Chapter 5

Economic impact of the Royal Project Foundation on the nationwide economy

5.1 Introduction

Thailand aims to become the kitchen of the world. The Agro-industrial sector is a major opportunity for the economic growth of Thailand. The concept of *Food Valley* is at the national agenda to construct a complete cluster and network of agricultural production sites, leading to quality food production. The Royal Project Foundation (RPF) is one of major producers in the agro-industry sector of Thailand. Its merits to the Thai economy should be assessed. However, there is no quantitative study about the impact of the RPF on the nationwide economy of Thailand. This study will use the latest SAM of Thailand in 2010 and the computable general equilibrium model (CGE) to quantify the economic impact of the RPF on the Thai economy. It will investigate the impacts of 15 scenarios which focus on the role of government funding in various situations.

5.2 Methodology

This study uses the KS-CGE model Type IV. The model was developed by Komsan Suriya in 2012. It uses the Social Accounting Matrix (SAM) of Thailand in 2010 for its database. In this study, the SAM includes the following 16 production sectors:

Sector 1: Agriculture
Sector 2: Mining and quarrying
Sector 3: Food manufacturing
Sector 4: Textile industry
Sector 5: Saw mills and food products
Sector 6: Paper industries and printing
Sector 7: Rubber, chemical and petroleum industries

Sector 8: Non-metallic products
Sector 9: Metal, metal products and industries
Sector 10: Other manufacturing
Sector 11: Public utilities
Sector 12: Construction and others
Sector 13: Trade
Sector 14: Transportation and communication
Sector 15: Services
Sector 16: The Royal Project Foundation

The CGE analysis was divided into 15 scenarios as follows:

Scenario 1: Increasing government funding to only RPF sector by 10%, 20% and 30%.

Scenario 2: Increasing government funding to only RPF sector by 10% and export of RPF also increases 10%, 20% and 30%.

Scenario 3: Increasing government funding to only RPF sector by 10% and household consumption of RPF's products also increases 10%, 20% and 30%.

Scenario 4: Labor cost (wage) increases by 10%, 19.52%, 20% and 30% across the board. The increase of 19.52% of the labor cost reflects the real situation when the government issues the Raising Income Policy which will lift the daily wage from THB251 to THB300.

Scenario 5: Labor cost (wage) increases by 19.52% and government funding to RPF increases by 7.89%. This rate of expansionary government funding presents the realistic amount that the RPF would receive in the following year.

Scenario 6: Labor cost (wage) increases by 19.52% and the analysis will find the

optimal increase of government funding to RPF that would neutralize the negative impact.

Scenario 7: Production cost of agricultural sector (sector 1) increases by 5%, 10% and 15% across the board.

Scenario 8: Production cost of agricultural sector (sector 1) increases by 10% and government funding to RPF increases by 7.89%.

Scenario 9: Production cost of agricultural sector (sector 1) increases by 10% and the analysis will find the optimal increase of government funding to RPF that would neutralize the negative impact.

Scenario 10: Production cost of food manufacturing sector (sector 3) increases by 5%, 10% and 15% across the board.

Scenario 11: Production cost of food manufacturing sector (sector 3) increases 10% and government funding to RPF increases 7.89%.

Scenario 12: Production cost of food manufacturing sector (sector 3) increases by 10% and the analysis will find the optimal increase of government funding to RPF that would neutralize the negative impact.

Scenario 13: Production cost of agricultural sector (sector 1) and food manufacturing sector (sector 3) increase by 10% at the same time across the board.

Scenario 14: Production cost of agricultural sector (sector 1) and food manufacturing sector (sector 3) increase by 10% at the same time and government funding to RPF increases by 7.89%.

Scenario 15: Production cost of agricultural sector (sector 1) and food manufacturing sector (sector 3) increase by 10% at the same time and the analysis will find the optimal increase of government funding to RPF that would neutralize the negative impact.

5.3 Specification of KS-CGE Type IV model

Suriya and Sudtasan (2013) have described the mathematical settings of the KS-CGE model Type IV as follows:

The model is a system of linear equations based on three matrices: **XP**=**Y,** where **X, P** and **Y** represent, respectively, the domestic economy, the endogenous price and the external trade. The system can be solved for **P** using the Gauss-Seidel iteration method. It implies the CES technology. Input ratios change according to the change of price ratios. Shephard's lemma can be used to calculate the optimal **X** after the price changes. The routine is iterated until **P** has converged.

KS-CGE Type IV follows the settings of John Shoven and John Whalley (1972) who firstly introduced a framework for CGE. Their model is called the Shoven-Whalley model. Its major assumptions are constant return to scale and perfect competition.

The model was originally designed for a closed-economy. It can be extended to a small open economy model by applying the Armington assumption. Armington (1969) assumes that products traded internationally are differentiated on the basis of their country of origin. Therefore, goods produced domestically and imported from the rest of the world are not perfectly substituted. This assumption allows the model to treat imported goods separately as another set of products.

Suriya (2011) explained the Shoven-Whalley model step by step as follows:

Step 1: Optimization of production

The model works with F firms, H Households and M markets (commodities, labor and capital markets). A firm seeks for an optimal quantity to find its maximized profit. A household seeks for the maximized utility under a budget constraint. A market seeks for a price to clear the market.

Given,

f is a firm.

x_f is a production quantity of the firm.

a_{if} is the input from market i required for a production of one unit of output. Thus all inputs from market i for the production of x_f units equal to $a_{if} x_f$.

b_{jf} is the output sold in market j that is transformed by one unit of x_f. Thus all the products sold in market j which are transformed by x_f units of outputs equal to $b_{jf} x_f$.

c_f is the of production of one unit of output.

p is the price of one unit of input and also one unit of output.

a is the quantity of inputs.

$F_f(a)$ is a production function using inputs equal to a units.

The cost function is defined as follows:

$$c_f(p) = \min_a \left\{ p \cdot a \mid F_f(a) = 1 \right\} \tag{5.1}$$

Given that the production function, $F_f(a)$ is concave and homogeneous at degree one, it yields a unique solution, Consequently, it is possible to apply the Hotelling-Shepard-lemma to find an optimal quantity of inputs needed for the production of one unit of output.

$$\frac{\partial c_f(p)}{\partial p_i} = a^* = a_{if} \tag{5.2}$$

The application of the Hotelling-Shepard-lemma helps the CGE modeling bypass the deal with production function $F_f(a)$ because the quantity of output is already optimal.

