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A CGE MODEL FOR ASSESSING THE ECONOMY-WIDE EFFECTS OF REMOVING THE COOKING OIL SUBSIDY IN MALAYSIA

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ABSTRACT

The Malaysian government eliminated the subsidy on cooking oil from January 2017 in its efforts to improve market efficiency and curb the smuggling of the product into neighboring countries. Implementing this policy will impact the economy through changes in relative prices and improvements in resource allocation. This article simulates the economy-wide effects of this policy reform using a computable general equilibrium model based on the country's latest input-output tables (2015) under short and long-run scenarios. The simulation results show that the subsidy removal substantially increases the price of cooking oil which in turn affects the prices of other food and agricultural products and causes a mild contraction in the overall economy. The results also show that in addition to the impact on the cooking oil sector, the oil palm sector is also somewhat affected by this policy as upstream linkages are taken into account in both the model and database. The Hicksian welfare criterion shows that household welfare decreases marginally as a result of the subsidy removal.

JEL Classification: C68, D04, H20

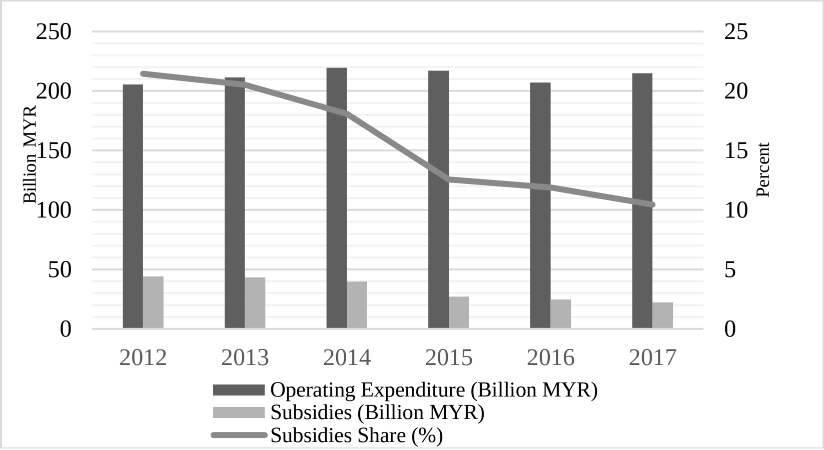
Key words: CGE modelling, Subsidy removal, Agricultural inter-linkages, Malaysia

1. INTRODUCTION

Subsidies and price controls are among the important policy toolkits for managing the economies of developing countries and Malaysia is no exception. However, the costs of these policies often outweigh the benefits when the economy is developing fast. To address efficient resource allocation issues, many developing economies evaluate their economic policies and have instituted price reforms and subsidy rationalization measures. However, subsidy rationalization efforts remain constrained as many policy plans have been delayed based on the argument that subsidy policies have objectives that go beyond economic rationales. In the Malaysian context, efficient resource allocation is a critical element for ensuring sustainable and inclusive economic growth as noted in the 11th Malaysia Plan (Economic Planning Unit, 2016).

The agricultural sector in Malaysia is strongly tied-in with other sectors through forward and backward linkages. Further, rationalizing any protection policy in this sector will also affect other aspects of the economy such as the government budget, social issues, and even natural capital such as land. In other words, food security is not the only objective of having a strong agricultural sector as it also has economy-wide ramifications. Thus, discussions on the multifunctionality of the agricultural sector are among the significant issues for economic analysts and policy makers.

FIGURE 1
Government Operating Expenditure and Subsidies, Malaysia



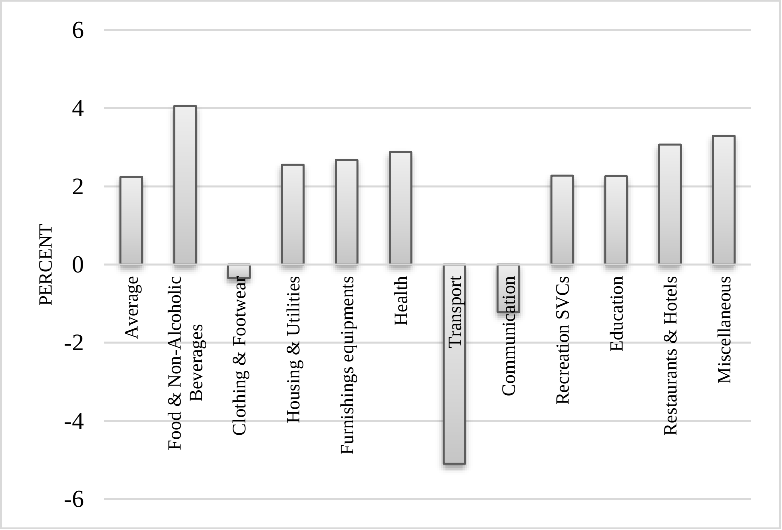
Source: Annual Economic Report, Ministry of Finance Malaysia (2016).

Among agricultural products, cooking oil receives substantial food subsidy support in Malaysia mainly because of its interlinkages with the oil palm sector.[1] In 2013, almost 20 percent of government operating expenditure was allocated to subsidies and social assistance

(Ministry of Finance Malaysia, 2016). For 2017, the government has allocated about MYR 22 billion[2] or approximately 10 percent of total operating expenditure for this purpose (Ministry of Finance Malaysia, 2016). As shown in Figure 1, the share of subsidies in government operating expenditure has shrunk from 21.5 percent in 2012 to 12 percent in 2016 (right-side column measurement).

