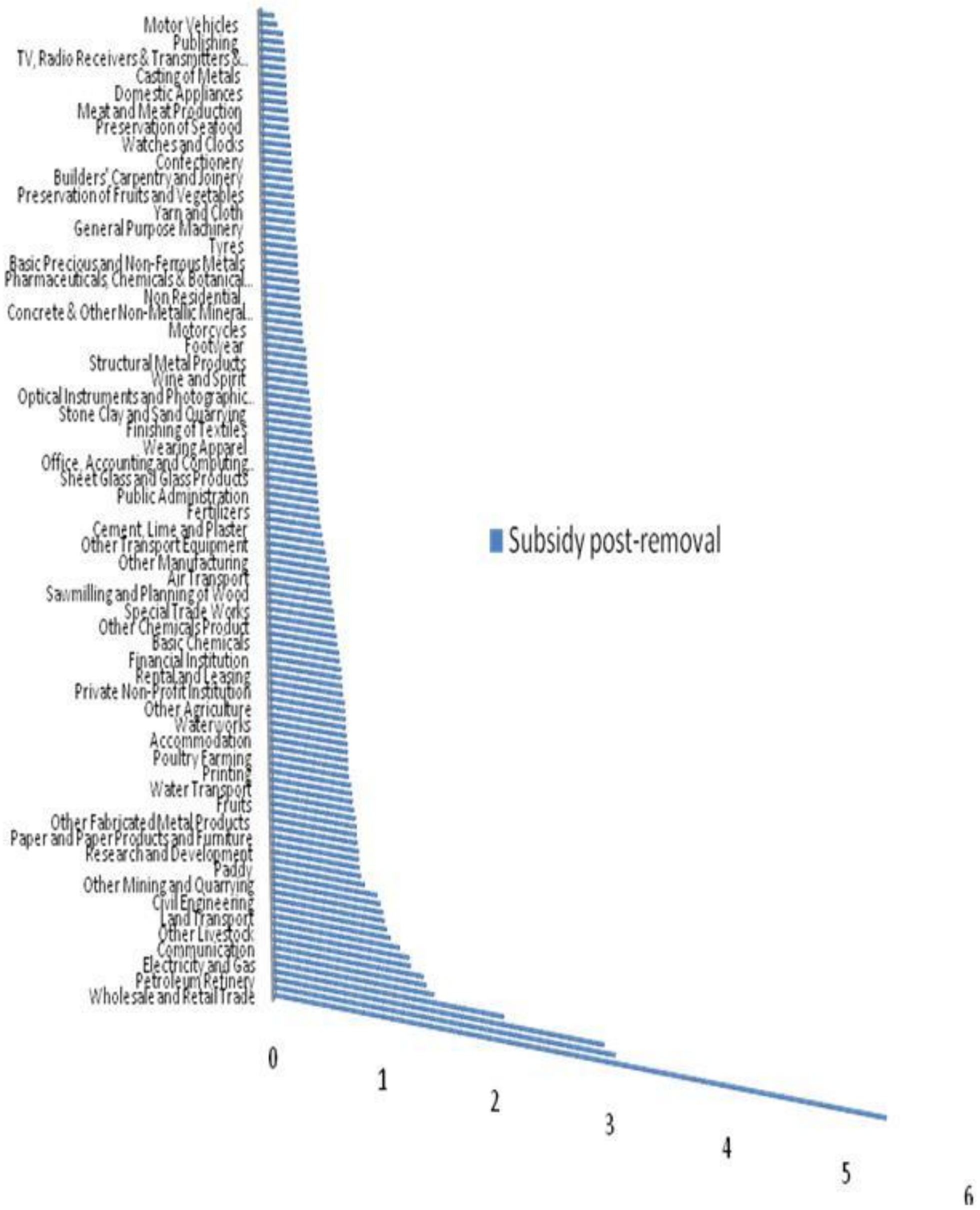
Figure 6: Price Increase by Removal of Subsidy



Source: Estimated from I-O Table 2005

Note: Each of the 120 sectors is represented by a bar, but only 60 sectors were label as displayed at the left hand side due to limited space of this figure.

Figure 7: Impact of Removing Fuel Subsidy by Highest Ranked Sectors, 2005 (%)



Source: Estimated from the I-O Table 2005

3.2. Total Effect:

The entire effects of subsidy removal, also referred to as multipliers, are basically derived from many direct and indirect (include induce) effects that amount in the inversed matrix represented by the equation $(I-A)^{-1}$. Thus, the baseline is represented by $(I-A_o)^{-1}$ matrix and post-subsidy removal matrix by $(I-A)^{-1}*$, with the symbol star, i.e.* represents augmented inversed matrix. The overall output multipliers direct, indirect and induced from the weighted average of all sector's output multipliers describe an increase in the economy's overall output resulting from a ringgit increase in output as fuel subsidies are removed or redistributed from the economy. The differences in impact can be clearly shown by comparing the baseline with post-subsidy scenarios. Similarly, it results in more value added and workers enjoying more income (0.34) times as shown in Table 10.

Table 10: Estimates of Multipliers before and after Subsidy Removal, 2005

Simulations	**Output (Weighted)**	**GDP**	**Workers Income**
Base point	1.87	1.33	0.09
Subsidy removal	1.93	1.41	0.43
Differences	0.06	0.08	0.34

Source: Estimated from the I-O Table 2005

In terms of output, Table 10 shows that the removal of subsidy will increase 0.06 index of output multiplier effect. In other words, a ringgit removal of subsidy will increase an output of six cents at the final demand. These trends of increase were also found for GDP that increase by almost ten cent (0.08) at the final demand. The most encouraging effect comes from worker's income that experiences an increase of 34 cents from subsidy removal.

