INTEGRATED INPUT-OUTPUT ANALYSIS OF THE ECONOMIC IMPACT OF HIGHER OIL PRICE IN MALAYSIA

KHALID BIN ABDUL HAMID

FEP 2010 11

INTEGRATED INPUT-OUTPUT ANALYSIS OF THE ECONOMIC IMPACT OF HIGHER OIL PRICE IN MALAYSIA

KHALID BIN ABDUL HAMID

DOCTOR OF PHILOSOPHY
UNIVERSITI PUTRA MALAYSIA

2010

INTEGRATED INPUT-OUTPUT ANALYSIS OF THE ECONOMIC IMPACT OF HIGHER OIL PRICE IN MALAYSIA

By

KHALID BIN ABDUL HAMID

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

November 2010

Dedicated to:

My wife and four children

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

INTEGRATED INPUT-OUTPUT ANALYSIS OF THE ECONOMIC IMPACT OF HIGHER OIL PRICE IN MALAYSIA

By

KHALID BIN ABDUL HAMID

November 2010

Chairman: Professor Zakariah Bin Abdul Rashid, Ph.D.

Faculty: Economics and Management

The global increase in crude oil prices since 2003 onwards has had negative consequences on countries dependent heavily on oil imports. In contrast, oil-exporting countries, although receiving a positive impact, also faced adverse effects. With increasing oil demand for imports and at the same time as declining oil supply for exports, rising oil price has exerted more pressure on the current oil consumption activities manifested in almost every form of modern living in Malaysia. Despite gaining more income and revenue from rising oil prices, the country's economy will be susceptible to the rapid increase in oil consumption and lowering of oil production, resulting in imbalances of interindustry performances as well as affecting the well-being of its households.

Realizing the problems faced by these economic agents in times of rising oil prices, the government has endeavored to minimize their difficulties and burden mainly by subsidizing a portion of the domestic petrol price making it the lowest possible. This has caused petrol prices at local pump stations to be the cheapest amongst Asean countries excluding Brunei. Overlooking this benign step, the government has not heeded the root problems regarding particularly the vulnerability of oil importation and increase in cost of production. In addition, the low petrol price has distorted the local market with

wastages, hoarding, smuggling, panic buying and countless others that particularly put forth more burden to producers and household using considerable oil inputs proportion in their daily activities.

Meanwhile many renowned researchers such as Bacon and Kojima (2004) opined that higher crude oil price could seriously impact a country over a longer time. In keeping fuel prices low, it may rapidly inflate the government's budget and deplete oil reserves sooner than is expected. While oil production gradually declines corresponding to the ever-expanding oil consumption, relatively small oil stocks and deposits may threaten the economy's vulnerability. Such huge amounts of subsidy cost will not only disrupt efforts in promoting efficiency and diversification to succeed from high energy price as viewed by Park (2004), but deviate itself from the market's general equilibrium as debated amongst many researches in the oil literature.

The study tries to achieve its objectives in examining the impact of oil price increase on the country's susceptibility, interindustry performances and distributional welfare effect. The integrated I-O analysis assumes other things fixed, an increase of US$1 of crude oil price will directly generate an output of 0.0448 percent. Therefore, an increase of US$60 will result a positive output amounting RM47 billion. A lower net positive gain was empirically evident in the dependency analysis comprising a declining trend of SSR, lowering OVI and high EEEI for Malaysia. Although positive overall results is gained, a detail analysis by multiplier, linkages and leakages expose a larger net impact of oil price increase compared with the previous oil crisis. The Leontief's modified price system proves the economy in the 2000s to be less susceptible than in the 1970s. Many claimed that this success was due to public policies in increasing efficiency and diversification, but our analysis proved this is inadequate since the success could be influenced by temporary effects of entry and exit of industries. As such, introduction of Goods and Services Tax (GST) is a good move to encourage optimality. Simulation of 40 sectors of the Malaysian economy reveals that 22 sectors have relative measure less than one, whilst 18 other sectors have ratios more than one but constitute less than 38 percent of GDP. This confirm of

less susceptibility and the vast potential to increase efficiency and diversification. The leading oil sector, Petrol & coal products sector is still a key sector in backward and forward linkages, even more in leakages results. As a leading sector extensively used by other sector, and ranked the highest in leakages since it imported the highest inputs of oil in order to satisfy its production system, it is most beneficial to ensure it is manage efficiently particularly in critical times confronting bottlenecks and soaring temporary consumption during oil price hike.

Findings on regressive income distribution pattern indicate a pro-rich strategy is more practiced compared to pro-poor. This reflects an imbalance economic policy that demands a more targeted programme to protect the poorest of households. Therefore, to insulate the most vulnerable group, a subsidy system based on incremental oil-consumption directed only to qualified and targeted low income earners must be emulated. In terms of welfare effects on food, a glaring dissimilarity was found between the high costs of marketing or FMCI of 1.483 in Malaysia compared with only 1.06 by the US. This is due to loose interconnectedness and dependence on imported inputs. To rectify this, a niche in cluster of food production with competitive world-class standard should be created and promote oil dependent sectors to optimize their oil utilization and efficiency to upgrade the country's industrial and marketing chains.

In conclusion, analogous to the general equilibrium theory and supported by our analysis and findings, we reckon that the main objectives have been met. The study shows that the oil sector is still leading and a significant sector within the economy's having less susceptibility now but has weaken over time, sharing of burden between the economic agents as well as appropriate and targeted measures overcoming welfare effects. This should serve as a guide to better manage and sustained oil resources efficiently to eschew the negative effects of oil price increase in the future.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan mendapatkan Ijazah Doktor Falsafah

ANALISA INPUT-OUTPUT BERSEPADU KE ATAS IMPAK EKONOMI DARIPADA HARGA MINYAK YANG LEBIH TINGGI DI MALAYSIA

Oleh

KHALID BIN ABDUL HAMID

November 2010

Pengerusi: Profesor Zakariah Bin Abdul Rashid, PhD

Fakulti: Ekonomi dan Pengurusan

Kenaikan harga minyak mentah global semenjak dan selepas 2003 telah meninggalkan kesan negatif ke atas negara-negara yang bergantung kuat kepada import minyak. Sebaliknya, negara-negara pengeksport minyak, sungguhpun berimpak positif, turut terjejas. Dengan meningkatnya permintaan untuk import minyak serentak dengan penurunan penawaran minyak untuk dieksport, kenaikannya memberi tekanan kuat ke atas penggunaan minyak semasa yang zahir hampir di setiap bentuk aktiviti kehidupan moden di Malaysia. Walaupun pendapatan dan hasil telah meningkat dari kenaikan harga minyak, keutuhan ekonomi boleh terjejas dengan penggunaan mendadak minyak yang berterusan dan penurunan pengeluaran minyak, mengakibatkan ketakseimbangan prestasi antara industri serta membawa tekanan ke atas kebajikan isirumahnya.

Menyedari permasalahan yang dihadapi oleh agen-agen ekonomi ini ketika naiknya harga minyak, pihak kerajaan berusaha untuk meminimakan kesukaran dan bebanan mereka dengan mensubsidikan sebahagian dari harga petrol tempatan menjadikannya serendah mungkin. Ini menyebabkan harga petrol di stesen minyak tempatan termurah di kalangan negara-negara Asean kecuali Brunei. Walaupun langkah ini bertujuan baik, namun ia terlepas pandang masalah akar umbi terutama ketergantungan kepada import minyak dan kenaikan kos pengeluaran. Tambahan pula, harga rendah

bahan api itu menjejaskan pasaran tempatan melalui pembaziran, sorok bekalan, penyeludupan, belian panik dan sebagainya yang lebih mengeruhkan keadaan pengeluar dan isirumah yang mengguna sebahagian besar bahan input minyak di dalam aktiviti sehariannya.

Sementara itu, banyak pengkaji ternama seperti Bacon dan Kojima (2004) berpendapat harga lebih tinggi minyak mentah semakin serius impaknya jika ia berlarutan pada jangka panjang. Untuk mengekalkan harga bahan api rendah mungkin mengelembungkan bajet kerajaan dan sekaligus menghauskan rezab minyak negara lebih awal dari jangkaan. Sementara pengeluaran minyak semakin menurun serentak kenaikan mendadak penggunaannya, diikuti simpanan minyak yang relatif kecil mungkin mengancam keutuhan ekonomi. Sejumlah besar kos subsidi bukan sahaja menjejaskan usaha menggalak kecekapan dan kepelbagaian untuk lolos dari kemelut kenaikan harga tenaga seperti pandangan Park (2004), tetapi juga menyimpangkan dari pasaran keseimbangan umum seperti diperdebatkan dalam karya mengenai minyak.

Kajian ini cuba mencapai objektif-objektifnya dengan menilai impak kenaikan harga minyak ke atas keutuhan ekonomi Malaysia berbanding krisis sebelumnya di tahun 1970an; prestasi antara industri serta kesan kebajikan kepada isirumah. Analisa I-O bersepadu mengandaikan perkara lain tetap, sejumlah kenaikan AS$1 harga minyak mentah secara terus akan menjana output sebanyak 0.0448 peratus. Oleh itu, kenaikan AS$60 pada 2006 akan menghasilkan satu impak positif output sebanyak RM47.1 bilion. Satu kenaikan bersih yang rendah dari analisa kebergantungan menunjukkan arah aliran menurun SSR, pengurangan OVI dan tingginya intensiti tenaga EEEI bagi Malaysia. Sungguhpun positif keseluruhannya, ukuran terperinci oleh analisa pengganda, rantaian dan bocoran menunjukkan impak bersih besar berbanding kenaikan harga minyak sebelumnya. Sistem harga Leontief diubahsuai mendapati ekonomi tahun 2000an kurang lemah berbanding tahun 1970an. Ramai beranggapan dasar awam setakat ini telah berjaya meningkat keefisyenan dan kepelbagaian, tetapi analisa kami menghujahkan ia tidak mencukupi memandangkan kesan sementara keluar dan masuk industri-industri. Oleh itu wajar pengenalan cukai barang dan perkhidmatan

(GST) dijadikan langkah baik bagi menggalakkan optimaliti. Simulasi 40 sektor ekonomi Malaysia mendedahkan 22 sektor berkeputusan relatif kurang dari satu, manakala 18 sektor melebihi satu tetapi hanya terdiri dari 38 peratus daripada KDNK. Ianya mengesahkan kurangnya ketergantungan dan potensi besar bagi meningkatkan keefisyenan dan kepelbagaian. Peneraju sektor minyak, Sektor Keluaran petrol dan arangbatu masih menerajui rantaian kebelakang dan kehadapan, lebih-lebih lagi dapatan bocoran. Sebagai sektor teraju yang sangat luas penggunaannya ditambah kedudukan tertinggi dalam rantaian bocoran kerana jumlah besar import untuk input minyak sistem pengeluarannya, maka ada baiknya dipastikan ianya diselenggarakan secekapnya terutama ketika kesukaran dan kenaikan mendadak penggunaan dari naiknya harga minyak.

Dapatan kebajikan isirumah bersifat regresif melambangkan strategi pro-kaya lebih terpakai dari yang pro-miskin. Ini mencerminkan dasar ekonomi tidak seimbang dan suatu program bersasaran diperlukan bagi melindungi mereka yang paling terjejas iaitu termiskin di kalangan isirumah. Untuk melindungi mereka, satu sistem subsidi menggunakan minyak bertahap bagi golongan sasaran dan berpendapatan rendah mesti dilaksanakan. Dari aspek kesan kebajikan terhadap makanan pula terdapat perbezaan ketara di antara kos pemasaran atau FMCI yang tinggi bagi Malaysia pada 1.483 berbanding hanya 1.06 bagi Amerika Syarikat. Ini kerana rantaian-hubungan yang longgar antara industri dan ketergantungan kepada input yang diimport. Untuk mengatasinya perlu diwujudkan kluster niche industri makanan yang berkelas dunia dan galakan kepada sektor yang bergantung kepada minyak untuk mengoptimakan penggunaan dan kecekapannya.

Kesimpulannya, analogi dari teori keseimbangan umum serta didokong analisa dan dapatan kami menunjukkan objektif-objektif utama telah tercapai. Kajian menunjukkan bahawa sektor minyak masih menerajui dan penting di dalam ekonomi walaupun keutuhannya telah mulai lemah, perkongsian beban di antara agen ekonomi serta juga langkah teratur mengatasi kesan negatif kebajikan. Ini boleh memandu pengurusan dan pengekalan sumber minyak lebih cekap bagi menghadapi kesan negatif kenaikan harga minyak pada masa depan.

ACKNOWLEDGEMENTS

First and foremost, all my gratitude goes to Allah, the Most Gracious, the Most Merciful; His Grace and Guidance have brought this work to completion.

I would like to express my utmost appreciation to Professor Dr. Zakariah Bin Abdul Rashid for his invaluable guidance, patience and encouragement, without which the analysis and write-up of this thesis would not have been possible to accomplish. His critical suggestions and creative technical ability have enabled me to combine the econometric and input-output models into an understandable and workable piece of research tool. He has exposed me to invaluable lessons on critical thinking that are practical and effective in undertaking research.

My sincere thanks are extended to my thesis supervisory committee comprising Professor Dr. Mohd. Shahwahid bin Haji Othman and Dr. Normazwana bte Ismail for their personal support, valuable guidance and encouragement during the course of study. They were very helpful in providing me direction and were willing to listen to and discuss whatever difficulties I encountered in preparing this thesis.

I would like to express my deep appreciation to Associate Professor Dr. Zulkornain bin Yusof, Associate Professor Dr. Law Siong Hook, Professor Dr.

Ahmad Zubaidi Baharumshah and generally all lecturers in the Faculty of Economics and Management which had directly and indirectly providing me the requisite research environment enriching me with ideas, suggestions, comments and guidance throughout this study.

Special appreciation is extended to Professor Dr. Annuar Bin Md Nassir, Dean of the Faculty of Economics and Management, for his strong support, kindness, encouragement as well as recommendations. I shall remember him always for his jovial way of encouraging me on the path to finalising my study.

During the preparation of the thesis, I have benefitted from many friends and colleagues, especially from Dr. Mohd Rosli Bin Mohamed, Director of the Energy Section, Economic Planning Unit; Dato' Dr. Ali Bin Hamsa, Director-General of UKAZ, Prime Minister's Department; Dr. Haji Mohamed Thalha, Senior Consultant to the Malaysian Institute of Economic Research (MIER); Dato' Dr. Hj. Sohaimi Bin Hj. Mohd Salleh, Director-General of JAWHAR; Mdm. Agnes Maria Sam and Dato' Dr. Irwan Siregar from the Ministry of Finance; Dato' Dr. Muzahet Bin Masruri, Secretary-General of the Ministry of Unity, Culture, Arts and Heritage, Malaysia; and countless others.

I also thank Mr. K.C. Khoo for his great patience and careful attention in editing and correcting the presentation and language of the manuscript for this study. I feel very privileged being selected by the Ministry of Science, Technology and Innovation as well as supports of the Public Services

Department, Malaysia, for giving the opportunity to conduct and sponsoring the full course of my study.

I owe a great debt to my late father, Haji Abdul Hamid Bin Mohd Akip; my mother, Zainun bte Dollah; my uncles, the late Haji Abdul Rahman Musa, Haji Bahari and Abdul Rahim; my brother, Haripin Abdul Hamid; and my sisters, Hajjah Seti Zaleha and Puan Siti Rogayah; who have played their parts in supporting me morally and financially to achieve my educational goals.

Finally, my special and deepest thanks and love go to my wife, Salina bte Jaafar, for her affection, sacrifice, patience, support and encouragement. My children, Hani Najmi, Hanna Najwa, Haidhar Munzer and Haiqal Naufal, in their own beautiful ways, have continuously provided me with love and inspiration. I greatly love them all.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

API	The term API gravity (a standard adopted by the American Petroleum Institute) is commonly used to express the specific gravity of petroleum. API gravity is defined as: (141.5 / 60° specific gravity at 60° F) – 131.5.
APM	automatic pricing mechanism
ASEAN	Association of South-East Asian Nations with Countries including Indonesia, Malaysia, Phillipines, Singapore and Thailand.
BNM	Bank Negara Malaysia
CGE	computable general equilibrium
CPI	consumer price index
DGE	dynamic general equilibrium
DOS	Department of Statistics, Malaysia.
EEEI	entire energy efficiency intensity
EPU	Economic Planning Unit
FDI	foreign direct investment
GDP	Gross domestic product
I-O	input-output
IMF	International Monetary Fund
LNG	liquefied natural gas
LPG	liquefied petroleum gas; refers to propane, butane and their isomers, which are gases at atmospheric pressure and normal temperature
MCPA	Malaysian classification of products by activity
OLS	ordinary least square
OPEC	Organization of Petroleum Exporting Countries
OVI	overall vulnerability index
PITA	petroleum income tax act

PSC	production sharing contract
RAS	Restricted Additive Schwarz, an I-O technique for predicting new coefficients
SME	Small and Medium Enterprise
SNA	system of national accounts (1993). Integration of I-O framework into the system of national accounts was developed by the United Nations in 1968.
SSR (I)	self-sufficiency index (ratio)
WDI	World Development Indicator

Measurements

bbl	barrel
bcf	billion cubic feet
bcm	billion cubic metres
bnbl	billion barrels
bpd	barrels per day
btu	British thermal unit
btsb	Billion tank stock barrels
ktoe	kilo tone of oil equivalent
mmBtu	million British thermal unit
mbd	million barrels per day
mtoe	million tonnes of oil equivalent
tcf	trillion cubic feet
toe	tonne of oil equivalent

Formulas and equations

C	consumption

I	investment
G	government
X	exports
M	imports
DD	demand
SS	supply
η	elasticity
β	beta as representing coefficient
α	teta as representing coefficient
D	dummy variable
Ln	term used as measurement representing logarithm

CHAPTER 1

INTRODUCTION

1.1 Background

Since the recent rise in global crude oil price from 2003 onwards, countries that depended heavily on the importation of oil have faced negative consequences in their economy, and even economies with high degree of self-sufficiency have also been experiencing rising production costs and decreasing household welfare effect. It is known that no one country, be it big or small, is capable of insulating itself completely from the detrimental impacts of rising oil price. The fact remains that for so many years we have become greatly dependent on oil and its vital uses in our daily lives, with its influence not limited to fueling, lighting and cooking, but in almost every human activity in the modern world directly or indirectly. In this light, there is evidence that oil price escalation has had detrimental effect on the economy. In addition, production techniques and household uses are lacking in diversification and efficient allocation of resources. Park (2004) proposed that diversification and efficiency can mitigate to buffer the impacts of energy price increases, particularly those of oil.

The phenomenon of oil shock may be explained by other than demand and supply such as convincing theories like business cycle, general equilibrium, or productivity that may portray a better picture of oil impact. Many researchers believe, however, that for whatever reasons, while protracted high oil prices are a recipe for disaster, even the short-term impacts are

critical if counter measures are not carefully considered. For instance, Bernstein (1990) averred that a recession can be triggered if oil price rises by at least US$40 to US$50 per a barrel and remains at this level for six to nine months. Even if crude oil increases by US$10 per a barrel, it would offset consumption, income, savings, exports and other economic indicators which are vital to economic growth.

