Impact Assessment of Thailand's Promotion of Strategic Export Industries: A Computable General Equilibrium Model (CGE) Approach

by

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Abstract

Thailand currently promotes some industries to become strategic export industries so as to enhance her competitiveness in the world market. By use of the multi-sectoral CGE model, this paper aims to assess the impact of such promotion in three of Thailand's strategic industries: food, tourism and automotive industries on the Thai economy. Thailand's 1998 input-output table is the main database used. The results lead to policy recommendations for positioning the country's export sector.

Introduction

Thailand has attempted to promote her competitiveness so as find her place in the world market. Currently, Thailand has chosen five strategic sectors, namely, motor vehicles and parts (Detroit of Asia), food products (kitchen of the world), fashion, software, and tourism, all of which are called global niche markets. These sectors have first priority in any government promotion. They were chosen from an analysis of global trends and Thailand's capital, classified into physical capital, financial capital, human capital, and social capital (NESDB, 2002). Furthermore, a recent study also chose these five sectors to enhance their competitiveness (NESDB, 2003). However, the impact of increases in exports from these sectors, especially the economy-wide impact, is not clear.

In determining the country's position in the world market, it is not enough to determine the position from the analysis of export capability only but the impact of export expansion should also be considered. According to some economic theories, while export of goods and services in one sector does have positive impacts on the economy such as, an increase in national income, the expansion of some sectors; it also has some negative impacts on the economy as well such as inflation and even the contraction of some sectors. In some of these, it is not even clear if the increase in exports will have a positive or negative impact on such variables as social welfare, consumption, trade balance, etc. Therefore, it is crucial to assess the impact of exports on the economy, which will become important information to be used when deciding the country's strategic sectors.

This paper attempts to fill the gap in this information by using the computable general equilibrium model (CGE model) to assess the impact of increased exports in Thailand's strategic sectors. However, the paper limits its scope to the study of three of these five export sectors only, namely, food products, automotive, and tourism due

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to the lack of input structure data from the software sector and the different promotion characteristics of the fashion sector compared to other sectors. Furthermore, export increase in this study is limited to that caused by a shift in export demand, not a shift in supply.

A shift in demand may be caused by various policies or events such as the seeking of new markets, the reduction of tariffs in the import market, or an increase in consumer income. A shift in supply however, might be caused by the development of production technology, or an increase of labor productivity.

The paper is organized into six sections. The following section presents an overview of the CGE model specification used in this study. The following sections discuss the model's data base, running simulation, the result and its interpretation. The conclusion, policy recommendations, and future research direction are outlined in the final section.

Overview of the CGE model[1]

The CGE model used in this paper is a multi-sectoral, single country model, which covers economic activities in Input-Output table (I/O table), such as production, private consumption, government consumption, investment, inventories, exports, special exports, imports, margins, transportation, and tax collection. This model uses the comparative static approach in producing results, that is, results are in the form of "if there are shocks to some of the exogenous variables, how will other variables in model change in the new equilibrium".

The equations in the model are composed of linear and non-linear equations, which can be classified into behavioral equations, identity equations, and equations used for aggregating variables, which are also used for calculating macro variables. The model is a simultaneous equation system, which can be solved by converting non-linear equations into linear equations using the linearization method, and subsequently uses the numerical method which can reduce the linearization error to solve the equation system (see Horridge, 2001). Most of the results are shown in the form of percentage change.

The model expresses economic activities according to the Neoclassical assumption, that is, any absolute changes in price have no effect on real variables, which can be affected only by the change of relative price.

1. Production

The model assumes that each sector produces only one commodity. The commodity market is assumed to be perfectly competitive, that is, the action of a single producer cannot affect the market price of the commodity itself. Producers are assumed to be price takers represented by a representative producer. The objective of the producer is to minimize cost, given a certain level of production output.

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[1] The details of the model can be seen from Chareonwongsak (2001).

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Production factors are composed of intermediate goods, and primary factors such as labor, capital, and land. Intermediate goods and primary factors cannot be substituted for each other. Furthermore, intermediate goods cannot be substituted for one another, that is, technology used for production is a fixed proportion, represented by the Leontief function. Factor markets are also assumed to be perfectly competitive.

Intermediate goods come from two sources, domestic production and imports. Both can be substituted for the other expressed by a constant elasticity of substitution function (CES function[2]). Primary factors can be substituted with one another and expressed by a CES function also.

