Impacts of External Price Shocks on Malaysian Macro Economy-An Applied General Equilibrium Analysis

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Abstract

This paper examines the impacts of external price shocks in the Malaysian economy. There are three simulations are carried out with different degrees of external shocks using Malaysian Social Accounting Matrix (SAM) and Computable General Equilibrium (CGE) analysis. The model results indicate that the import price shocks, better known as external price shocks by 15% decreases the domestic production of building and construction sector by 25.87%, hotels, restaurants and entertainment sector by 12.04%, industry sector by 12.02%, agriculture sector by 11.01%, and electricity and gas sector by 9.55% from the baseline. On the import side, our simulation results illustrate that as a result of the import price shocks by 15%, imports decreases significantly in all sectors from base level. Among the scenarios, the largest negative impacts goes on industry sectors by 29.67% followed by building and construction sector by 22.42%, hotels, restaurants and entertainment sector by 19.45%, electricity and gas sector by 13.%, agriculture sector by 12.63% and other service sectors by 11.17%. However significant negative impact goes to the investment and fixed capital investment. It also causes the household income, household consumption and household savings down and increases the cost of livings in the economy results in downward social welfare.

Keywords: Trade Liberalization, External Price Shocks, Applied General Equilibrium Analysis, Malaysian economy

JEL Classifications: F0, F1

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1. Introduction

External price shocks, especially oil prices immobile matter to the health of the world economy. Higher oil prices since 1999 – partly the result of OPEC supply-management policies – contributed to the global economic downturn in 2000-2001 and are dampening the current cyclical upturn: world GDP growth may have been at least half a percentage point higher in the last two or three years had prices remained at mid-2004 levels. By March 2004, crude prices were well over $10 per barrel higher than three years before. International oil prices started to increase sharply in 2004 and reached to historically high levels in early June 2008. Current market conditions are more unstable than abnormal, in part because of geopolitical uncertainties and because tight product markets – notably for gasoline in the United States – are reinforcing upward pressures on crude prices. Higher prices are contributing to stubbornly high levels of unemployment and exacerbating budget-deficit problems in many OECD, Non-OECD and other oil-importing countries. The adverse economic impact of higher external shocks of oil prices on oil-importing developing countries is generally even more severe than for OECD countries. This is because their economies are more dependent on imported oil and more energy-intensive, and because energy is used less efficiently. Developing countries are also less able to weather the financial turmoil wrought by higher oil-import costs. On average, oil-importing developing countries such as Malaysia, use more than twice as much oil to produce a unit of economic output as do OECD countries.

The high and rising oil prices in the international market are affecting the Malaysian economy, through its effect on the balance of payments (BOP) and on domestic prices through various channels. As fuel and food are core elements in Malaysian household budgets, higher fuel prices as a result of external shocks along with other price increases reduced disposable income and demand. Increased cost of doing business and margin compression would erode producers' profits and may cause them to cut back on output. CIMB (2008) estimates lower for private consumption growth to 6.3% in 2008 (from 7% previously) and 5.5% in 2009 (10.8% in 2007) and for private investment growth to 6.5% in 2008 (from 7.1% previously) and will be 6.6% in 2009 (12.3% in 2007). There are set out some measurable impact on the broad sectors of the economy such as transportation and logistic industry, food retailers, petty traders, auto, construction, consumer, media, property and toll operators. Domestic price pressures are here to stay for some time, stoked by sustained high food and energy prices. Domestic consumer price inflation has been rising in recent months, with CPI hitting a 14-month high of 3% in April 2008 on soaring food prices (CIMB, 2008).

There are several studies addressed the role of trade and external prices shocks (especially oil price shocks) in determining the extent recession, macroeconomic instability and real business cycle, exports-imports magnitude, causality and asymmetric macroeconomic responses caused by the oil price shocks (Rasche and Tatom's 1977, 1981; Darby 1982; Bruno and Sachs 1982, 1985; Hamilton 1983; Griffin 1985; Mork 1989; Wirl 1990; Dahl and Yucel 1991; Eastwood's 1992; Mork's 1994; Mork et al. 1994; Hamilton 1996; Backus et al. 2000; Barsky et al. 2002; Hamilton et al. 2004; Fiorella de Fiore et al. 2006). However the methodologies employed in those studies are

varied and so are their results but it is evident that external price shocks extent recession unless appropriate trade policy is in place. Several studies have given a detailed evaluation of import price shocks in the world economy, but little attention has been applied to inquiring about these relationships in the Asian newly industrialized and highly export-oriented countries (so called NICs[2]) such as Malaysia. Malaysia is currently highly liberalized economy and it plays a crucial rule in influencing domestic activities and balance of payments situation of the country. Currently fuel and food are core elements in Malaysian household budgets, higher fuel prices as a result of external shocks along may reduce disposable income and social welfare. Therefore, the principle focus of this study is to show empirically the impact of external price shocks on macroeconomic indicators such as on domestic production, imports, household income and consumption, household savings, enterprise savings, total economic investment, and other related GDP variables and their different magnitudes of different degrees of external shocks.

The paper is organized as follows. A literature with background is summarized in section 1. In section 2, we present the underlying model, which is based on Computable General Equilibrium (CGE) techniques. Simulation results are carried out in Section 3. The discussions with policy recommendations are given in Section 4 and Appendix A is a presentation of the Malaysian computable general equilibrium model in complete equation form.