Unlike oil-importing countries which face hard times with higher costs of oil imports, Malaysia has been fortunate as a net oil-exporting country benefitting from the increases in revenue from oil exports with higher crude oil price. However, this does not mean Malaysia is unshakable from the detrimental effects of oil prices, as many have argued that our importation costs should be taken into consideration, since they will result in a negative revenue gain or leakages in the economy. This is crucial if the economy is too dependent on oil such as sectors that have both high forward linkages and leakages (UNIDO, 1985). If it turns out that oil is a key sector with high linkages, it will likely have high leakages too.

Since oil is very much depended upon and is also highly demanded product, it plays an important part in our livelihood. Oil, known as petroleum[1] in Malaysia, falls not only under primary and secondary commodities, but also tertiary commodities as listed under the Malaysian Classification of Products by Activity or MCPA (2005). Oil is grouped as a subset under crude oil and natural gas extraction while coal mining is another group aggregated from

[1] Petroleum is defined as hydrocarbons that encompass oil, gas, and other products produced from refining of crude oil and gas.

crude petrol, natural gas and coal in the Malaysian mining sector. Oil in the secondary commodities group is classified as petrol and coal products falls under the manufacturing sector. And again, oil-related sectors are also listed in the tertiary commodities group such as electricity and gas sector. Among the rich mineral resources such as tin, coal and arable land, oil is the most outstanding and important in Malaysia. Therefore, above all, how intensively oil is utilized will determine whether the country will reap optimum benefits from its stocks and management, particularly in the midst of rising oil prices in tandem with the ever-increasing domestic oil consumption rate.

From a little-known small-scale commercial activity in the early 19th century, the oil industry did not fully grow as a very important industrial driver for the most part until the 1970s when large oil and gas deposits in Malaysia were found viable for exploration and exploitation. Since then, the oil sector has continued to contribute annual average revenue of about 30 percent of the GDP and has become one of the largest export commodities in Malaysia. It was especially through 1980 to 1997 that oil played a major role in transforming the traditional mainly agriculture economy to one based on manufacturing. Soon, the spillover effect of the oil industry witnessed the rapid development of heavy industries, which helped the economy to survive the financial crisis of 1997. Since then, oil has dominated significantly in its contribution to the GDP, in investments as well as private and government purchases, and vastly in the industrial sectors' expansion in the Malaysian economy.

The country is very fortunate to be blessed with natural resources, particularly oil which is produced domestically for exports with some fraction of it manufactured in the upstream and downstream sectors[2]. While oil is one of the very important export commodities, the country also imports a large portion of different types of oil products for its domestic utilization and thus faces both positive and negative impacts from the exogenous oil price increases. This has particularly affected important macroeconomic indicators such as inflation and unemployment. Above all, dependence on imported oil is suspected to be the main cause of the potentially bigger detrimental effect, especially on the intermediate sectors' costs of production.

In the event of rising oil prices, panic buying usually arises amongst the public at large. Many issues have clouded the public's perceptions particularly as to whether or not their disposable incomes have shrunk in value because oil prices have shot up the prices of not just their basic goods and services but have rippled into all non-food items. Thus, despite the government's effort in protecting some segments of low-income earners in the economy by subsidizing their oil-related products, making its petrol price lower than its neighbors', the issue of equitable distribution of assistance amongst the poor households has not been seen as meeting its goals. Even more the issue of burden sharing from oil price effects amongst producers, consumers and the government institutions and agencies is still left unsettled.

[2] Compared with Brunei, Iran and Saudi Arabia, Malaysia has small oil stocks. Malaysia is a non-OPEC member and moreover has no real influence in the world's oil market.

1.2 Importance of the Oil Industry to Malaysia

The above section described some transformations of the Malaysian economy that have taken place during the development and production of oil. This continuous growth of the oil industry can be traced from the composition of the overall Malaysian GDP. Initially, since its independence in 1957, Malaysia, from a traditional agriculture country, has now transformed itself into a progressive economy (Zakariah and Chan, 1995). This achievement is remarkable when compared with that of other countries that gained independence at about the same time, such as Ghana, but have failed to achieve similar accomplishment (Asare and Wong, 2004). For some people, this trend may be attributed to the long-term Vision 2020 of the previous Prime Minister, Dr. Mahathir Mohamad (Ali Abul Hassan, 1997). But to many other researchers such as Zakariah and Chan (1995), the economy's structure to a greater extent has been determined by resource endowment which is reflective in its production system. They reiterate that this structural shift is largely contributed by the rich supply of natural resources, particularly ample reserves of oil, gas and arable land.

Further, Rohana and Zakariah (2007) working at the macro-level of aggregation, found that the economy was experiencing a structural change which was more significant in 1991-2000 than in 1978-1991. They supported the view that Malaysia had experienced structural formation during the oil development periods. There was a significant fall in the share of the agriculture sector and a significant increase in the service sector over the whole 1978-2000 period. In addition, the most notable improvement in the

share of the manufacturing sector was achieved in the period of 1991 to 2000. This implicitly shows that oil, as a critical input in the intermediate sectors of the economy, had played an important role in the structural shift, as also established by prominent Asian researchers like Gan (1985), Fong (1986), Jomo (1990), Hill (2000) and Navaratnam (2003).

1.2.1 The Oil Industry's Contribution to the Economy

The Malaysian economy has tremendously changed since the 1960s having a GDP of RM6,249 million in 1960, then expanding over four decades and in 2002 reaching a GDP of RM234,050 million and recently to RM528,311 million[3] in 2008 even after facing a financial crisis and recessions. The expansion of the economy has for many years been driven by oil in various interindustry sectors. From the outset, the Malaysian economy and generally that of the world have seen many changes. The financial crisis of 1997, for instance, gave the hardest impact that was particularly felt in the Asean countries; from 2000 onwards Malaysia was still on the brink of its economic recovery.

1.2.1.1 Gross Domestic Product

Table 1.1 shows that the economic performance of the Malaysian GDP improved in the manufacturing sector, explaining how oil had contributed to the economy even through the 1997 financial crisis. This is supported by the

[3] GDP value is in constant price of 2000 at purchaser's price.

economic reports of Bank Negara, the Malaysian central bank. From 2000 to 2002 the Malaysian economy showed a speedy recovery. It was also reported that a year later, in 2003, the economy performed better due to the surge in demand for imports, particularly of oil and electronic equipment.

Table 1.1: Malaysia: GDP by industry of origin from 1960 to 2002[e] (1987 constant prices in percentage)

Economic Activity/Year	1960	1970	1980	1990	1995	2000	2001	2002[e]
Agriculture, Livestock Forestry & Fishery	40.7	30.6	23.4	18.5	10.1	8.4	8.2	7.9
Mining & quarrying	6.1	6.5	10.3	9.7	8.1	7.3	7.1	6.9
Manufacturing	8.4	13.1	20.6	26.6	26.8	31.8	28.4	28.5
Construction	3.1	3.9	4.7	3.5	4.4	3.3	3.2	3.2
Electricity, gas & water	1.5	2.7	1.5	1.9	3.5	0.4	3.9	4.0
Transport, storage & communication	4.3	4.1	5.8	6.8	7.3	8.0	8.2	8.2
Wholesale & ret.trade, hotels& restaurants	15.3	14.5	12.4	10.9	15.0	14.4	14.2	14.1
Finance, insurance, real estate & business	5.9	6.2	8.5	9.5	10.2	12.2	12.8	13.2
Government services	5.3	6.9	10.5	10.6	7.0	6.7	6.7	6.7
Other services	9.4	11.5	2.3	2.1	7.6	7.4	7.3	7.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(in RM million)	(6,249)*	(20,924)	(44,512)	(80,284)	(168,691)	(213,691)	(223,619)	(234,050)

Sources: Various issues of the Economic Report (2002) Ministry of Finance and Economic Planning Unit (2001)

Note: [e] denoted estimation figures and * with parentheses are total GDP in RM million and percentages reported exclude bank service charges and import duties.

Table 1.1 indicates that in terms of sectoral growth for the period of more than three decades, the Malaysian economy had undergone a period of rapid and sustained growth. In that period of time, between 1988 and 1997, it had experienced broad diversification and sustained rapid growth averaging 9 percent annually. By 2000, the total GDP had reached RM213,691 million, a more than three-fold increase over the GDP in 1960. The overwhelming growth of the Malaysian economy had been supported by new foreign and domestic investments that played a significant role in the transformation of the economy.

This positive effect was further extended to the rapid growth of the manufacturing sector and coupled with the influence of oil, had grown from 13.1 percent of the GDP in 1970 to 31.8 percent in 2000. However, both the Agriculture and Mining sectors, which accounted for 37.1 percent of the GDP in 1970, had their share dropped to less than half, i.e. 15.7 percent in 2000. This intuitively matched the Manufacturing sector's growth pattern as found by Verleger (2000) who opined that a rapid growth of an economy provides a suitable condition for an increase in crude oil price.

Table 1.2 deviates slightly from Table 1.1 in order to show that the Electrical & electronic products sub-sector produces major export products that include electronic components of which Malaysia is one of the world's largest exporters. Of the total exports, 65.7 percent was contributed by this sub-sector in 1995, increasing to 72.5 percent in 2000 portraying the highest share of export compared with any single export product.

In contrast, the Agriculture sector, which was once a leading sector in the 1960s with about 40.7 percent share of the GDP, plunged to only 7.9 percent in 2002. Other sectors like Transport and Services, although not presenting steep declines in this period, generally exhibited decreasing trends. As these sectors shrank, the Manufacturing industry including the Electrical & electronic products flourished.

Table 1.2: Malaysia: Exports of manufactured goods*, 1995-2000 (RM million)

Industry	Share of export				Average annual growth rate, 1995-2000 (%)
	1995		2000		
	RM	%	RM	%	
Resource-based	22,896.4	15.5	42,923.9	13.5	13.4
Food	3,218.1	2.2	4,508.5	1.4	7.0
Beverages & tobacco	397	0.3	1,206.6	0.4	24.9
Petroleum products	3,126.6	2.1	8,130.7	2.6	21.1
Chemical & chemical products	6,256.5	4.2	15,011.3	4.7	19.1
Rubber products	3,267.5	2.2	4,695.0	1.5	7.5
Wood products	4,953.7	3.4	6,801.3	2.1	6.5
Non-metal mineral products	1,676.7	1.1	2,570.5	0.8	8.9
Non-resource-based	113,172.	76.9	252,383.3	79.4	17.4
Textile, clothing & footwear	6,518.5	4.4	10,433.4	3.3	9.9
Manufacturing of metal	4,655.6	3.2	8,617.8	2.7	13.1
Electrical & electronic products	96,747.8	65.7	230,429.3	72.5	19.0
Transport equipment	5,251	3.6	2,902.8	0.9	-11.2
Other manufactures	11,183.7	7.6	22,601.1	7.1	15.1
Total	147,253	100	317,908.3	100.0	16.6
Percent of total gross exports	79.6		85.2		

Source: Economic Planning Unit (2001)

Note: * excludes exports of processed palm oil and other edible oil products

Some may find it rather complicated to view clearly how oil has helped in physical output and even in many different indirect forms. As discussed prior to this, the above Table 1.2 captures the structures of the economy that are led by the Oil and Electrical & electronic products sub-sectors that had helped the economy to grow and expand from 2000 to 2002 and give momentum during the surge in demand for both commodities from 2003 onwards. However, the most important issue here lies on how much oil inputs had affected the economy directly and indirectly during the increase in oil price. This determination of effect is implicit in the share of oil inputs in the respective sectors particularly the manufacturing industries.

Despite the GDP growth being steered by the manufacturing sector and not the oil industry itself, the former still depends on oil as its main input for the success of its output. Therefore, given that oil stands as the main driver of

the manufacturing industry, any rise in oil price will certainly have considerable consequences for the entire economy.

1.2.1.2 Revenues

Oil has since the 1970s offered a stream of revenues through exports and taxation and many other ways. Such revenues are vital for funding the government's social and developmental programmes. Oil provides two main sources of income, through direct and indirect taxes. Figure 1.1 shows that out of the total government's revenue, oil and gas constituted 16 percent or RM11.73 billion in 1995 which increased to 41 percent or a value of more than five times at RM65.60 billion in 2008. This five-fold increase in 2008 is an indication that oil and gas has been largely and steadily become a very important source of revenue to the country.

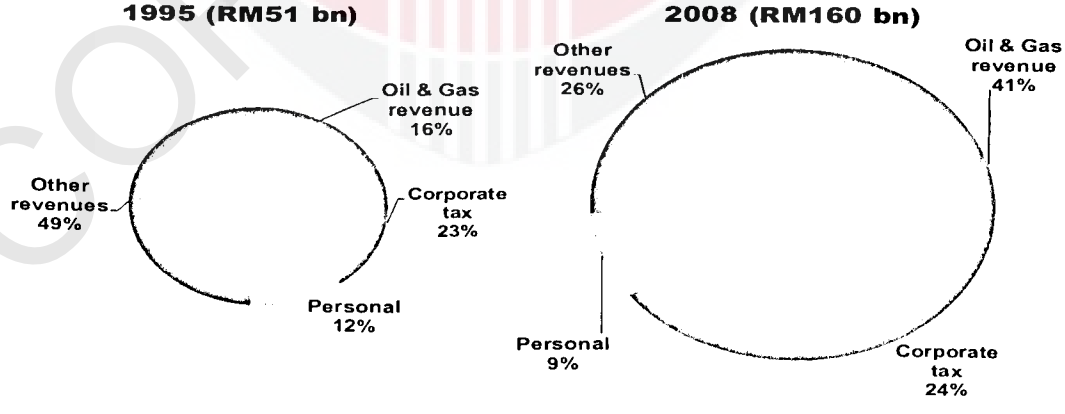


Figure 1.1: Malaysia: Federal Government's Revenue from Oil and Gas, 1995 and 2008 (in Percent Share)

Sources: Various Economic Report of the Ministry of Finance, Malaysia

The rises in oil price from 2003 to 2006 saw expansions in revenues since exports fetched more value as shown in various economic reports of the Treasury (MOF, 2002). Several reports illustrate a steady flow of revenue increase from direct tax, particularly from the petroleum income tax (PITA), gained during oil price rises particularly from 2004 to 2005 when it jumped from US$42 to US$57 per barrel. Table 1.3 gives some clear comparisons between tax collections on oil and gas, i.e. direct taxes, indirect taxes and exports. From these values, direct taxes stand out as they increased more significantly than other revenues over time.

In this context, many have asked, why should án oil-exporting country raise fuel prices at a time it was making record profits. Thus, in February 2006, oil price increase became an issue when Petronas was on track for another year of record earnings. This unfortunately made the state-owned company a target of consumer protests. The unexpected timing and magnitude of oil price increase appeared to have intensified public anger (*New Straits Times*, 2006).

Table 1.3: Malaysia: Comparisons between oil exports and revenues, 2001-2009 (RM billion)

Year	Direct tax	Indirect tax	Export
2001	9,859	1,083	15,118
2002	7,334	768	16,192
2003	8,466	1,106	17,913
2004	11,479	1,539	18,295
2005	14,800	2,029	19,714
2006	20,404	2,325	24,542
2007	20,453	2,271	26,089
2008	24,511	2,886	26,770
2009	35,826	2,939	27,700

Sources: Various issues of Economic Report, Ministry of Finance, Malaysia

The above Table 1.3 shows that after the financial crisis of 1997 and even after 2001 onwards, all revenue components had increased steadily except for the almost constant indirect tax. In 2009, direct tax which amounted to RM35.8 billion, surpassed even the collection from export of RM27.7 billion. Again this was caused by the marked increase in oil price that reached its peak of US$145.29 on 3 July 2008[4].

This marked increase in oil price expanded the collection of direct tax component of revenue as shown in Figure 1.2. The direct tax curve criss-crosses the export curve and surpasses it portraying that oil has been increasingly contributing to the government's revenue particularly in terms of direct tax and export duties. However, this expansion is an exception for indirect tax, which was almost at the same level all the time during the rise in oil price from 2003 to 2009. It is likely that the government would constantly receive higher revenue even with the constant or marginal decline in volume of exports, particularly if export volume is increased.

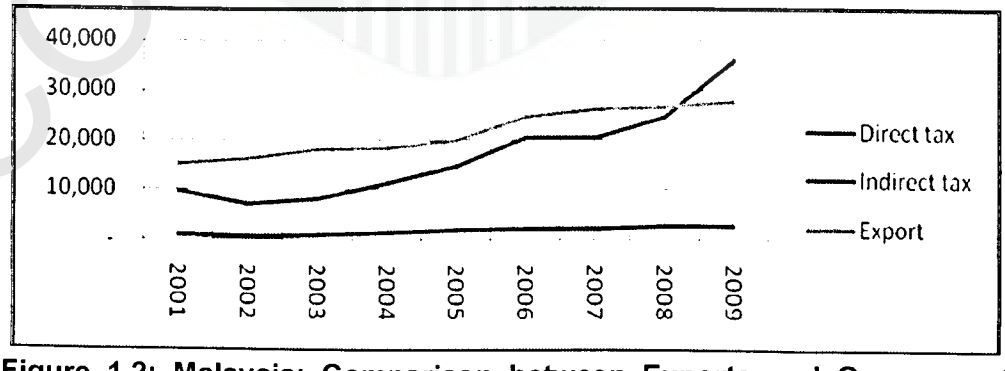


Figure 1.2: Malaysia: Comparison between Exports and Government Revenue from Petroleum, 2001 to 2009 (RM Million)

Sources: Various issues of Economic Report of the Ministry of Finance, Malaysia.

[4] Based on the one month future market price of West Texas Intermediate at the New York Mercantile Exchange (NYMEX), this was an historic highest increase in world's crude oil price.

Contradictory to revenue collection, in 2004 the direct oil subsidy bill cost the government a sum of RM4.8 billion with revenue loss of RM7.1 billion, which amounted to a total cost of RM11.9 billion (Dow Jones, 2005). In 2005, several price increases caused the oil subsidy to rise to a total of RM15.44 billion before the July oil price increase (EPU & NEAC, 2005).

As discussed in the previous section, the concerned group of people had argued why Petronas, a state-owned company, vested in petroleum exploration and exploitation, could not assist in giving lower and subsidized prices of oil products. Petronas (2006), in many of its publications, has stressed that price subsidy contradicts its governing objective to maximize profit. Nevertheless, Petronas pays the government about RM60 billion annually in taxes.

1.2.1.3 Macroeconomic Indicators

The Malaysian economy performed fairly in terms of macroeconomic indicators through the 1990s, particularly for inflation and unemployment. This was brought about by the impact from the financial crisis of 1997. With the slumped growth of the economy in 2000, and soon after the increase in oil price in 2003, the global economy experienced another crisis this time more serious and basic, i.e. the food crisis, and later has been hard hit by the recent subprime financial crisis that particularly exploded in the US.