The Malaysian government reduced the subsidy on cooking oil in the last quarter of 2016 as part of a rationalization program aimed at improving the federal government's balance sheet, enhancing market efficiency, and to check outward smuggling of the commodity.[3] The subsidy reduction increased the cooking oil price, indirectly affecting the cost of other cooking oil intermediate inputs as producers sought to maintain profit margins by passing the higher costs to consumers. As a result, although headline inflation was low for the previous three quarters of 2016, rationalization within the food category caused food inflation to register the highest values.[4] In other words, headline inflation was only 2.2 percent during this period compared to an average of 4.1 percent for food, based on Department of Statistics (2016) data.

FIGURE 2
Average and Sectoral Consumer Price Index (CPI)



Source: Author's calculation based on Department of Statistics, Malaysia (2016).

It is worth mentioning that this rise in the average price of food products occurred prior to the cooking oil subsidy cut highlighting the fact that food prices rise faster than for other goods. The distributional pressure from the higher expenditure on food products is inevitable as low-income Malaysians would be the most vulnerable group. According to consumer price index data (see Figure 2), 30 percent of an average Malaysian's expenditure is on foods and non-alcoholic beverages. Those living in rural areas and those earning less than MYR 3,000 spend almost 40 percent of their income on food (Department of Statistics, 2016).

Beginning January 2017, the subsidy on cooking oil in Malaysia was completely removed. Although cooking oil is one of the basic commodities consumed by the household sector, continuing the subsidies is economically inefficient over the long-term. Any subsidy decreases resource allocation efficiency and could stifle productivity and lead recipients to become over-dependent on the subsidy. The disadvantage of a subsidy provision is a deadweight loss to the economy. A cut in the cooking oil subsidy can be used to improve productivity in cooking oil production in particular and improve overall economic productivity within the agriculture sector.

Removal of the cooking oil subsidy will affect the Malaysian economy through different price effects. Nevertheless, subsidy rationalization is a progressive step toward achieving Malaysia's long-term economic development targets. Therefore, the question to be addressed is what will be the economy-wide impacts of removing the cooking oil subsidy in Malaysia particularly since it may have direct and indirect impacts on other agricultural commodities especially palm oil.

Various economic models have sought to identify the impacts of different agricultural policies in Malaysia. However, they rely on partial equilibrium or econometrically simulated estimations since huge time-series data on subsidies over a long enough period are unavailable to enable econometric-based simulation. Although Othman and Jafari (2011) analyzed the effects of a 10 percent reduction in the cooking oil consumption subsidy, the results were based on simulating the scenario within a multi-commodity and multi-stage production partial equilibrium approach which does not model the whole economy explicitly. The simulation results show the price increase for cooking oil and related products when total output for this sector is affected negatively. The analysis does not cover the impacts of a designed policy on macroeconomic and detailed sectoral effects between agricultural sub-sectors. Further, in terms of local studies, some researchers show the negative economy-wide effects of removing the subsidy for fuel in Malaysia (Abdul Hamid and Abdul Rashid, 2012; Solaymani and Kari, 2014).

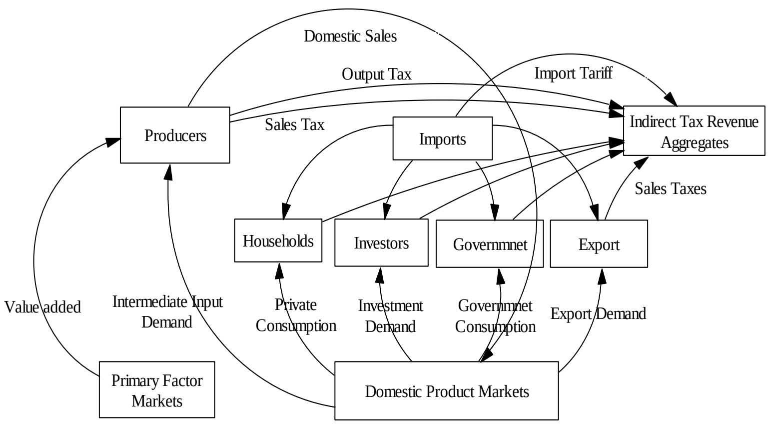
Generally, although the mentioned economic models do identify and predict the elements affecting agricultural product supply and demand, they lack the capability to simultaneously analyze the behavior of all agents in the economy. This study tries to fill this gap in both analysis and literature aspects. It analyzes the effects of the cooking oil subsidy reform on Malaysia's macroeconomic and welfare sectors by applying a quantitative model. This article evaluates the direct and indirect effects of a cooking oil subsidy removal by applying a static Computable General Equilibrium (CGE) model that takes into account the linkages between different markets such as commodity and primary factors on one side and among different activities in the economy such as households, producers, investors, and the foreign trade sector on the other. The rest of this article is organized as follows: Sections 2 and 3 will discuss the methodology components such as model description and database, respectively; Section 4 presents the simulation results and discussion, while Section 5 concludes the article and proposes some policy implications.

2. DESCRIPTION OF MALAYSIA'S CGE MODEL

The CGE model applied in this study is based on the well-known CGE model (ORANI-G) developed by Horridge (2006). It features a single country model with the capacity for doing static simulations (in this case with and without subsidy removal policy). The fundamental part of the model belongs to the Walras-Johansen class of economy-wide models and the whole economy is presented through a quantitative and disaggregated level of industries that endogenously determine general equilibrium quantities and prices. Compared to the partial equilibrium version, a general equilibrium model takes into account all linkages between different agents and sectors in the economy. Figure 3 depicts the linkages between different institutions in the model of this article. Production linkages in the benchmark-data use Malaysian input-output tables and further include a representative household sector, the government sector, foreign sector, different investment sectors, and changes to inventories together with the micro and macro-economic aspects, resource supplies, trade balances, and other market constraints.