The revenue function is defined as follows:

$$r_f(p) = \max_b \left\{ p \cdot b \mid T_f(b) = 1 \right\} \tag{5.3}$$

where $T_f(b)$ is the Transformation function of instant product b to be in a form of original output of x_f.

When the transformation function is convex and homogeneous at degree one, applying the Hotelling-Shepard-lemma yields the following result:

$$\frac{\partial r_f(p)}{\partial p_i} = b^* = b_{jf} \tag{5.4}$$

This is again the optimal quantity of instant products.

Step 2: Optimization of consumption

The expenditure function is defined as follows:

$$e_h(p, u_h) = \min_d \left\{ p \cdot d \mid U_h(d) \geq u_h \right\} \tag{5.5}$$

When $U_h(d)$ is a utility function $U_h(d)$ is quasi-concave and has a unique function, applying the Hotelling-Shepard-lemma yields an optimal quantity of consumption of a commodity.

$$d_{ih} = \frac{\partial e_f(p, u_h)}{\partial p_i} \tag{5.6}$$

Step 3: General equilibrium

Assuming perfect competition, a firm seeks for an optimal quantity of output, x_f, yielding the largest profit, zero profit in this case.

$$r_f(p) - c_f(p) = 0 \tag{5.7}$$

A household needs to seek for the maximized utility, u_h, under a budget constraint:

$$e_h(p, u_h) - E_h \cdot p = 0 \tag{5.8}$$

A market needs to find optimal prices, p, to make the market clear:

$$\sum_f x_f (b_{jf} - a_{if}) = \sum_h (d_{ih} - E_{ih}) \tag{5.9}$$

Step 4: Specification of functions

In this study, the cost function was defined as a constant elasticity of substitution (CES) function:

$$c_f^{1-\sigma_f} = \sum_i \alpha_{if} p_i^{1-\sigma_f} \tag{5.10}$$

Assuming that the elasticity of substitution to be equal or greater than zero, $\sigma_f \geq 0$, we get the following result:

$$a_{if} = \alpha_{if} \left(\frac{p_i}{c_f} \right)^{-\sigma_f} \tag{5.11}$$

where:

α_{if} is called a shift parameter.

It also specifies the revenue function as a CES function:

$$r_f^{1+\eta_f} = \sum_j \beta_{jf} p_j^{1+\eta_f} \tag{5.12}$$

When the elasticity of transformation is equal or greater than zero: $\eta_f \geq 0$, we get the following result:

$$b_{jf} = \beta_{jf} \left(\frac{p_i}{r_f} \right)^{\eta_f} \tag{5.13}$$

An expenditure function is specified as follows:

$$e_h = u_h \pi_h \tag{5.14}$$

where:

π_h is called the price index. It is an expenditure that yields a certain level of utility;

u_h is the level of utility.

The price index is also specified as a CES function. It is named the price index because it contains p inside.

$$\pi_h^{1-\mu_h} = \sum_i \gamma_{ih} p_i^{1-\mu_h} \tag{5.15}$$

Given the elasticity of substitution is equal or greater than zero: $\mu_h \geq 0$, we get the following equation:

$$d_{ih} = u_h \gamma_{ih} \left(\frac{p_i}{\pi_h} \right)^{-\mu_h} \tag{5.16}$$

It is interesting to see that γ_{ih} is another shift parameter that can be written as follows:

$$\gamma_{ih} = \frac{d_{ih}^0}{\left(e_h^0\right)^{\mu_h}}$$

In this equation, if the elasticity of substitution equals one, then the shift parameter γ_{ih} is the ratio of consumption of commodity i to total consumption of the household:

$$\gamma_{ih} = \frac{d_{ih}^0}{e_h^0} \qquad ; \ \mu_h = 1 \tag{5.17}$$

γ_{ih} is an adjustment mechanism in the expenditure function. The benefits of γ_{ih} can be seen in the following equation of price index:

$$\pi_h^{1-\mu_h} = \sum_i \gamma_{ih} p_i^{1-\mu_h} \tag{5.18}$$

Assuming $\mu_h = 0$, we get $\gamma_{ih} = d_{ih}^0$. Then the price index has the following simple expression:

$$\pi_h = \sum_i d_{ih}^0 p_i \tag{5.19}$$

Therefore, the price index simply refers to the total value of initial consumption.

5.4 Results

This section presents the results of the simulations of counterfactuals in 15 scenarios according to the changes of government funding to the Royal Project Foundation (RPF) with the situations of increasing demand from both external and domestic consumers, increasing labor cost and intermediate costs.

The results of scenario 1, an increase of government funding to only RPF by 10%, 20% and 30% are presented in Table 5.1.

Table 5.1: Scenario1: Increasing government funding to only RPF by 10%, 20% and 30%

Increasing government funding to only RPF by 10%, 20% and 30%			
Sector	10%	20%	30%
Sector 1: Agriculture	0.00	0.01	0.01
Sector 2: Mining and quarrying	0.00	0.01	0.01
Sector 3: Food manufacturing	0.01	0.01	0.02
Sector 4: Textile industry	0.01	0.02	0.02
Sector 5: Saw mills and food products	0.01	0.01	0.02
Sector 6: Paper industries and printing	0.00	0.01	0.01
Sector 7: Rubber, chem & petroleum	0.00	0.01	0.01
Sector 8: Non-metallic products	0.00	0.01	0.01
Sector 9: Metal, metal prod & indust	0.01	0.01	0.02
Sector 10: Other manufacturing	0.01	0.02	0.03
Sector 11: Public utilities	0.00	0.01	0.01
Sec 12: Construction+ Sec16: Others	0.02	0.03	0.05
Sector 13: Trade	0.01	0.02	0.03
Sector 14: Transport and	0.01	0.02	0.02
Sector 15: Services	0.01	0.01	0.02
Sector 17: Royal Project Foundation	3.36	6.73	10.10
m-sector 1: Importers of agriculture	0.00	0.00	0.00
m-sector 2: Importers of mining	0.00	0.00	0.00
m-sector 3: Importers of food manufact	0.00	0.00	0.00
m-sector 4: Importers of textiles	0.00	0.00	0.00
m-sector 5: Importers of wood products	0.00	0.00	0.00

Table 5.1: (Continued)