1.2.1.3.1 Inflation

In economics, a rise in the general level of prices of goods and services in an economy over a period of time is termed as inflation. Mishkin (1997) stated that a continuous rise in price level affects individuals, businesses and the government. High inflation is undesirable as it erodes the purchasing power of money that causes a drop in real income (and thus a drop in an individual's standard of living), the weakening of a country's currency, and a decline in long-term economic growth. The price inflation is calculated using inflation rate, the annualized percentage change in a general price index (normally the consumer price index) over time.

Bruner (1974), Deardoff (2001) and Johnson (2005) were of the view that inflation has negative impact by bringing loss to stability in the real value of money and other monetary items over time. Uncertainty about future inflation may discourage investment and saving, and high inflation may lead to shortages of goods if consumers begin hoarding out of concern that prices will further increase in the future. It is positive if used as a mitigation of economic recession and it also gives debt relief by reducing the real level of debt.

Economists generally agree that high rates of inflation and hyperinflation are caused by an excessive growth of money supply. Analyses of which factors determine low to moderate rates of inflation are more varied. Low or moderate inflation may be attributed to fluctuations in real demand for goods

and services, or changes in available supplies such as during scarcities, as in the case of oil or in the growth in money supply. However, the consensus view is that a long and sustained period of inflation is caused by money supply that grows faster than the rate of economic growth.

At present, most mainstream economists favour a low steady rate of inflation. Low (as opposed to zero or negative) inflation may reduce the severity of economic recession by enabling the labour market to adjust more quickly in a downturn, and the risk of liquidity trap that prevents monetary policy from stabilizing the economy. Monetary authorities have the task of keeping the rate of inflation low and stable.

Generally, the central banks control the size of the money supply circulating in the economy through the setting of interest rates, open market operations, and the setting of banking reserve requirements. Table 1.4 reflects the low inflation rates in Malaysia from 2004 with estimates up to 2010. Despite hopes to control inflation at the lowest possible rates, during the period of oil price increase from 2003 onwards, the estimated inflation rate has been predicted to amplify to a high degree, i.e. as high as 5.4 percent in 2008.

Table 1.4: Malaysia: Inflation rate, 2004-2010^{e} (percent per year)

Year	2004	2005	2006	2007	2008	2009	2010^{e}
Malaysia	1.4	3.1	3.6	2.0	5.4	1.5	2.4

Source: Asian Development Bank (2004)
Note: ^{e} denotes estimation figures

1.2.1.3.2 Unemployment

At the same time, in the course of rising oil price temporarily or permanently, the several aforementioned economic indicators explain some relationships. Higher oil prices shift income from oil-importing countries to oil-exporting countries. This adverse change of trade for oil importers will reduce income, lower real consumption, cause deterioration in the balance of trade and exert downward pressure on the exchange rate. Thus, impacting to slower economic growth, rising inflation and increase in unemployment rate.

Abel and Bernanke (1998), in relating unemployment to oil prices, proclaimed that, "A popular explanation for the productivity slowdown is the large increase in energy prices that followed the OPEC oil embargo in 1973. As companies responded to high energy prices by using less energy, the amount of capital and labour declined, reducing productivity showing generally negative effects on all major industrial countries".

Oil constitutes one of the most important and critical inputs for the production of a wide range of goods and services, and is used for transportation in businesses of all types. Thus, higher oil prices increase the cost of inputs. Further, if cost escalation is unable to be transferred onto consumers, economic inputs such as labour and capital stock may have to be reallocated. Therefore, higher oil prices can cause worker layoffs and the idling of plants, reducing economic output in the short term. Although there is wide agreement that high oil prices have negative effects on macroeconomic

variables, the magnitude and duration of the effects are uncertain. Using the retrospective window of the 1970s on the above economic indicators, we suspect that these indicators may explain the weakening of economic vulnerability, sector performances and welfare distribution amongst groups of people in the economy.

1.2.1.3.3 Performance during Oil Shock

There have been many studies concerning the detrimental effects of oil shocks on economic performances. One particularly interesting response was given by Japan when faced with the energy crisis of 1970s, as follows:

The Japanese, by all rights, since they have no domestic energy resources, should have been devastated by it. Instead, because they have to be nimble, they had seen it coming and had already begun to shift their economy, as a matter of national policy, from a predominantly smokestack one to a high-technology one, weeding out the energy-consuming industries. They went through one brief period of great hardship and now, some 10 years after the Arab-Israeli war of 1973, they have cut back on the percentage of energy used while raising quite dramatically their production (Halberstam, 1983).

Affected by the infamous and detrimental oil shock of 1973, the above-mentioned Japanese experience reminds us of the dreadful economic conditions that prevailed. Around that time, Malaysia, confronted by the 1973-74 crisis and as a country that depends heavily on exports of commodities goods, was faced with a low GDP (Gan, 1985), widespread and rapidly rising inflation, a high CPI around 13 percent, as in OECD countries (Fong, 1986), over-dependence on traditional agriculture, inequitable income distribution particularly amongst local races, and small contributions from foreign direct investment (FDI) (UNIDO, 1985). Masking all these difficulties oil has established itself as an important sector in the economy, and has

slowly industrialized and improved the economy towards lower inflation, more equality of income distribution and more incoming of FDI. In the first oil shock, the economy recorded an offset of important macroeconomic variables that relate to structure and growth of the economy. This has helped Malaysia steer an improved economy and be equipped with better tools than previously in coping with future oil crises.

1.2.1.4 Industry, Commerce and Household Fuel

The Malaysian Government has for a long time implemented price control and subsidy programmes for essential items to keep general prices or the CPI at a low level. In 2007, a total expenditure of RM40.1 billion was spent on subsidies to keep prices at an accepted level (*New Straits Times*, 2008). As in the earlier section, subsidy on oil alone cost a total of RM11.9 billion in 2004 (*Dow Jones*, 2005) and increased to RM15.44 billion in 2005 (EPU & NEAC, 2005). This subsidy easily escalated to about RM28 billion in 2008 with the rising oil price trend to more than US$100 per barrel, to keep petrol products prices at an accepted level. In contrast, subsidies create many other issues like smuggling and hoarding, which lead to shortages, a prominent problem in Malaysia due to the gaps in costs of subsidies in petrol products. A little rumour about oil price increase can spark panic and result in long queues at petrol pump stations. In another instance, all vehicles moving in and out of Thailand have been under close scrutiny to evade smuggling of cheaper Malaysian petrol compared with Thailand's higher petrol prices.

Removing the existing oil subsidy has been considered but a formal plan had yet to materialize as of 2007. In 2008, the government experimented on removing price controls on construction materials such as cement and steel bars while banning exports to ensure steady supply. However, the success remains to be seen. On 14 June 2008, the government embarked on an urgent programme to ease the burden of people impacted by oil price increase by giving cash rebate amounting to RM625 to each motorist with engine capacity of 2,000 cc above, whilst the one with lower engine capacity of up to 250 cc was given RM150. This benefit of lower fuel price was also followed suit by the lower tariff rates of electricity for domestic, commercial and industrial consumers.

For many, these measures are in line with the practice of good governance, i.e. as guardian of oil resources, the government has the responsibility to redistribute oil revenue to the public at large in an equitable way through development programmes or specific shares of revenue. However, from the standpoint of welfare effect on household expenditure, care must be taken to manage the economy so as the oil effect does not to add burden to the poorest in the group, nor to worsen the middle income or rich group. Thus, based on these arguments, it is of utmost importance to determine whether these measures have benefited the welfare of the public at large.

1.2.2 The Oil Industry's Contribution to Energy Inputs

Oil has been used in various sectors of the economy directly and indirectly. Crude oil, natural gas and coal sector produced an amount of about RM41.3 billion of output in the economy in 2000 (Table 2, Malaysian I-O Table 2000). Of the total commercial energy supply to the energy balance, each sub-sector contributed respectively 45.3 percent, 42.2 percent and 0.4 percent of output. In the same year, the oil exports were more than twice the oil imports or in another way the share of imports over exports was 37.3 percent. In terms of final energy used, the Transport sector led with 40.6 percent share, followed by the Industrial sector with 38.4 percent share and the balance was shared by the Residential and commercial services, Other non-energy and Agriculture sectors.

1.2.2.1 Crude Petrol, Natural Gas and Coal

Zakariah and Chan (1995), in decomposing the trade performance of Malaysian manufacturers, found that oil is amongst the capital-intensive sectors in the economy. In 1990 the export of electrical machinery, petroleum products and mining constituted about 52 percent of the total Malaysian exports. This shows that oil has dominantly played a large role as the accelerator and driver of the economy.

1.2.2.2 Petroleum Products

According to the EIA (2007) statistics, Malaysia consumed 21 million tonnes of petroleum products in 2003. Of the total, diesel accounted for 43 percent, gasoline 34 percent, aviation kerosene 9 percent, heavy oil 8 percent, LPG 6 percent, and non-aviation kerosene a negligibly small percent. The market was shared amongst Esso, Petronas and Shell which have refining capacities. Petroleum products are regulated and subsidized, with the largest unit of fuel subsidies given to LPG. Domestic petrol product prices increased in February, March and July 2005, at which time the government announced there would be no further increase for the rest of the year. In February 2006 fuel prices increased by 23 percent.

1.2.2.3 Types of Oil Product

Generally, people view oil as a product that serves their needs in wide and multi-use systems. However, the complexities of modern living with inventions, gadgets and machines to meet the demands, have given way to more complex uses of oil as products. Complexities caused mismatch among the oil products to correspond to the needs of their uses. To lessen the complexities, the DOS, Malaysia, classifies the oil industry under the Mining and quarrying sector which comprises three important commodities, i.e. crude petroleum, natural gas and coal. This is also in line with the IEA (2005) Energy Statistics Manual that defines oil as hydrocarbons that include but are not limited to petroleum, gas, etc. Over and above this the oil industry sectors

are divided into the primary sector in terms of crude, secondary sector as petroleum products and electricity and gas, and also the tertiary sector as heating materials and industrial products.

1.2.2.3.1 Domestic Crude Oil

Crude oil types are important in the oil market since selected crude oils are of high demand. In Malaysia, there exist seven types of oil product produced by the domestic production facilities as shown in Table 1.5.

Table 1.5: Petronas' selling prices of Malaysian crude oils for 2000 (term price, US$ per bbl)[1]

Crude types	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Tapis Blend	25.73	27.51	28.66	26.12	29.57	31.57	31.62	32.63	35.52	33.50	32.99	27.60
Labuan	25.73	27.51	28.66	26.12	29.57	31.57	31.62	32.63	35.52	33.50	32.99	27.60
Miri Light	25.73	27.51	28.66	26.12	29.57	31.57	31.62	32.63	35.52	33.50	32.99	27.60
Bintulu Crude	25.43	27.21	28.36	25.82	29.27	31.27	31.32	32.33	35.22	33.20	32.69	27.30
Terengganu*	25.31	27.10	28.18	25.48	29.04	31.05	31.09	31.43	34.32	32.30	31.79	36.40
Bintulu*	24.53	26.31	27.46	24.92	28.37	30.37	30.42	31.53	34.42	32.40	31.89	26.50
Dulang	24.63	24.41	27.56	25.02	28.47	30.47	30.52	31.93	34.78	33.09	32.42	26.85

Source: Petronas (2006)

Note: [1]denotes monthly average prices calculated based on the weekly pricing submitted to the Asian Petroleum Price Index. *denotes condensates on term prices for five Malaysian crude oil products at the end of year prevailing prices. Prices are quoted in United States dollar per barrel on f.o.b. basis

Generally, crude oil of light grade is more in demand than that of heavy grade. Some market observers like Morgan Stanley (2004) remark that the increase in crude oil price is being driven by the fact that the latest increases in crude oil production have been mostly heavy crude oils, and heavy crude oils are the wrong crude oils to serve demand needs. They contend that what is really needed by refiners is light, low-sulfur crude oil, and that production of

the wrong crude oil is driving up prices. Thus, the chaotic issue of mismatch of oil products results.

The IEA (2005) supports the view that production of heavy crude oil increases the price difference between light and heavy crude oils, and that an increase in this price difference does not translate into a higher overall price. In fact, the opposite view has been put forward that high crude oil prices tend to increase the price difference apart from any increases in heavy crude oil production. Therefore, high light-heavy crude price differences do not drive up prices.

Higher crude oil prices increase the price difference between residual fuel prices and prices for gasoline and distillate. Residual fuel price is affected by alternative fuel prices and generally does not increase with crude oil price. That by itself tends to keep the prices of heavy crude oils from increasing as fast as those of light crude oils. If marginal volumes of crude oil production are heavy, that further depresses heavy crude oil prices.

Finally, if refineries are running at high capacity, one might expect yield of residual fuel to increase as conversion capacity becomes fully utilized, which helps to keep heavy crude oil prices lower than lighter crude oils. But these heavy crude oils are still used, and having those volumes is better than not having any increased volumes.

In Malaysia, Tapis Crude, described as sweet crude which is low in sulphur, high in distillates and having less gasoline compound is not suitable for local use, said Hassan Marican, President and Chief Executive Officer of Petronas (Mikhail, 2008). As Tapis is amongst the most expensive crudes in the world market, the country gains more by exporting it. In this way, importing the cheaper oil, which is sour crude with high sulphur and less distillates but is high in gasoline compound, costs less and is suitable for the domestic use.

1.3 Energy Supply and Demand

Generally, there will be a depressing energy situation in Malaysia if oil price keeps rising in the long run. Although there will be more revenue, more risks will be exposed by spending more money on subsidy and importation. Thus, a better solution is to have an oil price increase which is followed by economic efficiency and stability.

In spite of high optimism that the country's oil reserves are potentially large standing at 5.36 billion barrels for oil and 14.82 billion barrels for gas in 2007 (National Energy Balance, Malaysia, 2007), there is no way Malaysia can be confident it would not turn into a net oil importer country in a couple of years. Although, Petronas is assured that Malaysia has an equivalent of 20.18 billion barrels domestically and 6.31 billion barrels of international oil and gas reserve as of 1 January 2007 (Oil and Gas Journal, 2007), the state of depleting oil production and rising oil consumption could sway confidence into a doldrums of problems to energy planners.

Despite these concerns, assuming the government's estimates are correct, and with the prevailing current production rates, Malaysia is poised to sustain its oil production for 22 years and gas for 39 years. It was ranked 23th in terms of world oil and 14th for gas reserves. In addition, out of its international reserves, 40.4 percent is oil and 59.6 percent is gas.

Malaysia produced about 861,800 bpd of oil in 2004 (EIA, 2007), higher than the average of about 700,000 bpd as prescribed by the government's sustainable plan. Although with a high rate of oil consumption, similar to the world's oil consumption which will expand by more than 30 percent by 2030, for sure there is no turning back on the country's rapid economic development and oil will still be the main driver behind the industrialization wheel.

1.3.1 Energy Supply

Malaysian oil reserves depend largely on the capacity of oil production from its exploration fields. The higher the production capacity the sooner the oil reserve depletes, which is currently at a reserve-to-production ratio of 10.6, based on year 2002 production of 37 million tonnes. Oil and gas are explored over approximately 565,555 square kilometers in offshore Sabah, Sarawak and Terengganu with a total of 36 percent covered under the PSC areas.

Until 1993, exploration and production activities had taken place in the broad continental shelf offshore, but have since moved into deeper offshore areas,

with water depths of 200 meters or more. To date, five major sedimentary basins have been identified as petroleum bearing with water depths of between 25 and 200 meters. This has resulted in discoveries of 140 oil fields and 182 gas fields although there are large potential areas for exploration and development (Petronas, 2006).

In confronting the incidence of peak oil, a situation where oil production is at its maximum and is declining, measures are geared to increase oil reserves; the most worrying part is brought about by the expectation that the country may become a net oil importer by 2011 if no large deposits of oil are discovered (Mikhail, 2008). Thus, overexploitation of oil for exports may result in depletion of oil resources that opens the risks of dependence on other countries for oil with no stocks left for the future. Table 1.6 is sourced from the EIA (2007) showing that Malaysia's oil resources are increasing steadily. Since oil exploration and exploitation are actively been pursued by Malaysia, the existing reserves are generally at a sustainable level.

Table 1.6: Malaysia: Oil and gas reserves, 1975-2007

Year	Oil* (bnbbl)	Gas (TCF)
1975	0.9	18
1985	3.3	52
1995	4.2	85
2000	4.5	84
2007	5.4	89

Source: Publications of EIA (2007)
Notes: * denotes oil that includes condensate, bnbbl is acronym for billion barrels, as TCF is for trillion cubic feet

The preceding IEA data are clearer when transformed into graphical presentation as shown in Figure 1.3, which depicts clear differences between Malaysian oil and gas reserves. In 1975, natural gas had a potential reserve

of about 18 TCF together with 0.9 billion barrels of crude oil which at that time was relatively new in exploration and development. However, recently in 2007 gas reserves have increased to 89 TCF (14.82 billion barrels) compared with only about 5.4 billion barrels of crude oil.

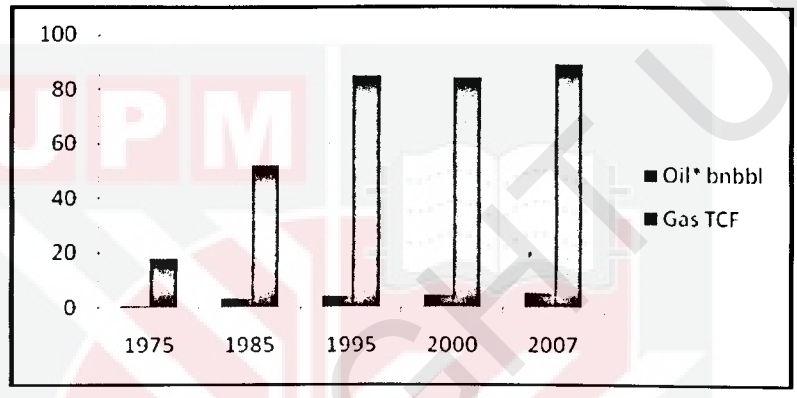


Figure 1.3: Malaysia: Oil and Gas Reserves, 1975-2007

Source: Various publications of the EIA (2007)
Notes: *denotes Oil that includes condensate, bnbbl is acronym for billion barrels as TCF is for trillion cubic feet

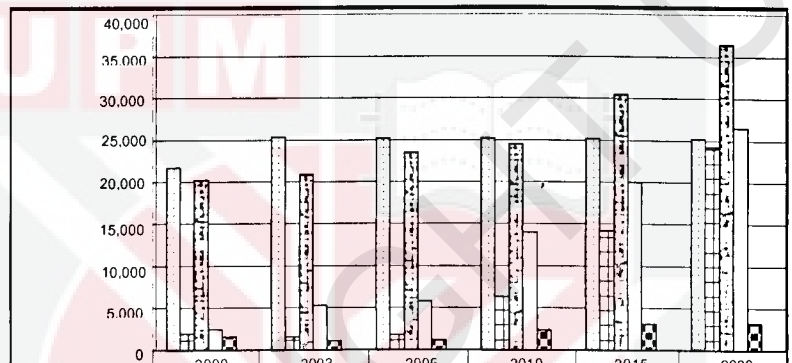
For almost two decades after the 1970s, Malaysia had successfully diversified its energy consumption by taking advantage of its domestic energy resources, particularly oil, hydropower, natural gas and coal. Out of the need to diversify these resources, the Four-Fuel Diversification Strategy, 1981 was formed meriting on the combination of fuel mix with the purpose to sustain fuel resources.