Producers use primary factors such as capital, labor and land as well as intermediate inputs in order to produce their outputs. By consuming commodities, production activities pay indirect taxes in the form of sales taxes. Household and other final demanders pay consumption taxes. Another indirect tax imposed on the level of activity for producers is output tax. This production tax is subjected to the level of output from each industry. Inventories demand commodities from production activity. Government purchases commodities from produced or imported commodities. The household consumes commodities either from domestic produced or imported and investment activity consumes commodities as well. Producers export (import) commodities to (from) the export sector (imported source commodities). Producers pay returns to the providers of primary factors such as labor, land, and capital. An indirect tax revenue account collects all revenues from all taxpayers as intermediate or final users. Imported commodities are subject to import tariff, which increases revenue for the indirect tax account.

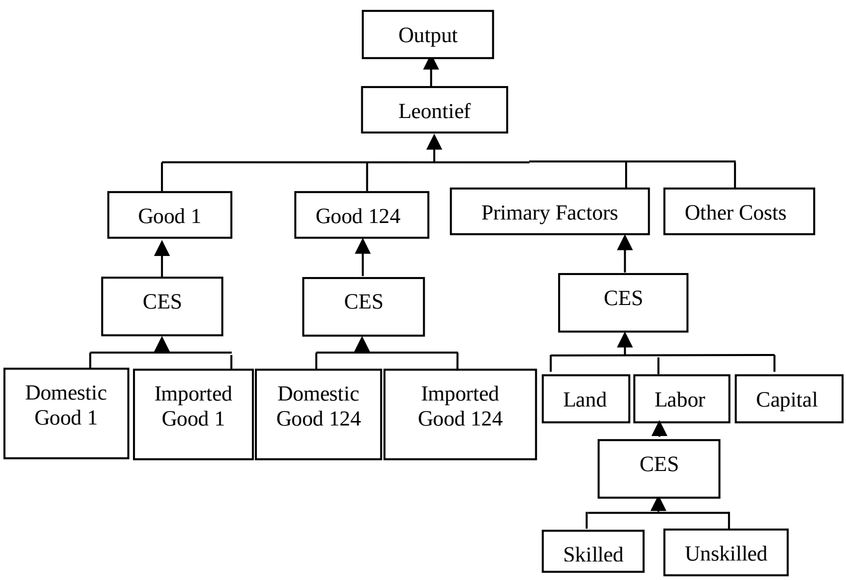
FIGURE 3
Institutional Linkages in the Model



Source: Adopted from Yahoo and Othman (2017b).

In line with Figure 3, Figure 4 provides a more detailed description of important structures in the model of this study as adopted from Horridge (2006).[5] Final demanders include investment (industry dimension), a representative household, a general government, and an export sector representing external demand. Figure 4A shows different separability assumptions in the nested production structure. Joint production is assumed and each industry produces several commodities. Following the MAKE or Supply matrix which shows the domestic production of goods and services at basic value, the rows of this matrix present the different activities (industries), and the columns show the goods and services (commodities) produced by the respective industries, published by the Department of Statistics (2015),[6] consuming a Constant Elasticity of Substitution (CES) combination of domestic and imported commodities. This modification incorporates Armington's (1969) assumption in which domestic and imported sources of each commodity are imperfect substitutes. The primary factor's composite is a CES aggregate of composite labor (skilled and unskilled), capital, and land (for the agricultural sector). At the top of the production structure, source-composited intermediate inputs, aggregated primary factors, and other industry-specific costs are combined using a Leontief production function. This depicts that composite commodity and primary inputs are demanded in direct proportion in respect to the level of output in each industry.

FIGURE 4A
Model Structure: Production*



The solutions to optimization problems are based on conventional neo-classical microeconomic theories for industries and households yield demand and supply equations for endogenous variables in the model. Industries minimize total costs in each nested level subject to the given input prices and a constant returns-to-scale production function. As Figure 4B shows, investors minimize the total cost of a unit of new capital subject to a CES function by choosing a combination of domestic and imported source-based commodities. The representative household sector maximizes a Klein-Rubin functional form utility function by consuming different source-composite goods, subject to an assumed budget constraint (see Figure 4C).

FIGURE 4B
Model Structure: Investment*

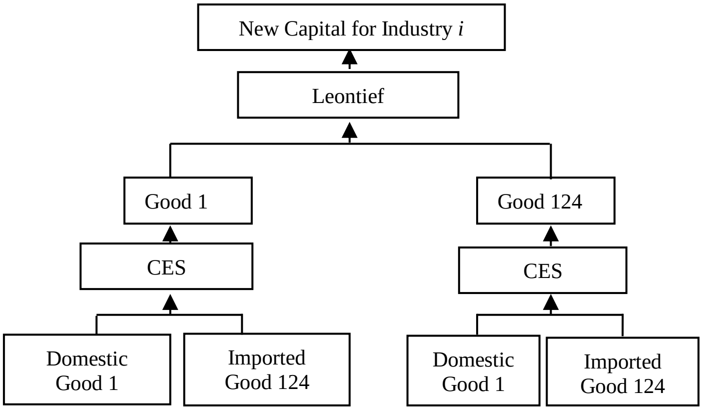
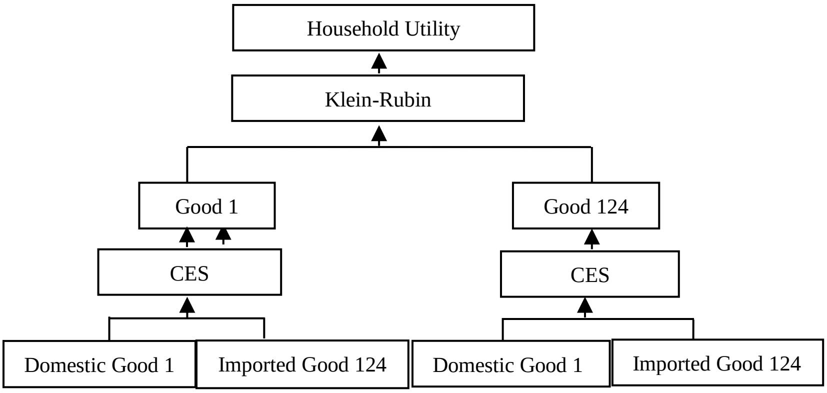