Sector	10%	20%	30%
m-sector 6: Importers of paper	0.00	0.00	0.00
m-sector 7: Importers of rubb, chem,	0.00	0.00	0.00
m-sector 8: Importers of non-metalic	0.00	0.00	0.00
m-sector 9: Importers of matalic	0.00	0.00	0.00
m-sector 10: Importers of other	0.00	0.00	0.00
m-sector 11: Importers of utilities	0.00	0.00	0.00
m-sector 14: Importers of trans and	0.00	0.00	0.00
m-sector 15: Importers of services	0.00	0.00	0.00
m-sector 16: Importers of others	0.00	0.00	0.00
HH1: Poorest decile	0.01	0.01	0.02
HH2: Second poorest decile	0.01	0.01	0.02
HH3: Third poorest decile	0.01	0.01	0.02
HH4: Fourth poorest decile	0.01	0.01	0.02
HH5: Lowest middle decile	0.01	0.01	0.02
HH6: Lower middle decile	0.01	0.01	0.02
HH7: Higher middle decile	0.01	0.01	0.02
HH8: Highest middle decile	0.01	0.01	0.02
HH9: Second richest decile	0.01	0.01	0.02
HH10: Richest decile	0.00	0.01	0.01
ENT: Institutions	0.00	0.01	0.01
GOV: Government	0.00	0.00	0.01
MARGIN: Transaction costs	0.01	0.02	0.03
TAX: Taxation	0.00	0.00	0.01
GDP Growth	0.00	0.01	0.01
Inflation	0.00	0.00	0.00

Source: Simulation using KS-CGE model Type IV in Matlab.

The increase of government funding to the RPF (sector 17) is a generator of the RPF's economic growth. By raising the funding by 10%, the RPF will grow by around 3.36%. The number is doubled and tripled when the funding rises by 20% and 30%, respectively. The channel of the growth is that the RPF will use this funding to expand her production. It should be noted that this case is under stable demand from both domestic and external consumers. Therefore, the increasing supply of the RPF's products will reduce the products' prices. The whole economy will benefit from this expansion of the RPF such as food manufacturing (sector 3) and households. However, the effect on the whole economy is not so significant, so that the GDP is quite unchanged. This is because the income of the RPF sector is so small, THB1.24

million Baht, compared to the values of whole economy of around THB32,000 million Baht.

The results of scenario 2, an increase of government funding to only RPF by 10% and export of RPF also increased by 10% 20% 30% will be presented in the Table 5.2.

Table 5.2: Scenario 2: Increasing government funding to only RPF by 10% and export of RPF also increases by 10%, 20% and 30%

Increasing government funding to only RPF by 10% and export of RPF also increases 10%, 20% and 30%			
Sector	10%	20%	30%
Sector 1: Agriculture	0.00	0.00	0.00
Sector 2: Mining and quarrying	0.00	0.00	0.00
Sector 3: Food manufacturing	0.00	0.00	-0.01
Sector 4: Textile industry	0.00	0.00	-0.01
Sector 5: Saw mills and food products	0.00	0.00	0.00
Sector 6: Paper industries and printing	0.00	0.00	0.00
Sector 7: Rubber, chem & petroleum	0.00	0.00	0.00
Sector 8: Non-metallic products	0.00	0.00	0.00
Sector 9: Metal, metal prod & indust	0.00	0.00	0.00
Sector 10: Other manufacturing	0.00	0.00	-0.01
Sector 11: Public utilities	0.00	0.00	0.00
Sec 12: Construction+ Sec16: Others	0.01	0.00	-0.01
Sector 13: Trade	0.00	0.00	0.00
Sector 14: Transport and	0.00	0.00	-0.01
Sector 15: Services	0.00	0.00	0.00
Sector 17: Royal Project Foundation	2.86	2.36	1.86
m-sector 1: Importers of agriculture	0.00	0.00	0.00
m-sector 2: Importers of mining	0.00	0.00	0.00
m-sector 3: Importers of food manufact	0.00	0.00	0.00
m-sector 4: Importers of textiles	0.00	0.00	0.00
m-sector 5: Importers of wood products	0.00	0.00	0.00
m-sector 6: Importers of paper	0.00	0.00	0.00
m-sector 7: Importers of rubb, chem,	0.00	0.00	0.00
m-sector 8: Importers of non-metalic	0.00	0.00	0.00
m-sector 9: Importers of matalic	0.00	0.00	0.00
m-sector 10: Importers of other	0.00	0.00	0.00
m-sector 11: Importers of utilities	0.00	0.00	0.00
m-sector 14: Importers of trans and	0.00	0.00	0.00
m-sector 15: Importers of services	0.00	0.00	0.00
m-sector 16: Importers of others	0.00	0.00	0.00
HH1: Poorest decile	0.00	0.00	0.00
HH2: Second poorest decile	0.00	0.00	0.00

Table 5.2: (Continued)

Sector	10%	20%	30%
HH3: Third poorest decile	0.00	0.00	0.00
HH4: Fourth poorest decile	0.00	0.00	0.00
HH5: Lowest middle decile	0.00	0.00	0.00
HH6: Lower middle decile	0.00	0.00	0.00
HH7: Higher middle decile	0.00	0.00	0.00
HH8: Highest middle decile	0.00	0.00	0.00
HH9: Second richest decile	0.00	0.00	0.00
HH10: Richest decile	0.00	0.00	0.00
ENT: Institutions	0.00	0.00	0.00
GOV: Government	0.00	0.00	0.00
MARGIN: Transaction costs	0.00	0.00	-0.01
TAX: Taxation	0.00	0.00	0.00
GDP Growth	0.00	0.00	0.00
Inflation	0.00	0.00	0.00

Source: Simulation using KS-CGE model Type IV in Matlab.

In this situation, the RPF receives an increase government funding of 10% and uses it to expand her production. At the same time, the external demand for the RPF products increase. Then the RPF will allocate a portion of products to export to the rest of the world. This will cause a shortage of the supply in the domestic market which will lift the price of RPF's product. Therefore, the RPF will grow but at a slower pace than in the case of stable demand. As seen from the results, the RPF will grow around 2.86% compared to 3.36% in the case of stable demand.

The results of scenario 3, an increase of government funding to only RPF by 10% and household consumption of RPF also increases by 10% 20% 30% will be presented in the Table5.3.