Sectoral Impact

Having a new structure of post-subsidy, we work-out the normal assessment process of direct and indirect effect of Leontief's model. Firstly, we divide the total input with the share of a sector to get the direct effect in terms of technical coefficient. Next, we transformed the A-matrix into an inversed matrix, $(I-A)^{-1}$. If the subsidy is phased out, the technical coefficient in the intermediate demand will be higher in terms of its share. This expansion of technical coefficient is similar to efficient values practiced by developed countries. Contrarily, the primary quadrant is offset and becomes less in terms of share than previously. These post-removals of subsidy have varying degrees of index in terms of multiplier effects over different sectors depending on how much subsidy influenced in their inputs.

The higher the multiplier index represents the greater influence of subsidy in their production components, whereas the lower the index shows lower or very small relation to the effects of fuel subsidy. Heavily subsidize prone sectors are sectors with high dependence on energy such as Wholesale and retail trade, Petrol refinery, Electricity and gas as well as Communication. Whereas, less subsidy effected sectors are found in Own dwellings, Motor vehicles, Publishing etc. The compelling differences in both of these situations depend on the magnitude of types, size and the structure of the economy. Sectors heavily dependent on oil subsidy would not let go the opportunity in terms of low costs in inputs through incentives and exemption available in the market. Further, this incentivizes many other sectors to use more of the lower costs of energy inputs as shown in Figure 3. This phenomenon is also found by Khalid and Zakariah (NEB, 2012) who demonstrated increased spending on cheaper oil in household expenditure for all household level especially for higher income group. Low energy inputs like diesel and kerosene has become extensively used by households.

3.3. Macroeconomic Results from MIER-CGE Model

It is further noted that productivity is mostly damaged by rising prices, rather than by absolute price levels. In fact, countries with different price levels can compete equally in the global market thanks to other competitiveness factors (e.g., infrastructure and human capital, or knowledge). In this context, countries with lower energy intensity, which are often the ones with higher energy prices, will be less vulnerable to future energy price increases. Malaysia in this respect is in a disadvantageous situation relative to current competitors that confront higher absolute prices, but have reached lower energy intensity.

Table 11 exhibit results of the affected sectors. The model simulates a price changing scenario owing to the price escalation in cost of production in energy utilization by industry sector and household sector due to fuel subsidy removal represented by an increase in indirect tax. Some preliminary findings about the impact on the economy reveal that government will have a perpetual overall budget deficit, a big proportion of which comprise of subsidy.

Table 11: Effects of Subsidy Removal across Sectors

Description	10% increase	20% increase	30% increase
(Balance of trade)/GDP (change)	0.31	0.61	0.92
Aggregate employment: wage bill weights	144.72	289.43	434.15
Overall wage shifter	-259.25	-518.49	-777.74
Uniform % change in powers of taxes on intermediate usage	0	0	0
Uniform % change in powers of taxes on investment	0	0	0
Uniform % change in powers of taxes on household usage	0	0	0
Ratio, consumption/GDP	-23.5	-47	-70.5
Upward demand shift, non-traditional export aggregate	0	0	0
Right demand shift, non-traditional export aggregate	0	0	0
Uniform % change in powers of taxes on non tradtnl exports	0	0	0
Uniform % change in powers of taxes on tradtnl exports	0	0	0
Uniform % change in powers of taxes on government usage	0	0	0
Overall shift term for government demands	0	0	0
Ratio between f5tot and x3tot	0	0	0
Economy-wide "rate of return"	-26.8	-53.61	-80.41
Imports price index, C.I.F., $A	0	0	0
GDP price index, expenditure side	-33.03	-66.05	-99.08
Duty-paid imports price index, $A	0	0	0
Real devaluation	33.03	66.05	99.08
Terms of trade	-7.78	-15.56	-23.34
Average capital rental	57.51	115.03	172.54
Average nominal wage	-259.25	-518.49	-777.74
Consumer price index	-16.16	-32.32	-48.48
Price, non-traditional export aggregate	-6.67	-13.34	-20.01
Exports price index	-7.78	-15.56	-23.34
Government price index	-111.83	-223.66	-335.49
Inventories price index	-265.37	-530.74	-796.11
Exchange rate, RM/$world	0	0	0
Number of households	0	0	0
Average real wage	-243.09	-486.17	-729.26
Utility per household	0	0	0
C.I.F. $A value of imports	29.29	58.58	87.87
Nominal GDP from expenditure side	7.34	14.68	22.03
Nominal GDP from income side	7.18	14.36	21.53
Value of imports plus duty	29.29	58.58	87.87
Aggregate tariff revenue	-6.73	-13.46	-20.19
Aggregate revenue from all indirect taxes	-10	-20	-30
Aggregate payments to capital	57.51	115.03	172.54
Aggregate payments to labour	-114.53	-229.06	-343.59
Aggregate payments to land	53.19	106.37	159.56
Aggregate "other cost" ticket payments	52.44	104.88	157.32
Aggregate revenue from indirect taxes on intermediate	20.81	41.62	62.42
Aggregate revenue from indirect taxes on investment	-27.84	-55.69	-83.53