FIGURE 4C
Model Structure: Household Demand*



*Source: Adopted from Horridge (2006), commodity and industry numbers are based on current research.

Modeling export demand for domestically-produced goods is achieved through the inverse relationship between its demand and the corresponding price measured in foreign currency. Considering that Malaysia is a small open economy that cannot determine the world price of commodities, it is assumed that imported commodity prices are determined exogenously. It is assumed that government consumption follows household consumption.[7] As Figure 3 shows, different types of indirect taxes are recognized in the model and database. Finally, in line with other CGE models, the perfect competition assumption is underlined in the model's equations[8] which imply zero pure profits in all markets such as commodity and primary factors.[9] As commonly used within CGE literature, the change in welfare resulting from a change in commodity prices is measured by the Hicks (1943) equivalent variation (EV). The EV measurement is added to the model equations linking household linear expenditure system (LES) and commodity prices following Horridge (2005).

3. DATABASE

TABLE 1
Model Database (MYR Million)

		1	2	3	4	5	6
		Producers	Investors	H'hold	Export	Gov't	I'tories
	Dim.	IND	IND	1	1	1	1
Flows	COM* SRC	1,179,672	173,951	362,457	648,671	106,540	9,108
Margins	COM* SRC* MAR	86,532	9,020	19,041	54,213	0	-
Taxes	COM* SRC	2,804	4,338	5,647	4,039	6	-
Labor	OCC	335,794					
Capital	1	401,534		Dim.	IND		
Land	1	57,909		COM	2074171		
Prod. Tax	1	9,926		Joint Production Matrix			

Note: Taxes refer to net taxes. Land data is disaggregated from payments to capital for agricultural sectors following Narayanan, Aguiar and McDougall (2015).

Table 1 shows the constructed database for the model in this study. The database is derived from the 124-commodity-industry supply and uses tables published by the Department of Statistics (2015).[10] Although the tables distinguish between domestic and imported sources, the lack of detailed entries for other flows (depicted by Table 1) does not allow for a more comprehensive subsidy removal analysis in this paper. For instance, generating land rental data, constructing detailed commodity-by-industry margins and tax matrices, and explicit import tariff data are important for creating the database for the CGE model of this article. In total, the constructed database incorporates 124 multi-product industries, 124 multi-industry commodities, 2 different labor skill types, a 124-dimension investment matrix, and detailed tax and margin commodities.[11]

Further, the model recognizes three different price valuations, namely, basic, producer, and market. Accordingly, flows valued at basic prices (and direct use of margin commodities) and added to margins (indirect use of margin commodities) and indirect taxes[12] will yield market prices. In the model, 5 types of margin commodities are identified as one trade margin and four transport margins comprising land, air, water, and other transport. As the numbers corresponding to the changes in the inventory column refer to incomplete commodities not delivered to final consumers, taxes and margins are not applicable to these transactions.

In line with the research objectives and to deliver accurate resource reallocation effects arising from the subsidy removal, the cooking oil subsidy data is explicitly assumed in the database[13] and, in the after-subsidy-removal case, there will be no subsidy for cooking oil consumed by the industry and household sectors in the updated database. To close the model and make assumption on how the economy will respond to the subsidy removal, short run and long run closures are assumed.[14] Considering that a common feature of CGE models is that only relative prices matter, and that all price and nominal variables change relative to changes in one exogenous price variable, the nominal exchange rate is chosen as the numeraire in both simulations in this article. In the short-run closure, capital stock is fixed and immobile between sectors since the time frame is not long enough to allow for installation of a new unit of capital to reflect technology improvements. Also, by assuming fixed real wages in the labor market aggregate employment is allowed to change. Therefore, the price of capital and labor clear the market for these factors. The GDP from the expenditure side and total real investment is treated as exogenous while the composition of industrial capital creation is allowed to vary relative to higher profitability levels between industries. Government consumption follows household demand, and the trade balance is determined endogenously. The long-run closure allows wages to vary in order to keep the economy in full employment while the capital factor is free to adjust and move among industries. On the expenditure side, all GDP components including investments are determined endogenously.

The simulation results are provided by solving the model using the GEMPACK software suite (Codsi and Pearson, 1988) which is implemented on a database based on the latest input-output tables published by the Malaysian Department of Statistics (2015) and other behavioral parameters taken from Malaysia's CGE models in the literature such as Yahoo and Othman (2017a). The completed model and database is utilized to derive the percentage changes in endogenous variables such as GDP, aggregate and sectoral employment, commodity outputs and prices, household consumption, welfare, and external trade effects resulting from the cooking oil subsidy reform policy.