Table 5.3: Scenario 3: Increasing government funding to only RPF by 10% and household consumption of RPF also increases by 10%, 20% and 30%

Increasing government funding to only RPF by 10% and export of RPF also increases 10%, 20% and 30%			
Sector	10%	20%	30%
Sector 1: Agriculture	0.00	0.00	0.00
Sector 2: Mining and quarrying	0.00	0.00	0.00
Sector 3: Food manufacturing	0.00	0.01	0.00
Sector 4: Textile industry	0.00	0.01	0.01
Sector 5: Saw mills and food products	0.00	0.00	0.00

Table 5.3: **(Continued)**

Sector	10%	20%	30%
Sector 6: Paper industries and printing	0.00	0.00	0.00
Sector 7: Rubber, chem & petroleum	0.00	0.00	0.00
Sector 8: Non-metallic products	0.00	0.00	0.00
Sector 9: Metal, metal prod & indust	0.00	0.01	0.00
Sector 10: Other manufacturing	0.00	0.01	0.01
Sector 11: Public utilities	0.00	0.00	0.00
Sec 12: Construction+ Sec16: Others	0.01	0.01	0.01
Sector 13: Trade	0.00	0.01	0.00
Sector 14: Transport and	0.00	0.01	0.01
Sector 15: Services	0.00	0.00	0.00
Sector 17: Royal Project Foundation	3.28	3.21	3.13
m-sector 1: Importers of agriculture	0.00	0.00	0.00
m-sector 2: Importers of mining	0.00	0.00	0.00
m-sector 3: Importers of food manufact	0.00	0.00	0.00
m-sector 4: Importers of textiles	0.00	0.00	0.00
m-sector 5: Importers of wood products	0.00	0.00	0.00
m-sector 6: Importers of paper	0.00	0.00	0.00
m-sector 7: Importers of rubb, chem,	0.00	0.00	0.00
m-sector 8: Importers of non-metalic	0.00	0.00	0.00
m-sector 9: Importers of matalic	0.00	0.00	0.00
m-sector 10: Importers of other	0.00	0.00	0.00
m-sector 11: Importers of utilities	0.00	0.00	0.00
m-sector 14: Importers of trans and	0.00	0.00	0.00
m-sector 15: Importers of services	0.00	0.00	0.00
m-sector 16: Importers of others	0.00	0.00	0.00
HH1: Poorest decile	0.00	0.00	0.00
HH2: Second poorest decile	0.00	0.00	0.00
HH3: Third poorest decile	0.00	0.00	0.00
HH4: Fourth poorest decile	0.00	0.00	0.00
HH5: Lowest middle decile	0.00	0.00	0.00
HH6: Lower middle decile	0.00	0.00	0.00
HH7: Higher middle decile	0.00	0.00	0.00
HH8: Highest middle decile	0.00	0.00	0.00
HH9: Second richest decile	0.00	0.01	0.01
HH10: Richest decile	0.00	0.00	0.00
ENT: Institutions	0.00	0.00	0.00
GOV: Government	0.00	0.00	0.00
MARGIN: Transaction costs	0.00	0.01	0.01
TAX: Taxation	0.00	0.00	0.00
GDP Growth	0.00	0.00	0.00
Inflation	0.00	0.00	0.00

Source: Simulation using KS-CGE model Type IV in Matlab.

When the government increases her funding to the RPF by 10% and the RPF uses it for the expansion of the production, and at the same time the demand of domestic consumers rises around 10%, the results show that RPF will benefit from this situation by a growth of around 3.28%. This number is larger than that in the case of expansion of external trades (2.86%) but less than that in the case of just the expansion of government funding with stable demand (3.36%). This is because the rising demand in domestic market will raise the price of the RPF's products but the supply of the products are in the domestic market, therefore the price will not rise too much. The rising price will lift the costs of some other related sectors, then the economy will grow but at a slower rate than the case of the stable demand.

The results of scenario 4, where labor cost (wage) increase**s** by10% 20% 30%, will be presented in the Table5.4.

Table 5.4: Scenario 4: Labor cost (wage) increases by 10%, 19.52%, 20% and 30%

Labor cost (wage) increase by 10%, 19.52%, 20% and 30%				
Sector	10%	19.52%	20%	30%
Sector 1: Agriculture	-4.41	-7.76	-7.91	-10.75
Sector 2: Mining and quarrying	-4.54	-7.98	-8.13	-11.05
Sector 3: Food manufacturing	-7.18	-12.63	-12.88	-17.49
Sector 4: Textile industry	-8.37	-14.72	-15.01	-20.39
Sector 5: Saw mills and food	-6.31	-11.10	-11.32	-15.38
Sector 6: Paper industries and	-4.32	-7.59	-7.74	-10.51
Sector 7: Rubber, chem & petroleum	-3.67	-6.46	-6.58	-8.95
Sector 8: Non-metallic products	-3.96	-6.96	-7.09	-9.64
Sector 9: Metal, metal prod & indust	-7.18	-12.63	-12.87	-17.49
Sector 10: Other manufacturing	-9.60	-16.88	-17.21	-23.38
Sector 11: Public utilities	-4.44	-7.80	-7.96	-10.81
Sec 12: Construction+ Sec16: Others	-16.71	-29.39	-29.96	-40.71
Sector 13: Trade	-8.53	-14.99	-15.28	-20.76
Sector 14: Transport and	-8.89	-15.63	-15.93	-21.64
Sector 15: Services	-5.48	-9.63	-9.81	-13.33
Sector 17: Royal Project Foundation	-6.45	-11.34	-11.57	-15.71
m-sector 1: Importers of agriculture	-0.07	-0.13	-0.13	-0.18
m-sector 2: Importers of mining	-1.15	-2.03	-2.07	-2.81
m-sector 3: Importers of food	-0.31	-0.54	-0.55	-0.75
m-sector 4: Importers of textiles	-0.12	-0.21	-0.21	-0.29
m-sector 5: Importers of wood	-0.15	-0.26	-0.26	-0.35

Table 5.4: (Continued)