Table 1.7: Selected oil exporting countries' profiles in 2007

Country	Production (mbd)	Reserves (btsb)	Consumption (mbd)	Total Population
Saudi Arabia	10.5	264.2	1.9	24 million
Venezuela	2.9	79.7	0.5	27 million
Brunei	0.2	1.1	0.012	5 million
Malaysia	0.7	4.2	0.4	26 million
World Total	83.0	1,201	90.0	6 billion+

Source: Adapted from Market review of OPEC Bulletin and EIA (2007)
Note: mbd is acronym for million barrels per day, as btsb is for billion tank stock barrels

In comparison with other big oil producers such as Saudi Arabia and Venezuela as shown in Table 1.7, Malaysia is not only a small country but owns a production capacity too small to influence the world's oil market. This has induced the country to adopt a sustainable policy that mobilizes foreign reserves in order to prolong its domestic reserves for future generations.



	2000	2003	2005	2010	2015	2020
Crude oil	21,673	25,344	25,180	25,180	25,180	25,180
Petroleum product	1,922	1,601	1,800	6,300	14,200	24,200
Natural Gas	20,194	20,878	23,500	24,500	30,400	36,400
Coal & Coke	2,486	5,316	5,800	14,000	20,000	26,500
Hydropower	1,560	1,056	1,100	2,400	3,100	3,200
Total	47,835	54,195	57,380	72,380	92,880	115,480

Figure 1.4: Malaysia: Energy Supply by Source, 2000-2020 (in KTOE)

Source: Economic Planning Unit (2005)

Figure 1.4 depicts Malaysia's energy supply by source from 2000 to 2020. The total energy supply grew by 13 percent from 2000 to 2003, expanding by 34 percent in the period from 2003 to 2010 and is projected to expand by 60 percent in 2020. The main sources of energy supply in 2003 were crude oil and petroleum products (49.7 percent of the total energy supply in 2003), natural gas (38.5 percent), coal and coke (9.8 percent) and hydroelectricity (2.0 percent). This trend of energy supply mix is expected to continue beyond 2005 to 2020. However, this does not explain whether the supply of oil can still be sustained for a longer period if the country depletes its resources in the projected period.

At any one time by comparing fuel utilization with other types of energy fuel, crude oil is at all times used by more than 45 percent compared with any other single fuel. Even though natural gas is also largely used, in terms of facilities, oil enjoys a wider reception. At present natural gas is widely promoted for greater fuel utilization than oil, but the effect remains to be seen. In ensuring sufficient energy supply for the country's rapid economic industrialization and to sustain for future generations, perhaps there is a window for diversifying new energy sources particularly gas-based products that exist in higher reserves compared with oil.

Over the years, oil production generally appears to be increasing steadily from 1990 and beyond. With this trend of oil production, and given a small but constant reserve, it is estimated that oil will still be produced for about 18 years more. However, in terms of the country's net export over import, reports show that the trend is declining. This portrays the possibility of Malaysia becoming a net importer of oil earlier than expected. The following Figure 1.5 clearly illustrates the consumption patterns that correspond to petroleum net exports over imports in Malaysia.

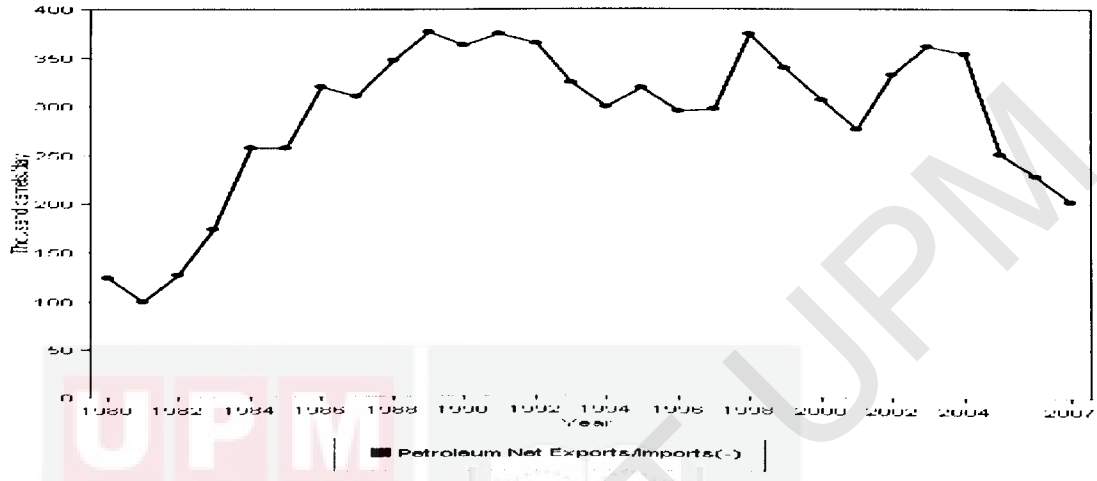


Figure 1.5: Malaysia: Petroleum Net Exports over Imports (Thousand Barrels Per Day)

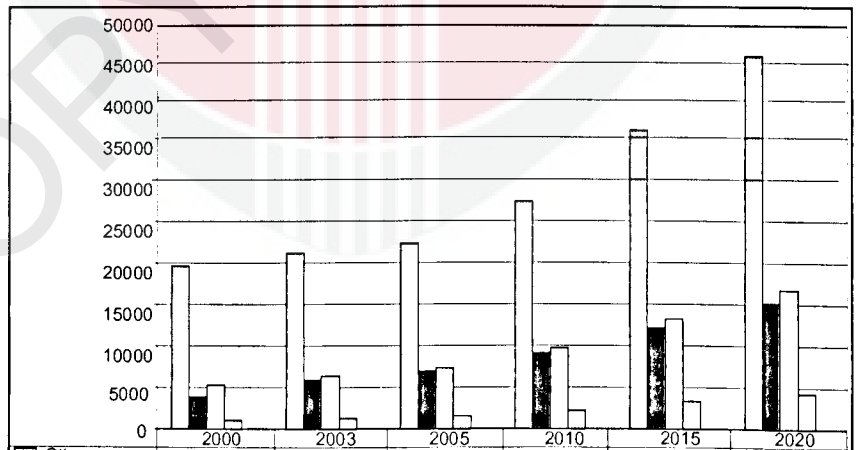
Source: Energy Information Administration (2007)

Figure 1.5 shows an initially upward trend or increase in net gain from exports and imports from 1980 to 1990. Thereon it fluctuated and from 2003 onwards it declined steeply portraying a downturn trend of Malaysia's net oil export over imports. The declining net gain curves coincided with times of crises or higher oil prices. These low level points of 1981, 1994, 1997, 2001 and recently 2004 mark lower net gains with the rise of oil prices in the world market.

The negative slopes of Figure 1.5 indicate that exports had proportionally decreased whilst the shares of imports had risen. The recent decline from 2003 onwards implicitly represents the oil supply and demand changes corresponding to the rises in oil price. Whilst it is clear that this negative slope was brought about by the imbalances between the rate of oil production and its consumption in the economy, it also shows the long-term trend if oil price increases indefinitely.

1.3.2 Energy Demand

Malaysia's growth of total energy demand is higher compared with its supply, growing at 16 percent from 2000 to 2003 and is projected to expand by 68 percent from 2010 to 2020. This rapidly growing energy demand of more than four-fold increase will likely be materialized by the end of this decade. Oil has remained a dominant fuel followed by electricity, natural gas and coal as shown in the following Figure 1.6. The Eighth Malaysia Plan (EPU, 2001) stipulates strengthening the energy sector to support the development of Malaysia into a knowledge-based economy thereby enhancing its resilience and competitiveness. The importance of oil has always been established particularly in the industrial, transportation, commercial and residential sectors and is implicitly the lifeblood of the country's industrialization system.



	2000	2003	2005	2010	2015	2020
Oil	19582	21175	22300	27800	36000	45900
Natural Gas	3863	588	6900	9100	12100	15100
Electricity	5263	6313	7300	9700	13200	16700
Coal	991	1212	1600	2200	3300	4300
Total	29699	34587	38100	48800	64600	82000

Figure 1.6: Malaysia: Energy Demand by Fuel, 2000 - 2020 (KTOE)

Source: Economic Planning Unit, Prime Minister's Department (2005)

In this expanding demand trend, the Industrial sector is expected to overtake the Transport sector as the largest consumer of energy by 2010, followed by the Residential & commercial and Non-energy sectors as given in Table 1.8.

Table 1.8: Malaysia: Energy demand by sector, 2000-2020 (in ktoe)

Sector	2000	2003	2005	2010	2015	2020
Industrial	11,406	13,472	14,822	20,073	27,833	35,538
Transport	12,071	14,271	15,589	19,873	25,647	33,347
Residential &	3,868	4,399	5,171	6,531	8,453	10,407
Non-energy	2,250	2,345	2,413	2,435	247	2,506
Agriculture	104	98	105	127	187	207
Total	29,699	34,585	38,100	49,039	62,367	82,005

Source: Economic Planning Unit, Prime Minister's Department (2005)

The data in Table 1.8 differ from those in Figure 1.6 in terms of energy demand by sector from 2000 to 2020. The increasing trend of demand for energy goods and services grows with the increasing consumption, investment and government's expenditure that clearly marks the increasing energy demand required by the above five major sectors' production processes.

In order to reduce instability and negative impact of rising oil price, the position of oil as an energy source is crucial in the plan to develop and improve the economy. With oil still playing a vital role in developing a productive economy out of the interindustry's value added and spin-offs, or even in generating new sectors or industries, it is critical to ensure that the dominant role of oil in times of rising oil price positively impacts the susceptibility of the economy.

1.3.2.1 Volume of Oil Sales

Ordinary consumers buy petrol products and not crude oil and thus product prices are of more concern to users. Product prices broadly follow crude prices but different factors are at play. Product prices peaked in September 2005 because of hurricane Katrina and surpassed those in June 2005 except for those during the US Gulf War (Bacon and Kojima, 2006). In many instances correlation between crude and refined products is weak. This gives effects on the demand and supply of the world's oil market. With the world's rising oil price, a closer look at monthly sales of petroleum in Malaysia reveals a higher volume of sales from 2003 to 2006 (Figure 1.7). This positive gain represents a higher return compared with the normal or lower oil prices, which represent higher revenue collection that can be used to pump-prime the economy during economic slowdown or stimulate an economic recovery.

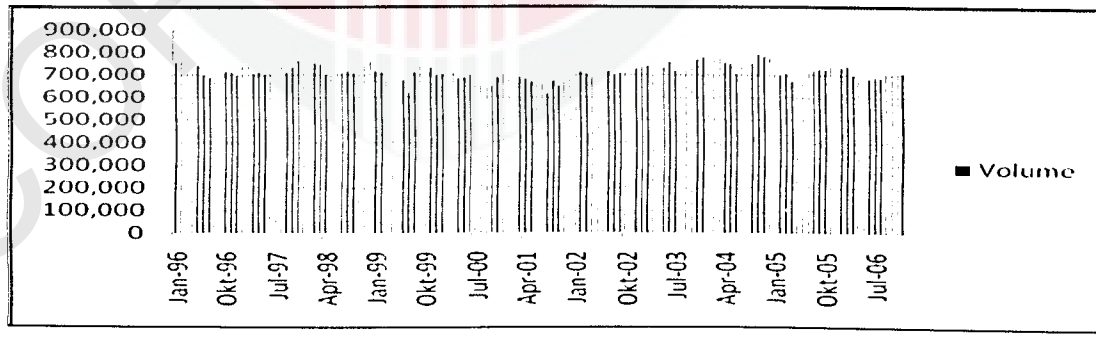


Figure 1.7: Malaysia: Monthly Volumes of Oil Sales, 1996 to 2006 (Barrels Per Day)

Sources: Various publications of Economic Report of the Ministry of Finance, Malaysia

One of the ways to view the relationship between exports and imports is through examining the aggregate effect of positive or negative gain from oil

sales. The negative or positive gain is implicitly portrayed in the following Figure 1.8 by the increase in price of Malaysian Tapis Crude. Observe that the increase initially started from a lower tier and then jumped to a higher tier from 2003 onward.

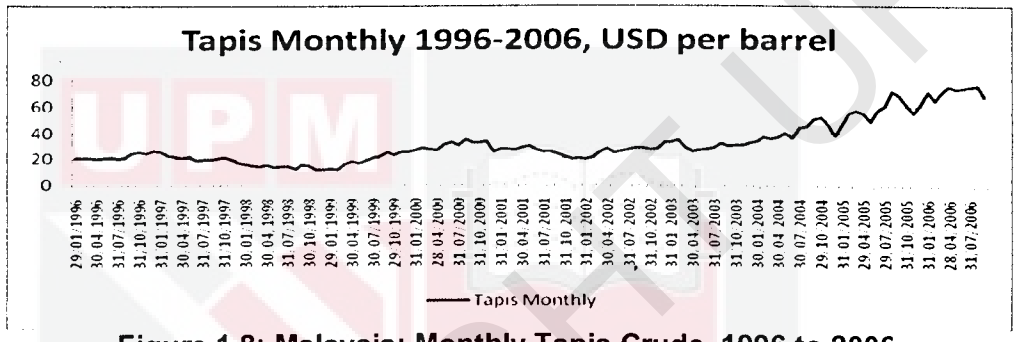


Figure 1.8: Malaysia: Monthly Tapis Crude, 1996 to 2006 (in US$ Per Barrel)

Source: Statistics compiled by Tax Division, Ministry of Finance, Malaysia

Similarly, in the same way, Figure 1.9 shows the increasing trend of oil price based on weekly Tapis Blend spot prices (FOB) where a dramatic sharp peak emerged on reaching a marked point of US$148 per barrel at the end of January 2008. This signifies that the building up of prices went on until it reached a peak in 2008, and then it plunged to most likely a stable price of between US$50 and US$70 per barrel after the marked increase.

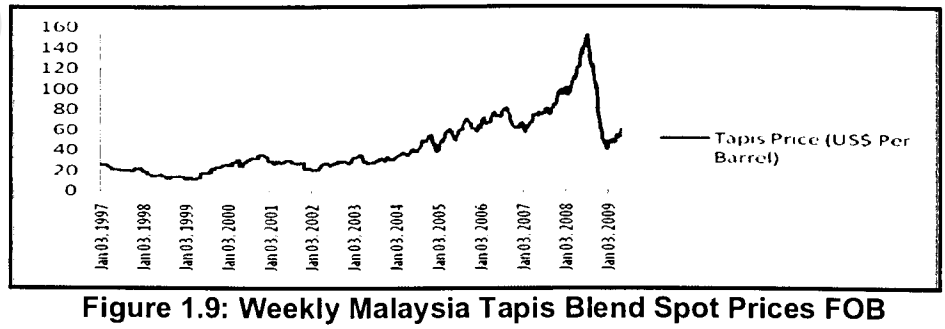


Figure 1.9: Weekly Malaysia Tapis Blend Spot Prices FOB (US$ Per Barrel)

Source: The Energy Information Administration (2009).
Note: Weekly data is presented in compressed annual data.

In terms of price and the quality of crude oil, Bacon and Kojima (2006) compared the prices between three types of crude oils; prices of Brent, WTI (highest priced) and OPEC basket (lowest priced) found a similar upward trend. This similarity was also found between the prices of the expensive Tapis Crude and other higher price crudes such as Dated Brent which share the same increasing trend as shown in the following Figure 1.10.

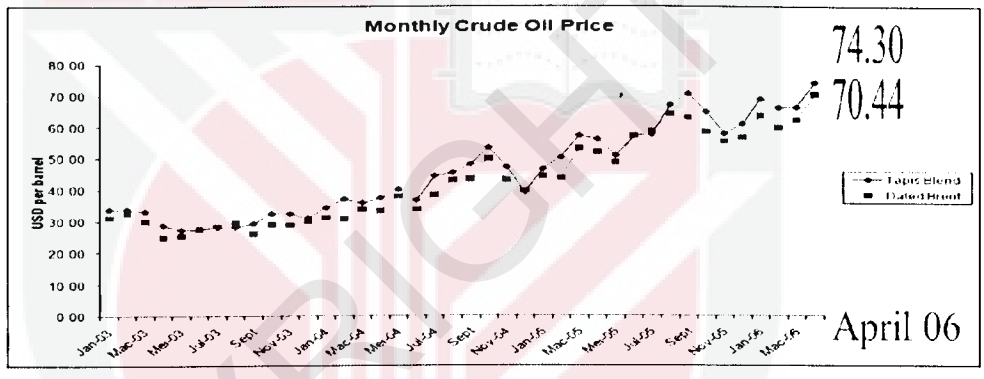


Figure 1.10: Similarities between Tapis Blend and Dated Brent, 2003 – 2006 (US$ Per Barrel)

Source: Statistics compiled by Tax Division, Ministry of Finance, Malaysia (2009)

1.3.2.2 Oil Exports

Commencing from a mere export value of RM165.4 million in 1970 (Ariff, 1991), crude oil exports increased to RM6,718.9 million in 1980 and reached RM32,643 million in 2006. Figure 1.11 shows the important periods when oil exports featured increases in value. The steady increase of oil exports raised the importance of government's revenue contributions. In 2007, the export value of crude petroleum was the third largest among the top commodities of total exports. The increase was the result of higher average unit per value

and export volume by 2.1 percent or RM40.2 per tonne respectively. In the same year, crude oil exports contributed 12.4 percent of the total Malaysian exports.