4. RESULTS AND DISCUSSION

The simulated effects on Malaysia's GDP and other macroeconomic indices arising from the removal of the cooking oil subsidy are shown in Table 2. Overall, the economic indicators change only marginally. It is not surprising to see the decrease in real GDP under both scenarios. The subsidy removal distorts the economy as cooking oil prices and production costs increase.[15] In other words, removing the cooking oil subsidy increases production costs, and industries respond to that by scaling down production thus reducing real GDP. Numerical results show that GDP growth rates decline relatively less over the long-run compared to the short-run. This is due to capital movements and investment effects occurring in the long run and, indeed, producers substitute more cooking oil with other agricultural inputs in response to the price increases caused by subsidy removal. As expected, in both scenarios, the Consumer Price Index (CPI) increases but marginally. The subsidy removal adds extra costs to commodity production and prices rise as producers pass on the higher costs to consumers. Consequently, households respond by consuming less of the expensive commodity. Specifically, simulations show a relatively large short-run increase in the growth rate for this index (0.04 percent) and smaller rise in the long-run (0.02 percent). Further, real household consumption decreases by 0.11 percent and 0.07 percent in the short-run and long-run, respectively.

Regarding the assumptions under the two different closure rules, aggregate employment in the short run decreases by 0.24 percent while full employment is achieved under the long-run, and average real wages decrease by 0.2 percent in the long-run (see Table 2). In terms of government revenue, it is interesting to note that they are higher in the long-run as compared to the short-run. In the short-run, government revenues increase to about MYR 762.2 million compared to MYR 770.2 million in the long-run. This outcome reflects that under long-run assumptions when capital installation is active and investments increase, producers demand more intermediate inputs compared with the short-run when capital stock is assumed fixed. Consequently, government revenues increase, first from the subsidy removal, and second from the higher sales tax returns arising from the increase in demand for intermediate goods.

TABLE 2
Results of Key Macroeconomic Variables

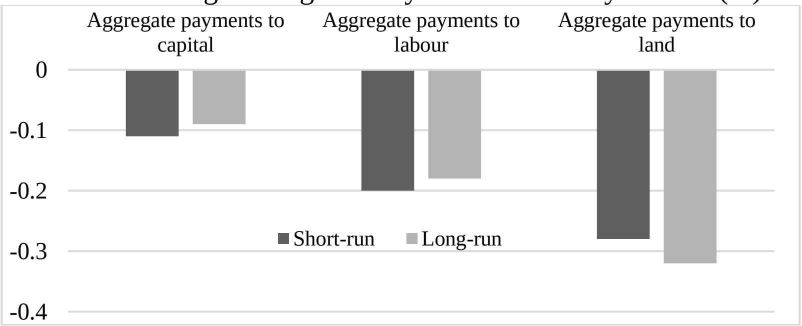
	Cooking oil subsidy removal	
	Short-run: fixed real wage, flexible employment	Long-run: Full employment, flexible real wages
Real GDP	-0.1	-0.02
Real GDP[a]	-827.45	-195.02
Government revenue[a]	762.28	770.24
Government revenue	2.64	2.8
Equivalent variation (EV)[a]	-416.68	-257.67
Consumer price index	0.04	0.02
Aggregate employment	-0.24	0
Average real wage	0	-0.2
Real household consumption	-0.11	-0.07

Notes: Except otherwise specified, figures are percentage change from base-run.
[a] Nominal change deviation from base-run: MYR million.

The welfare consequences resulting from removing the cooking oil subsidy are negative in line with real household consumption. Changes in household welfare are indicated by changes in the Equivalent Variation (EV) index which shows the maximum amount consumers are willing to pay to avoid any negative change in their current economic condition. Specifically, the ordinary change in the welfare criterion shows that representative households would be willing to pay a maximum MYR 416.6 million and MYR 257.6 million to avoid higher cooking oil prices in the short and long runs, respectively.

Figure 5 on the changes in payments to the primary factors of capital, labor, and land show that they decrease under both scenarios. In line with the results for other macroeconomic indicators, the effects under the short-run assumptions are lower for capital and labor while the adverse effects occur on land in the long-run. This is due to the long-run conditions when the investment and demand for capital increases more as compared to the fixed capital stock assumption in the short-run. In other words, since the supply of capital and land is assumed fixed in the short-run, the decrease in payments to them reflects the decline in their prices. It is reasonable to see capital and land prices drop due to a decrease in the demand for them during the economic contraction following the removal of the cooking oil consumption subsidy.

FIGURE 5
Percentage Changes in Payments to Primary Factors (%)

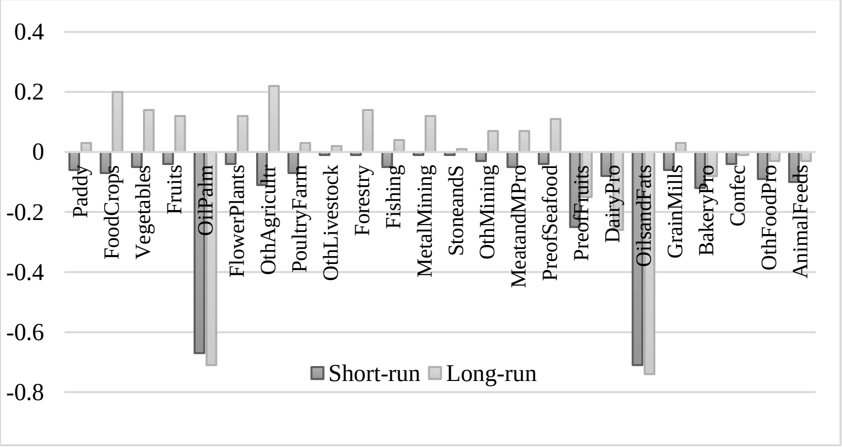


Source: Simulation results.