Moreover, there are other costs of production such as other expenditures that are not accounted as either intermediate goods or primary factors. These costs include production tax, which we assume to be proportionate to the level of output. The structure of production in the model can be seen in figure 1.
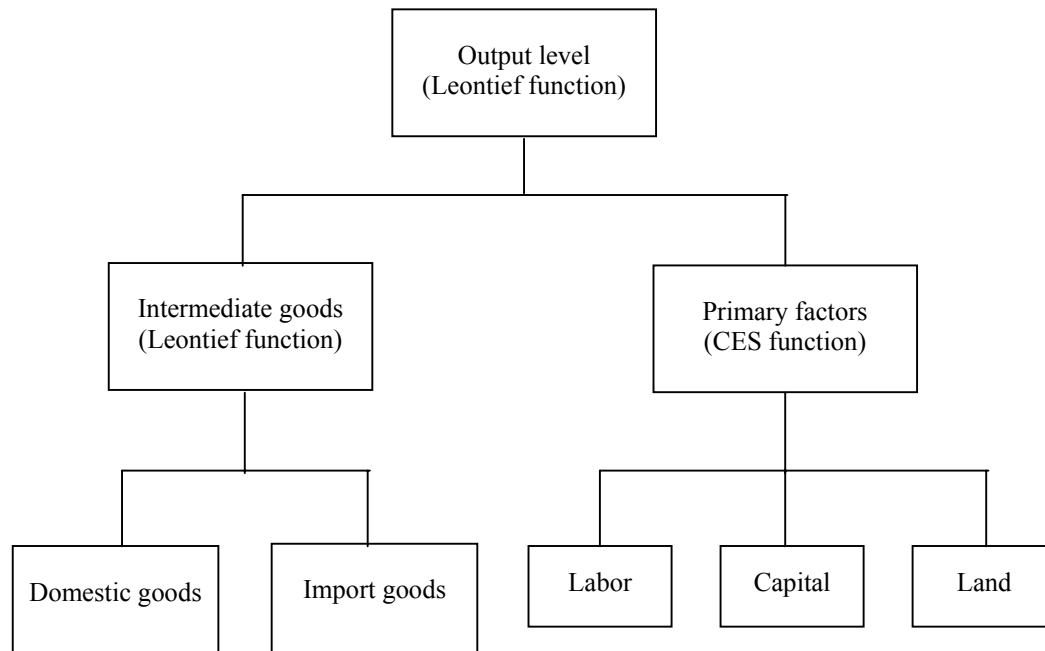

Figure 1: Production structure in the model

Primary factors can be explained in more detailed as follows.

Labor

[2] CES function is in the form of $A(\sum_{i=1}^{n} \delta_i X_i^{-\rho})^{-\frac{1}{\rho}}$, where the elasticity of substitution is equal to $\frac{1}{1+\rho}$.

The model assumes that there is only one group of labor that can be mobilised across sectors. Therefore, there is only one wage rate in the economy.

In the short run, real wage rate is assumed to be unchanged to the shock, that is, the percentage change in the wage rate is equal to the rate of inflation. Therefore, in the short run employment can be changed.

In the long run, the employment is assumed to be unchanged to the shock, that is, the employment will remain at the same level prior to the shock with the wage rate adjusted.

Capital goods

We assume that the capital stock is always fully utilized, in other words, the capacity utilization of capital is assumed to be 100%.

In the short run, capital goods are assumed to be specific factors, that is, capital goods cannot be mobile across sectors and must remain constant in each sector. This is so because it must take a period of time to change the capital stock through investment. Thus, in the short run, rental price of capital in each sector will vary in its value.

In the long run, capital is assumed to be mobile across sectors; therefore, there is only one value of rental price of capital in the economy. Capital stock can be affected through investment.

Land

Land is assumed to be a specific factor that cannot be mobile across sectors, and is fixed both in the short run and long run, that is, the supply schedule of land is a vertical line at all times.

2. Investment

This includes both private investment and government investment. The model assumes that there is only one type of capital goods. The technology used for producing capital goods is assumed to be a fixed proportion represented by a Leontief function. Intermediate goods used for producing capital goods can be either domestic or imported that can be substituted with each other by a constant elasticity of substitution.

Investment level

In the short run, investment level is assumed to be fixed because investors have not adjusted their investment behavior, while in the long run, investment level varies with the rate of return on investment and the current capital stock as shown in the following equation (see details in Dixon, et al., 1982).

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$$INV = KAGG \cdot \left[\left(\frac{RORF}{ROR} \right)^{-\frac{1}{\beta}} - (1 - \delta) \right]$$

INV	is real investment
KAGG	is current capital stock
ROR	is current rate of return
RORF	is expected rate of return
δ	is depreciation rate of capital goods
β	is parameter (> 0)

We assumed that the current rate of return and the expected rate of return would remain unchanged to the shock in the long run. The rate of return is defined in the following equation, which can be interpreted as follows: rate of return is equal to the revenue received from renting a unit of capital goods (*RAVG*) calculated in per unit cost of producing those capital goods, minus the depreciation rate.