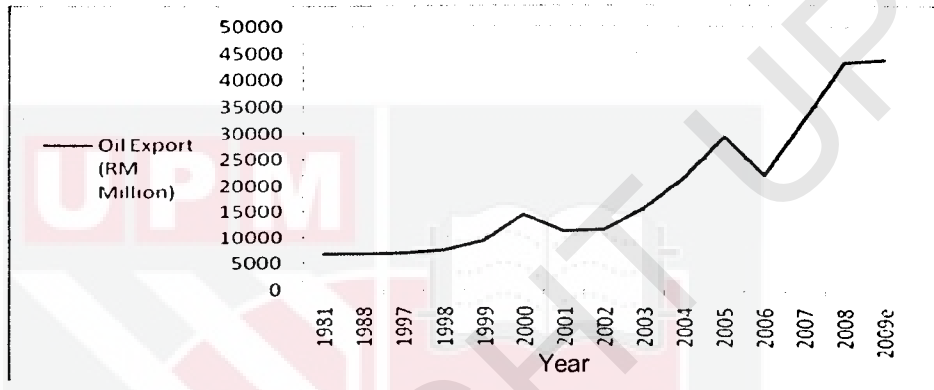


Figure 1.11: Malaysia: Oil Exports from 1981 to 2009[e] (in RM Million)

Sources: Various publications of the Economic Report, Ministry of Finance, Malaysia
Note: [e] denotes estimation figures

Out of this total export value, the major oil player, Petronas, contributed revenues in terms of tax, dividend, royalty and export duty as illustrated in Table 1.9 below. Given that oil is still amongst the largest leading export commodities, a major revenue contributor and the manufacturing industry's main driver, any hike in oil price will certainly produce significant effect on the economy.

Table 1.9: Petronas' contributions to the Malaysian Government from financial years 1999/2000 to 2004/2005 (in RM billion)

Petronas' contribution	FY 99/00	FY 00/01	FY 01/02	FY 02/03	FY 03/04	FY 04/05
Corporate & petroleum taxes	6.1	9.9	7.5	8.6	10.5	14.3
Dividends	4.1	4.1	4.1	5.1	5.1	9.1
Royalties (to Federal & State Govt.)	2.6	4.1	3.5	4.1	4.5	6.2
Petroleum export duties	0.7	0.9	0.7	0.8	1.1	1.6
Total	13.4	19.0	15.8	18.6	21.3	31.2

Source: Economic Planning Unit and National Economic Advisory Council (2005) of the Prime Minister's Department

1.3.2.3 Oil Consumption

In 2004, the country consumed about 508,040 bpd of petroleum products and imported about 26 percent or 133,330 bpd of crude oil (EIA, 2007). Malaysia had a consumption of a mere 0.62 percent from the world's total use of about 83 million bpd. Domestically, the above-mentioned consumption is about 60 percent of 861,810 bpd which is the total Malaysian oil production.

Within this consumption share, the Malaysian household expenditure survey (HES) 2004/05 revealed that each household spent more than one fifth of their average monthly income on petroleum products from the items classified under housing, water, electricity, gas and other fuels. Figure 1.12 depicts the household expenditures for the main groups in 2004/05 which explicitly show that the spending of oil was the biggest item, i.e. 22 percent, and is increasing in trend compared with other items of household expenditure.

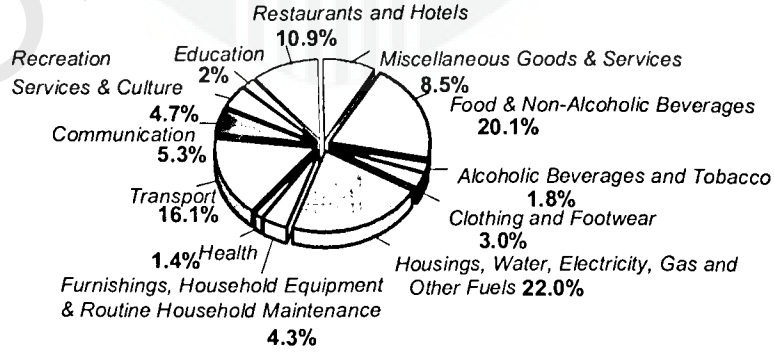


Figure 1.12: Malaysia: Composition of Average Monthly Household Expenditure by Group, 2004/05

Source: Household Expenditure Survey 2004/05, Department of Statistics, Malaysia.

Consumers and producers alike in the residential, commercial and industrial sectors worry during times of oil price rise and are concerned about the costs they are facing in order to plan ahead their incomes or activities. The increase in the world's oil price from around US$30 per barrel in 2003 to more than US$100 a barrel recently in January 2008 has created uneasiness for many groups of people.

The rising crude oil price brings about price increases in the domestic petroleum products that will directly affect the households' income share through their spending on the basket of goods and services. This extended increase in oil price consequently ripples into other non-oil expenditure and puts pressure on inflationary rates that suppress their real incomes; the people thus receive less goods and services for the same incomes. Hence, a higher oil consumption in the midst of oil price rising will likely impact not only on real incomes but also on retail prices of food, shrinking the incomes from those supposed to be received before the oil price increases.

1.4 Factors Aggravating the Effect of Rising Oil Prices

Generally, the economy depends significantly on the oil industry's output for use as inputs in other non-oil industries. The dominance of oil as inputs is clearly indicated from the importation of oil by more than 60 percent for domestic utilization (EIA 2007). In addition, although Malaysia uses a product-mix of fuels comprising different types of fuel such as coal, natural gas, hydro, and renewable energy, oil is still popularly and widely used.

1.4.1 Dominant Role of Oil

With the dominant role played by oil, any increase in its price will certainly be felt by the production system and affect its wider consumption. The more oil is used in an industry or production system, the more likely it affects the industry or sector concerned. Similarly, the higher the share of oil consumption in the Malaysian economy, the more it is impacted in times of oil increase corresponding to the increase of oil imports. This had been also found by Valadkhani and Mitchell (2002) in their study on the Australian economy, likewise by Uri and Boyd (1996) in Mexico where increased costs of production were shown in both countries with increased oil consumption. The only differences are that countries with different sets of economic conditions are impacted in different degrees. The bottom line is that the more oil is utilized, the more vulnerable is the economy to rising oil prices.

1.4.2 Resource Development and Oil Dependency

In view of the rate of increase in consumption of petroleum products of about seven percent from 1991 to 2000, Malaysia is predicted to end its net oil exports status in a couple of years if Malaysia reaches its point of peak oil. If no significant oil discoveries are made in the coming years, then it is likely that the oil impact will be aggravated in the midst of oil price rising.

In addition, oil dependency is said to worsen in the coming years in conjunction with the above phenomenon. The EIA (2007) recorded that

Malaysia in 2004 had a share of 54.8 percent or 278,610 bpd of imported oil. Another 45.2 percent or 229,430 bpd was produced locally for domestic needs as shown in Table 1.10. This plainly means that in terms of oil imports, Malaysia is more dependent on foreign oil than being able to produce enough locally for its own consumption.

Table 1.10: Malaysia: Oil consumption and production, 2004 (thousand barrels per day)

Oil consumption and production	Thousand barrels per day ('000 bpd)	Percent*
Oil import for consumption	278.61	54.8
Local oil production for consumption	229.43	45.2
Total oil consumption	508.04	100.0
Total oil production	764.00	100.0

Source: Figures from Energy Information Administration (2007)
Note: *denotes author's own estimates.

Table 1.10 illustrates that since the production declined after its last peak in 2004, oil consumption (508.04 bpd) has always been on the rise due mainly to economic growth and rapid industrialization expansion. After the peak, oil production continued to decline whilst oil consumption kept climbing creating the tendency to close the gap by importing (54.8%), resulting in accelerating rate of the country becoming a net importer of oil.

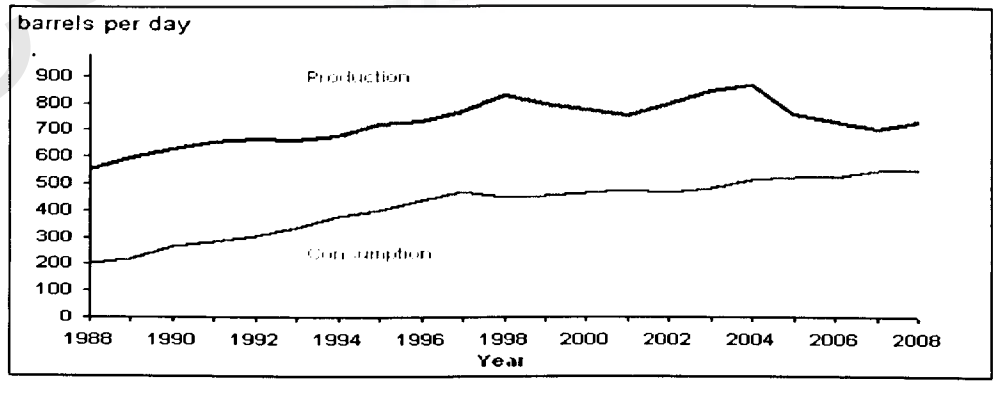


Figure 1.13: Malaysia: Oil Production and Consumption, 1988-2008 (barrels per day)

Source: Energy Information Administration (2007)

Notwithstanding the above, with rapidly increasing trend of oil consumption and oil production on the decline, the gap between import share of production and consumption has become closer towards 2008 as portrayed in Figure 1.13 narrowing the net imports in between.

The oil consumption and production trends can be clearly explained by focusing on the import share of production. *Import share is measured as tonnes imported relative to tonnes of domestic production.* Figure 1.14 shows that the import share of production in 1975 was about 60,000 tonnes comprising both the share of oil imports and the local production. In 1976 it decreased to 40,000 tonnes, which means that the share of imports had decreased by 20,000 tonnes relative to the increase in local oil production. The import shares were large but decreased over the 1970s since oil had just been established and the supply of oil was mostly from imports. However, in the 1980s, domestic oil production picked up and its share started to grow, shown by the declining share of imports over production. Beyond 2000 onwards, the share of imports to oil production increased to an almost steady level, resulting from an increasing share of imports relative to production.

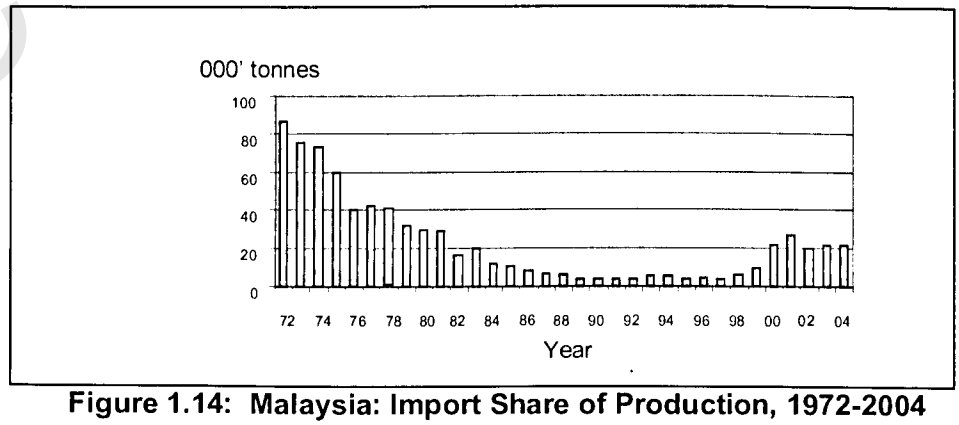


Figure 1.14: Malaysia: Import Share of Production, 1972-2004 (Thousand Tonnes)

Source: Data from Energy Information Administration (2007)

1.4.3 Measure of Welfare Distribution

There are numerous studies on fuel products and the welfare effects of oil on the public or household at large during an increase in oil price. Recent researchers such as Kpodar (2006), Coady and Newhouse (2005) as well as Adriamihaja and Vecchi (2007) have estimated that an oil price increase respectively in Mali, Ghana and Madagascar generally shows regressive patterns, hitting the poor much harder than the rich. In Malaysia, the differences in welfare effect between urban and rural households are suspected to be caused by the differences in energy infrastructure and facilities. This is important as Sabah and Sarawak have only about 85 to 90 percent electricity coverage (EPU, 2001). In these rural areas, with the lack of electricity, people still use basic and traditional energy products, mostly kerosene, to power their household activities including lighting and cooking.

In analysing welfare distribution, some of the concepts of welfare should be clarified. Firstly, economists believe that welfare in terms of subsidy is not neutral from the distributive standpoint. Rose (1986) stated that subsidy deviates from equitable distribution and is not distributive in nature. In normative economics, be it the theory of second best or optimality, it is questionable whether the poor are the real beneficiaries of the price subsidies; what the exact extent of their benefit is; and the overall effect, progressive or regressive, on the income distribution of the people at large.

Secondly, there are concerns about the consequences of price subsidies in terms of allocational efficiency. Are subsidies the most effective or efficient

way to protect the real income of the poor? In the presence of binding budget constraints, subsidies are likely to divert resources from other social expenses, which may be more effective in reaching the poor. Moreover, by altering the structure of relative prices, subsidies may affect the incentives for households to use their energy efficiently.

Thirdly, there are also fiscal considerations. Even if price subsidies are not financed by reductions in other social expenditures, they may eventually cause fiscal distress such as increases in budget deficit and debt. Thus, it can be argued that they may lead to adjustment policies, e.g. increase in taxes with offsetting effects.

As distribution is particularly important to ensure socio-economic objectives, the effect of higher oil prices is normally felt amongst the poorest groups. Thus, resource distribution and relocation should also provide for the poorest group at least to lessen their share of burden. Real income losses may be substantial, as higher oil prices will not only imply higher prices for petroleum products directly consumed by households, but also higher prices of other goods which use oil as an intermediate good in the production process. In fact, the Malaysian HES of 2004/05 reveals that more than one fifth of each monthly average household income (Figure 1.12) goes to spending on fuel under the share of expenditure on housing, electricity, gas and others.

Further results from this survey show that poorer individuals with average monthly income below RM500 spent only 4.2 percent of their household

expenditure on transportation compared with the richer individuals with monthly income above RM5,000 who spent 27.8 percent on transportation. This ironically admits the facts that the fuel subsidy of RM16 billion from January to August 2007 is helping the rich more than the poor (EPU-NEAC, 2005). This leaves the poorer individuals with no choice but to tighten their belts in times of rising food prices whilst their high share of income spent on food and energy remains at the same level.

1.4.4 Prices of Oil-Based Products

Generally there are two types of oil prices; first is the price of crude oil that is traded internationally which gives exogenous impact to the economy. Second that of petroleum products that endogenously affects the economic activity in a country. Each of these commodities has different factors affecting their supply and demand for their goods. As we have mentioned earlier, crude oil differs from type to type whether heavy or light crude; petroleum products also have different classifications depending on the sectors or industries or motor vehicles utilizing them.

1.4.4.1 Exogenous Oil Prices

As stated in the earlier sections, generally the increase in oil prices impacts negatively on the economy of the oil-importing countries, whereas the oil-exporting countries gain positively. The following Table 1.11 shows an

uncertain global trend in oil price that changes the stability of oil trade over a period of time from 1970 to 2008.

Table 1.11: Average world's crude oil prices from 1970 to 2008 (US$ per barrel)

Year	Price[a]	Year	Price	Year	Price
1970	1.80	1983	30.00	1996	22.28
1971	2.29	1984	29.00	1997	20.71
1972	2.29	1985	28.00	1998	13.74
1973	2.90	1986	28.00	1999	19.35
1974	11.65	1987	17.52	2000	29.85
1975	10.46	1988	17.50	2001	24.91
1976	11.51	1989	16.37	2002	26.12
1977	12.09	1990	13.25	2003	30.09
1978	12.70	1991	16.54	2004	41.48
1979	14.54	1992	17.19	2005	58.48
1980	28.00	1993	14.96	2006	60.89
1981	32.00	1994	14.76	2007*	90.00
1982	34.00	1995	16.13	2008**	100.00

Sources: Various issues of Petroleum Press Service (2006) and Petroleum Economist (2006)
Note: [a] represent the mid-year price of Arabian Light ex Ras Tanura as a proxy for the world's oil price,*denote forecasted world's oil price and **symbolize anticipated world's oil price

From the beginning of World War II in 1939, crude oil prices were very low between US$1.80 and US$4.00 per a barrel (Petroleum Economist, 2006). From the 1950s to the early 1970s, oil prices in nominal terms were almost stable and declined in real terms to around US$1.80 per a barrel. Table 1.12 shows that in 1971, oil price started to increase unpredictably. The oil price hikes in 1973 and 1974 were the result of OPEC members' oil embargo, which, in turn, triggered the 1970s oil crisis. During the Gulf War in 1990, the oil price increase from US$13.25 to US$16.54 produced detrimental effects on macroeconomic variables and further uncertainties (Zakariah and Shahwahid, 1994). The impact of change worked through imports and exports of crude oil and petroleum products.

Since the historic increase to US$145.29 per barrel in 2008, oil has not been expected to return to its base of US$20 per barrel (trends of 1980s and

1990s) but to hover around US$50 to US$75 per barrel or more. The fluctuation of the world average annual oil price is a reflection of the many instances of chaos, economic crises, wars and climatic changes from 1970 to 2007 as shown in Figure 1.15 below.

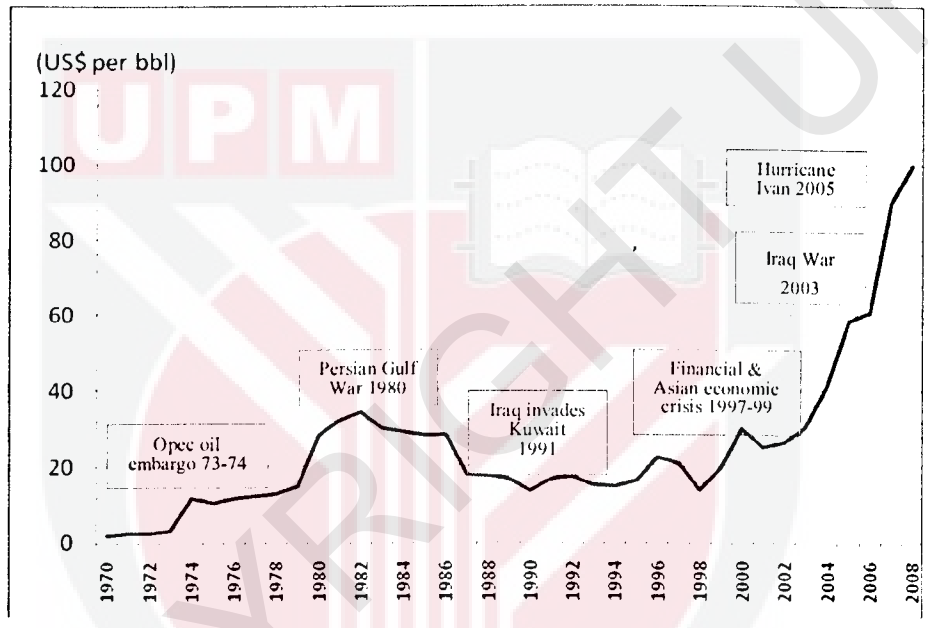


Figure 1.15: World's Average Crude Oil Prices, 1970-2008 (US$ Per Barrel)

Source: Extrapolated from Table 1.11.

Being a small open economy exporting only about or less than 1 percent of world's oil production compared with large producers, Malaysia cannot influence nor have any control whatsoever on events happening in the international trade, particularly on world oil prices. However, having oil as the third largest export commodity, Malaysia has the option of getting the highest returns now or to sustain its oil reserves for the future generations.