2. Methodology

A static computable general equilibrium (CGE) model of the Malaysian economy is constructed for this study. The model consists of ten industries, one representative household, three factor production, and rest of the world. The CGE technique is an approach that tries to develop one of the fundamental concepts of economics, namely to grasp the complex interdependent relationships among decentralized actors in an economy by considering the actual outcome to represent a 'general equilibrium'. More compactly, the technique expresses that the 'equilibrium' of an economy is reached when expenditures by consumers exactly exhaust their disposable income, the aggregate value of exports exactly equals import demand, and the cost of pollution is just equal at the margin of the social value of damage that it causes. The benchmark model representing the baseline economy is constructed using a Social Accounting Matrix (SAM)[3]. A SAM is a snapshot and code database for CGE analysis that reflecting monetary flow of interactions among institutions in the Malaysian full economy which is shown in Table 3.

The Malaysian CGE model is presented in this section, which is a set of non-linear simultaneous equations followed by Dervis et al (1982) and Robinson et al (1999) model; where the number of equations is equal to the number of endogenous variables. This section introduces the framework of the CGE model and algorithm for solving the objectives. The equations are classified in four different blocks, such as price, production, institutions and system constraints are presented as follows.

[2] NISc means newly industrialized countries

[3] SAM matrix is estimated by the Authors using the Malaysian updated 2000 input-output table and national accounts Malaysia 2005 (DOS, 2005). For more details of aggregated SAM see Table 3.

Table 2 The direction of Malaysian trade in the world economy from 1990 to 2005

Direction	RM million*						% of Total					
	Exports			Imports			Exports			Imports		
	1990	2000	2005	1990	2000	2005	1990	2000	2005	1990	2000	2005
ASEAN	23065.5	99028	139208	15085.0	74940	110823	29.0	26.5	26.1	19.1	24.1	25.5
Singapore	18052.1	68574	83333	11800.0	44696	50828	22.7	18.4	15.6	14.9	14.4	11.7
Indonesia	920.7	6484	12580	850.8	8623	16566	1.2	1.7	2.4	1.1	2.8	3.8
Thailand	2788.0	13485	28723	1881.2	11987	22889	3.5	3.6	5.4	2.4	3.8	5.3
Philippines	1054.6	6558	7476	427.3	7562	12192	1.3	1.8	1.4	0.5	2.4	2.8
European Union	12204.5	51019	62629	12494.4	33527	50512	15.5	13.7	11.7	15.8	10.8	11.6
United Kingdom	3136.0	11566	9470	4312.3	6080	6522	3.9	3.1	1.8	5.5	2.0	1.5
Germany	3096.8	9336	11259	3389.2	9282	19265	3.9	2.5	2.1	4.3	3.0	4.4
USA	13487.0	76579	105033	13232.5	51744	55918	16.9	20.5	19.7	16.7	16.6	12.9
Canada	-	3043	2847	-	1445	2133	-	0.8	0.5	-	0.5	0.5
Australia	-	9210	18042	-	6052	8171	-	2.5	3.4	-	1.9	1.9
Selected NEA[4]	-	103784	149105	-	117828	169236	-	27.8	27.9	-	37.8	39.0
Japan	12588.9	48770	49918	23584.5	65513	62982	15.8	13.1	9.4	16.7	21.0	14.5
China	-	11507	35221	-	12321	49880	-	3.1	6.6	-	4.0	11.5
Hong Kong	2523.1	16854	31205	1497.5	8557	10797	3.2	4.5	5.8	1.9	2.7	2.5
Korea Rep.	3677.0	12464	17945	2033.6	13926	21604	4.6	3.3	3.4	2.6	4.5	5.0
Taiwan	1728.1	14189	14813	4323.0	17511	23974	2.2	3.8	2.8	5.5	5.6	5.5
South Asia	-	10529	21245	-	3030	4504	-	2.8	4.0	-	1.0	1.0
India	-	7312	14972	-	2748	4164	-	2.0	2.8	-	0.9	1.0
CSA	-	5633	6169	-	2587	6786	-	1.5	1.2	-	0.8	1.6
Africa	-	2996	7649	-	1421	2511	-	0.8	1.4	-	0.5	0.6
Others	-	11449	21866	-	18886	23415	-	3.1	4.1	-	6.1	5.4
Rest of the World	10372.3	-	-	11478.8	-	-	13.0	-	-	14.5	-	-

Sources: Malaysian 8th and 9th development plan, Department of Statistics, Malaysia. * US$ 1= 3.5 RM

[4] Selected North East Asian Countries

Table 3 Sectoral aggregation of Malaysian SAM 2005 ('000 RM)

Incomes			1	2		3			4	5	Total
			Commodities /activities (1..94)	Factors		Institutions			Capital account	Rest of the world	
				Labor	Capital	Household	Firms	Government			
1	Commodities /activities (1..94)		Intermediate inputs 315,449,327			Households consumption 128,711,893		Government consumptions 45,279,605	Investment 80,834,327	Exports 505,533,849	Domestic demand 1,075,809,000
2	Factors	Labor	Value added 108,121,000							Factor incomes from abroad 0	GNP at factor cost 385,438,000
		Capital	Value added 277,317,000								
3	Institutions	Household		Household income from labor 108,121,000	Household income from capital 61,531,128			Transfers 815,247		Transfers form abroad 0	Household income 170,467,375
		Firms			Farm cap. Income 143,553,296			1,940,000			Firms income 143,553,296
		Government	Tariffs, indirect taxes 14,925,043			Income taxes 11,845,874	Taxes 38,267,688			Borrowing 1,675,585	Government income 66,714,190
4	Capital account					Households savings 12,752,178	Firms savings 105,285,608	Government savings 20,619,339		Capital transfer -13,707,017	Total savings 124,950,108
5	Rest of the world		Imports 359,996,631		Inflow 72,232,576	Transfers 17,157,430			Foreign capital 44,115,781		Total row 493,502,416
Total			Domestic supply 1,075,809,000	Factor outlay 385,438,000		Household expenditure 170,467,375	Firms expenditure 143,553,296	Government expenditures 66,714,190	Total investment 124,950,108	Foreign exchange earnings 493,502,416	2,460,434,385

Source: Authors' calculations

2.1 Price block

Import price

Domestic price of import goods PM_i is the tariff, tm_i induced market price times exchange rate, ER can be expressed as:

$$PM_i = pwm_i(1+tm_i).ER \qquad (1)$$

where, pwm_i is the world price of import goods by sector.