$$ROR = \frac{RAVG}{PINV} - \delta$$

RAVG	is average rental price of capital
PINV	is price of producing capital goods

3. Private consumption

We used a constant difference of elasticity (CDE) function (Hertel, 1997) as the private expenditure function because this function is more generalized than a CES function yet at the same time less generalized than the Translog function. The data used to calibrate the coefficients in the function are still available and the data required for calibrating the function was demand elasticity of income, and own price elasticity. The CDE function can be shown in the following way:

$$\sum_{i \in CM} B_i \cdot UH^{\beta_i \gamma_i} \cdot \left[\frac{PC_i}{E(CPI, UH)} \right]^{\beta_i} \equiv 1$$

$E(\cdot)$ is the minimum expenditure that can maintain utility *UH* while the price of consumption is *PC*

UH	is the private utility
PC_i	is the consumption price of goods *i*
B_i	is the expenditure share for goods *i*

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β_i, γ_i are the parameters calculated from demand elasticties of income and own-price elasticities

CPI is consumer price index
CM is the commodity set

Consumer goods are classified into domestic and import goods which can be substituted with each other.

Private factor income comes from the owning of production factors which are labor, capital, and land.

$$YH = \alpha_{YH} \cdot Y$$

YH is private factor income
α_{YH} is the share of private factor income in total factor income
Y is total factor income

We assumed that the share of private factor income (α_{YH}) is fixed.

Private expenditure on consumption was assumed to be proportionate to private income minus income tax as follows. It is assumed in the model that APC is constant.

$$CEXPH = APC \cdot (YH - INCTAX)$$

$CEXPH$ is private consumption expenditure
APC is average propensity to consume
YH is private household income
$INCTAX$ is income tax

4. Export

We used the standard form of export equation in international trade. From the I/O table, there is no import used directly for export (re-export).

$$X_i = AX_i \cdot \left(\frac{PX_i}{PWX_i \cdot E} \right)^{-\eta_i} \qquad , i \in CM$$

X_i is export quantity of commodity i
AX_i is coefficient
PX_i is export price of commodity i in foreign currency
PWX_i is world export price of commodity i in foreign currency
E is the nominal exchange rate
η_i is the export elasticity of commodity i

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5. Special export

Special export refers mainly to expenditure by foreigners in Thailand, particularly tourism expenditure. The special export equations have the same functional form as the export equations. From the I/O table, there are no imports used directly for special export.

$$SX_i = ASX_i \cdot \left(\frac{PSX_i}{PWSX_i \cdot E} \right)^{-\eta_i} \qquad , i \in CM$$

SX_i is special export quantity of commodity i

ASX_i is a coefficient

PSX_i is special export price of commodity i in foreign currency

$PWSX_i$ is the special export price of commodity i in the world market (foreign currency)

6. Government consumption

The model assumes that the government's objective is to maximize utility subject to budget constraints. The government utility function is assumed to be a Cobb-Douglas function as follows:

$$UG = \prod_{i \in CM} G\_C_i^{\alpha_{Gi}}$$

UG is government utility

G_C_i is the quantity of commodity i used by government consumption

α_{G_i} is a parameter

Each commodity comes from two sources namely, domestic commodity and import commodity; both are substitutable commodities.

Government revenue comes from two sources, revenue from being the owner of factors of production, and revenue from taxation as shown in the following equation. The model assumes that the government's owning share of production factors is fixed and it further assumes that government expenditure is proportionate to government revenue.

$$YG = \alpha_{YG} \cdot Y + TAXREV$$

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YG   is government revenue

α_{YG} is the government's owning share in the factors of production

TAXREV is tax revenue

7. Inventories

The model assumes that there is no change in inventories. Moreover, there is no tax and margin on inventories, that is, the price of inventories is equal to the basic price of the commodities.

8. Margin

Margin is used as a facilitator for distributing goods and services from producers to users, which are consumers, exports, etc. Margin includes trade and transport. From the I/O table, there is no margin in distributing margin, that is, there is no margin on margin. We assume that the quantity of trade and transport usage is proportionate to the quantity of distributed commodities for all activities.

9. Tax

Tax is composed of direct and indirect tax. Indirect tax includes sale tax, production tax, and tariffs, while direct tax includes income tax.

Sales tax is collected in the form of an ad valorem tax. Production tax is assumed to be a specific tax, which is accounted for in other costs.

10.   Equilibrium condition

This condition states that at the point of equilibrium, supply quantity must be equal to demand quantity. However, because this model is a single country model, there is an equilibrium condition for domestic goods only.

11.   Zero profit condition

Since the commodity market is assumed to be a perfect competition market, there is no excess profit for the producers. Therefore, the revenue from selling goods must be equal to the total cost of producing goods.

12.   Price equations

This is the group of equations that determine the purchaser price of different users, for example, consumer price, export price, government consumption price, and the like. The import price is also included and defined in this group.