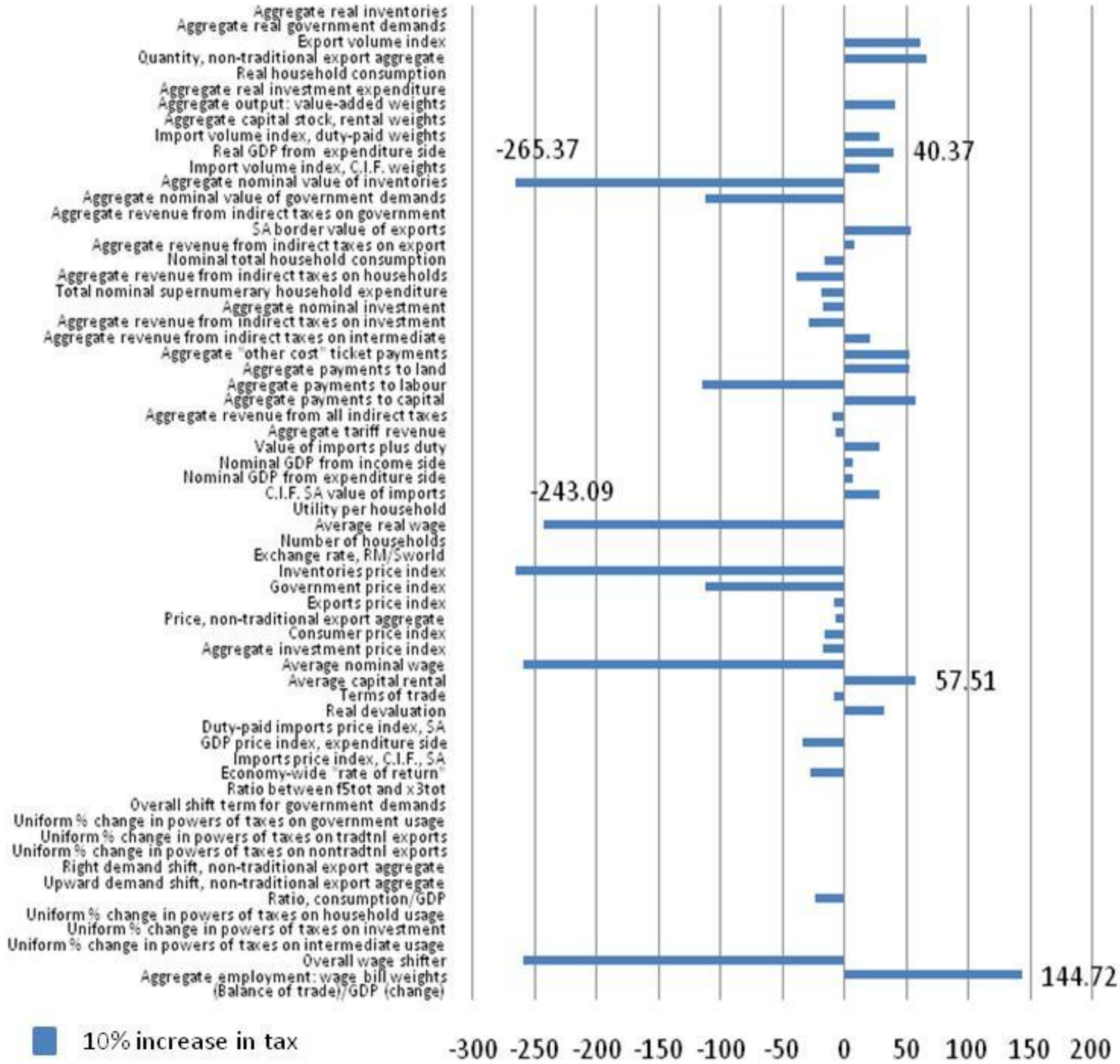
Description	10% increase	20% increase	30% increase
Aggregate nominal investment	-16.7	-33.4	-50.11
Total nominal supernumerary household expenditure	-17.98	-35.96	-53.93
Aggregate revenue from indirect taxes on households	-38.11	-76.21	-114.32
Nominal total household consumption	-16.16	-32.32	-48.48
Aggregate revenue from indirect taxes on export	8.93	17.87	26.8
A border value of exports	53.63	107.25	160.88
Aggregate revenue from indirect taxes on government	-0.01	-0.02	-0.03
Aggregate nominal value of government demands	-111.83	-223.66	-335.49
Aggregate nominal value of inventories	-265.37	-530.74	-796.11
Import volume index, C.I.F. weights	29.29	58.58	87.87
Real GDP from expenditure side	40.37	80.74	121.1
Import volume index, duty-paid weights	29.29	58.58	87.87
Aggregate capital stock, rental weights	0	0	0
Aggregate output: value-added weights	41.41	82.82	124.23
Aggregate real investment expenditure	0	0	0
Real household consumption	0	0	0
Quantity, non-traditional export aggregate	66.71	133.41	200.12
Export volume index	61.41	122.81	184.22
Aggregate real government demands	0	0	0
Aggregate real inventories	0	0	0

Source: MIER-CGE model.

By simulating three phases of increases in indirect taxes of 10%, 20% and 30% representing removal of fuel subsidy will demonstrate that the budget deficit, exchange rate fluctuation and high fuel world price provides a pressure on budget capacity to stimulate the Malaysian economy. The government has designed several fiscal policies, including reducing fuel subsidy, and our results show the impact of reducing fuel subsidy on macroeconomic variables, agricultural sector, and income distribution. To concentrate on more detail, Figure 8 illustrates an increase of 10% indirect tax exogenously in the CGE model.

Figure 8 confirms that wages of skilled labour decline steadily in response to the change in fuel price, whereas increases in land and capital rental will probably arise from substituting subsidy removal. *Households will lose their income following the reduction in fuel subsidy, which then decreases the welfare of households. Since incomes are not evenly distributed within society according to household groups* (as proven by Khalid and Zakariah (NEB, 2012)) an increased fuel price at consumer level will, in particular, hit hard the poor group and *declines their real GDP*.