Export price

Export price of export goods PE_i is the export tax induced international market price times exchange rate ER as:

$$PE_i = pwe_i(1-te_i).ER \qquad (2)$$

where, te_i export tax rate of export goods by sector, and pwe_i is the world price of export goods by sector.

Composite price

The composite price P_i is the price paid by the domestic demanders, can be specified as:

$$P_i = \left(\frac{PD_i D_i + PM_i M_i}{Q_i} \right) \qquad (3)$$

where, D_i and M_i are the quantity of domestic and imported goods respectively, and PD_i is the price of domestically produced goods sold in the domestic market, PM_i is the price of imported goods, and Q_i is the composite goods.

Activity price

The sales or activity price PX_i is composed of domestic price of domestic sales and the domestic price of exports can be expressed as:

$$PX_i = \frac{PD_i.D_i + PE_i.E_i}{X_i} \qquad (4)$$

where, X_i stands for sectoral output.

Value added price

Value added price PV_i is defined as residual of gross revenue adjusted for taxes and intermediate input costs, is specified as:

$$PV_i = \frac{PX_i.X_i(1-tx_i) - PK_i.IN_i}{VA_i} \quad (5)$$

where, tx_i is defined as tax per activity and IN_i stands for total intermediate input, PK_i stands for composite intermediate input price and VA_i stands for value added.

Composite intermediate input price

Composite intermediate input price PK_i is defined as composite commodity price times input-output coefficients.

$$PK_i = \sum_j a_{ij}.P_j \quad (6)$$

where, a_{ij} is the input-output coefficient matrix.

Numeraire price index

In computable general equilibrium model, the system can only determine relative prices, and solves for prices relative to a numeraire. In this model the numeraire is the gross national price deflator (gross domestic product can be used). Producer price index and CPI are also commonly used as numeraire in applied CGE studies. In this model:

$$PP = \frac{GDPVA}{RGDP} \quad (7)$$

where, *PP* is GDP deflator, *GDPVA* is the GDP at value added price, and *RGDP* is the real GDP.

2.2 Production block

This block contains quantity equations, which describe the supply side of the model. The fundamental form must satisfy certain restrictions of general equilibrium theory. This block define production technology and demand for factors as well as CET transformation functions combining exports and domestic sales, export supply functions and import demand and CES aggregation functions as follows[5]:

[5] The production function here is nested. At the top level, output is a fixed coefficients function of real world value added and intermediate inputs. Real value added is a Cobb-Douglas function of capital and labor. Intermediate inputs are required according to fixed input-output coefficients and each intermediate input is a CES aggregation of imported and domestic goods.

$$X_i = a_i^D \prod_f FDSC_{if}^{\alpha if} \tag{8}$$

where, $FDSC_{if}$ indicates sectoral capital stock and a_i^D represents the production function shift parameter by sector.

On the other, the next equation expresses first order conditions for profit maximization as follows:

$$WF_f.wfdist_{if} = PV_i.\alpha_{if} \frac{X_i}{FDSC_{if}} \tag{9}$$

where, $wfdist_{if}$ represents sector- specific distortions in factor markets, WF_f indicates average rental or wage, α_{if} indicates factor share parameter-production function and PV represents the value added price.

Intermediate inputs IN_i are the function of domestic production can be defined as follows:

$$IN_i = \sum_j a_{ij}.X_j \tag{10}$$

where a_{ij} indicates input-output coefficients.

On the other, the CET transformation function combining exports and domestic sales can be defined as:

$$X_i = a_i^T [\gamma_i E_i^{\rho_i^T} + (1-\gamma_i) D_i^{\rho_i^T}]^{\frac{1}{\rho_i^T}} \tag{11}$$

where, X_i indicates the sectoral domestic sales, a_i^T is the CET function shift parameter by sector, γ_i holds the sectoral CET function share parameter, E_i is the export demand constant by sector and ρ_i^T is the production function of elasticity of substitution by sector.

The export supply functions, which depend on relation price (P^e/P^d) can be expressed in the following function:

$$E_i = D_i \left[P_i^e (1-\gamma_i) \Big/ P_i^d.\gamma_i \right]^{1/\rho_i^T} \tag{12}$$

Likewise, the world export demand function for sectors in an economy, $econ_i$ is assumed to have some power can be expressed as follows:

$$E_i = econ_i \left[pwe_i \Big/ pwse_i \right]^{\eta_i} \tag{13}$$

where, $pwse_i$ represents the sectoral world price of export substitutes and η_i is the CET function exponent by sector.

On the other, composite goods supply describes how imports and domestic product are demanded can be defined as:

$$Q_i = a_i^C \left[\delta_i M_i^{-\rho_i^C} + (1-\delta_i) D_i^{-\rho_i^C} \right]^{-1/\rho_i^C} \tag{14}$$

where, a_i^C indicates sectoral armington function shift parameter, and δ_i indicates the sectoral armington function share parameter.