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13. Other equations

These equations were used to calculate the summation of different variables including macro variables. This includes for example aggregate consumption, total import, total export, real GDP, current account balance, GDP at the current price, GDP deflator, consumer price index, terms of trade, etc.

Social welfare measurement

The concept of Equivalent Variation (EV) was used to measure the social welfare change in monetary units (see Hertel, 1997). EV is equal to the amount of money that must be paid to society in the case when the policy is not implemented, in order to maintain the social utility at the same level just as if the policy had been implemented. For this study, social utility is the summation of the private utility and the government utility. EV can be calculated as follows.

$$EV = u * INC / 100$$

u is the percentage change of total utility of the population which is the summation of private utility and government utility.

INC is the total income of the private and the government sectors after tax as follows:

$$INC = YG + YH - INCTAX$$

Model Data Base

The model data base is mainly composed of an I/O table. Other data in the data base includes import tariff rates, primary factor shares, factor income shares, various elasticities that can be obtained from econometric estimation. However, for this study the elasticities are obtained from a literature survey.

1. Input-output table data

The I/O table used in this study is Thailand's I/O table of the year 1998, which is the most recently updated. According to the original I/O table, there are 180 sectors in the table. This will cause the model to be too large for producing and interpreting meaningful results. Therefore, we aggregated the original 180 sectors into 30 sectors as shown in Table 1.

Table 1: Sector aggregation used in this study

Sector	Sector
1. Cereals	16. Metal Products
2. Vegetables, Fruits and Nuts	17. Machinery and Equipment
3. Rubber	18. Electrical Machinery and Appliances
4. Other Crops	19. Motor Vehicles and Parts

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5. Livestock	20. Other Manufacturing Products
6. Forestry and Fishery	21. Utility
7. Mining	22. Construction
8. Food Processing	23. Trade
9. Beverage and Tobacco	24. Restaurant and Hotel
10. Textile and Leather	25. Transport
11. Wood Products	26. Communication
12. Paper and Printing	27. Finance
13. Chemical and Petroleum Products	28. Real Estate
14. Rubber and Plastic Products	29. Public Services
15. Non-Metallic Products	30. Other Services

Source: Aggregated from the 180-sector I/O table by the author

2. Primary factor share

Since the original I/O table does not disaggregate the use of land in the agricultural sectors, we utilized the primary factor value share from the OECD (1993) for this purpose. The value shares of labor, capital, and land for the agricultural sectors are 42%, 7%, and 51%, respectively.

3. Tariff rate

We obtained the import tariff rate for the year 2001 from the TRAINS[3] data base (UNCTAD, 2003) and used the effectively applied rate and aggregate to 21 commodities (exportable commodities) using import values as weighting values.

4. Model's parameters

We obtained most of the model's parameters from a literature review. Most of the parameters come from the GTAP database (Hertel, 2002) and included Armington elasticities of substitution between domestic and import commodities; parameters in private consumption equations; export elasticities; and elasticities of substitution between primary factors. The last parameter is gross to net rate of return, which is calculated from the I/O table data.

Gross to net rate of return ratio is calculated from the I/O table data by using total capital rental value and total depreciation value as shown in the following equation.

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[3] TRAINS is a data base of tariff and import value between countries classified by commodities, published by UNCTAD.

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$$GNRR = \frac{\text{capital rental value}}{\text{capital rental vaue} - \text{depreciation value}}$$

GNRR is the gross to net rate of return

According to the model's assumption that there is only one type of capital goods, we calculated the economy-wide level of GNRR and found it to be equal to 1.299.

5. Factor income share

We calculated the factor income share from Thailand's national income accounts of the year 1998 and found the private factor income share to be 0.75 and the government factor income share to be 0.04 for the total factor income.

Running simulation

After the model was implemented, we tested for the model's homogeneity and the quantity of lost goods from the model calculation then used it to run a simulation. We used the Gragg multi-step method accompanied with extrapolation to solve for the model's solution in order to reduce linearization error. The steps we used were steps 2, 4, and 6.

Figure 2 shows how we shock the exogenous variable in running simulation.
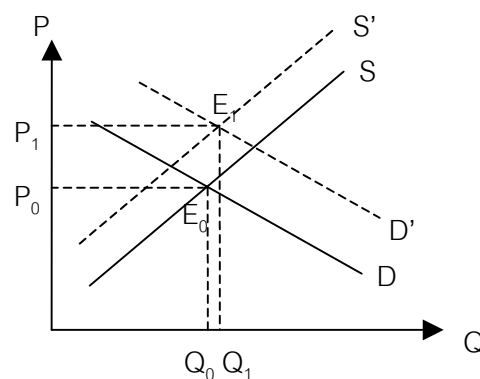

Figure 2: The method of shock in simulation

From figure 2, S and D are the supply and demand schedule respectively of export markets prior to the shock. The equilibrium is at E_0. After shock, S and D change to S' and D' respectively and the new equilibrium is at E'. We shift the export

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demand curve (D to D') so that the area of $P_0E_0Q_0Q_1E_1P_1$ equals to 1,000 million baht. The reason of this method of shock is that, since each sector has a different size of export volume, its impact size can vary greatly. As a result, we cannot compare the impacts across sectors however, to shock using the same export value would let us compare impacts among sectors. Results from this shock can be interpreted as "what would happen if the export value increased by 1,000 million baht". The simulations are divided into short-run simulations and long-run simulations.