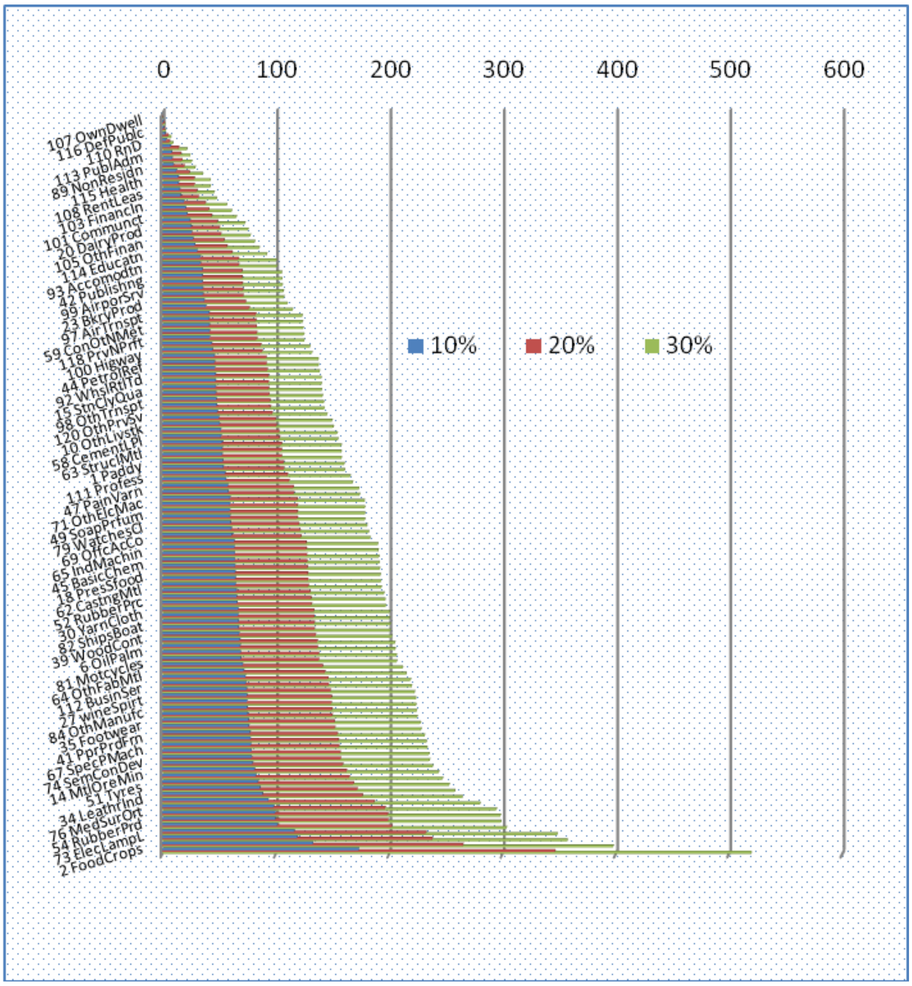
Figure 8: Change of 10 % Indirect Tax on Macroeconomic Variables, 2005



Source: I-O table 2005.

The *reduction in fuel subsidy tends to increase prices of industrial outputs* that are highly depended on fuel, such as manufacturing, transportation and fishery sectors. Figure 9 illustrates the ten lowest sectors of the economy includes sectors related to crude oil, many of them not being directly subsidized, this means that by lowering indirect tax in terms of fuel subsidy will impact some sectors, sectors that do not depend on fuel oil as main inputs. The change in fuel price influenced by subsidy removal does not have significant effects on sectors such as Dwellings, Other Public Administration and Defense and Public Order.

Figure 9: Sectoral Output Post-subsidy Removal (in %)



Source: Estimated from MIER-CGE model

3.4. Reallocation of Subsidy

By employing the I-O model the total effect of subsidy removal in the long run exhibits structural reform of the current economic structure anticipated to be more technologically efficient (with lower technical coefficient compared to the basic prices of A-matrix) and enhances value added (VA) (which include wages and operating surplus (OS)). The total output portrays that subsidy reform spurs redistribution of total output by reducing intermediate input but enhancing VA and/or OS. An introduction of subsidy rows, with negative sign, adjusts (net) domestic taxes row.