Lastly, the import demand function which depends on relative price (P^d/P^m) can be expressed as follows:

$$M_i = D_i \left[P_i^d . \delta_i \Big/ P_i^m (1-\delta_i) \right]^{1/1+\rho_i^C} \tag{15}$$

2.3 Domestic institution block

This block consists the equations that map the flow of income from value added to institutions and ultimately to households. These equations fill out the inter-institutional entries in the SAM defined as:

$$Y_f^F = \sum_i WF_f . FDSC_{if} . wfdist_{if} \tag{16}$$

where, Y_f^F defines factor incomes, which in turn are distributed to capital and labor households equations, $FDSC_{if}$ indicates sectoral capital stock, $wfdist_{if}$ represents sector-specific distortions in factor markets and WF_f indicates average rental or wage.

The household factor income from capital can be defined as follows:

$$Y_{capeh}^H = Y_1^F - DEPREC \tag{17}$$

where, Y_{capeh}^H indicates the households income from capital, Y_1^F represents capital factor income and *DEPREC* indicates depreciations of capital.

Similarly households labor income, Y_{labeh}^H defines as:

$$Y_{labeh}^H = \sum_{f \neq 1} Y_f^F \tag{18}$$

where, Y_f^F indicates the factor incomes.

On the other hand, tariff equation *TARIFF* can be expressed as follow:

$$TARIFF = \sum_i pwm_i.M_i.tm_i.ER \quad (19)$$

Similarly, the indirect tax *INDTAX* is defined as:

$$INDTAX = \sum_i PX_i.X_i.tx_i \quad (20)$$

Likewise, household income tax is expressed as:

$$HHTAX = \sum_h Y_h^H.t_h^H \quad h = cap, lab \quad (21)$$

where, Y_h^H indicates households income, t_h^H represents income tax rate.

On the other, the export revenue (subsidy) *EXPSUB* can be expressed as:

$$EXPSUB = \sum_i pwe_i.E_i.te_i.ER \quad (22)$$

Whereas the total government revenue (*GR*) is obtained as the sum up the previous four equations as:

$$GR = TARIFF + INDTAX + HHTAX + EXPSUB^* \quad (23)$$

* the sign of *EXPSUB* depends on the economic policy whether government taking export tax or giving subsidies.

The depreciation (*DEPREC*) is the function of capital stock can be defined as:

$$DEPREC = \sum_i depr^i.PK_i.FDSC_i \quad (24)$$

where, $depr^i$ represents the sectoral depreciation rates.

On the other, household savings (*HHSAV*) is a function of marginal propensity to save and income can be expressed as:

$$HHSAV = \sum_h Y_h^H.(1 - t_h^H).mps_h \quad (25)$$

where, mps_h indicates marginal propensity to save.

Likewise government savings (GOVSAV) is a function of *GR* and final demand for government consumptions can be defined as follows:

$$GOVSAV = GR - \sum_i P_i.GD_i \quad (26)$$

where, GD_i represents final demand of government consumptions.

Lastly, the components of total savings include financial depreciation, household savings, government savings and foreign savings in domestic currency (*FSAV.ER*)

$$SAVING = HHSAV + GOVSAV + DEPREP + FSAV.ER \quad (27)$$

The following section provides equations that complete the circular flow in the economy, determining the demand for goods by various actors. First, the private consumption (*CD*) is obtained by the following assignments:

$$CD_i = \sum_h \left[\beta_{ih}^H . Y_h^H . (1 - mps_h) . (1 - t_h^H) \right] / P_i \quad (28)$$

where, β_{ih}^H indicates the sectoral household consumption expenditure shares.

Likewise, the government demand for final goods (*GD*) is defined using fixed shares of aggregate real spending on goods and services (*gdtot*) as follows:

$$GD_i = \beta_i^G . gdtot \quad (29)$$

where, β_i^G express sectoral government expenditures.

Inventory demand (*DST*) or change in stock is determined using the following equation as follows:

$$DST_i = dstr_i . X_i \quad (30)$$

where $dstr_i$ indicates the sectoral production shares.

On the other, aggregate nominal fixed investment (*FXDINV*) is estimated as total investment (INVEST) minus inventory accumulation as:

$$FXDINV = INVEST - \sum_i P_i . DST_i \quad (31)$$

The sector of destination (*DK*) is calculated from aggregated fixed investment and fixed nominal shares, $kshr_i$ using the following function:

$$DK_i = kshr_i . FXDINV / PK_i \quad (32)$$

The next equation translates investment by sector of destination into demand for capital goods by sector of origin (ID) using the capital composition matrix, b_{ij} as:

$$ID_i = \sum_j b_{ij} . DK_j \quad (33)$$

Lastly the two equations show the nominal and real GDP, which are used to calculate the GDP deflator specific as numeraire in the price equations. Real GDP

(RGDP) is defined from expenditure side and nominal GDP (GDPVA) is generated from value added side as follows:

$$GDPVA = \sum_i PV_i.X_i + INDTAX + TARIFF + EXPSUB \quad (34)$$

$$RGDP = \sum_i \left(CD_i + GD_i + ID_i + DST_i + E_i - pwm_i.M_i.ER\right) \quad (35)$$

2.4 Systems constraints block

This block defines the constraints that are satisfied by the economy as a whole without being considered by its individual agents. The model's micro constraints apply to individual markets for factors and commodities. With the few exceptions (for labor, exports, and imports), it is assumed that flexible prices clear the markets for all commodities and factors. The macro constraints apply to the government, the savings-investment balance, and the rest of the world. For the government, savings clear the balance, whereas the investment value adjusts to changes in the value of total savings. For the rest of the world, the alternatives of a fixed exchange rate or flexible foreign savings are permitted in the current formulation.