Sector	10%	19.52%	20%	30%
m-sector 6: Importers of paper	-0.16	-0.29	-0.29	-0.40
m-sector 7: Importers of rubb, chem,	-0.18	-0.31	-0.32	-0.43
m-sector 8: Importers of non-metalic	-0.24	-0.41	-0.42	-0.57
m-sector 9: Importers of matalic	-0.20	-0.36	-0.36	-0.49
m-sector 10: Importers of other	-0.13	-0.23	-0.24	-0.32
m-sector 11: Importers of utilities	-0.07	-0.13	-0.13	-0.18
m-sector 14: Importers of trans and	0.00	0.00	0.00	0.00
m-sector 15: Importers of services	0.00	0.00	0.00	0.00
m-sector 16: Importers of others	-0.02	-0.03	-0.04	-0.05
HH1: Poorest decile	-5.66	-9.95	-10.15	-13.79
HH2: Second poorest decile	-5.73	-10.08	-10.28	-13.96
HH3: Third poorest decile	-5.87	-10.33	-10.53	-14.31
HH4: Fourth poorest decile	-5.84	-10.27	-10.47	-14.22
HH5: Lowest middle decile	-5.67	-9.96	-10.16	-13.80
HH6: Lower middle decile	-5.75	-10.11	-10.31	-14.01
HH7: Higher middle decile	-5.56	-9.77	-9.96	-13.53
HH8: Highest middle decile	-5.61	-9.86	-10.05	-13.66
HH9: Second richest decile	-5.39	-9.47	-9.66	-13.12
HH10: Richest decile	-4.53	-7.96	-8.12	-11.03
ENT: Institutions	-3.12	-5.49	-5.60	-7.60
GOV: Government	-2.20	-3.87	-3.95	-5.37
MARGIN: Transaction costs	-8.63	-15.18	-15.47	-21.02
TAX: Taxation	-2.20	-3.87	-3.95	-5.37
GDP Growth	-3.70	-6.51	-6.64	-9.02
Inflation	-3.67	-6.45	-6.58	-8.93

Source: Simulation using KS-CGE model Type IV in Matlab.

The scenario shows that the 10% increase of the labor cost will cause the RPF's economy to drop by around 6.5%. When simulating the counterfactual of the Raising Income Policy of the government which will lift the wage from THB251 per day to THB300, we discover that the economy of the RPF will fall by around 11%. Other major industries such as agriculture (sector 1) and food manufacturing (sector 3) will also suffer from the recession of by around 8% and 13% respectively. The government budget will decrease by around 4%. Household income will also drop by around 8% to 11%. Households in the third and fourth decile (third and fourth poorest) will be the ones who will suffer the most among other households. Overall GDP will drop by around 6.5%.

An important point of the interpretation of the numbers of the GDP growth is at the middle-term prediction the KS-CGE model does not present the annual growth rate of the GDP but the growth rate for approximately 5 years. For example, when the number shows that the GDP will drop by around 6.5%, this may happen in 5 years. Therefore, the annual growth rate should be divided by 5. Then the result should be converted to be around minus 1.3% per year. This result is well calibrated with the prediction of the Bank of Thailand on the effect of the increasing labor cost on the Thai economy.

From these results, the economy will experience the deflation of 6.45%. In this aspect, it should be noted that this results come out because the KS-CGE model Type IV cannot capture the stagflation problem, the rising cost will cause both rising price and unemployment at the same time.

The results of scenario 5, labor cost (wage) increase 19.52% and Government funding to RPF increases by 7.89% will be presented in the following table.

Table 5.5: Scenario 5: Labor cost (wage) increases 19.52% and government funding to RPF increases by 7.89%

Sector	Results
Sector 1: Agriculture	-7.76
Sector 2: Mining and quarrying	-7.98
Sector 3: Food manufacturing	-12.63
Sector 4: Textile industry	-14.72
Sector 5: Saw mills and food products	-11.10
Sector 6: Paper industries and printing	-7.59
Sector 7: Rubber, chem & petroleum indust	-6.46
Sector 8: Non-metallic products	-6.96
Sector 9: Metal, metal prod & indust	-12.62
Sector 10: Other manufacturing	-16.87
Sector 11: Public utilities	-7.80
Sec 12: Construction+ Sec16: Others	-29.38
Sector 13: Trade	-14.98
Sector 14: Transport and communication	-15.62
Sector 15: Services	-9.62
Sector 17: Royal Project Foundation	-8.98
m-sector 1: Importers of agriculture	-0.13
m-sector 2: Importers of mining	-2.03
m-sector 3: Importers of food manufact	-0.54

Table 5.5: (Continued)

Sector	Results
m-sector 4: Importers of textiles	-0.21
m-sector 5: Importers of wood products	-0.26
m-sector 6: Importers of paper	-0.29
m-sector 7: Importers of rubb, chem, petro	-0.31
m-sector 8: Importers of non-metalic prod	-0.41
m-sector 9: Importers of matalic products	-0.36
m-sector 10: Importers of other manufact	-0.23
m-sector 11: Importers of utilities	-0.13
m-sector 14: Importers of trans and telecom	0.00
m-sector 15: Importers of services	0.00
m-sector 16: Importers of others	-0.03
HH1: Poorest decile	-9.95
HH2: Second poorest decile	-10.08
HH3: Third poorest decile	-10.32
HH4: Fourth poorest decile	-10.26
HH5: Lowest middle decile	-9.96
HH6: Lower middle decile	-10.11
HH7: Higher middle decile	-9.76
HH8: Highest middle decile	-9.86
HH9: Second richest decile	-9.47
HH10: Richest decile	-7.96
ENT: Institutions	-5.49
GOV: Government	-3.87
MARGIN: Transaction costs	-15.17
TAX: Taxation	-3.87
GDP Growth	-6.51
Inflation	-6.45

Source: Simulation using KS-CGE model Type IV in Matlab.

It is clear that the increase of 7.89% of the government funding to the RPF is not enough to compensate the increasing labor cost of 19.52%. The RPF will still suffer from the recession of around 9%. The overall economy will also drop by around 6.5%.

The results of scenario 6, labor cost (wage) increases by19.52% and find the optimal increase of government funding to RPF that would neutralize the negative impact will be presented in the following table.

Table 5.6: Scenario 6: Labor cost (wage) increases by 19.52% and the study will find the optimal increase of government funding to RPF that would neutralize the negative impact

Sector	Results
Sector 1: Agriculture	-7.75
Sector 2: Mining and quarrying	-7.96
Sector 3: Food manufacturing	-12.61
Sector 4: Textile industry	-14.70
Sector 5: Saw mills and food products	-11.08
Sector 6: Paper industries and printing	-7.58
Sector 7: Rubber, chem & petroleum indust	-6.45
Sector 8: Non-metallic products	-6.95
Sector 9: Metal, metal prod & indust	-12.60
Sector 10: Other manufacturing	-16.85
Sector 11: Public utilities	-7.79
Sec 12: Construction+ Sec16: Others	-29.33
Sector 13: Trade	-14.96
Sector 14: Transport and communication	-15.60
Sector 15: Services	-9.61
Sector 17: Royal Project Foundation	0.00
m-sector 1: Importers of agriculture	-0.13
m-sector 2: Importers of mining	-2.02
m-sector 3: Importers of food manufact	-0.54
m-sector 4: Importers of textiles	-0.21
m-sector 5: Importers of wood products	-0.26
m-sector 6: Importers of paper	-0.29
m-sector 7: Importers of rubb, chem, petro	-0.31
m-sector 8: Importers of non-metalic prod	-0.41
m-sector 9: Importers of matalic products	-0.36
m-sector 10: Importers of other manufact	-0.23
m-sector 11: Importers of utilities	-0.13
m-sector 14: Importers of trans and telecom	0.00
m-sector 15: Importers of services	0.00
m-sector 16: Importers of others	-0.03
HH1: Poorest decile	-9.93
HH2: Second poorest decile	-10.06
HH3: Third poorest decile	-10.31
HH4: Fourth poorest decile	-10.25
HH5: Lowest middle decile	-9.94
HH6: Lower middle decile	-10.09
HH7: Higher middle decile	-9.75
HH8: Highest middle decile	-9.84
HH9: Second richest decile	-9.45
HH10: Richest decile	-7.95