For labor, since the model assumes sticky wages and, in turn, fixed real wage rates in the short-run, the decrease in payments reflects changes in both the nominal wage rate and in employment. In the model, we fully index the nominal wage rate to the consumer price index (CPI) so that the nominal wage rate increases following the subsidy removal. Under the long-run scenario, payments to all primary factors decrease and growth rates are lower except for land which experienced a faster rate, compared to the short-run situation. Indeed, payments to land decrease with the higher rate compared to capital and labor. This is due to the removal of the consumption subsidy on cooking oil output as this sector is heavily based on the oil palm sector which is a large user of land.

As Figure 6 on the sectoral output effects of the subsidy removal policy on selected industries clearly shows, output of the cooking oil sector decreased the most followed by the oil palm industry. An important feature shown in the figure is the increase in output from sectors such as other agriculture and food crops in the long-run. This is explained by the substitution effect. The cooking oil subsidy removal together with the assumption on long-run capital movements means that agricultural sectors producing substitute commodities will increase capital investments to meet the lowered demand for cooking oil and palm oil products. This leads to an increase in output by sectors producing the substitute commodities (see Figure 7 for more clarification).

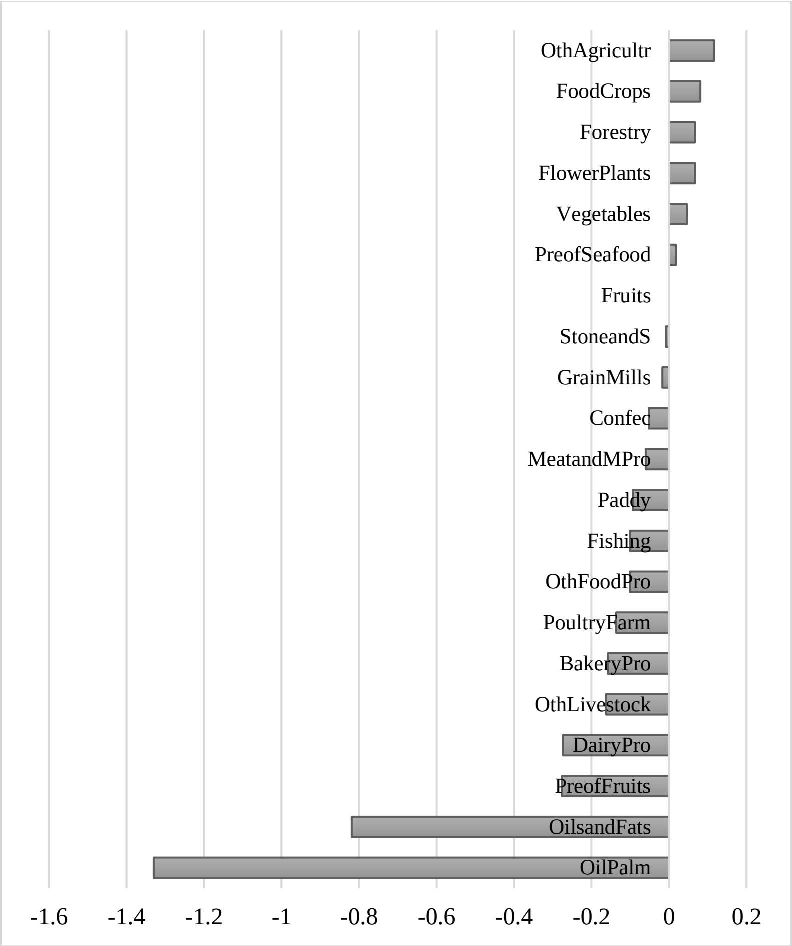
FIGURE 6
Percentage Changes in Sectoral Outputs (%)



Source: Simulation results.

In line with the results for the sectoral outputs, Figure 7 depicts the industrial demand for capital in the long-run. It shows that the oil palm and cooking oil sectors are directly affected by the subsidy removal policy. The figure for sectoral capital demand is in line with the sectoral output effects where they experience higher output reduction and decreased demand for capital inputs, even in the long-run. On the other side of Figure 7, sectors producing substitute commodities increase their demand for capital and output levels to meet the market demand for agricultural products. These sectors are other agriculture, food crops, forestry, flower plants, and vegetables.

FIGURE 7
Percentage Changes in Demand for Capital in Long-Run

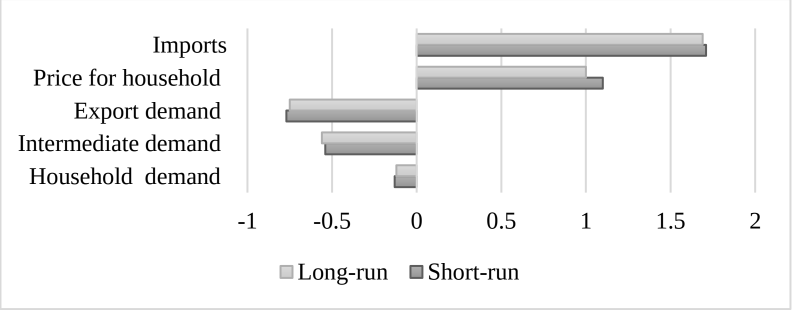


Source: Simulation results.