Product market equilibrium condition requires that total demand for composite goods (Q_i) is equal to its total supply as:

$$Q_i = IN_i + CD_i + GD_i + ID_i + DST_i \quad (36)$$

Market clearing requires that total factor demand equal total factor supply and the equilibrating variables are the average factor prices which defined earlier and this condition can be expressed as follows:

$$\sum_i FDSC_{if} = fs_f \quad (37)$$

The following equation is the balance of payments represents the simplest evidence form: foreign savings (*FSAV*) is the difference between total imports and total exports. As foreign savings set exogenously, the equilibrating variable for this equation is the exchange rate (*ER)*. Equilibrium will be achieved through movements in ER that effect export import price. This balancing equation can be expressed as:

$$pwm_i.M_i = pwe_i.E_i + FSAV \quad (38)$$

Lastly the macro-closure rule is given as:

$$SAVING = INVEST \quad (39)$$

where total investment adjusts to equilibrate with total savings to bring the economy into the equilibrium.

2.5 Database: *Social accounting matrix of Malaysia*

The model is based on a social accounting matrix (SAM) of information system that provides initial information on the structure and composition of production, the sectoral value added and the distribution of value added among factors of production and households. The updated Input-Output (I-O) table (94x94) of the year 2005 provides the principal data for SAM and main data source for CGE calibrations. The adopted Input-Output table is a transaction table of intermediate inputs grouped by commodity by commodity at producer prices. The parameter values on the other are obtained in such a way that the model's solution for the base year is capable of same reproducing the assembled equilibrium data in the SAM. By imposing this restriction, the parameter values have been determined from outside the SAM manner of the model's solution for the base year. Before doing so, the sectoral classification of the I-O table is redesigned for SAM 2005 to confirm the desired estimation and policy formulation. After some adjustments for balancing the 102x102 SAM are aggregated to 17x17 sectors, among which 10 are production sectors. Table 3 presents the aggregated SAM of the Malaysian Economy.

3. Results and discussion

3.1 Effects of import price shocks on Malaysian economy

The simulations carried out are based on SAM of the Malaysian economy and the experimental scenario codes and simulation experiments for this study are listed in Table 4. The scenario 1 represents the world price shocks, namely an increase in import prices in the international market. In this simulation the study finds some macroeconomic impacts on Malaysia. These simulations are carried out in three steps such as 1a, 1b and 1c and which represents 5%, 10% and 15% increase in external shocks respectively with trade policy. The simulation effects of import price shocks on domestic production are presented in Table 5. A rise of import prices causes depreciates the real exchange rate that makes import goods expensive in the domestic market. As a result, the demand for imported intermediate input falls and the domestic production decreases. In the Malaysian case, the increase of imports price also fall the domestic output in almost all scenarios.

Table 4 scenario codes and definition of the simulations

Scenario codes		Simulation specifications
Scenario 1	Scen 1a	5 % increase in world market price of import goods+ current trade policy
	Scen 1b	10% increase in world market price of import goods+ current liberalization
	Scen 1c	15% increase in world market price of import goods + current trade policy & existing trade liberalization

Theoretically an increase of import prices deteriorates the terms of trade, import contracts most importantly prices of import goods of domestic market increase. More compactly, it means that import goods are more expensive and production and employment may contract causing a fall in household's income. Consumers can afford less quantity of both domestic and imported goods. Government revenue and savings also falls.

According to our simulations the import price shocks by 5 percent decreases a large domestic production in building and construction sector by 10.006 percent, hotels, restaurants and entertainment sector by 2.949 percent, financial services and real estate sector by 1.307 percent, industry sector by 0.207 percent, agriculture sector by 1.122 percent and electricity and gas sector by 0.872 percent from the baseline. Likewise, the import price shocks by 10 percent decreases a large in domestic production of the building and construction sector by 19.467 percent, hotels, restaurants and entertainment sector by 6.623 percent, industry sector by 2.982 percent, agriculture sector by 3.980 percent and electricity and gas sector by 0.872 percent, financial services and real estate sector by 2.659 percent from the baseline. Among the sectors, the largest decrease in domestic production is in building and construction sector by 25.886 percent, hotels, restaurants and entertainment sector by 12.042 percent, industry sector by 12.015 percent, agriculture sector by 11.011 percent, utility sector by 9.550 percent in scenario 1c (15% increase of import price shocks) from the base level. However the simulation finds positive effects on transport and other service sectors (i.e. see Table 5 for more details).

Table 5 Impact of import price shocks on domestic production

Sectors	Baseline (100 million RM)	Percentage change from the baseline		
		Scen 1a	Scen 1b	Scen 1c
Agriculture	429.55	-1.122	-3.980	-11.011
Utility	495.28	--	--	--
Industry	6023.98	-0.207	-2.982	-12.015
Electricity and gas	207.64	-0.872	-3.312	-9.550
Buildings and constructions	491.22	-10.066	-19.467	-25.886
Wholesale and retail trade	629.76	1.004	0.312	-5.085
Hotels restaurants & entertainment	251.02	-2.949	-6.623	-12.042
Transport	635.31	1.655	3.012	2.530
Financial services & real estate	1038.69	-1.307	-2.659	-4.225
Other services	555.64	0.223	0.574	1.263

Source: Authors' simulations

On the import side, the simulations confirm the trade theory. In the scenarios 1a, 1b and 1c imports decrease in all production sectors as well as service sectors. The import price shocks by 5 percent decreases a large in imports on utility sector by 17.368 percent, building and construction sector by 12.956 percent, financial service and real estate sector by 10.315 percent, wholesale and retail trade sector by 7.781 percent, agriculture sector by 6.258 percent, hotels, restaurants and entertainment sector by 6.876 percent, other

service sector by 5.684 percent, electricity and gas sector by 2.272 percent, industry sector by 2.272 percent and transport sector by 3.759 percent from baseline.