1.4.4.2 Excessive Speculative Activity

Traditionally the futures market involved transactions between producers, oil refiners and fund managers who were well exposed to oil-related investments. They entered the market with the aim to secure profits in refinery activities or investment earnings. However, today's futures markets are dominated by fund managers who conduct businesses to gain profits by avoiding commercial principles. In June 2006, the US Senate investigation into the oil and gas industry reported solid testimony of large speculation behind the increase in oil price. This increase is approximated to be three times of Goldman Sachs commodity three years ago (MOF, 2008). The depreciation of the US dollar also contributes to the speculation in oil futures. Oil, particularly crude, is seen as a shield against a weak dollar, low interest rate, high inflation as well as falling equity and real estate markets.

1.4.4.3 Domestic Prices and Subsidies

The domestic prices of petroleum products are regulated and determined using the automatic pricing mechanism (APM) which was established in 1983 with the following formula:

$$\textit{Retail Price} = \textit{Singapore Posting Price} + \textit{Operation Cost} + \textit{Company's Profit} + \textit{Dealers Commission} + \textit{Sales Tax} + \textit{Subsidy.}$$

Employing this formula and comparing fuel prices in the Asean region, the pump prices of gasoline and diesel in Malaysia are lower than those in other Asean countries except Brunei (Figure 1.16).

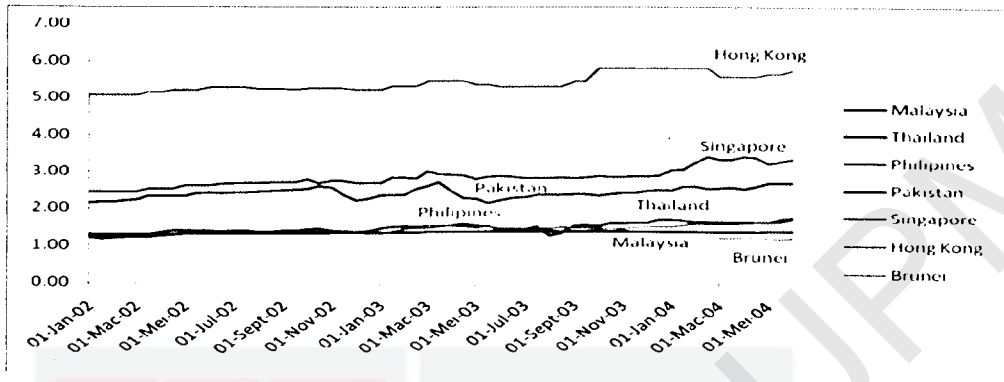


Figure 1.16: Comparison of Malaysian with Selected Asian Countries' Petroleum Product Prices, 2002 to 2004 (RM Per Litre)

Source: Statistics compiled by Tax Division, Ministry of Finance, Malaysia (2009)

In the same way, gas and electricity are also subsidized to ensure that the prices of these fuels are stable and meet the industrial, commercial and residential needs. Thus, for instance, if oil prices were without subsidy in 2004, the following prices shown in Table 1.12 would stand: 244.82, 244.26 and 243.41 sen per litre respectively for Peninsular, Sabah and Sarawak.

Table 1.12: Retail prices of gasoline (RON97)*(sen per litre)

Gasoline (RON97)	Peninsular	Sabah	Sarawak
Product cost	164.21	164.21	164.21
+ Operational cost	9.54	8.98	8.13
+ Company margins	4.45	4.45	4.45
+ Petrol station commission	8.00	8.00	8.00
+ Sales tax	58.62	58.62	58.62
= Actual price	**244.82**	**244.26**	**243.41**
- Sales tax (exemption)	58.62	58.62	58.62
- Subsidy	24.20	25.64	23.79
= Retail price	**162.00**	**160.00**	**161.00**

Source: EPU and NEAC (2005).
Notes: *Prices with effect from 31 July 2005.

Subsidies are monies paid to producers or retailers of a given product by the government in order to lower the product's retail price. It is a form of assistance for a given industry or segment of society provided that the amount meets the government's budgeted allocation and state of finance. This is undertaken to ensure that subsidized fuels like diesel and LPG are used by

those truly requiring subsidy to shelter them against oil price impact, i.e. segments of people such as fishermen, public transport operators and operators of river transportation in Sabah and Sarawak.

As subsidy has the objective to support the strength of the economy, a bigger fraction of an economy influenced by oil will likely receive a bigger share of subsidy in the increase in oil price. The percentages of subsidy for different types of petroleum products at the pump prices in 2005 are given in the following Table 1.13.

Table 1.13: Malaysia: Fuel prices without and with subsidy in 2005 (RM per litre)

Petrol product types	Without Subsidy	Subsidized price	Difference	Percent of subsidy
RON95	2.45	1.62	0.83	33.9
Diesel	2.07	1.28	0.79	38.2
LPG	2.39	1.45	0.94	39.3

Source: Table 4 of publication by Economic Planning Unit and National Economic Advisory Council, Prime Minister's Department (2005)

It is within the purview of the Ministry of Domestic Trade and Consumer Affairs to set the percentages and formulas in order to ensure adequate, secure and cost-effective supply particularly to protect the low-income consumers including small and medium enterprises (SMEs). By using the APM, oil prices can be effectively monitored to a lower level.

1.4.5 Peak Oil

Other factors that may also influence the escalation of oil price are peak oil, geopolitical upheaval and climatic change. We shall not seek further in-depth study into the latter two factors since they have been much debated, require

long research and different approaches. However, just to name a few, researchers such as Bernstein (1990), Verleger (2000), and McKibbin (2004) have declared that the more rapid the economic growth is combined with the above factors, the more are the effects of higher oil price.

An intriguing theory on oil price increase is that global oil production will decline and deplete at some point in time, leading to lower supply or even shortage. This is called the peak oil theory based on the reason that there is theoretically a limited amount of fossil fuel existing in the whole world, and the remaining resource is technically difficult to extract and therefore more expensive to explore and develop. Eventually, oil reserves will only be economically feasible for extraction at high prices.

Although there is much contention about the exact timing and the form of peak oil, there are very few who do not acknowledge the valid concept of a peak production. These few remaining proponents claim that oil is of abiotic origin and rapidly self-renewing, thus defying the concept of peak oil. Others, believing that overproduction of oil may lead to price drops, such as in the early 1980s, have held back efforts in the search of new oilfields.

There are predictions that oil has reached its peak level due to over exploitation leading to discontinuity of investment in oil exploration and development. Many reports such as that of Hubbert (1956) have stated that the peak level had already begun in 2006 and the recent oil level is at a plateau; many say that the maximum borders of production have been

reached. Above all, the peak oil theory has yet to produce rock-hard empirical evidence that the situation of peak oil had materialized at some point.

1.4.6 Oil in Policy Perspectives

Initially, the government formulated the National Energy Policy of the 1950s with the function to oversee petroleum activities in the country. Then, in 1974, realizing the intensifying importance of energy resources particularly oil, the Petroleum Development Act 1974 was enacted to regulate petroleum and petrochemical industries, and later in 1975 the National Petroleum Policy was passed by parliament to regulate the oil and gas industry in the pursuit to support the economic development. Next, in 1979 the National Energy Policy was formalized to ensure adequate, secure and cost-effective supply, discourage wasteful and non-productive patterns of consumption and meet environmental concerns.

In 1980, the National Depletion Policy was approved to conserve the energy resources, particularly oil and gas, and in 1981, the Four-Fuel Diversification Policy was passed with the objective to reduce overdependence on a single source of fuel, and latest in 2000, the Five-Fuel Diversification Policy was passed for the same purpose.

All these policies are enacted to promote the sustainable use of renewable and non-renewable resources of energy. Realizing the dominant role of oil in

the economy, through the above policies, an equitable distribution and attractive investment climate is offered to sustain economic growth. In the context of higher oil prices, the above policies converge on the ground to focus on the government's concern over depleting oil reserves in the country, higher oil prices and increasing subsidy burden. Above all, the more critical aspect in dealing with the energy sector is not just the size of the impact, but the main motivation to find means and ways to tackle issues in relation to the depleting oil reserves, permanent high oil prices and increasing subsidy burden.

Realizing that raising the domestic petroleum product prices can likely increase inflation and the unemployment rate, the government has tried to curb these problems by lowering petrol prices to amongst the lowest levels in Asean countries. However, the government has overlooked the root problem that oil subsidy increases costs of production, spurs hoarding and wastages and other market distortions. Based on concerns that these issues have not been successfully solved, but still linger, a solution should be initiated to mitigate this problem effectively armed with measures that determine the indirect effects on dominating factors, speculative activity, resource development, welfare, targeted policies and other parameters that contribute significantly to oil price rising.

1.5 Research Design

In our quest to investigate the effects of higher oil price on the economy, following the conventional research design, it is always beneficial to define

some of the terms as found in the industry which is unavoidable in line with the argument of Babbie (1998) who stated, "defining the terms used is very important so that the terms only refer to given definitions by the researcher". Thus, it is pertinent to avoid ambiguity by providing some important definitions, terms and meanings as used in the research design of this study.

1.5.1 Definition of Terms

As this study relates to oil prices and economics, some terms are common to readers who have been exposed to these fields; however, the following are a few important terms that need to be defined clearly to assist the reader's understanding:

- *Higher* means increase in altitude or magnitude of an element; in our case it means the increase in crude oil prices or high oil prices.
- *Oil* in this paper refers to fuel, or exclusively for the purpose of detailed discussion is defined as petroleum or specific types of hydrocarbon material used for industry, transportation, and the like. It does not include oils and fats which are food based such as cooking oil.
- *Crude oil*, as in the Petroleum Economist dictionary, refers to natural liquid composed mainly of a mixture of hydrocarbons of different types (paraffins, naphthenes, aromatics, olefins) associated with oxygen, nitrogen and sulphur compounds and traces of metals.
- *Consumers* in this study refers to households or private consumption as defined in the I-O table; user of oil from petroleum products.
- *Peak oil* is the point in time at which the maximum petroleum production rate is reached, after the rate of production enters its terminal decline (Hubbert, 1956).
- *Producers* in this study refers to upstream exploitation firms, as well as downstream petroleum companies dealing with petroleum drilling and refining, and marketing which is related to the oil business.
- *Impact* is generally ambiguous; it has been used in a variety of contexts, synonymously with a variety of terms such as effect, result, incidence, significance, contribution, consequence and importance (Jensen and West, 1986).

In this study it is important that each of the above-mentioned terms is clearly recognized and, generally parties who are interested in estimating oil price increase effects are then able to have a better understanding of the impacts whether they represent policy-makers, producers or private households.

1.5.1 Problem Statement

The excellent nine-percent economic growth performances from 1980 to 1997 are attributed to the competitive oil exports prices (Table 1.1). The period of broad diversification and sustained economic growth in the decades of 1980s and 1990s has occurred due to the abundant oil resources particularly ample reserves of oil, gas and arable land (Zakariah and Ahmad, 1999). Since the oil sector had remained vibrant over a period of time as one of the largest contributors of exports and revenues generating more than five-fold the value in 1995 to RM65 billion in 2008 (Figure 1.1), will the current hike in oil price affect on its susceptibility better or worse than the first oil shock in the s1970s. Our interest of study primarily begins with highlighting the size of the oil sector in estimating whether its composition still dominates the economy in the midst of rising oil price.

In the mean time, Malaysia's rate of oil production has declined since its peak in 2004 as depicted in Figure 1.13. With oil consumption always on the rise, the country is anticipated to become a net oil importer should no significant oil discovery be made (Petronas, 2006). This situation may expose the country to dependence on oil from other countries and could severely affect

its vulnerability in terms of efficiency and diversification measures that finally affect the susceptibility of the economy.

Normally a temporary but seldom a permanent event, an oil price increase creates events of shortages and to a certain extent increases cost of input production. As such, the unexpected timing and magnitude of oil price increase have appeared to intensify public anger (*New Straits Times*, 2006). False rumours about price increases have sparked panic and resulted in long queues at filling stations (*New Straits Times*, 2005). As oil is a dominant energy source, any change in oil price will directly affect the sector's performance, even more than that of sectors dependent highly on oil as their main input. In addition, if producers "pass through"[5] these increased effects from their inputs to their outputs in terms of goods and services, it will ripple into inflationary pressures in consumption, gross output and value added in other sectors of the economy. Otherwise or at the same wave-length, employment is affected as labour and capital may have to be reallocated. All these boils down to how much would the sector tolerate in terms of new levels of final demand output, value added, import, income, taxes and employment.

As industries in the economy expand in their different respective capacities, literally large players consume higher volumes whilst small players such as SMEs and smaller firms have to make do with subsidy in times of higher oil prices. Although these large and small segments have different sets of

[5] Price-based policies that determine the extent to which various groups in society (users, government and suppliers) bear the cost of higher prices.

problems and mitigating measures, they face similar allocation efficiency tribulations in coping with higher oil price. There will be exiting and entering of firms and industries, be they big or small players depending on how they can survive the heat of oil price increase. As such, high performance firms will transform themself by using better fuels or diversify the use of other fuels, whilst low performance firms may have to reallocate their inputs or may have to leave the industry. Our emphasis will be on examining their interindustry behavior in the midst of oil price rising.

Concerned about the problems and burden brought about by rising oil prices, the government tries to give a hand by lowering the domestic oil price. As a result, petrol prices at pump stations in Malaysia rank the cheapest in Asean countries excluding Brunei. However, the policy of low petrol price contradicts with market liberalization that leads to distortions, tightening of the existing market and deviate from the root cause of the problem. This will certainly have severe impacts on sectoral performance and deviate markets from converging to its equilibrium.

These effects are further insulated with regulated oil prices and various subsidies not limited to oil with the purpose to protect the poor group which is very vulnerable to these effects. To ensure they are uplifted in these difficult times, fishermen, boat operators and SMEs that earn low incomes have generally been given subsidies to assist in times of oil increase. Thus, the government's budget expenditure has expanded and inflates (as described in sub-section 1.2.1.2). Despite this expansion many concerned groups find this

measure ineffective and it was suspected to have leaked to the higher income groups and not to the targeted poor groups. Thus, this subsidy programme has failed to achieve its target to help the poor (Bacon and Kojima, 2006).

In the mean time, as oil price increased, prices of basic food products also escalated. The oil price increase in 2005 sparked the increase in these prices by 60 percent of their original prices (*New Straits Times*, 2005). The producers of food products and traders claimed that the costs of inputs, particularly in transportation, had forced them to increase the prices of their products. Therefore, there exist gaps in income distribution and price of consumer food products in terms of their effectiveness to cope with the effect of rising oil price.

Finally, oil price increase also poses a higher risk to welfare effect particularly on income distribution and consumer goods. As oil prices rises, likewise inflation rises and consequently brings about a lower value of disposable income for households. On one hand, inflation keeps increasing due to increase in general price level; on the other, it also poses a higher burden which actually should be shared amongst various parties in the economy. If a higher budget is allocated for a subsidy plan that tries to protect lower income earners, higher income earners are also affected though by only a small degree compared with the poorest groups in the economy. However, many argue that it is more beneficial to let market forces set the optimal level. After

all, in the midst of the failure of a free market, new solutions must be sought in the quest to protect the most vulnerable or poorest groups in the economy.

Therefore, in a broad sense, this study hopes to prove the hypothesis that although there are signs that the current oil hike which began in 2003 is quite detrimental to the economy, the impact is less compared with that of the previous first oil crisis in the 1970s. Secondly, in the same vein, it aims to investigate how much effect the increase in oil price has on sectoral share, particularly in terms of production cost. Thirdly, it attempts to examine in terms of economic welfare distribution, for the most part in household income distribution and retail price of food products, whether the households and their purchasing power in terms of disposable income for food are further adversely affected in times of rising petroleum product prices.

1.5.3 Research Questions

In trying to determine the impacts of oil price increase, especially on a country which is still a net oil exporter but also imports a relatively huge amount of oil products, several questions arise from issues brought about by the increase and should be addressed. These are:

- What are the quantum and extent of susceptibility caused by the increase in oil price and the detrimental effect on the Malaysian economy?
- What are the conditions for an oil crisis to happen? Does Malaysia consciously or unconsciously have the basic conditions for an oil crisis?
- How does the sectoral performance react to the short-term impact of increased oil price?
- Should the increasing burden caused by the higher costs of oil price be shared amongst various parties in the economy in order to optimize economic welfare?

- How can the subsidy costs to consumers or targeted groups be reduced, so that the total subsidy costs or burden are reduced?
- How can the government encourage the reduction of oil consumption on petroleum products (and of the aggregate petroleum import bill when the cost of import is increasing)?
- How can the government achieve "buy in" by the public in response to the policies it pursues?

The above diverse and multi-directional issues could pose a tiresome and tedious task to come up with details and answers. Thus, before addressing each issue of the research question, it is wise to identify the magnitude of the problems. Therefore, in order to scientifically respond to the selected and related questions, it is beneficial if we use the basic principles of Fayol (1949) which simplify the many elements and dimensions of issues from the general to the specific. In this order, to answer the above appropriate research questions with relevancy, sorting and refining them can be undertaken according on the objectives given in the next section.

1.5.4 Objectives of the Study

The general objective of this study is to examine the economic impact of higher oil price on the Malaysian economy. The specific objectives of the study are as follows:

i. To analyse the overall susceptibility between the first oil crisis in 1973-74 and the latest oil crisis since 2003;

ii. To estimate the sectoral economic impacts in terms of multiplier effect, interindustry linkages as well as inflationary rates; and

iii. To examine the welfare effect of the Malaysian households in terms of income distribution and retail price of consumer food products.

By focusing on these specific objectives, it is hoped that valuable information about the impact of oil price increase on the economy in general and the petroleum industry in particular may be obtained. Furthermore, questions concerning the distribution burdens shared amongst parties in the economy can be addressed so that the economic welfare can be optimized. For the study, the general equilibrium model is employed using integrated input-output analysis, combining the latest I-O analysis, econometric tools and welfare distribution analysis.

1.5.5 Motivation of Research

The study tries to expand the general findings of Zakariah and Shahwahid (1994) who argue that Malaysia always has surpluses in the oil trade but deficits in the trade in petroleum products. The expansion suggests that the Malaysian economy's susceptibility to higher oil prices may offer some policy options on how to handle the imbalances in the interindustry's sectors as influenced by the oil price impact. This will directly relate to policies directed at the distribution of impacts and increased production costs that will likely fall on many segments of the economy.

For that purpose, some comparatively new techniques, with extension of the most recent techniques of the joined econometric and I-O model, Leontief's price system and welfare distribution analysis, will be employed. These methods are relatively new in the area of I-O, particularly in Malaysia. Thus, this motivates us to analyse the oil impact phenomenon in Malaysia in a way that differs from previous work with the hope to raise suggestions on policies

related to oil price impact. The evident advantage of this study lies in the analyses of the effects on the production structure, growth and distribution of the oil impact on the economy concurrent with the oil price increase.