Figure 8 shows the price and demand effects resulting from the removal of the subsidy on the cooking oil sector. Since Malaysia is relatively an open economy, any policy will have an effect on the sector's competitiveness. Therefore, external trade results have important implications for macro-economy policy makers. The figure shows cooking oil exporters being adversely affected by the subsidy removal under both scenarios with export volumes decreasing by 0.77 percent and 0.75 percent in the short and long runs, respectively. The smaller reduction in the long run matches the results for other macroeconomic variables since the subsidy removal raises cooking oil prices in Malaysia making its exports more expensive and less attractive to overseas consumers. As a result, the export demand for cooking oil drops. Under the long-run scenario, exports decline at a lower rate due to the effects of capital movements.

Importers, on the other hand, benefit from the subsidy removal policy. As domestic prices rise, given the fixed nominal exchange rate in the model, it becomes relatively cheaper for locals to consume foreign goods thus increasing the demand for imported cooking oil. The subsidy removal leads to an increase of about 1.12 percent in the price of cooking oil for the household sector as producers pass on the higher production costs. This is confirmed when comparing the corresponding demand for the intermediate and household sectors where the reduced demand for cooking oil by industries is larger than for the household sector. In other words, producers have more substitution possibilities between different commodities on the one hand and among goods and primary factors on the other, as shown in Figure 4A. As the household sector does not benefit as much from such substitution possibilities the reduction in demand is less.

FIGURE 8
Percentage Changes in Demand in Long-Run



Source: Simulation results.

5. CONCLUSION AND POLICY RECOMMENDATIONS

Cooking oil is one of the basic items in the household purchasing basket. Any change in its price affects household consumption and welfare especially among low-income groups. Thus, a slight increase in the commodity price will decrease its demand from low-income consumers and vice versa. On the other hand, subsidy rationalization is an effective means for securing long term economic development in Malaysia. To achieve that, a smooth transition from market deficiencies due to price control policies, such as subsidies, to the competitive market needs to take place. Further, achieving stable economic growth coupled with affordable cost of living ensures economic stability and income equality in Malaysia.

The Malaysian government has removed the subsidy on cooking oils from January 2017. To evaluate the impact of this policy, this article utilized a CGE model complemented with a constructed database based on the 2015 Malaysian input-output tables. Two different scenarios over the short and long terms were considered involving different time frames and changes in primary input markets.

Overall, the simulation results show that cooking oil subsidy removal causes a mild contraction in real GDP and a decrease in household welfare, although these adverse impacts are lower in the long-run due to the capital movement assumptions used in the model closure. There is a larger decrease in demand for cooking oil by intermediate users compared to households while producers pass on the increase in production costs to final users in the form of higher output prices. Household welfare decreases mostly in the short-run. The sectoral effects show that the cooking oil and oil palm sectors reduce their outputs most while output from other agriculture sectors producing substitute commodities will increase. In terms of external trade, subsidy removal increases the domestic price of cooking oil resulting in the sector losing its trade competitiveness and suffering a reduction in exports, while imports increase.

The negative macroeconomic and welfare effects of the subsidy rationalization policy have important implications for Malaysian policy makers. The removal of subsidies on essential commodities such as cooking oil have to be carefully studied together with other complementary policies in order to mitigate the negative effects on the household sector as well as on its competitiveness. The results of the model simulation indicate that cooking oil subsidy removal would not generate direct positive economic effects for Malaysia and, as such, it is important that the policy be complemented by some form of compensation plan or strategy. A complementary policy such as monthly cash transfers or distributing coupons to low-income groups to purchase subsidized polybag cooking oil could be considered but this may lead to other economic costs in monitoring the system and inflation. Therefore, designing a revenue recycling policy through other tax reforms may be more efficient besides reducing the adverse macroeconomic effects. As such, future research should consider employing a Social Accounting Matrix (SAM) within a computable general equilibrium framework to explore the impacts of cooking oil subsidy removal complemented with revenue recycling through reforms in Malaysia's tax system.

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ENDNOTES

1. Malaysia is ranked as the top producer and second highest exporter of palm oil in the world.

2. Malaysian Ringgit or MYR (Malaysia's currency unit).

3. The Malaysian Palm Oil Association (2008) revealed that some neighboring countries are benefiting from Malaysia's cooking oil subsidy policy.

4. Excluding Alcoholic Beverages & Tobacco products.

5. See Horridge (2006) for a detailed description of model codes and database presented in the Australian economy.

6. This shows that the MAKE matrix assumed in the database is not diagonal where off-diagonal elements are not equal to zero.

7. This modification is due to the model theory which is based on an input-output table and not a Social Accounting Matrix (SAM).

8. In the field of trade policy analysis Harris (1984) embedded market imperfection features, such as market power and price-setting condition in some industries, especially, where imperfect competition is often associated with the presence of economies of scale (Harrison, Rutherford, and Tarr, 1997). On the other hand, the benchmark dataset by which structural parameters in a CGE model are estimated

amounts to assuming that equilibrium conditions, holds at a given time depends on data availability. Usually, most of the data usually come from an Input-output table or a Social Accounting Matrix (SAM). Since the basic theory in these data sources is based on constant return to scale and Leontief functional form, these data can be used to estimate industrial production volumes, industrial demand for intermediate factors and value added components, prices and tax levels. However, they cannot determine the extra information required by an imperfect competition model, such as relative amount of fixed costs, number of firms and profit margins. Indeed, modeling under imperfect competition assumptions, obliged the modeler to show the behavior for every sector in the economy, but typically, sectoral time-series data, which are needed, are unavailable especially for developing countries. Considering this lack calls for assumptions supported by strong economic priors: the neoclassical assumptions. Thus, the model of this study is characterized based on a standard CGE model that follows the typical Walrasian hypotheses: perfect competition, price taking and market clearing rules.