Results

Results from the model are shown in table 2 and table 3.

Table 2: Impacts on macroeconomic variables

Variable	Sector					
	Food Processing		Motor vehicles and parts		Tourism	
	Short-run	Long-run	Short-run	Long-run	Short-run	Long-run
Value change (million Baht)						
1. EV	59	277	351	404	182	578
2. Current account balance	320	257	288	168	305	165
Percentage changes						
3. Nominal GDP	0.022	0.020	0.016	0.016	0.023	0.024
4. Real GDP	-0.002	0.004	0.007	0.010	0.003	0.014
5. Real private consumption	0.003	0.009	0.008	0.010	0.006	0.017
6. Real investment	0	0.007	0	0.012	0	0.021
7. Real government consumption	-0.007	-0.001	0.013	0.010	-0.002	0.003
8. Export volume	0.012	0.014	0.028	0.027	-0.032	-0.033
9. Special export volume	-0.050	-0.039	-0.027	-0.023	0.162	0.182
10. Import volume	0.009	0.011	0.023	0.022	0.007	0.013
11. National income	0.025	0.023	0.014	0.014	0.025	0.024
12. Capital stock	0	0.007	0	0.012	0	0.021
13. Employment	-0.007	0	0.012	0	0.009	0
14. GDP Deflator	0.024	0.016	0.009	0.006	0.020	0.010
15. Consumer price index	0.021	0.014	0.006	0.004	0.019	0.007
16. Wage rate	0.021	0.014	0.006	0.015	0.019	0.024
17. Real wage rate	0	0.000	0.000	0.011	0	0.016

Variable	Sector					
	Food Processing		Motor vehicles and parts		Tourism	
	Short-run	Long-run	Short-run	Long-run	Short-run	Long-run
18. Export price (f.o.b.)	0.019	0.014	0.007	0.004	0.006	0.006
19. Terms of Trade	0.019	0.014	0.007	0.004	0.006	0.006
20. Rate of return	0.017	0	0.009	0	0.021	0
21. Rental price of capital	0.020	0.003	0.013	0.003	0.027	0.005
22. Tax revenue	0.005	0.008	0.029	0.029	0.014	0.022
23. Tariff revenue	0.010	0.013	0.059	0.042	0.006	0.014
24. Private consumption expenditure	0.025	0.023	0.014	0.014	0.025	0.024
25. Government consumption price	0.018	0.012	0.008	0.011	0.020	0.017
26. Price of capital	0.007	0.003	0.006	0.003	0.010	0.005
27. Total utility	0.001	0.007	0.008	0.010	0.004	0.014
28. Private utility	0.004	0.01	0.009	0.012	0.007	0.020
29. Government utility	-0.009	-0.001	0.018	0.016	-0.003	0.006

Table 3: Output results by Sector

Sector	Food Processing		Motor vehicles and parts		Tourism	
	Short-run	Long-run	Short-run	Long-run	Short-run	Long-run
1. Cereals	0.036	0.059	-0.002	-0.005	-0.006	-0.005
2. Vegetables, Fruits and Nuts	0.003	0.009	0.000	0.000	0.001	0.005
3. Rubber	-0.004	-0.003	-0.001	-0.003	-0.005	-0.005
4. Other Crops	0.007	0.017	-0.002	-0.004	-0.005	-0.004
5. Livestock	0.022	0.042	-0.002	-0.003	-0.004	-0.003
6. Forestry and Fishery	0.010	0.042	0.000	-0.001	-0.001	0.005
7. Mining	-0.002	-0.002	0.000	0.004	-0.002	0.007
8. Food Processing	0.055	0.080	-0.003	-0.005	-0.007	-0.006
9. Beverage and Tobacco	-0.009	-0.004	0.001	0.005	0.012	0.032
10. Textile and Leather	-0.015	-0.018	-0.005	-0.014	-0.011	-0.003
11. Wood Products	-0.018	-0.008	-0.003	-0.002	-0.013	-0.005
12. Paper and Printing	-0.007	-0.003	-0.001	0.000	-0.003	0.010
13. Chemical and Petroleum Products	-0.006	-0.001	0.000	0.005	0.002	0.020
14. Rubber and Plastic Products	-0.011	-0.005	-0.003	0.001	-0.012	-0.002
15. Non-Metallic Products	-0.008	-0.003	-0.002	0.005	-0.010	0.003
16. Metal Products	-0.011	-0.014	-0.002	0.003	-0.013	-0.018
17. Machinery and Equipment	-0.013	-0.015	-0.001	0.009	-0.014	-0.013
18. Electrical Machinery and Appliances	-0.010	-0.018	-0.004	-0.012	-0.012	-0.025
19. Motor Vehicles and Parts	-0.017	-0.021	0.711	1.028	-0.019	-0.019
20. Other Manufacturing Products	-0.020	-0.023	-0.008	-0.016	-0.008	0.009
21. Utility	-0.003	0.002	0.004	0.008	0.001	0.012
22. Construction	0.000	0.007	0.000	0.012	0	0.021
23. Trade	-0.002	0.004	0.003	0.007	0.003	0.013
24. Restaurant and Hotel	-0.019	-0.013	0.001	0.004	0.035	0.058
25. Transport	-0.007	0.001	-0.002	0.003	0.036	0.052