Similarly the import price shocks by 10 percent decreases a large in imports in utility sector by 35.891 percent, building and construction sector by 24.450 percent, financial service and real estate sector by 19.698 percent, wholesale and retail trade sector by 16.451 percent, agriculture sector by 13.536 percent, hotels, restaurants and entertainment sector by 13.834 percent, other services by 11.202 percent, electricity and gas sector by 8.657 percent, industry sector by 6.353 percent and transport sector by 7.951 percent from baseline. Among the sectors, the largest decrease in imports is in utility sector by 54.414 percent, followed by building and construction sector by 32.428 percent, financial service and real estate sector by 27.970 percent, wholesale and retail trade by 27.537 percent, agriculture sector by 23.541 percent, hotels, restaurants and entertainment sector by 21.603 percent, other services by 16.772 percent, electricity and gas sector by 16.519 percent, industry sector by 14.952 percent, and transport sectors by 13.435 percent results in 15 percent import price shocks (Table 6).

Table 6 Impact of import price shocks on imports

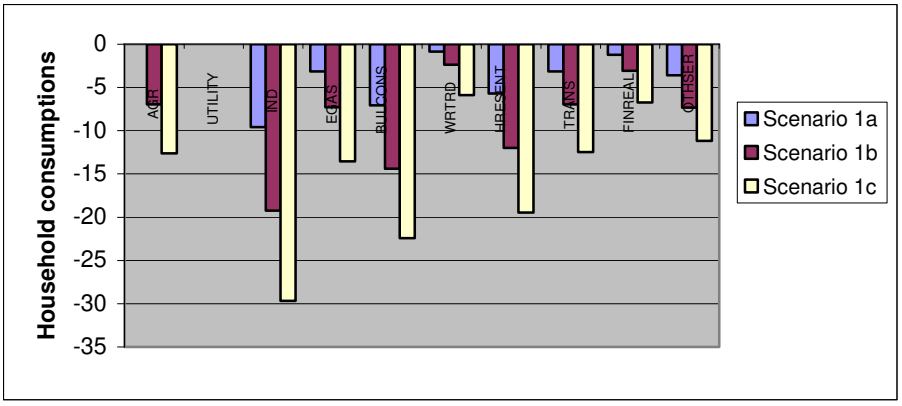
Sectors	Baseline (100 million RM)	Percentage change from the baseline		
		Scen 1a	Scen 1b	Scen 1c
Agriculture	39.28	-6.258	-13.536	-23.541
Utility	56.42	-17.368	-35.891	-54.414
Industry	2829.92	-2.272	-6.353	-14.952
Electricity and gas	20.69	-3.736	-8.657	-16.519
Buildings and constructions	131.29	-12.956	-24.450	-32.428
Wholesale and retail trade	71.06	-7.781	-16.451	-27.537
Hotels restaurants & entertainment	54.57	-6.876	-13.834	-21.603
Transport	167.42	-3.759	-7.951	-13.435
Financial services & real estate	127.12	-10.315	-19.698	-27.970
Other services	102.19	-5.684	-11.202	-16.772

Source: Authors' simulations

The effects of import price shocks on household consumption are shown in Table 12. The simulation finds all negative effects on household consumptions in all (1a, 1b and 1c) scenarios. The import price shocks by 5 percent decreases a large in household consumptions on industry sectors by 9.597 percent followed by building and construction by 7.049 percent, hotels restaurants and entertainments by 5.708 percent, electricity and gas by 3.136 percent, transport sectors by 3.132 percent, agriculture sector by 3.043 percent and other service sectors by 3.603 percent from the baseline. Among the scenarios, the largest negative impacts goes on industry sectors by 29.666 percent (scenario 1c) followed by building and construction by 22.415 percent, hotels restaurants and entertainments by 19.453 percent, electricity and gas by 13.551 percent, agriculture by 12.632 percent and other service sectors by 11.171 percent from the baseline (i.e. see Table 7 for more details). The simulations confirm that, the import price shocks cause the

household income and savings down (see effects on macroeconomic variables) and household consumption utility for all selected scenarios (Figure 1).

Figure 3 Impact of import shocks on household consumption (% change from baseline)



Source: Authors' simulations

Table 7 Impact of import price shocks on household consumption

Sectors	Baseline (100 million RM)	Percentage change from the baseline		
		Scen 1a	Scen 1b	Scen 1c
Agriculture	84.28	-3.043	-6.946	-12.632
Utility	0.00	--	--	--
Industry	429.00	-9.597	-19.228	-29.666
Electricity and gas	43.30	-3.136	-7.286	-13.551
Buildings and constructions	4.30	-7.049	-14.380	-22.415
Wholesale and retail trade	24.87	-0.841	-2.386	-5.875
Hotels restaurants & entertainment	166.88	-5.708	-11.974	-19.453
Transport	150.86	-3.132	-6.938	-12.457
Financial services & real estate	308.06	-1.209	-3.082	-6.738
Other services	75.57	-3.604	-7.318	-11.171