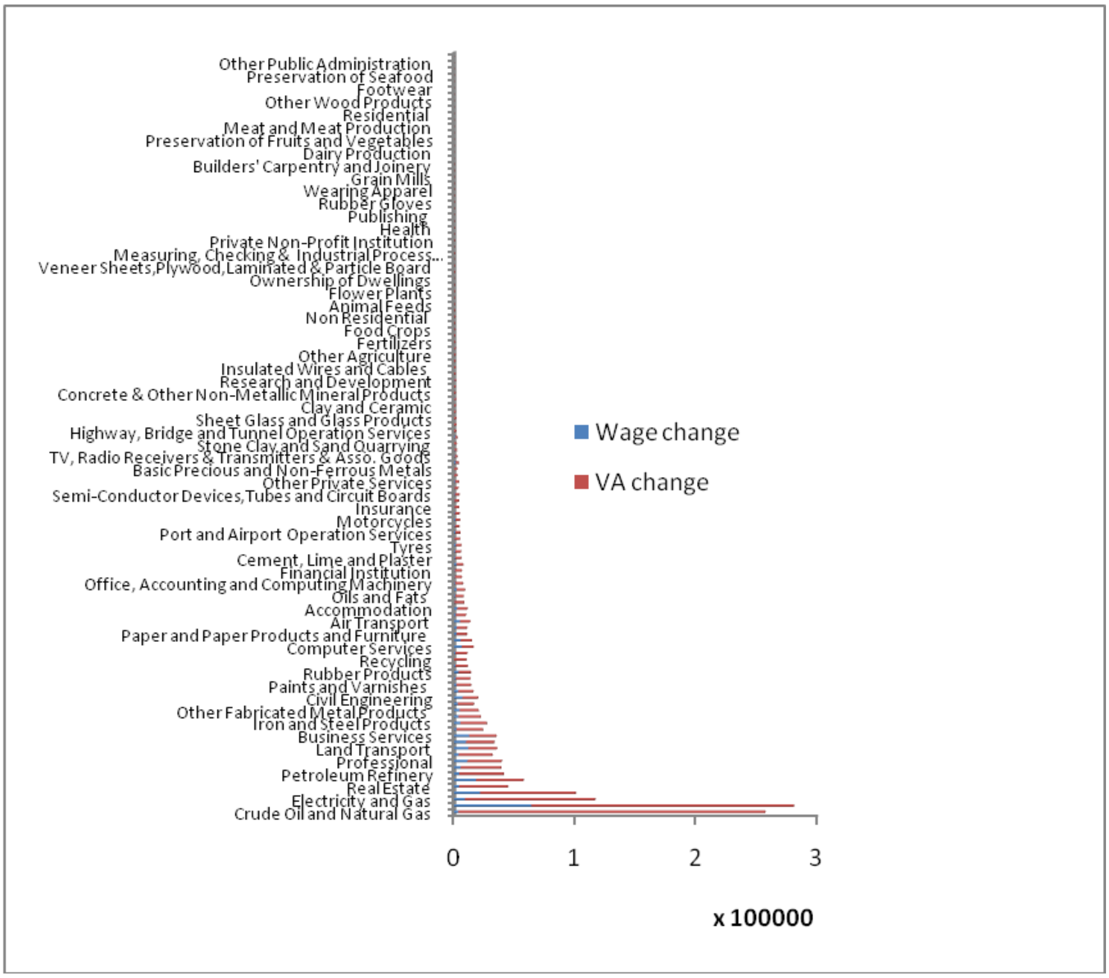
Removing subsidy as shown in the I-O model, is equivalent to an introduction of a dummy row with identical values of the subsidy row but with the positive sign, and has the effect of enhancing VA and/or OS. Since the value of column total remains unchanged, (the introduction of dummy row above) this has to be followed by a reduction of an equivalent value in the intermediate input quadrant, distributed along the column by the total intermediate input share; this represents the effect of improved efficiency in production, reflected by smaller input coefficient and higher VA and OS, and a structural reform due to subsidy reduction. Comparing the technical coefficients, *ex-ante* and *ex-post*, measures the technological enhancement due to subsidy removal.

The highest VA and CE comprises of Crude oil and natural gas, Wholesale and retail trade, Electricity and gas, Banks, Real estate, Amusement and recreational services, Petroleum refinery, Communication, professional services and Other mining and quarrying as shown in Figure 10 (Estimated results are list in Appendices, Table A1). Whereas sectors with the lowest VA and CE comprise Wooden and cane containers, Other public administration, Domestic appliances, Preservation of seafood etc. This assumed that the structure of the economy is the same with autonomous expenditure as with subsidy. If the reallocation policy changes according to poor, wage or growth, then the scope of dimension need to be changed accordingly.

Subsidy removal has double-edge effects - efficiency effects, reflected by reduction in technical coefficients in the A-matrix and allocative effects, reflected by enhancement in VA and/or OS through increased autonomous expenditure as a result of reallocating the extra fund from removal back to the system. The new A-matrix after removal, say A', can be derived by letting the subsidy of sector *j* reduce its intermediate inputs in all *i* sectors based on the existing sectoral total intermediate input share. The A' matrix will be technically more efficient than the A matrix because the A' consists of lower technical coefficients, thereby exerting a positive impact on the factor inputs (but output multiplier is lower too, to give way for higher factor inputs; thus leading to higher primary factor input multipliers).

Removal will directly reduce factor inputs, therein exerting a negative impact on GDP. Extra funds from the removal will have to be channeled back to the economic system through autonomous expenditure, which has positive impact on the factor inputs. The net result from removal depends on whether the positive impact on factor input due to technical gains and allocative effects outweigh the negative impacts of the direct removal.

Figure 10: Reallocation of Subsidy after Removal (at Level of Change in RM)