Table 5.6: (Continued)

Sector	Results
ENT: Institutions	-5.48
GOV: Government	-3.87
MARGIN: Transaction costs	-15.15
TAX: Taxation	-3.87
GDP Growth	-6.50
Inflation	-6.45

Source: Simulation using KS-CGE model Type IV in Matlab.

The government needs to increase her fund to the RPF by at least 37.80% to neutralize the effect of increasing labor cost. The increasing fund should be around THB143 million even though the increasing labor cost that the RPF needs to spend is around THB37 million. It is clear that labor cost is included in every production. Therefore, its effect on the Thai economy is huge. Just the 19.52% increase of the labor cost will cause all industries to raise their prices or suffer from less profit. This will cause the whole economy to drop into recession of around 6.5%. The long term price will fall and demonstrate the deflation around 6.45% too.

The results of scenario 7, production cost of sector 1 (agriculture) increases by 5% 10% 15% will be presented in the following table.

Table 5.7: Scenario 7: Production cost of sector 1 (agriculture) increases by 5%, 10% and 15%

Production cost of sector 1 (agriculture) increases by 5%, 10% and 15%			
Sector	5%	10%	15%
Sector 1: Agriculture	-7.47	-13.77	-19.15
Sector 2: Mining and quarrying	-7.63	-14.06	-19.55
Sector 3: Food manufacturing	-12.14	-22.37	-31.11
Sector 4: Textile industry	-14.08	-25.96	-36.09
Sector 5: Saw mills and food products	-10.62	-19.57	-27.21
Sector 6: Paper industries and printing	-7.25	-13.37	-18.59
Sector 7: Rubber, chem & petroleum	-6.18	-11.39	-15.84
Sector 8: Non-metallic products	-6.65	-12.26	-17.05
Sector 9: Metal, metal prod & indust	-12.07	-22.25	-30.94
Sector 10: Other manufacturing	-16.15	-29.78	-41.40
Sector 11: Public utilities	-7.46	-13.75	-19.12
Sec 12: Construction+ Sec16: Others	-28.10	-51.82	-72.08

Table 5.7: (Continued)

Sector	5%	10%	15%
Sector 13: Trade	-14.34	-26.44	-36.77
Sector 14: Transport and communication	-14.94	-27.54	-38.29
Sector 15: Services	-9.22	-16.99	-23.63
Sector 17: Royal Project Foundation	-10.84	-19.99	-27.79
m-sector 1: Importers of agriculture	-0.12	-0.22	-0.31
m-sector 2: Importers of mining	-1.94	-3.58	-4.98
m-sector 3: Importers of food manufact	-0.52	-0.95	-1.33
m-sector 4: Importers of textiles	-0.20	-0.37	-0.51
m-sector 5: Importers of wood products	-0.25	-0.45	-0.63
m-sector 6: Importers of paper	-0.28	-0.51	-0.71
m-sector 7: Importers of rubb, chem,	-0.30	-0.55	-0.76
m-sector 8: Importers of non-metalic	-0.40	-0.73	-1.02
m-sector 9: Importers of matalic	-0.34	-0.63	-0.88
m-sector 10: Importers of other	-0.22	-0.41	-0.57
m-sector 11: Importers of utilities	-0.12	-0.22	-0.31
m-sector 14: Importers of trans and	0.00	0.00	0.00
m-sector 15: Importers of services	0.00	0.00	0.00
m-sector 16: Importers of others	-0.03	-0.06	-0.08
HH1: Poorest decile	-9.38	-17.29	-24.03
HH2: Second poorest decile	-9.50	-17.51	-24.35
HH3: Third poorest decile	-9.74	-17.95	-24.95
HH4: Fourth poorest decile	-9.68	-17.84	-24.80
HH5: Lowest middle decile	-9.55	-17.61	-24.49
HH6: Lower middle decile	-9.70	-17.87	-24.85
HH7: Higher middle decile	-9.36	-17.26	-24.00
HH8: Highest middle decile	-9.45	-17.43	-24.23
HH9: Second richest decile	-9.08	-16.73	-23.27
HH10: Richest decile	-7.63	-14.07	-19.56
ENT: Institutions	-5.25	-9.68	-13.46
GOV: Government	-3.71	-6.84	-9.51
MARGIN: Transaction costs	-14.53	-26.78	-37.24
TAX: Taxation	-3.71	-6.84	-9.51
GDP Growth	-6.23	-11.49	-15.98
Inflation	-6.19	-11.40	-15.83

Source: Simulation using KS-CGE model Type IV in Matlab.

The rising intermediate cost of the agricultural sector (sector 1) will harm the Thai economy enormously. The RPF sector will fall almost at the double rate compared to the increasing rate of the agricultural cost. When the cost rises 10%, the RPF will fall around 20%. Other sectors will be negatively affected as a whole. Agricultural sector will also fall by around 14% too. The food manufacturing sector

(sector 3) will suffer from the recession around 22%. Every household decile will experience the reduction of their income by around 14% to 18%. The government will lose around 7% of its income. The overall economy reflected by the GDP growth will be around minus 11.5%. A deflation of around 11.4% will affect the Thai economy.

The results of scenario 8, production cost of sector 1 (agriculture) increases by 10% and government funding to RPF increase by 7.89% will be presented in the following table.