Source: Authors' simulations

At the macroeconomic side in Malaysia, the import price shocks increase the real exchange rate in all scenarios that means real exchange rates depreciates and real GDP, and government revenue, investment, fixed capital investment and employment falls in all scenarios. The simulations in the study finds that 5 percent increase in import price shocks decline real GDP by 0.354 percent, nominal GDP by 0.354 percent and government revenue by 0.713 percent in scenarios 1a and 1b but export price shocks causes a rise in tariff by 8.643 percent, export taxes by 6.665 percent. Import price shocks also decreases the enterprise savings, household savings, social welfare as well as employment in all scenarios from baseline (Table 8). More specifically, import price shocks decreases the real GDP by 0.354 percent in scenario 1a, 0.549 percent in scenario 1b and by 0.762 percent by scenario 1c and that also decreases the investment by 5.572 percent in 1a, by 11.436 percent by 1b and 16.110 percent by 1c and fixed capital

investment by 8.438 percent by 1a, by 16.767 percent in 1b and 22.065 percent in 1c, enterprise savings by 0.432 percent in scenario 1a, 1.275 percent in scenario 1b and 2.646 percent in scenario 1c. Likewise household savings decline by 1.081 percent in scenario 1a, 3.209 percent in scenario 1b and 7.663 percent in scenario 1c and economic welfare by 1.513 percent in 1a, 4.484 percent in 1b and 10.309 percent in 1c as well as employment by 0.012 percent in scenario 1a, 0.013 percent in scenario 1b and 0.015 percent in scenario 1c from the baseline. Similarly, cost of living increases by 8.588 percent in 1a, by 14.572 percent in 1b and by 20.622 percent in 1c from the base level.

Table 8 Impact of import price shocks on GDP items

Sectors	Baseline (100 million RM)	Percentage change from the baseline		
		Scen 1a	Scen 1b	Scen 1c
Real exchange rate	1.00	6.720	13.616	19.629
Real GDP	3854.20	-0.354	-0.549	-0.762
Nominal GDP	3854.38	-0.354	-0.549	-0.762
Government revenue	667.14	-0.713	-0.662	-1.231
Investment	1249.50	-5.572	-11.436	-16.110
Fixed capital investment	1026.32	-8.438	-16.767	-22.065
Tariff	33.85	8.643	15.435	15.534
Export tax	20.85	6.665	10.582	5.948
Enterprise tax	382.67	-0.432	-1.276	-2.646
Household tax	118.45	-1.082	-3.209	-7.663
Enterprise savings	1435.53	-0.432	-1.275	-2.646
Household savings	127.52	-1.081	-3.209	-7.663
Employment *	10.54	-0.012	-0.013	-0.015
Welfare**	1.00	-1.513	-4.484	-10.309
Cost of living**	100.00	-8.588	-14.572	-20.622

Source: Authors' simulations, * in million person, ** indexing.

4. Concluding remarks

This paper represents the impacts of external price shocks in the Malaysian economy and indicates that it raises the cost of living quite badly in the economy. The external price shocks falls the domestic production and imports in almost all scenarios and as a highly importing country these impacts are very sensitive. Import price shocks cause the household income, household consumption and household savings down as well as social welfare. Import price shocks also decrease real GDP, nominal GDP and government revenue in scenarios in all scenarios and significant negative impact goes on investment and fixed capital investment.

Our simulations indicate that if Malaysia experience the external shocks like the selected scenarios or less than that badly impacts would set off on investment and fixed capital investment and the turn down the economy quite heavily. In that case the removal of tariff and export tax could further improve domestic production, promote exports and could mitigate the effects of international price shocks through increasing

competitiveness of the economy but trade liberalization should be carefully associated with the international market condition such as on the basis of effects on internal balance of payments. This position now is vital for the world economy with the current trend of world wide external price shocks. Recently both in developed and developing countries experiencing negative impact on the economy's production, exports, imports and employment because of the petroleum price shocks in the international market. For example, in the year 2007 and first quarter of 2008 petroleum price has gone up more than five times its 2004 price level which causes the rethinking the country's internal trade policy together with other price international price shocks of other importing inputs and consumer goods. Now the time has come to rethink the world trade policy together with external price shocks and needs to take action subsidy policy in highly effective sectors.

The simulations confine that the external shocks in the international market causes significant negative impact on the Malaysian employment and severely reduce the welfare of people through reducing their level of savings and level of consumption and because high living costs. Malaysia is now experiencing the external price shocks especially on oil markets, so efforts should be made to use the substitute of imported petroleum and other imported raw materials in agriculture, industry, transport and utility sectors, which could efficiently insulate the economy from at least petroleum external shocks. This is particularly very crucial for the country's future development because with the expansion of the economy. On the other hand the removal of tariff and export tax could further improve domestic production, promote exports and could mitigate the effects of international price shocks through increasing competitiveness of the economy. However further liberalization or full liberalization should be carefully associated with the international market condition and on the basis of effects on internal balance of payments, otherwise further elimination of tariff and export tax may not be fruitful.

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Appendix

The equations, variables and parameters of the CGE model of Malaysia are as follows:

A.1. Price Block

$$PM_i = pwm_i(1+tm_i).ER$$

$$PE_i = pwe_i(1-te_i).ER$$

$$P_i = \left(\frac{PD_iD_i + PM_iM_i}{Q_i} \right)$$

$$PX_i = \frac{PD_i.D_i + PE_i.E_i}{X_i}$$

$$PV_i = \frac{PX_i.X_i(1-tx_i) - PK_i.IN_i}{VA_i}$$

$$PK_i = \sum_j a_{ij}.P_j$$

$$PP = \frac{GDPVA}{RGDP}$$

A.2. Production Block

$$X_i = a_i^D \prod_f FDSC_{if}^{\alpha if}$$

$$WF_f.wfdist_{if} = PV_i.\alpha_{if} \frac{X_i}{FDSC_{if}}$$

$$IN_i = \sum_j a_{ij}.X_j$$

$$X_i = a_i^T [\gamma_i E_i^{\rho_i^T} + (1-\gamma_i) D_i^{\rho_i^T}]^{\frac{1}{\rho_i^T}}$$

$$E_i = D_i \left[P_i^e(1-\gamma_i) \Big/ P_i^d.\gamma_i \right]^{1/\rho_i^T}$$

$$E_i = econ_i \left[pwe_i \Big/ pwse_i \right]^{\eta_i}$$

$$Q_i = a_i^C \left[\delta_i M_i^{-\rho_i^C} + (1-\delta_i) D_i^{-\rho_i^C} \right]^{-1/\rho_i^C}$$

$$M_i = D_i \left[P_i^d . \delta_i \Big/ P_i^m (1-\delta_i) \right]^{1/1+\rho_i^C}$$