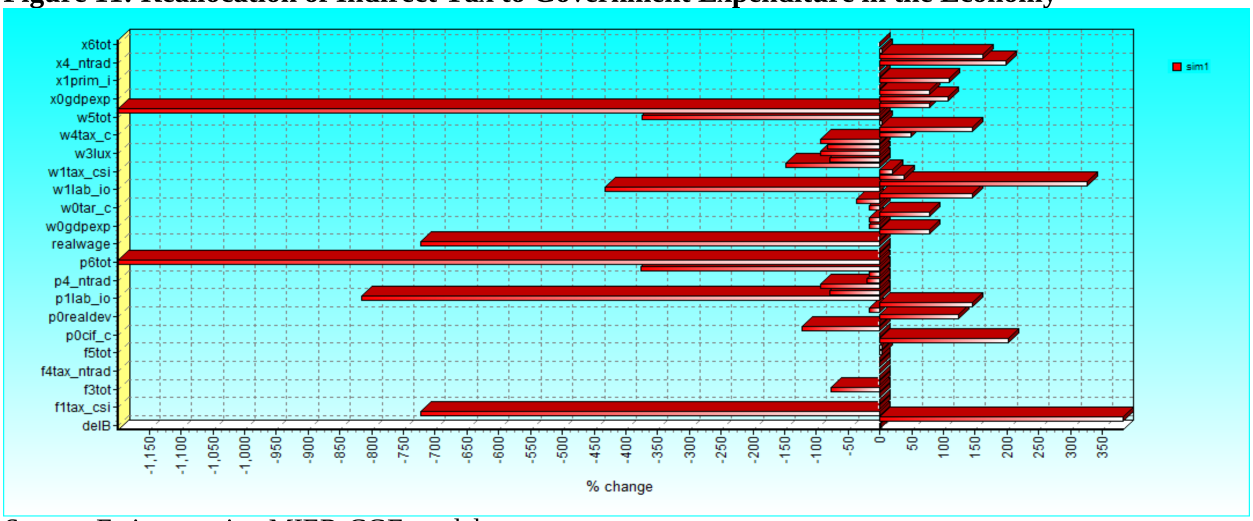
Source: Estimates from I-O Table 2005

Subsidy, regardless of whether applicable to producer or consumer, is naturally a transfer payment; therein unlike autonomous expenditure, subsidy does not create value-added. However, on the other hand consumer subsidy will increase disposable income, which will perhaps increase households' consumption (C) while producer subsidy will reduce costs of production, which will increase margin and probably investment (I). The positive effect of subsidy will only materialise if there is an increase of C or I, whichever is the case, respectively. Subsidy removal, therefore, will reduce GDP because there won't be any corresponding increase in either C or I as subsidy is removed. The amount of subsidy removed, instead, can be used to push government expenditure (G) up. In all the three cases, increase of C, I or G is all that matters because it is the autonomous expenditure that will at the end create value. Thus, pro-poor strategy will be guided by how this removal behaves between sectors.

The moment subsidy is removed; two separate effects can be traced: (i) the instant subsidy is removed, the value of indirect taxes is reduced because subsidy is the negative element. In order to let the value of total input remain intact, VA has got to be increased by the equivalent amount, which requires some amount of autonomous expenditure, presumably in the form of G. Given the intended increase in value-added, it is possible by using I-O formulation to estimate the necessary amount of autonomous expenditure required to support the intended increase, which previously shaped the pattern of G. (ii) The moment subsidy is removed, the cost of production, which was previously borne by government will have to be borne by producer in the form of increases in the cost of intermediate input, $A^* = A \times s$, where $1 > s > 0$, but inevitably a decrease in primary input while total input will remain unchanged, passes the cost increase to consumers in the form of *an* increase in p; i.e. change(P) $= (I - A)^{-1}\, s$, where s is the vector of subsidy; reducing real but maintaining nominal GDP.

In taking into account relocation scheme using the MIER-CGE model, we relocate the approximate total fuel subsidy amounting to RM 24 billion into the government expenditure and derived the following graph as in Figure 11. We ran indirect tax and government expenditure exogenously over all sectors selecting sectors with significant taxation coefficients.

Figure 11: Reallocation of Indirect Tax to Government Expenditure in the Economy



Source: Estimate using MIER-CGE model

Reallocating-Pro-wage and Pro-growth

In reallocating fuel subsidy into the above policies, we simulate by redistributing subsidy into the intermediate and later it is inversed. The pro-poor strategy as discussed above is computed when the inversed is multiplied with total fuel subsidy to get total effects on value added and compensation of employee. Although the extensions can be clearly detailed using price-shift modeling, it is not attempted here. Next, pro-wage distribution can be executed by the same method but using the compensation of employee or worker's income. Finally, pro-growth strategy is modeled by examining capital and technology using the baseline intermediate demand and comparing it to the latest intermediate output. An in-depth study can be undertaken by involving the operating surplus in the primary quadrant or the capital stock to analyse change in technology. However, the pro-growth strategy which tend more to be production expansion will naturally be contrasted to the poor reallocating programme since the dimensions will be different.

4. Analysis

Sensitivity of price depends on many factors. The first two illustrated by the I-O model will be in terms of direct and indirect effects for country-wide, sectoral and households. Industry behaves in varying degrees to adjustment in the phasing out of subsidy. Some may adjust input in unexpected ways in economizing the use of energy by substituting other energy sources and passing some of the burden of the higher costs to their customers by raising price of goods or products. There are significant variations between industries since they use different proportion of energy inputs and generate different amounts of output. As such the less energy intensive industry and domestic resources-based industry are less prone towards the restructuring of subsidy.

Government as an active economic agent *should compensate reducing the fuel subsidy removal by direct assistance such as cash hand-outs to poor people provided it spurs productivity and increases welfare*. The compensation can also be given indirectly to the poor through the development of infrastructure, which may solve some supply side bottlenecks in the economy. Typically energy subsidy and policy interventions will focus on energy pricing and government intervention as main tools. Energy pricing must ensure economic efficiency, social equity and financial viability by adhering to the principles of recovering long-run marginal cost while preserving the environment from externalities and attempting to provide commercial energy access for everyone. Most commonly applied, *marginal cost pricing* ensures revenue generated is sufficient to cover the operating costs of the utility, and consumers will evaluate accurately the cost of their decision to consume an extra unit of energy. While *short-run marginal cost pricing* comprises the cost of crude fuels and other materials, labor costs and maintenance, excluding capital costs, its *long-run version* includes the cost of increasing output by expanding capacity. The former is preferred as it is not only easier to estimate but also encourages an efficient use of existing capacity.

Historical cost recovery pricing, on the other hand, sets energy product price at a level that allows recovery of past expenditures while permitting an acceptable market rate of return to be earned, but it can send incorrect economic signals, particularly when the set price does not equal marginal cost. It does not promote efficiency as the rate of return is fixed. Another type of pricing mechanism, *market pricing,* involves trading energy between suppliers and consumers at the market price. Bids are accepted in the market place from producers of energy to produce at a given price, thus encouraging competition among producers and leading to efficiency. However, market imperfections may prevail in practice, leading to inefficiency and uncertainty. *Discriminatory energy pricing* is used to extract higher revenues by differentiating prices, applicable only when differentiated user groups are clearly identifiable, therein income redistribution and fostering economic development may be achieved through low energy pricing to specific sectors. The method is quite common in pricing electricity and natural gas but not so in petroleum products because of difficulties in preventing resale and arbitrage. *Opportunity cost pricing* is based on the value of energy would have been if it could be offered and purchased outside the country rather than consumed domestically, as such it uses international prices to measure the domestic cost of energy and thereby its local price, consequently exposing domestic prices to instability and differences in social, economic and natural circumstances are also ignored. Similar to the case of Iran (UNEP, 2003) a two-tiered pricing structure for oil products for power plants and for other consumers is used in Malaysia.