Table 5.8: Scenario 8: Production cost of sector 1 (agriculture) increases by 10% and government funding to RPF increases by 7.89%

Sector	Results
Sector 1: Agriculture	-13.77
Sector 2: Mining and quarrying	-14.06
Sector 3: Food manufacturing	-22.37
Sector 4: Textile industry	-25.95
Sector 5: Saw mills and food products	-19.57
Sector 6: Paper industries and printing	-13.36
Sector 7: Rubber, chem & petroleum indust	-11.39
Sector 8: Non-metallic products	-12.26
Sector 9: Metal, metal prod & indust	-22.25
Sector 10: Other manufacturing	-29.77
Sector 11: Public utilities	-13.75
Sec 12: Construction+ Sec16: Others	-51.81
Sector 13: Trade	-26.43
Sector 14: Transport and communication	-27.54
Sector 15: Services	-16.99
Sector 17: Royal Project Foundation	-17.85
m-sector 1: Importers of agriculture	-0.22
m-sector 2: Importers of mining	-3.58
m-sector 3: Importers of food manufact	-0.95
m-sector 4: Importers of textiles	-0.37
m-sector 5: Importers of wood products	-0.45
m-sector 6: Importers of paper	-0.51
m-sector 7: Importers of rubb, chem, petro	-0.55
m-sector 8: Importers of non-metalic prod	-0.73
m-sector 9: Importers of matalic products	-0.63
m-sector 10: Importers of other manufact	-0.41
m-sector 11: Importers of utilities	-0.22
m-sector 14: Importers of trans and telecom	0.00
m-sector 15: Importers of services	0.00

Table 5.8: (Continued)

Sector	Results
m-sector 16: Importers of others	-0.06
HH1: Poorest decile	-17.28
HH2: Second poorest decile	-17.51
HH3: Third poorest decile	-17.94
HH4: Fourth poorest decile	-17.83
HH5: Lowest middle decile	-17.61
HH6: Lower middle decile	-17.87
HH7: Higher middle decile	-17.26
HH8: Highest middle decile	-17.42
HH9: Second richest decile	-16.73
HH10: Richest decile	-14.07
ENT: Institutions	-9.68
GOV: Government	-6.83
MARGIN: Transaction costs	-26.77
TAX: Taxation	-6.83
GDP Growth	-11.49
Inflation	-11.40

Source: Simulation using KS-CGE model Type IV in Matlab.

These results show that the increase of government funding just around 7.89% will not be able to help the RPF to recover its economy when the cost of agricultural sector (sector 1) rises by 10%. The economy of the RPF will still fall around 18%. At the same time, the agricultural sector will also affected by its rising cost. Its economy will shrink by around 14%. Another related sector, the food manufacturing (sector 3) will be under recession of around 22%.

The results of scenario 9, production cost of sector 1: (agriculture) increases by 10% and find the optimal increase of government funding to RPF that would neutralize the negative impact, is shown in Table 5.9.

Table 5.9: Scenario 9: Production cost of sector 1(agriculture) increases by 10% and the study will find the optimal increase of government funding to RPF that would neutralize the negative impact

Sector	Results
Sector 1: Agriculture	-13.75
Sector 2: Mining and quarrying	-14.03
Sector 3: Food manufacturing	-22.33
Sector 4: Textile industry	-25.91

Table 5.9: (Continued)

Sector	Results
Sector 5: Saw mills and food products	-19.54
Sector 6: Paper industries and printing	-13.34
Sector 7: Rubber, chem & petroleum indust	-11.37
Sector 8: Non-metallic products	-12.24
Sector 9: Metal, metal prod & indust	-22.21
Sector 10: Other manufacturing	-29.72
Sector 11: Public utilities	-13.73
Sec 12: Construction+ Sec16: Others	-51.72
Sector 13: Trade	-26.38
Sector 14: Transport and communication	-27.49
Sector 15: Services	-16.96
Sector 17: Royal Project Foundation	0.00
m-sector 1: Importers of agriculture	-0.22
m-sector 2: Importers of mining	-3.57
m-sector 3: Importers of food manufact	-0.95
m-sector 4: Importers of textiles	-0.37
m-sector 5: Importers of wood products	-0.45
m-sector 6: Importers of paper	-0.51
m-sector 7: Importers of rubb, chem, petro	-0.55
m-sector 8: Importers of non-metalic prod	-0.73
m-sector 9: Importers of matalic products	-0.63
m-sector 10: Importers of other manufact	-0.41
m-sector 11: Importers of utilities	-0.22
m-sector 14: Importers of trans and telecom	0.00
m-sector 15: Importers of services	0.00
m-sector 16: Importers of others	-0.06
HH1: Poorest decile	-17.25
HH2: Second poorest decile	-17.48
HH3: Third poorest decile	-17.91
HH4: Fourth poorest decile	-17.80
HH5: Lowest middle decile	-17.58
HH6: Lower middle decile	-17.84
HH7: Higher middle decile	-17.23
HH8: Highest middle decile	-17.39
HH9: Second richest decile	-16.70
HH10: Richest decile	-14.04
ENT: Institutions	-9.66
GOV: Government	-6.82
MARGIN: Transaction costs	-26.72
TAX: Taxation	-6.82
GDP Growth	-11.47
Inflation	-11.39

Source: Simulation using KS-CGE model Type IV in Matlab.

The government needs to increase the funding to the RPF by 73% to neutralize the negative impact from the rising intermediate costs of the agricultural sector (sector 1) by 10%. When the based funding is THB380 million, then the government should support around THB280 million to the RPF. While the RPF buys from agricultural sector around THB121 million baht per year in 2010. The increasing cost makes the RPF to spend THB12 million baht more to cover the cost. However, the reason why the RPF needs much more than that (THB280 million baht in comparison with THB12 million baht) is because the rising agricultural cost will lead to the rises of costs in other industries and especially the labor costs. Therefore, the impact of the rising agricultural cost is much larger than the rough calculation just for the nominal increase of the cost that the RPF buys products from agricultural sector.

The results of scenario 10, production cost of sector 3 (food manufacturing) increases by 5%, 10%, 15% will be presented in the following table.