A.3. Domestic Institution and Income Block

$$Y_f^F = \sum_i WF_f . FDSC_{if} . wfdist_{if}$$

$$Y_{capeh}^H = Y_1^F - DEPREC$$

$$Y_{labeh}^H = \sum_{f \neq 1} Y_f^F$$

$$TARIFF = \sum_i pwm_i . M_i . tm_i . ER$$

$$INDTAX = \sum_i PX_i . X_i . tx_i$$

$$HHTAX = \sum_h Y_h^H . t_h^H \quad h = cap, lab$$

$$EXPSUB = \sum_i pwe_i . E_i . te_i . ER$$

$$GR = TARIFF + INDTAX + HHTAX + EXPSUB *$$

$$DEPREC = \sum_i depr^i . PK_i . FDSC_i$$

$$HHSAV = \sum_h Y_h^H . (1 - t_h^H) . mps_h$$

$$GOVSAV = GR - \sum_i P_i . GD_i$$

$$SAVING = HHSAV + GOVSAV + DEPREP + FSAV . ER$$

A.4. Domestic Institution and Expenditure Block

$$CD_i = \sum_h \left[\beta_{ih}^H . Y_h^H . (1 - mps_h) . (1 - t_h^H) \right] / P_i$$

$$GD_i = \beta_i^G . gdtot$$

$$DST_i = dstr_i . X_i$$

$$FXDINV = INVEST - \sum_i P_i . DST_i$$

$$DK_i = kshr_i . FXDINV \; / \; PK_i$$

$$ID_i = \sum_j b_{ij} . DK_j$$

$$GDPVA = \sum_i PV_i . X_i + INDTAX + TARIFF + EXPSUB$$

$$RGDP = \sum_i \left(CD_i + GD_i + ID_i + DST_i + E_i - pwm_i . M_i . ER \right)$$

A.5. Systems Constraints Block

$$Q_i = IN_i + CD_i + GD_i + ID_i + DST_i$$
$$\sum_i FDSC_{if} = fs_f$$
$$pwm_i.M_i = pwe_i.E_i + FSAV$$
$$SAVING = INVEST$$

A.6. Indices

i, j	Production sectors
h	Household

A.7. Variables

Variables	Definitions
G_i	Government final demand
D_i	Domestic sales of domestic output
C_i	Final demand for private consumption
E_i	Exports
DEPREC	Total depreciation rate
DK_i	Investment by sector of destination
DST_i	Inventory investment by sector
EXPSUB	Total export taxes or export subsidy
$FDSC_{if}$	Factor demand
FSAV	Foreign savings
FXDINV	Fixed capital investment
GDPVA	Nominal GDP in factor price
GOVSAV	Government savings
GR	Total government revenue
HHSAV	Total household savings
HHTAX	Household tax revenue
ID_i	Final demand for investment goods
INDTAX	Total indirect tax revenue
INT_i	Intermediate input demand
INVEST	Total investment
Y_h^H	Household income
Y_f^F	Factor income
X_i	Domestic output
WF_f	Average output price

$TARIFF$	Tariff revenue
$SAVING$	Total saving
$RGDP$	Real GDP
R	Exchange rate
Q_i	Composite goods supply
$PINDEX$	GDP deflator
P_i^x	Output price
PW_i^e	World price of export
P_i^v	Value added price
P_i^q	Price of composite goods
P_i^m	Domestic price of imports
P_i^k	Price of a unit of capital in each sector
P_i^d	Domestic sales price
P_i^e	Domestic price of exports
T_{CO_2}	Total carbon tax revenues
TQ_{CO_2}	Total carbon emissions
P_{CO_2}	Carbon price ($/ton)
t_i^d	Carbon tax of domestic product by sector
t_i^m	Carbon tax of import product by sector

A.8. Parameters

a_{ij}	Input output coefficients
a_i^C	CES function shift parameter
a_i^D	Production function shift parameter
a_i^T	CET function shift parameter
$alpha_{if}$	Production function share parameter
b_{ij}	Capital composition matrix
$depr_i$	Depreciation rate
$dstr_i$	Inventory investment ratio
$econ_i$	Export demand shift parameter
$X_{i(coal)}$	Coal by sector
$X_{i(oil)}$	Oil by sector
$X_{i(gas)}$	Gas by sector
fs_f	Aggregate factor supply

$gdtot$	Real government consumption
$kshr_i$	Investment destination share
mps_h	Household savings rate
pw_i^m	World price of imports
$pwse_i$	World price of export substitutes
t_h^H	Household income tax rate
t_i^e	Export tax/subsidy rate
t_i^m	Tariff rate on imports
t_i^x	Indirect tax rate
$wfdist_{if}$	Factor market distortion parameter
α_{ij}	Production function exponent
β_i^G	Government expenditure share
β_{ih}^H	Household expenditure shares
δ_i	CES function share parameter
η_i	Export demand price elasticity
γ_i	CET function share parameter
ρ_i^C	CES function exponent
ρ_i^T	CET function exponent