Given the above pricing mechanisms, what policy options are available to influence energy pricing? *Energy taxation* can be used to raise revenues effectively provided the demand for energy resources is relatively inelastic while c*ross subsidies*, usually resulting in allocative inefficiency, impose excess charges (prices greater than the cost of supply) to some users in order to subsidize other users (who pay prices less than the cost of supply). Another option would be through the adoption of *lower rates of return* by publicly owned energy utilities, but confusion remains over the degree to which the rate of return should be lowered to directly benefit consumers. Last but not least, *direct subsidies* may be granted by government funding for selected beneficiaries directly.

All the above options could be re-categorized under rationalization not reform policies in three most significant sub-level examinations particularly in removing subsidy in terms of private consumption, producer subsidy and tax foregone and combination of both consumer and producer. Attempts to reduce subsidies to fuel prices through price differential at points of sale for a category of consumers have proved to be ineffective in most countries, leading to development of informal/black fuel markets and smuggling. Notwithstanding an exclusive emphasis on the poor, it is important to identify more desirable uses of energy and petroleum products as we pursue budgetary savings from the reduction of fuel subsidies.

Targeting of fuel subsidies to the very poor should embrace a possibility of identifying *more effective social protection mechanisms* that protect the poorest households from increases in fuel prices, yet still have substantial savings left over to allocate to higher priority expenditures or tax cuts that benefit the population at large. To mitigate the adverse impact of energy price subsidy reforms, some countries adopt unconditional cash transfers either directly or indirectly through coupons and/or smart cards limiting certain quantities of petrol/LPG at subsidized prices. *Direct cash transfers* to beneficiaries via magnetic cards have been used to distribute coupons and implemented in some countries. A method to reform subsidies to fuel prices through conditional cash transfers has now become more popular to ensure greater social protection in development and has been practiced by Brazil, Chile, Indonesia and Turkey. An alternative method is by *transferring through smart cards or coupon systems*, therein limiting purchases of petroleum products, for example, kerosene. This method allows identification of households at a subsidized price and has been experimented with in Malaysia, Indonesia and Iran.

Yet another indirect measure may include packaged fuel price increases with a set of compensatory measures within a comprehensive safety net of the population, perhaps in the form of elimination of fees for attending primary and junior secondary school, enhancement of primary health care among poor groups, and/or an increase in the minimum wage. In all instances, in order to ensure prudent public expenditures on distortionary and badly targeted fuel subsidies, *managing energy prices* must insulate price setting as much as possible from political pressure.

At the end of the exercise, these analyses are expected to show that fuel subsidy reduction will improve economic efficiency as a whole to the economy due to mitigating market distortion as well as energy efficiency, which will result in a win-win situation for the government, economy and environment. These results are hoped to assist policy makers to opt on setting up a road map for energy subsidy reduction or removal and reallocate subsidy as a step towards energy market integration. On the other hand, results from the energy sectoral investment simulation provide insights on benefits of investments in each energy sector. This can help the policy makers prioritize investment decisions for the high impact sectors and to create an enabling environment to expedite the investment process to harness higher benefits in the market.

5. Conclusions

Research into the nature of fuel subsidy, how it influences output, value added and income which are redistributed and compensated to those most likely to be affected by its removal, will help design subsidy rationalisation strategy. Commercially sound discount when costs are low or demand is price sensitive are very influential in measuring the risks in public policy. However, although there are many reasons for discount, argument for the application of discount is not as strong as when price is sensitive.

Emphasis on cheap energy input in the production system is not a good policy to help the poor. Nor is it good policy for industrial customers. From an economic efficiency perspective, there is no case for subsidizing energy consumption by a particular industry. This will result in an inefficient allocation of resources and reduce national income and in the long-run contribute to loss of competitiveness. The preferred pricing policy from this perspective is to charge customers according to their fill supply costs and subscribe to the concept of value for money policy.

Phasing out subsidies impacts the structure, sectoral performance and welfare of the economy. Delaying the removal of subsidies will further exacerbate disadvantages as discussed in this paper and reduce Malaysia's competitiveness if market prices continue to rise. Tolerating delayed subsidy removal will only create more economic problems and the option recommended is to rationalize gradually to reap more efficient fuel utilization and efficiency in the future. It is also recommended that Malaysia should not only pursue policies of subsidy rationalization, but also consider the adoption of a goods and sales tax (GST) and minimum wage should it aspire to be competitive. Losing competitiveness will permit neighbouring countries like Indonesia, Thailand, and Vietnam to surpass Malaysia's development path as these countries have demonstrated a more serious commitment to advance their economies by undertaking GST, minimum wage and subsidy rationalization.