Sector	Sector					
	Food Processing		Motor vehicles and parts		Tourism	
	Short-run	Long-run	Short-run	Long-run	Short-run	Long-run
26. Communication	-0.007	-0.005	-0.001	-0.001	0.031	0.06
27. Finance	-0.003	0.004	0.004	0.009	0.005	0.017
28. Real Estate	-0.001	0.007	0.001	0.008	0.004	0.033
29. Public Services	-0.010	-0.002	0.013	0.009	0.005	0.012
30. Other Services	-0.007	0.000	-0.007	0.002	0.021	0.039

We chose results of some key variables that have wide impact to the economy, including sectoral outputs, to be interpreted. Those key variables are social welfare (EV), real GDP, employment, and consumer price index.

The social welfare result can be interpreted by analyzing the national income together with consumer price index. This is due to the fact that social welfare is measured from the total utility of the population. If the national income increases, social welfare will increase and vice versa. If the consumer price index increases, social welfare will decrease and vice versa. The social welfare will finally increase or decrease will depend on the size of change of these two variables.

1. Food processing exports

Sector characteristics

From the I/O table, the food processing sector has a 12% share in consumption. Within the sector 39% is exported, 34% consumed, and 27% used as intermediate goods in other sectors. It is the important downstream industry of many other sectors such as cereals (90%[4]), vegetables/fruits/nuts (18%), other crops (57%), livestock (71%), forestry and fishery (45%), and food processing itself (8%).

The sector is also an important upstream industry for livestock (43%[5]), forestry and fishery (9%), food processing (9%), beverage and tobacco (8%), restaurant and hotel (20%).

It also imports intermediate goods, which are food processing (6%[6]), metal products (2%).

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[4] This figure shows the percentage of total output of that sector (cereals, in this case) distributed to the food processing sector. Hereafter, we use this format when mentioning an important downstream industry.

[5] This figure shows the percentage of food processing used in total input structure of that sector (livestock, in this case). Hereafter, we use this format when mentioning an important upstream industry.

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Social welfare

From table 2 it can be seen that a 1,000 million baht increase in food processing exports, contributes an increase in social welfare of some 59 million baht in the short run, and 277 million baht in the long run. The national income is increased by 0.025% while the consumer price index is increased slightly less by 0.021%. Therefore, social welfare is increased at the lower level compared to other two sectors.

The increase of national income is mainly caused by the expansion of cereals (the upstream industry of food processing), food processing, forestry and fishery sector, and trade. However, the country losses income in the contraction of industrial sectors, particularly the restaurant and hotel sector, textile and leather sector, and in the electrical machinery and appliances sector. Contraction in the restaurant and hotel sector is caused by a decrease in use from tourism due to the higher prices of restaurant and hotel, while the contraction of most industrial sectors is caused by the contraction of exports due to the higher export price.

The higher prices in restaurant and hotel are mainly caused by the increased price of food processing, whereas higher export prices in the industrial sectors are caused mainly by the higher costs from trade sector, used for distributing intermediate goods between sectors.

CPI

CPI is increased by 0.021% in the short run mainly because of the increased price of food processing since food processing is a major component of consumption. Furthermore, the CPI is also increased from the increased price of other intermediate goods used in food processing, such as products from forestry and fishery, and vegetables, fruits, and nuts. Restaurant and hotel that use food processing, as intermediate goods, are also major causes of increased CPI.

The increased CPI also causes wage rate to increase, thus causing sectors in the economy to suffer from the higher cost of production.

In the long run, the CPI is increased by 0.014%, lower than that which occurs in the short run. This is caused by a reduction in the average rental price of capital, causing the cost of production generally to decrease. This is because the capital stock can be expanded and become more mobile across sectors in the long run.

Real GDP and Employment

In the short run, Thailand suffers from a decrease of real GDP and aggregate employment by 0.002%, and 0.007%, respectively. This is mainly caused by contraction in most sectors. However, in the long run real GDP reverses its direction to be increased by 0.004%.