9. It should be emphasized that since the core economic structure of the model in this study is based on an input-output based CGE model, the analysis focuses on the demand-side of the Malaysian economy including intermediate and final demand in which the latter includes households, government, exports, and changes in inventory demand.

10. Although the release date of the database is 2015, the benchmark economic situation refers to 2010 as depicted by the Malaysian Department of Statistics.

11. Since the database of the model includes a multi-production matrix (industry-by-commodity) in which off-diagonal entries are not zero, and domestic and imported absorption matrices are commodity-by-industry, therefore for meeting the market clearance criterion in commodity market and industrial costs and also for validating the model, commodity-by-industry tables are used. (Total cost for each industry is equal to its total output and total sales for each commodity is equal total demand for that commodity).

12. Taxes refer to net taxes (taxes-subsidies).

13. According to Malaysia's 2010 input-output tables published by the Department of Statistics (2015), and the Malaysian Standard Industrial Classification (MSIC), commodity and industry titled "Oils and fats" include cooking oil data. Indeed, only the entries for

absorption matrix of net taxes on domestic commodities show negative numbers and absorption matrix of net taxes on imported commodities has no data (no taxes and subsidies on imported). Therefore, imported cooking oil has no subsidy data and is not affected after removing the subsidy removal policy.

14. Using the absorption matrix of net taxes (domestic), the value of subsidy for cooking oil received by different sectors is calculated, then using the corresponding cells in the domestic absorption matrix, the rate of subsidy for different users has been calculated (the measurement is in %). Then in the shock file, the power of subsidy which is calculated as: Power of subsidy = 1+(ad valorem rate), have been shocked in opposite sign. Therefore, in the after simulation updated files, the ad valorem rate of subsidy become zero which means subsidy removal or 100% reduction in subsidy rate for each specific user.

15. Although, in fact it is subsidies that cause distortions to the economy, from the GE modeling perspective, since the economy is modeled under equilibrium in the benchmark including the subsidy, thus after removing the subsidies, the economic system treats it as imposing an indirect tax. Hence, without considering any compensation policy or revenue-recycling scheme, the subsidy removal causes a distortion in the economy. In other words, when revenues from subsidy removal are not rechanneled back into the economy, GDP as expected decreased. Hamid and Rashid (2012) confirm this claim for Malaysia.

REFERENCES

Abdul Hamid, Khalid, and Zakariah Abdul Rashid, “Cambodia’s Electricity Sector in the Context of Regional Electricity Market Integration.” In *Energy Market Integration in East Asia: Theories, Electricity Sector and Subsidies*, edited by Y. Wu, X. Shi and F. Kimura, 207-52. Jakarta: ERIA Research Project Report, 2012.

Armington, Paul S. “A Theory of Demand for Products Distinguished by Place of Production.” *Staff Papers (International Monetary Fund)* 16, no. 1 (1969): 159-78.

Codsi, George, and K.R. Pearson. “Gempack: General-Purpose Software for Applied General Equilibrium and Other Economic Modellers.” *Computer Science in Economics and Management* 1, no. 3 (1988): 189-207.

Department of Statistics, Malaysia. “Input-Output Tables for Malaysia for 2010.” Putrajaya: Department of Statistics, 2015.

______. "Online Statistics and Data." Putrajaya: The Office of Chief Statistician, Department of Statistics, 2016.

Economic Planning Unit. "Eleventh Malaysia Plan 2016-2020." Malaysia: Economic Planning Unit, Malaysia (2016).

Haris, Richard. "Applied General Equilibrium Analysis of Small Open Economies with Scale Economies and Imperfect Competition." *American Economic Review* 74, no. 5 (1984): 1016-32.

Harrison, G.W., T.F. Rutherford, and D.G. Tarr. "Quantifying the Uruguay Round." *The Economic Journal* 107, no. 444 (1997): 1405-30.

Hicks, John R. "The Four Consumer's Surpluses." *The Review of Economic Studies* 11, no. 1 (1943): 31-41.

Horridge, Mark. "Percent Change Forms for the Equivalent and Compensating Variations with the Les." *Centre of Policy Studies and Impact Project*, Monash University, Australia (2005).

Horridge, Mark. "ORANI-G: A Generic Single-Country Computable General Equilibrium Model." *Centre of Policy Studies and Impact Project*, Monash University, Australia (2006).

Ministry of Finance, Malaysia. "Federal Government Administrative Centre." Putrajaya: Ministry of Finance, 2016.

Narayanan, Badri, Angel Aguiar and Robert McDougall. *Global Trade, Assistance, and Production: The GTAP 8 Data Base*. Center for Global Trade Analysis, Purdue University, 2015.

Othman, Jamal, and Yaghoob Jafari. "Effects of Cooking Oil Subsidy Removals on Related Markets in Malaysia: A Comparative Static, Multi-Commodity, Multi Stage Production Approach." *International Journal of Management Studies* 18, no. 2 (2011): 121-44.

Solaymani, Saeed, and Fatimah Kari. "Impacts of Energy Subsidy Reform on the Malaysian Economy and Transportation Sector." *Energy Policy* 70 (2014): 115-25.

Yahoo, Masoud, and Jamal Othman. "Carbon and Energy Taxation for CO_2 Mitigation: A CGE Model of the Malaysia." *Environment, Development and Sustainability* 19, no. 1 (2017a): 239-62.

______. "Employing a CGE Model in Analysing the Environmental and Economy-Wide Impacts of CO_2 Emission Abatement Policies in Malaysia." *Science of The Total Environment* 584-585 (2017b): 234-43.