1.5.6 Organization of the Study

This study examines the impact of oil price rise on the Malaysian economy's structure, growth and distribution. Detailed discussions on the issues, problems, theories and concepts of oil price rise as well as the methodology used in this study are distributed over five chapters.

The first chapter covers an introduction to the oil industry and what this study entails. The second chapter reviews the relevant literature that includes the chronology of theories relating to oil price trends in a general equilibrium environment. It examines the conventional and state-of-the-art theories as events of oil shock emerge in the modern economy highlighting its issues and impact. The third chapter discusses the methodology that encompasses econometric, I-O and welfare distribution methods. It explores the capability of integrated I-O model and explains the reason why it is more suitable to be used in this study compared with econometric and other models. The fourth chapter focuses on the results and analysis of findings on aggregated and sectoral impacts, inflationary rates and welfare distributions. Finally, the fifth chapter concludes with recommendations and the future course of the study.

REFERENCES

Abel, A.B. and Bernanke, B.S. (1998). *Macroeconomics,* 3rd Ed., Addison-Wesley, USA. pp 191.

Ahmad Fauzi P., Mohd Yusof S., Zakariah, A.R. and Mohd Shahwahid, O. (2004). *Economic Impact on the Malaysian Economy due to an increase of World Crude Oil Price: An Input-Output Analysis.* Paper presented at International Borneo Business Conference, Kota Kinabalu, 9-11 Dec 2004.

Ali Abul Hassan, S. (1997). Towards Attaining a Competitive and Resilient Economy by the Year 2020 the External Dimension. *Malaysia Management Review*, Vol. 27 No.3 Sept.1997.

Almon, C., Buckler, M., Horwicz, L.C., and Reimbold, T.C. (1974). *1985: Interindustry Forecasts of the American Economy.* Lexington Books, D.C. Heath and Co.

Andriamihaja, N.A. and Vecchi, G. (2007). An Evaluation of the Welfare Impact of Higher Energy Prices in Madagascar. *Africa Region Working paper Series No.106.* June 28, 2007.

Ariff, M., (1991). The Malaysian Economy: Pacific Connections. Kuala Lumpur: Oxford University Press.

Arrow, K.J. (1951). Alternative proof of the the substitution theorem for Leontief models in the general case. Chap.9 In activity Analysis of production and Allocation, ed. T.C. Koopmans, New York: John Wiley and Sons.pp 155-164.

Asare, B. and Wong, A. (2004). An Economic Development of Two Countries: Ghana and Malaysia. *West Africa Review.* ISSN:1525-4488. Web site: www.westafricareview.com/issue5/asare-wong.htm.

Asian Development Bank (2005). Asian Development Outlook 2005 Update. "The challenge of higher oil prices. Published 2005, Manila.

Babbie, E.D. (1998). *The practice of Social* Research, 8th Ed., Wadsworth Publishing Company, USA.

Bacon, R. and Kojima, M. (2006). *Coping with Higher Oil Prices.* Energy Sector Management Assistance Programme (ESMAP). The World Bank Group, June 2006.

Bank Negara Malaysia. (2002). *Bank Negara Annual Report* 2002, and various issues. Printed by Bank Negara Malaysia, Kuala Lumpur.

Baily, M.N. (1982). Productivity and the Services of Capital and Labor. Brookings Papers on Economic Activity, 1982:2, pp. 423-454. eds in Abel and Bernanke (1998) Macroeconomics.

Bernstein Reports (1990). *The Return of an Oil Shock*. Copyright of Black Book, Archive 469, Sanford C. Berstein & Co., LLC. Member of New York Exchange Inc. Web site: www.alliancebernstein.com Retrieved on October 2007.

Bergmann, B.R. (1972). *Assessing the Impact of Alternative Economic Outcomes on Social Objectives, Input-Output Techniques*, Proceedings of the Fifth International Conference on Input-Output Techniques, North Holland Publishing Company, London, pp. 31-43.

Bourbaki, N. (1939). *The Architecture of Mathematiques*. Published in 1939.

Bresnahan, T.F. (1989). *Empirical Studies of Industries with Market Power.* Handbook of Industrial Organization in R. Schamalensee & R. Willig (ed.1) Vol. 2, Chapter 17, pp. 1011-1057, Elsevier.

Bronfenbrenner, S.G. (1987). *Economics.* 2nd Ed., ISBN: 0-395-42980-33-06273. Houghton Mifflin Company.

Brunner, K. (1974). *Monetary Management, Domestic Inflation, and Imported Inflation*. University of Chicago Press.Chicago, pp.179- 208.

Bulmer-Thomas, V. (1982). *Input-output analysis in developing countries: Sources, methods and applications.* John Wiley & Sons Ltd., Chichester.

Bulmer-Thomas, V. (1986). Application of Input-Ouput Analysis for Less Developed Countries (LDCs). *Reading in Input-Output Analysis*. New York, Oxford University Press. 1986, pp.108-129.

Business Monitor International (2008). How to tackle oil prices of US100/bbl. Economic Outlook, Copy Deadline 14 January 2008.

Byrd, B. (1972). *The crude oil industry in the US and Leontief's Dynamic Model.* Input-Output Techniques, eds. A. Brody and A. P. Carter 1972, North-Holland Publishing Company.

CIA World Factbook. (2003). Web page address: https://www .cia.gov/library /publications/the-world-factbook/.Date posted 2003

Chenery, H.B. and Clark, P.G. (1959). *Interindustry Economics*. Ipswich Book Co. Ltd., Ipswich, Suffolk.

Chenery, H.B. (1960). Patterns of Industrial Growth. *American Economic Review*. 50:pp. 624-654.

Ciaschini, M. and Socci, C, (1990). Macro Multipliers Approach to Output Generation and Income Distribution in a SAM. *Deparment of Economics, ciasco@unims.it*. University of Macerata, Italy.

Claus, I. (2002). "Inter Industry Linkages in New Zealand". *New Zealand Treasury Working Paper* 02/09. June 2002.

Clements, B., Jung Hong-Sang, and Gupta, S. (2003). Real and Distributive Effects of Petroleum Price Liberalization: The case of Indonesia. *IMF Working Paper* No. 03/04. IMF Washington.

Coady, D. and Newhouse, D. (2005). Ghana:Evaluating Fiscal and Social Costs of Increase in Domestic Fuel Prices. *Technical Assistance Report*, Fiscal Affairs Department, International Monetary Fund, Washington D.C.

Coady, D., Moataz El-said, Gillingham, R., Kpodar, K., Medas, P. and Newhouse, D. (2006). The Magnitude and Distribution of Fuel Subsidies: Evidence from Bolivia, Ghana, Jordan, Mali, and Sri Lanka. IMF Working Paper 06/247. IMF, Washington D.C.

Conway, R.S.Jr. (1977). The Stability of Regional Input-output Multipliers. Environmental and Planning, A. 9: pp. 197-214.

Darrat, A.F., Gilley, O.W., and Meyer, D.J. (1996), US Oil Consumption, Oil Prices, and the Macroeconomy. *Empirical Economics*, vol.21:pp.317-334.

Deardorff, A. (2001). Money Supply. *Deardorff's Glossary of International Economics*. Date retrieved: April 2007. URL address: http:// www. deardoff.com

Debreu, G. (1954). Valuation Equilibrium and Pareto Optimum. *Proceedings of the National Academy of Science*. Vol.40.pp. 558-592.

Department of Statistics Malaysia, (1987). *Industrial Survey*, Department of Statistics Press, Kuala Lumpur.

Department of Statistics Malaysia, (2001). *Statistic Handbook* Malaysia 2001, Department of Statistics Press, Kuala Lumpur.

Department of Statistics Malaysia. (2005). *Input-Output Tables Malaysia 2000*. Department of Statistics, Kuala Lumpur. Published and printed on August 2005.

Department of Statistics Malaysia, (2006). *Household Expenditure Survey 2004/05*. Department of Statistics, Kuala Lumpur. Published and printed by DOS July 2006.

Devarajan, S, Go, D.S., Lewis, J.D., Robinson, S., and Sinko, P. (1997). *Simple General Equilibrium Modeling,* in J.F. Francois and K. Reinert, eds., Applied Methods for Trade Policy Modeling, Cambridge: Cambridge University Press, pp. 156-158.

Dickey, D.A. and Fuller, W.A. (1981). Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root, *Econometrica*, Vol.49, 1981, pp.1057-1072.

Dietzenbacher, E. and Lahr M.L. (2004). *Wassily Leontief and Input-Output Economics*, Cambridge University Press.

Dietzenbacher, E., Albino, V. and Kuhtz, S. (2005). The fallacy of using US-type input-output tables. *Mimeo* (paper presented at the 15th International Conferences on Input-Output Technique).

Dietzenbacher, E. (2008). Why Input-Output. *Proceedings* at Faculty of Economics and Management, Universiti Putra Malaysia on 10 June 2009.

Dillard, D., (1948). *The Economics of J.M. Keynes*. Prentice Hall Inc. Englewood Cliffs, N.J. pp. 85-100

Dow Jones International News (2005). Malaysia to raise diesel retail price to 88.1 sen/liter. February 28, 2005.

Duchin, F. (2004). Input-Output Economics and Materials Flow. Rensselaer Working Papers in economics, Dec. 2004.

Dyer, G. (2004). Oil Price Hike Blessing in Disguise. *Toronto Star*. Web page: http://www.torontostar.com.

Earthtrends (2006). Malaysia-Energy and Resources. Web page at: http://earthtrends.wri.org. Posted 2003. Date retrieved: 20 Nov. 2006.

Economic Planning Unit (2001). Eighth Malaysia Plan, 1995-2000. Printed by Percetakan Nasional. Released on 23 April 2001.

Economic Planning Unit (2005). *Policy Paper on Energy Sector*. Prime Minister's Department, 2005.

Economic Planning Unit (2007). Ninth Malaysia Plan, 2006 – 2010, Printed by Percetakan Nasional. Released on April 2007.

Economic Planning Unit and National Economic Action Council, Prime Minister Department (2005). "Oil Prices and Subsidies: An Explanation", 31st July 2005. Published and printed by the Prime Minister's Department.

Edwards, M.E. (2008). "Assesing the Quality of Economic Impact studies". St. Cloud State University. 2008.

Elitzak, H., (1996). Food Cost Review 1995. US Dept. Agr.., Econ. Res. Serv. AER-729.

Energy Information Administration (EIA) (2007). International Energy Annual 1995. Table Notes and Sources. Table Posted: August 6, 2007. URL: http://energystatistic.eia.com

Energy Information Administration (EIA) (2008). Official Energy Statistics from the US Government, posted August 2008. URL address: http://tonto.eia.doe.gov/country/country_energy data.cf

Energy Information Administration (EIA), (2009). Weekly Tapis Blend Spot Price FOB (Dollars Per Barrel) Date released: 5/20/2009. Date retrieved: November 2009. http://tonto.iea.doc.gov/pet/hist/weptapisw.htm

ESMAP Report (2001). Joint UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP). Pakistan Clean Fuels. Oct. 2001 Report 246/01. Retrieved from http://wds.worldbank.org.

Fayol, H. (1949). General and industrial management. Translated from the French edition (Durod) by Constance Storrs. Pitman.

Fisher, W.D. (1958). *Criteria for Aggregation in Input-Output Analysis.* The Review of Economics and Statistics, vol.40, no.3, August 1958. Eds. Ira Sohn, Readings in Input-Output Analysis, Oxford University Press (1986).

Fong, C.O. (1986). *New Economic Dynamo*: Structures and Investment Opportunities in the Malaysian Economy. Faculty of Economics and Administration, University of Malaysa. Allen and Unwin 1986.

Gan, K.P. (1985). *A General Equilibrium Cost-Benefit Approach to Policy Reform and Project Evaluation in Malaysia*. Phd. Thesis, University Microfilms International, 1985.

Geary, R.C. and Pratschke, J.L. (1968). Some Aspects of Price Inflation in Ireland. *Economic and Social Research Institute*, Dublin, Paper No. 40, pp.23-27.

Gerking, S.D. (1976). *Estimation of Stochastic Input-Output Models: Some Statistical Problems*, Interprint (Malta) Ltd. Netherlands.

Goldsmith, J. (1994). The Trap, New York. Carroll and Graf. Found in Ricardo's Difficult Idea, one of the various Krugman, P. articles (1994:1) posed on http://web.mit.edu/krugman/www/ricardo.htm

Golladay, F. and Haveman, (1977). The Economic Impact of Tax-trafsfer Policy, New York: Academic Press.

Gujarati, D.N. (1995). *Basic Econometrics*. 3rd Ed. McGraw Hill Book Company, New York.

Gujarati, D.N. (2003). *Basic Econometrics*. 4th Ed. McGraw Hill Book Company, New York Gujarati.

Guo, J. and Planting, M. (2001). *Using input-output analysis to measure U.S economic structural change over 24 years period, U.S. department of Commerce, Washington.*

Gupta, T.R. (1967). A Note on the Determination of Wage Increase with Price Rises Using Input-Output Analysis, Harvard Economic Research Project, Cambridge, Massachusetts.

Gupta, S., Clements, B., Fletcher, K. and Inchauste, G. (2003). Issues in Domestic Petroleum Pricing in Oil-Producing Countries," in Fiscal Policy Formulation and Implementation in Oil Producing Countries, ed. By J. Davis, R. Ossowski, and A. Fedelino. *IMF Working Paper.*

Halberstam, D. (1983). *Can we Rise to the Japanese Challenge?* Parade Magazine, October 9, 1983.

Hamilton, J.D. (1983). Oil and Macroeconomic Since World War II. *Journal of Political Economy*. January 1983. 91(2) pp. 228-248.

Hamilton, J.D. (1996).This is what happened to the oil price-macroeconomy relationship. *Journal of Monetary Economics*, 38, pp. 215-220.

Hamilton, J.D. and Ana M. Herrara (2000). Oil Shocks and Aggregate Macroeconomic Behaviour: The Role of Monetary Policy, Working Paper, USCD.

Hanson, K., (2002). Scenario Analysis with a US Computable General Equilibrium Model. The 12th Federal Forecasters Conference – 2002: Session 4, Washington, D.C., 2002.

Harris, R.I.D. (1995). *Using cointegration analysis in econometric modelling.* London; New York: Prentice Hall/Harvester Wheatsheaf.

Hassan Marican, (2006). "Petronas balances domestic portfolio with an aggressive overseas strategy - An interview with Tan Sri Hassan Marican, President and Chief Executive Officer of Petronas". *Oil and Gas Financial Journal*. Published: April 1, 2006.

Hill H., (2000). *The economic Development of Southeast Asia I, National Economic Trends*, pp. 169-188.

Hirschman, A.O. (1958). *Interdependence and industrialization*, in The Strategy of Economic Development. Yale University Press, ISBN 0-300-00559-8.

Hirsh Report (2006). Peaking of World Oil Production: Impacts, Mitigation & Risk Management. URL address:http://www.netl.doe.gov/publications/others/pdf/oil_peaking_NETL.pdf

Hubbert, M. K. (1956). Peak Theory. Publication: www.Hubbert.com.org

Hudson, E.A. and Jorgenson, D.W. (1974). Energy Policy and Economic Growth. Bell Journal of Economic Management Science, pp. 5461-5514.

International Energy Agency (IEA), (2005). Energy Statistics Manual 2005. URL: http://energystatistic.iea.com

International Monetary Fund (2007). International Financial Statistic Yearbook, 1997-2007. Date posted 2007.

Jensen, R.C., and West, G.R. (1986). *Australian Regional Development No:1 Input-Output for Practitioners: Theory and Applications,* Department of Economics, University of Queensland's, Australian Government Publishing Service, Canberra.

Johnson, P. M. (2005). *Money stock: A Glossary of Political Economy Terms* http:www.auburn.edu/johnspm/gloss/money_stock

Jomo, K.S. (1990). *Growth and Structural Change in the Malaysian Economy.* Handmills, Basingstoke, Hampshire: Macmillan.

Jordan, P. G. and Polenski, K. R., (1997). Multiplier Impacts of fishing activities in New England and Nova Scotia. 1997.

Jorgenson, D. (1990). Productivity and Economic Growth. *Harvard Institute of Economic Research discussion paper* no. 1487, June 1990.

Kahneman, D., (2005). Experienced Utility as a Standard of Policy Evaluation. Environmental & Resource Economics (2005) 32:pp.161-181. (C) Springer 2005.

Kazi, U.A. (1989). An Exploratory Stochastic Framework to Analyze the Relationship between Macro Oil Price Shock and Economic Development. Energy Economics, July 1989, pp. 228-238.

Khalid, A. H. (1999). *The Impact of Oil Price changes to the Economic Growth of Asean Countries*. M. Thesis, Vanderbilt University, USA.

Kilian, L. (2007). The Economic Effects of Energy Shocks. CEPR Discussion Paper No.DP6559. Centre for Economic Poliicy research, London.

Kpodar, K., (2006). "The Distributional Effects of Oil Price Changes on Household Expenditures: Evidence from Mali," *IMF Working Paper* 06/91 IMF, Washington D.C.

Kpodar, K., El-Said, M., Coady, D., Midas P.A., Newhouse, D., and Gillingham, R. (2006). "The Magnitude and Distribution of Fuel Subsidies: Evidence from Bolivia, Ghana, Jordan, Mali and Sri Lanka," *IMF Working Paper* 06/247 IMF, Washington D.C.

Krichene, N. (2005). A Simultaneous Equations Model for World Crude Oil and Natural Gas Market. *IMF Working Paper*, Feb. 2005.

Krugman, P. (2000). Ricardo's Difficult Idea, and various articles, 2000. The Unofficial Paul Krugman Web Page: www.krugman.com.org (1994:1)

Kumar, R. (1981). Regional Forecasting of Demand for Malaysia Wood products, Malaysia Forester, vol.44 No.1, pp.1-11.

Kumar, R. (1983). A Quantitative Analysis of the Elasticity of Export and Home Demand of Key Malaysian Wood Products. Kajian Ekonomi Malaysia 17(1), pp. 35-45.

Kushnirsky, F.I., (1982). A joined input-output and econometric approach to endogenous calculations of final demand and outputs. Journal of Policy Modeling, Elsevier, Vol. 4, pp. 413-423, Nov. 1982.

Labys, W. C., (2006). *Globalization, Oil Price Volatility, and the US Economy*, 2006.

L'esperance, King, A.E. and Sines, R.H. (1977). Conjoining an Ohio Input-Output Model with An Econometric Model of Ohio. Regional Science Perspectives, Vol. 7, No: 2, pp. 54-77.

Lee, G.K., Blakesley, L.L. and Butcher, W.R. (1977). Effects of exogenous price changes on a regional economy: An Input-Output Analysis. International Regional Science Reviews, Vol. 2, No. 1, pp. 15-27.

Lee, K. & Ni, S. (1995). Oil Shocks and the Macroeconomy: The role of Price Variability, *Energy Journal*, 1995 Vol.16 Issue 4, pp. 39.

Lee, T.H. (1971). Intersectoral Capital Flows in the Economic Development of Taiwan, 1985-1990. *Ithaca* Cornell University Press.