Sectoral outputs

Sectors that benefit from the export expansion of food processing are those in the agricultural sectors, except rubber, since they are the upstream industries of the

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[6] This figure shows the percentage of that imported commodity in total input structure of food processing. Hereafter, we use this format when mentioning import intermediate goods usage.

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food processing sector. Considered from the point of view of the value of output expansion, sectors that gain the most are cereals and livestock respectively.

The major sectors that suffer from the export expansion of food processing are textiles and leather products, electrical machinery and appliances, and restaurant and hotel.

2. Motor vehicles and parts

Sector characteristics

From the I/O table, motor vehicles and parts has a 0.6% share in consumption. Within this sector 49% is used for export, 32% is used as intermediate goods, 14% for consumption, and 14% for investment. It is the important downstream industry of motor vehicles and parts (7%), machinery and equipment (2%), and metal products (1%).

The motor vehicles and parts sector is also the important upstream industry of motor vehicles and parts (8%), and other services (5%).

Motor vehicles and parts uses imported intermediate goods such as motor vehicles and parts (14%), metal products (12%), machinery and equipment (4%), electrical machinery and appliances (4%), and chemical products and petroleum (2%).

Social welfare

From table 2, a 1,000 million baht increase in motor vehicles and parts exports contributes to a social welfare increase of 351 million baht in the short run, and 404 million baht in the long run. The national income is increased by 0.014% while the consumer price index (CPI) is increased by 0.006%. Consequently, social welfare is increased at a high level in the short run.

Increase in the national income is mainly caused by the expansion of motor vehicles and parts, trade, and public services. However, this increase in the national income is slightly offset by the contraction of some sectors.

The expansion of trade is caused by being use as margin for the export expansion of motor vehicles and parts. This causes the price of trade to increase.

The expansion of public services is caused by the expansion of government consumption because the government receives more revenue from tariff. This is because the import tariff of motor vehicles is high and also its Armington elasticity of substitution. When the domestic price of motor vehicles and parts is higher due to the increased export, import of motor vehicles and parts is increased. Therefore, tariff revenue is increased significantly.

The contraction of sectors that affects the national income are those of, for example, textile and leather, and other services sector, most of these is caused by the increased price of trade which is used as margin.

CPI

CPI is increased by 0.006% in the short run while increased by 0.004% in the long run. The increased export of motor vehicles does not affect domestic price level much because motor vehicles and parts have low share in consumption. Furthermore, 40% of motor vehicles and parts consumption is imported and that the import price is unchanged to the shock.

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Real GDP and employment

Real GDP is increased by 0.007% in the short run but increased by 0.01% in the long run. The increase of real GDP is mainly caused by the expansion of motor vehicles and parts only. All other sectors have little effect on real GDP growth.

Aggregate employment is increased by 0.012% with most of the increase occurring in the motor vehicles and parts sector, and the public services sector.

Sectoral outputs

Apart from the motor vehicles and parts sector, the sector that benefits significantly from increased exports is the public services due to the fact that the motor vehicles and parts sector has a few linkage industries only.

Sectors that lose most from increased exports of motor vehicles and parts are textile and leather, and other services. However, the impact is small only.

3. Tourism

Sector characteristics

The commodities that have a high share in tourism are transport (24%), restaurant and hotel (19%), textile and leather (11%), and other services (11%).

Tourism is the major final demand of transport (32%[7]), communication (24%), restaurant and hotel (24%), other manufacturing products (14%), other services (12%), and real estate (9%).

Social welfare

An increased income of 1,000 million baht from increased demand of tourism causes social welfare to be increased by 182 million baht in the short run, and by 578 million baht in the long run. The social welfare increase is caused by the increase of national income by 0.025%, while being offset by the increase of consumer price index, which is increased by 0.019%.

The increase of national income is mainly caused by the expansion of trade, transport, restaurant and hotel. In the case of transport, and restaurant and hotel that are mainly used in tourism, their expansion is caused directly by an expansion of tourism. The expansion in trade is bought about by it being used more as a margin for distributing goods to the tourism sector, or distributing goods to the industries supporting tourism.

CPI

CPI is increased by 0.019% in the short run and by 0.007% in the long run. A CPI increase is caused mainly by an increased consumer price in restaurant and hotel, real estate, transport, beverage and tobacco, and textile and leather.

In the short run, the CPI is increased rather more highly compared to the increase in the long run. This is because tourism is the final demand of sectors, most of which are highly capital intensive. Accordingly, while capital is expandable in the

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[7] The figure shows the percentage of total output of that sector (transport, in this case) distributed to tourism sector.

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long run, production costs would be much lower compared to that in the short run. This therefore causes the CPI to be lower considerably.