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Appendixes

Table A1: Estimated Results as used in Figure 10-Reallocation of Subsidy after Removal (level change in RM)

	Change	
Sector	**CE**	**VA**
Crude Oil and Natural Gas	3,834.9	252,549.9
Wholesale and Retail Trade	64,075.2	216,007.0
Electricity and Gas	9,341.0	106,993.2
Banks	21,834.2	78,466.2
Real Estate	4,516.3	39,910.1
Amusement and Recreational Services	18,527.3	38,621.6
Petroleum Refinery	4,564.8	36,489.4
Communication	5,794.3	33,108.2
Professional	11,385.5	27,825.2
Other Mining and Quarrying	4,202.9	27,439.3
Land Transport	12,168.3	23,295.8
Oil Palm	10,286.6	22,744.6
Business Services	12,725.3	22,222.9
Waterworks	2,256.8	21,570.0
Iron and Steel Products	5,568.1	21,386.5
General Purpose Machinery	4,102.9	17,931.3
Other Fabricated Metal Products	5,062.7	15,126.3
Other Transport Services	3,395.2	12,895.6
Civil Engineering	7,326.3	12,417.1
Structural Metal Products	3,885.9	11,971.1
Paints and Varnishes	2,393.2	11,557.8
Basic Chemicals	1,862.9	11,483.2
Rubber Products	4,104.7	9,615.5
Forestry and Logging	1,541.5	9,613.7
Recycling	469.1	9,596.6
Water Transport	1,383.5	9,502.5
Computer Services	6,629.0	9,347.7
Restaurants	5,832.6	8,772.1
Paper and Paper Products and Furniture	2,356.4	8,351.9
Plastics Products	2,494.9	8,159.3
Air Transport	5,329.1	7,987.6
Other Financial Institution	1,794.0	7,962.2
Accommodation	2,926.2	7,932.9
Other Chemicals Product	742.7	7,506.0
Oils and Fats	1,201.7	6,594.5
Motor Vehicles	2,577.0	6,322.6
Office, Accounting and Computing Machinery	1,122.2	6,231.4
Other Livestock	902.8	5,490.1
Financial Institution	906.7	5,470.9
Rental and Leasing	2,360.7	5,187.6
Cement, Lime and Plaster	1,166.3	4,614.5

Sector	Change	
	CE	Sector
Other Manufacturing	1,214.6	4,453.2
Tyres	1,811.3	4,068.9
Rubber Processing	735.4	4,020.6
Port and Airport Operation Services	1,400.3	3,780.8
Printing	930.1	3,406.9
Motorcycles	1,508.3	3,360.7
Other Textiles	1,101.9	3,314.1
Insurance	765.4	3,255.4
Special Purpose Machinery	723.9	3,254.0
Semi-Conductor Devices, Tubes and Circuit Boards	1,073.3	3,248.3
Rubber	669.9	2,761.4
Other Private Services	1,246.9	2,729.7
Other Electrical Machinery	370.7	2,297.9
Basic Precious and Non-Ferrous Metals	558.4	2,177.4
Public Administration	1,771.6	2,071.3
TV, Radio Receivers & Transmitters & Asso. Goods	928.9	1,770.6
Poultry Farming	612.0	1,727.0
Stone Clay and Sand Quarrying	569.0	1,616.5
Education	1,110.5	1,562.4
Highway, Bridge and Tunnel Operation Services	383.5	1,492.9
Electric Lamps and Lighting Equipment	482.2	1,458.4
Sheet Glass and Glass Products	513.5	1,386.8
Fishing	265.0	1,149.0
Clay and Ceramic	331.0	1,025.1
Special Trade Works	589.8	1,006.0
Concrete & Other Non-Metallic Mineral Products	351.8	981.9
Other Food Processing	202.0	952.7
Research and Development	630.2	939.0
Wine and Spirit	203.4	923.7
Insulated Wires and Cables	259.2	907.2
Sawmilling and Planning of Wood	265.7	872.4
Other Agriculture	261.5	857.8
Paddy	448.8	840.4
Fertilizers	210.7	788.4
Finishing of Textiles	136.6	708.3
Food Crops	332.0	675.6
Optical Instruments and Photographic Equipment	164.5	662.1
Non Residential	406.6	625.8
Casting of Metals	186.4	619.4
Animal Feeds	55.7	614.2
Yarn and Cloth	151.5	498.3
Flower Plants	200.7	487.8
Tobacco Products	88.0	445.2
Ownership of Dwellings	0.1	436.4
Defence and Public Order	379.1	434.5

	Change	
Sector	**CE**	**Sector**
Veneer Sheets,Plywood,Laminated& Particle Board	121.0	415.9
Ships & Boats Building, Bicycles & Invalid Carriages	91.6	370.4
Measuring, Checking & Industrial Process Equipment	181.3	363.6
Watches and Clocks	101.9	352.4
Private Non-Profit Institution	211.2	349.3
Other Transport Equipment	67.3	347.0
Health	170.9	343.6
Soap, Perfumes, Cleaning & Toilet Preparations	42.4	340.2
Publishing	66.9	239.1
Electrical Machinery and Apparatus	96.5	223.6
Rubber Gloves	143.1	220.2
Leather Industries	69.7	216.8
Wearing Apparel	60.0	215.4
Metal Ore Mining	64.1	204.1
Grain Mills	53.5	200.1
Fruits	96.7	173.7
Builders' Carpentry and Joinery	84.5	161.7
Soft Drink	36.4	156.9
Dairy Production	17.6	125.7
Pharmaceuticals, Chemicals & Botanical Product	28.7	96.6
Preservation of Fruits and Vegetables	14.6	75.4
Vegetables	44.4	73.7
Meat and Meat Production	42.8	73.3
Industrial Machinery	10.2	52.9
Residential	34.6	52.4
Confectionery	5.8	47.0
Other Wood Products	16.2	46.4
Bakery Products	16.6	45.9
Footwear	10.2	28.1
Medical, Surgical and Orthopaedic Appliances	4.9	19.1
Preservation of Seafood	3.1	11.9
Domestic Appliances	0.5	2.0
Other Public Administration	1.1	1.2
Wooden and Cane Containers	0.2	0.4

Source: Estimates from I-O Table 2005