Lee, C. and G. Schluter, (1993). "Growth and structural Change in U.S. Food and Fiber Industries: An Input-Output Perspectives", *American Journal of Agricultural Economics*, 75, (1993): 666-673.

Leontief, W. (1951). *The Structure of the American Economy 1919-1939*. New York University Press. 1951.

Leontief, W. (1966). *Input-Output Economics*. New York: Oxford University Press. (Second edition 1986).

Leontief, W. (1985). *Essays in Economics Theories, Theorizing, Facts and Policies*. Transaction Books, 1985.

Leontief, W. and Ford, D. (1972). *Air Pollution and the Economic Structure: Empirical Results of Input-Output Computations. In Input-Output Techniques,* Ed. A. Brody and A.P. Carter. Amsterdam: North-Holland. 1972.

Linnemann, M., (1987). *Interindustry linkages and process of international; integration*. Department of Applied Economics, University of Cambridge.

Lysenko, T. and de Souza, L.V. (2008). The Effects of Energy Price Shocks on Growth and Macroeconomic Stability in Selected Energy-Importing CIS Countries. *Mimeo*, EBRD and European Commision, Brussels.

Macbean, A.I. (1996). *Export Instability and Economic Development*. Harvard University Press, Cambridge, Massachuset. pp. 367.

Machado, A.C. & Milles, R.E. (1997). Empirical Relationships between the Energy and Information Segments of the US Economy. Elsevier, *Energy Policy*. Vol. 25, No.11, pp. 913-921.

MacKinnon, J.G. (1996). Numerical distribution functions for unit root and cointegration tests, *Journal of Applied Econometrics*, 11, pp.601-618.

Malaysian Classification of Products by Activity or MCPA, (2005). Published and printed on May 2005 by Department of Statistics, Malaysia.

Malik, A. (2008). How Pakistan is Coping with the Challenge of High Oil Prices. *MPRA Paper 8256*, University Library of Munich, Germany. File URL: http://mpra.ub.uni-muenchen.de/8256/. Retrieved on November 2008.

Mankiw, N.G. and Romer, D. (1991). New Keynesian Economics, Vol. 1 Imperfect Competition and Sticky Prices, MIT Press, ISBN 0-262-63133-4 Vol. 2 Coordination and Real Rigidities MIT Press, ISBN 0-262-63133-2.

McDonald, S. and van Schoor, M. (2005). A Computable General Equilibrium (CGE) Analysis of the Impact of an Oil Price Increase in South Africa. *PROVIDE Working Paper* No. 1 (Elsenburg: The Western Cape Department of Agriculture).

McKeough, K., Escay, J. and Sem, S. (1989). A Visual Overview of World Oil Markets. Policy, Planning and Research working papers, World bank, January 1989.

McKibbin, W., (2004). "*Oil price scenarios and the global economy*". Economic Scenarios.com. Pty. Ltd. Issue 9, 2004.

McGilvray, J. (1976). *Linkages, Key Sectors and Development Strategy: In Structure, System and Economic Policy*. Ed. W. Leontief. Cambridge University Press.

Meier, G. M. (1990). *Leading issues in Economic Development*. Issues on OPEC, p.422-25.

Miernyk, W. H. (1965). *The Elements of Input-Output Analysis*. Boulder: University of Colorado, pp. 42.

Mikhail R.A., (2008). Petronas To Still Produce Oil Should It Become Net Importer In 2011. *Bernama*, June 14, 2008.

Miller, R.E. (1966). *Interregional Feedbacks in Input-Output Models: Some Preliminary Results*. Papers of the Regional Science Association, 17, pp. 105-125.

Miller, R.E. and Blair, P.D. (1985). *Input-Output Analysis: Foundations and Extensions*. Prentice-Hall Inc., New Jersey.

Ministry of Finance. (2002). Various issues of e*conomic reports*, Kuala Lumpur; released date 2002. Retrieved on November 2006 from: http://www.mof.gov.my

Ministry of Finance, Malaysia, (2003). Various issues of *economic reports*. Kuala Lumpur: Percetakan Nasional Berhad.

Ministry of Finance, Malaysia, (2007). Various issues of economic reports. Kuala Lumpur, released date: 2007, retrieved on November 2008 from: http://www.mof.gov.my

Ministry of Finance, Malaysia, (2008). Economic reports of 2008/09. Kuala Lumpur, released date: 2009, retrieved on November 2009 from: http://www.mof.gov.my

Ministry of Finance, Malaysia, (2009). Statistics compiled by Tax Division, MOF. 2009.

Mishkin, F. (1997). Strategies for Controlling Inflation. National Bureau of Economic Research, *NBER Working Paper Series*, no. 6122, Cambridge.

Mishkin, F., and Bernanke, B.S. (1997). Inflation Targeting: A new Framework for Monetary Policy. *NBER Working Paper Series*, No. 5893, 1997.

Mitra-Kahn, (2008). Debunking the Myths of Computable General Equilibrium Models. March 2008. *SCEPA Working Paper*, 2008.

Miyazawa, K. (1976). Input-output Analysis and the Structure of Income Distribution, Berlin: Springer-Verlag.

Morgan Stanley Report, (2004). *Wrong crude is driving up oil prices*. Date posted 14 July 2004.

Mork, K. A. (1989). Oil and the Macroeconomy When Prices Go Up and Down: An Extension of Hamilton's Results. Journal of Political Economy 97(3): pp. 740-744.

Mork, (1997). Volatility of oil price changes. Journal of Econometrics 115, pp. 200-241.

Moses, A. (1974).Nations and Households Economic Growth: Essays in Honor of Moses Abramovitz Edited by Paul A. And Melvin W. Reder. New York Academic Press. 1974.

National Energy Balance, Malaysia, (2002). Ministry of Energy, Communications and Multimedia, Malaysia. Quarter 1 & 2, 2002.

National Energy Balance, (2007). Ministry of Energy, Water and Communications. Various issues in 2007. Web page: http://moetp.gov.my Date retrieved April 2007.

Navaratnam, R. (2003). Malaysia's Socioeconomic Challenges. Pelanduk Publications. 2003.

New Straits Times (2005). Price hike rumours spark petrol frenzy. July 1, 2005.

New Straits Times (2006). Little inkling of subsidy spending. March 6, 2006.

New Straits Times (2008). Proactive moves to offset oil, inflationary pressures. pp. 2, August 30, 2008.

Nicholson, K., O'Laughlin, B., Francisco, A. and Nhate, V. (2003). Fuel Tax in Mouzambique" Poverty and Social Impact Analysis (*Washington: World Bank*).

Nunnenkamp, P. (1982). The Impact of Rising Oil Prices on Economic Growth in Developing Countries in the Seventies. *Kyklos*, Vol.35 (1982), Fasc.4, pp.633-647.

O'Connor, R. & Henry, E. W., (1975). *Input-Output Analysis and Its Applications*. Charles Griffin & Co. Ltd. 1975.

Oil and Gas Journal (2005). Worldwide production. December 19, 2005.

Okposin, S.B. and Cheng M.Y. (2000). Economic Crises in Malaysia. Pelanduk Publications. 2000.

OPEC Bulletin on Market Review (2007). "Malaysian Oil and Gas Reserves".

Pai, M.A., and Sauer, P.W. (1979). *Relationship between power system equilibrium, load flow and gravity point stability*. University of Illinois at Urbana-Champaign.

Pareto, V., and Page, A. N. (1971), Translation of *Manuale di economia politica* ("Manual of political economy"), A.M. Kelley, ISBN 9780678008812.

Park, C. Y., (2004). Higher Oil Prices: Asian Perspectives and Implications for 2004-2005. *Asian Development Bank*, June 2004.

Paukert, F., Skola, J. and Maton, J. (1976). Redistribution of income, patterns of consumption and employment: a case study for the Philippines. Paper presented to the 6th International Conference of I-O techniques, April, 1976 Vienna.

Paul, C.J.M. (2000). Modelling and Measuring Productivity in the Agri-Food Sector: Trends, Causes and Effects. Department of Agricultural Economics, University of California, Davis. Giannini Foundation Monograph #45. (October 2000).

Pennsylvania Economy League of Southwestern Pennsylvania, L.L.C. (2008). *Economic impact of the Oil and Gas Industry in Pennsylvania*, November 2008.

Perumal, M. (1992). *New Budget Standard Poverty Lines for Malaysia*. University of Canberra. 1992.

Petroleum Economist, (2006). Various publications from 1999 to 2006. http://petroleum-economist.com.

Petroleum Press Service (2006). Various publications from 1970 to 2006. April 1971, pp.126, June 1972 and July 1973.

Petronas, (1984). "Petronas, A decade of Growth 1974-1984". *Nada Petronas.*

Petronas, (2006). Webpage on Crude Oil Products. www.petronas.com

Polenske, K.R. (2004). *Leontief's "magnificent machine" and Other Contributions to Applied Economics. Wassily Leontief and Input-Ouput Economics*. Cambridge University Press, pp. 11.

Polenske, K.R. (1978). Energy Analysis and the Determination of Multiregional Prices. Papers of the Regional Science Association 43(1978): pp. 83-97

Prebish-Singer (1949).The Economic Development of latin America 1950, Orig. in Spanish 1949. In post-war Relations between under-developed and Industrialised Countries, Feb, 1949.

Ramakrisnan, R., Subramaniam, G. (2006). A Study of the Patterns and Consumption of Crude oil and Petroleum Products in the Sultanate of Oman. *Energy Sources*, Part B,1: pp. 37-53, 2006. Taylor and Francis Group, LLC.

Ramanathan, R., (1995). *Introductory Econometrics With Applications.* Third Edition. 1995. The Dryden Press, Harcourt Brace College Publishers. November 1994.

Rasmussen, P.N. (1956). *Studies in Intersectoral Relations.* North Holland, Amsterdam, 1958; 80 pp.

Reed, A.J., Hanson, K., Elitzak, H., Schluter, G. and CED, ERS (1997). Changing Consumer food Prices: A User's Guide to ERS Analyses. US Department of Agriculture. *Technical Bulletin* No. 1862.

Richardson, H.W. (1972). Input-output and regional economics, Weidenfeld and Nicolson, London.

Rohana K. (2006). Structural Changes in the Growth of the Malaysian Manufacturing Sector from 1970-2000. PhD dissertation, Universiti Putra Malaysia.

Rohana K. and Zakariah, A.R. (2007). Structural Change, Linkages vs. Leakages in the Malaysian economy: 1991-2000. Retrieved from Webpage: http://www.iioa.org/pdf/16th conf/paper/kamaruddin I-O Turkey-07-Final.doc

Rose, A. (1986). *Input-Output Analysis of Income Distribution*. Paper presented in Honor of Wassily Leontief, American Economic Association Meetings, New Orleans, Louisiana. Dec. 29, 1986.

Roupas, C.V., (2009). Measurement of EU27 Oil Vulnerability. International *Journal of Energy Sector Management*, Vol.3, No.2, 2009, pp.203-218.Emerald Group Publishing Limited

Sakurai, K., (2004). How does Trade affect the Labour Market? Evidence from Japanese Manufacturing. *Japan and the World Economy*, 16:pp.139-161.

Scarf, H. (1967a). The Approximation of Fixed Points of A continuous Mapping. SIAM Journal of Applied Mathematics, 15: pp. 1328-43.

Scarf, H. (1967b). On the Computation of Equilibrium Prices. In Ten Economic Studies in the Tradition of Irving Fisher, edited by W.J. Fellner. New York, Wiley pp. 207-30.

Scarf, H. (1967c). The Core of an n Person Game. Econometrica 35: pp. 50-69.

Sekaran, U. (2005). *Research Methods for Business, "Air-Safety Violation of Delta Airlines"*. John Wiley & Sons, Inc. pp. 98 to 102, Fourth Publication, 2005.

Shoven, J.B. and Whalley, J. (1972). A general Equilibrium Calcualtion of the Effects of Differential Taxation of Income from Capital in the US. *Journal of Public Economics* 1 (3-3), November. pp. 281-321

Siddayo, C. M., (1988). Energy policy Issues in Developing Countries: Lessons from Asean Experience. Butterworth & Co (Publishers) Ltd. 1988.

Simmons, M.R. (2007). Gasoline Picture Looking Grim for Dog Days Summer. Energy Bulletin 14 May 2007. Energy Bulletin, Peak Oil Review. Retrieved from URL address: http: //www.energybulltin.net/node/29657.

Stelder, D., (2007). Input-Output Training Course, May 2007. Faculty of Economics Department of Spatial Economics, University of Groningen, The Netherlands.

Stevens, B.H., Treyz, G.I., and Kindahl, J.K. (1981). *Conjoining an input-output model and a policy analysis model; a case study of the regional economic effects of expanding a port facility*, Environment and Planning, A. 13(8) pp. 1029-1038.

Stone, R. (1963). Aprogramme for Growth. Vol. 3. I-O Relationship 1954-66, Report of Applied Economics; University of Cambridge, Chapmane & Hall (sept. 1963).

Straits Times (2006). Malaysians pump Petronas for answers. March 7, 2006.

Studenmund, A. H. (1997). Using Econometric: A Practical Guide. Addison Wesley. June 11, 2005. p.491

Syed Hamzah, D., (2003). Oil Security and Emergency Preparedness in Malaysia. *UN Security Presented in Paris*, France.

Tey, Y. S., Mad Nasir S., Zainalabidin M., Amin Mahir A. and Alias R. 2008a. A complete demand system of food in Malaysia. ICFAI University. Journal of Agricultural Economics 5(3): 17-29.

Traill, B., Colman, D. and Young, T. (1978). Estimating Irreversible Supply Function. *American Journal of Agricultural Economics*, 60(3), pp. 528-31.

Twight, C. (1989). The Political Economy of The National Defense Stockpile, *Review of Policy Research*, Vol. 8, Issue 4, pp. 774-799, June 1989.

Uma, S. (2005). Management Book on Research Design. Research Methods for Business, 4th Publication, 2005.

Unido Report (1985). "Analysis of Linkage Effects". Medium and Long Term Industrial Master Plan Malaysia, Vol. III Part 7. August 1985.

United Nation (1999). *Handbook of Input-Output Table Compilation and Analysis*. Department of Economic and Social Affairs, Statistics Division. Series F, No. 74. United Nations, New York, 1999.

Uri, N.D. and Boyd, R. (1996). An Assessment of the Economic Impacts of the Energy Price Increase in Mexico. *Journal of Economic Development*. Vol. 21 no.2, December 1996.

Uri, N.D. and Boyd, R. (1997). An Evaluation of the Economic Effects of Higher Energy Prices in Mexico. Elsevier, *Energy Policy*, Vol.25, pp. 205-215, 1997.

Valadkhani, A. and Mitchell, W.F. 2002, Assessing the Impact of Changes in Petroleum Prices on Inflation and Household Expenditures in Australia. *The Australian Economic Review*, 35: pp. 122-132.

Velins, E. (2005). Australia's Crude Oil Self-Sufficiency: Does it matter? *Defender*-summer 2005/06.

Velupillai, K.V. (2006). Algorithmic foundation of computable general equilibrium theory. Applied Mathematics and Computations 179, pp. 360-69.

Verleger, P.K. Jr., (2000). "Third Oil Shock: Real or Imaginary? Consequences and Policy Alternatives". *International Energy and Petroleum Issues, IIE Policy Brief*, April 2000.

Walras, L. (1874). *Elements d Economie Politique Pure. 1st ed., Lausanne: Corbaz, 1874; definitive ed., Paris: Pichon et Durand-Auzias, 1926; English transl. by William Jaffe. London: Allen and Unwin, 1954.*

Weiskoff, (1976). Income Distribution and Export Promotion in Puerto Rico In Advances in Output-Input Analysis. Review of Economics & Statistics, 51, pp. 56-66.

West, G.R. (1999). *Notes on Some Common Misconceptions in Input-Output Impact Methodology. Discussion Papers*, Department of Economics, The University of Queensland. Retrieved on November 2007 at: http://nla.gov.au/nla-cat-vn 1645587.

West, G.R. and Jackson R.W. (2004). Non-linear Input-Output Models: Practicability and Potential. *Paper presented at the 43rd Western Regional Science Association Meeting*, Maui, Hawaii, February 2004.

Whipple, T. (2007). Gasoline stockpile remain a serious problem. Energy Bulletin, Peak Oil Review. Retrieved from URL address: http: //www.energybulltin.net/node/29657.

Wikipeda Free Encyclopedia, Various articles; High Oil Prices, Consumer Surplus, Peak Oil. URL address: http://en.wikipeda.org/wiki/Oil_price_ increases_of_2004-2007.

World Bank, (2001). Pakistan: Clean Fuel, ESMAP Report No. 246/01. Washington: World Bank, Energy Sector Management Assistance Programme.

World Bank, (2003). Iran: Medium Term Framework for Transition, Converting Oil Wealth to Development, "Economic Report No. 25848-IRN (Washington).

Wohlgenant, M.K., H. Jensen and J. Chalfant (1994). "*Impact of Changes in Consumer Demand of Farm level Demand for Food," on Policy Implications for U.S. Agriculture of Changes in Demand for Food*. Eds. Iowa State University press, CARD.

Xu, W. (2002). Economic Impact of Texas Forest Sector, Forest Resource Development, Texas Forest Services, College Station, Texas, publication no:161.

Young, P.C., and Ritz, M.A. (1979). Updated input-output table of the U.S. economy, 1972. Published in 1979 by U.S. Dept. of Commerce, Bureau of Economic Analysis in Washington, 56 pp.

Zamzam Jaafar, et. al. (2001). "Self-Sufficiency Challenges for the Malaysian Energy Sector ". Malaysia Energy Centre, TNB 3rd Technical Conference.

Zakariah A. R. (1990). Decomposition of Malaysian Industries. *Pertanika J. Soc. Sci. & Hum.*

Zakariah A. R. and Sabarudin A.K., (1994). "Projection of sectoral Value-added: Comparative Analysis of Alternative methods". *Pertanika J. Soc. Sci. & Hum.* 2(1):pg 1-10(1994).

Zakariah A. R. and Shahwahid, O. (1994). "Economic Impact of Oil Trade in a Developing Country: An Empirical Investigation of Consequences of Recent Gulf Crisis in Malaysia". *Jurnal Ekonomi Malaysia*. Vol 1.1994.

Zakariah, A. R. and Chan K. Y. (1995). Trade Performance of Malaysian Manufactures: Product Composition and factor intensities". Asian *Economies*. Vol. 24 No. 1, March, 1995. pp. 46-72.

Zakariah, A. R. and Ahmad, E.E. (1999). Sources of Industrial Growth using the Factor Decomposition Approach: Malaysia, 1978-87. *The Developing Economies*. XXXVII-2 (June 1999) pp.162-96.

Zakariah A.R. and Soon J.J. (2002). Linkages and Imports of Malaysia, 1978-1987: An Input-Output Approach. *Analisis* 9 (1&2), pp. 135-155.