Real GDP and employment

Real GDP is increased by 0.003% in the short run but increased much more in the long run, that is, it is increased by 0.014%. This is because the CPI increase is much lower in the long run compared to the short run, thus causing the production cost to be much lower.

Aggregate employment is increased by 0.009% due to the expansion of the economy. Sectors that experience the highest increased employment are transport, restaurant and hotel, other services, and trade, while sectors that experience the greatest decrease in employment are textile and leather, electrical machinery and appliances, and food processing, respectively.

Sectoral outputs

Most of the service sectors are expanded because they are used directly in tourism. Sectors that benefit most are transport, and restaurant and hotel, respectively. Benefits experienced from the expansion of tourism in the industrial sectors are offset by decreased exports caused by the higher cost of production in general. Therefore, most of them are contracted except chemical products and petroleum, and beverage and tobacco because a high proportion of these sectors is used directly in tourism.

In the agricultural sectors, output contracts slightly due to the contraction of food processing. This is because they are supporting industries of food processing, the output of which is contracted, since food processing shares the same intermediate inputs, which are vegetable/fruits/nuts and forestry and fishery, with restaurant and hotel.

There are some sectors that are used in tourism, yet their output contracts. These sectors are textile and leather, and other manufacturing. This is because their export contracts more than the increase of output caused by tourism, due to the higher cost of production in general.

Conclusion

In this paper, the impact of export expansion caused by increased demand of three strategic sectors in Thailand was studied using a CGE approach. It was found that an increase of income from export may cause a negative impact on economic growth and aggregate employment. Furthermore, the export expansion of different sectors would cause significantly different impacts to the economy. Export promotion in one sector may have a negative impact on export promotion in another sector. For example, we found that the increase of export demand for food processing, and motor vehicles and parts, would cause a reduction in tourism.

A 1,000 million baht increase of export value of food processing would generate a benefit of 59 million baht increase to the social welfare in the short run, and 277 million baht increase to the social welfare in the long run.

In the short run, the country would suffer from a reduction in economic growth, that is, real GDP growth would decline by 0.002% with a reduction in

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aggregate employment of 0.007%. After all, in the long run real GDP would increase by 0.004%.

Inflation would be increased by 0.021% in the short run, with the increase reduced to 0.014% in the long run. The current account balance is 320 million baht more surplus in the short run, and 257 million baht more surplus in the long run.

All agricultural sectors benefit from increased export demand in food processing except the rubber sector. Sectors that gain the most are cereals and livestock, respectively.

Other sectors lose benefit from increased export demand in food processing. Sectors that lose the most are textile and leather, electrical machinery and appliances, and restaurant and hotel, respectively.

A 1,000 million baht increase in the export value of motor vehicles and parts would generate a benefit of 351 million baht increase to social welfare in the short run, and a 404 million baht increase to social welfare in the long run.

In the short run, real GDP would be increased by 0.007% with an increase in aggregate employment of some 0.012%, while in the long run real GDP would be increased by 0.01%.

Inflation would be increased by 0.006% in the short run, with the increase reduced to 0.004% in the long run. Current account balance is 288 million baht more surplus in the short run, with a decline of more surplus to 168 million baht in the long run.

The sector that benefits significantly from an increased export in motor vehicles and parts is the public services only. Sectors that lose benefit are textile and leather, and other services.

A 1,000 million baht increase in tourism would generate a benefit of 182 million baht increase to the social welfare in the short run, and 578 million baht increase to the social welfare in the long run.

In the short run, real GDP would be increased by 0.003% with an increase in aggregate employment of 0.009%, while in the long run real GDP would be increased by 0.014%.

Inflation would be increased by 0.019% in the short run, with the increase reduced greatly to 0.007% in the long run. The current account balance is 305 million baht more surplus in the short run, with a decline of more surplus to 165 million baht in the long run.

Sectors that benefit most from the expansion of tourism are transport, and restaurant and hotel. Sectors that lose benefit are most of those in industrial sectors.

The simulation results have shown that long-run impacts are more desirable than short-run impacts. Therefore, the short-run period should be shortened in order to gain more benefits from the long run. It is recommended that the capital installation period (investment period) should be reduced.

We found that trade sector plays an important role in determining the cost of many sectors because its price can affect the cost of production in the whole economy. As a consequence, the infrastructure in this sector should be developed.

As mentioned earlier, export promotion in one sector may impact undesirably on the export promotion of other sectors. Thus, the cross impact among policies of

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export promotion should be studied. This will lead to higher efficiency of the export promotion policies.

Future research should carry out firstly a comparative study among all sectors in the economy to identify sectors that cause the most desirable impact in their export expansion. This should help to determine the strategic sectors that would give the most benefit to the country. The second issue that needs to be addressed is to study the impact of sector export on income distribution since income distribution is another significant goal of the country's development. This would give further significant information to help determine the country's strategic sectors.

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