Table 5.10: Scenario 10: Production cost of sector 3 (food manufacturing) increases by 5%, 10% and 15%

Production cost of sector 3 (food manufacturing) increases by 5%, 10% and 15%			
Sector	5%	10%	15%
Sector 1: Agriculture	-4.96	-9.10	-12.59
Sector 2: Mining and quarrying	-5.10	-9.35	-12.94
Sector 3: Food manufacturing	-8.10	-14.86	-20.56
Sector 4: Textile industry	-9.41	-17.25	-23.87
Sector 5: Saw mills and food products	-7.09	-13.00	-17.99
Sector 6: Paper industries and printing	-4.85	-8.89	-12.30
Sector 7: Rubber, chem & petroleum	-4.13	-7.57	-10.47
Sector 8: Non-metallic products	-4.45	-8.15	-11.28
Sector 9: Metal, metal prod & indust	-8.07	-14.79	-20.47
Sector 10: Other manufacturing	-10.79	-19.79	-27.39
Sector 11: Public utilities	-4.99	-9.14	-12.65
Sec 12: Construction+ Sec16: Others	-18.78	-34.44	-47.66
Sector 13: Trade	-9.58	-17.57	-24.31
Sector 14: Transport and communication	-9.98	-18.31	-25.34
Sector 15: Services	-6.16	-11.29	-15.63
Sector 17: Royal Project Foundation	-7.24	-13.28	-18.37
m-sector 1: Importers of agriculture	-0.08	-0.15	-0.21
m-sector 2: Importers of mining	-1.30	-2.38	-3.29
m-sector 3: Importers of food manufact	-0.35	-0.63	-0.88

Table 5.10: (Continued)

Sector	5%	10%	15%
m-sector 4: Importers of textiles	-0.13	-0.25	-0.34
m-sector 5: Importers of wood products	-0.16	-0.30	-0.42
m-sector 6: Importers of paper	-0.18	-0.34	-0.47
m-sector 7: Importers of rubb, chem,	-0.20	-0.36	-0.50
m-sector 8: Importers of non-metalic	-0.26	-0.49	-0.67
m-sector 9: Importers of matalic	-0.23	-0.42	-0.58
m-sector 10: Importers of other	-0.15	-0.27	-0.38
m-sector 11: Importers of utilities	-0.08	-0.15	-0.21
m-sector 14: Importers of trans and	0.00	0.00	0.00
m-sector 15: Importers of services	0.00	0.00	0.00
m-sector 16: Importers of others	-0.02	-0.04	-0.06
HH1: Poorest decile	-6.26	-11.48	-15.88
HH2: Second poorest decile	-6.34	-11.63	-16.09
HH3: Third poorest decile	-6.50	-11.92	-16.49
HH4: Fourth poorest decile	-6.46	-11.85	-16.39
HH5: Lowest middle decile	-6.38	-11.69	-16.18
HH6: Lower middle decile	-6.47	-11.87	-16.43
HH7: Higher middle decile	-6.25	-11.46	-15.86
HH8: Highest middle decile	-6.31	-11.58	-16.02
HH9: Second richest decile	-6.06	-11.12	-15.38
HH10: Richest decile	-5.10	-9.35	-12.93
ENT: Institutions	-3.51	-6.43	-8.90
GOV: Government	-2.48	-4.54	-6.29
MARGIN: Transaction costs	-9.71	-17.80	-24.63
TAX: Taxation	-2.48	-4.54	-6.29
GDP Growth	-4.16	-7.63	-10.56
Inflation	-4.13	-7.57	-10.48

Source: Simulation using KS-CGE model Type IV in Matlab.

The rise of the intermediate cost of food processing sector (sector 3) is harmful to the RPF but the scale is less than the case of rising costs of agricultural products. The RPF will experience a drop of around 13% of its economy when the cost rise by 10%. The agricultural sector (sector 1) and the food manufacturing sector (sector 3) will also experience the shrinkage of their economies around by 9% and 15% respectively under a rising of around 10% of the cost. Households also suffer around 9% to 11%. Taxes will be reduced around 2.5%, leading to the same portion

of the decreasing of the government budget. GDP will drop around 4% with almost the same rate as the inflation situation.

The results of scenario 11, production cost of sector 3 (food manufacturing) increases by 10% and government funding to RPF increase by 7.89% will be presented in the following table.

Table5.11: Production cost of sector 3 (food manufacturing) increases by 10% and government funding to RPF increases by 7.89%

Sector	Results
Sector 1: Agriculture	-9.09
Sector 2: Mining and quarrying	-9.35
Sector 3: Food manufacturing	-14.85
Sector 4: Textile industry	-17.25
Sector 5: Saw mills and food products	-13.00
Sector 6: Paper industries and printing	-8.89
Sector 7: Rubber, chem & petroleum indust	-7.57
Sector 8: Non-metallic products	-8.15
Sector 9: Metal, metal prod & indust	-14.79
Sector 10: Other manufacturing	-19.79
Sector 11: Public utilities	-9.14
Sec 12: Construction+ Sec16: Others	-34.43
Sector 13: Trade	-17.56
Sector 14: Transport and communication	-18.30
Sector 15: Services	-11.29
Sector 17: Royal Project Foundation	-10.96
m-sector 1: Importers of agriculture	-0.15
m-sector 2: Importers of mining	-2.38
m-sector 3: Importers of food manufact	-0.63
m-sector 4: Importers of textiles	-0.25
m-sector 5: Importers of wood products	-0.30
m-sector 6: Importers of paper	-0.34
m-sector 7: Importers of rubb, chem, petro	-0.36
m-sector 8: Importers of non-metalic prod	-0.49
m-sector 9: Importers of matalic products	-0.42
m-sector 10: Importers of other manufact	-0.27
m-sector 11: Importers of utilities	-0.15
m-sector 14: Importers of trans and telecom	0.00
m-sector 15: Importers of services	0.00
m-sector 16: Importers of others	-0.04

Table 5.11: (Continued)

Sector	Results
HH1: Poorest decile	-11.48
HH2: Second poorest decile	-11.62
HH3: Third poorest decile	-11.91
HH4: Fourth poorest decile	-11.84
HH5: Lowest middle decile	-11.69
HH6: Lower middle decile	-11.87
HH7: Higher middle decile	-11.46
HH8: Highest middle decile	-11.57
HH9: Second richest decile	-11.11
HH10: Richest decile	-9.34
ENT: Institutions	-6.43
GOV: Government	-4.54
MARGIN: Transaction costs	-17.79
TAX: Taxation	-4.54
GDP Growth	-7.63
Inflation	-7.57

Source: Simulation using KS-CGE model Type IV in Matlab.

The increase of government funding by around 7.89% will not be able to boost up the economy of the RPF to level off the negative effect. The RPF will still suffer from a recession around of 11% together with other sectors. The agricultural sector (sector 1) will still fall around 9% and food manufacturing sector will still under recession of around 15%.

The results of scenario 12, production cost of sector 3 (food manufacturing) increases by 10% and find the government funding to RPF that would neutralize the negative impact will be presented in the following table.

Table 5.12: Production cost of sector 3 (food manufacturing) increases by 10% and the study will find the government funding to RPF that would neutralize the negative impact

Sector	Results
Sector 1: Agriculture	-9.08
Sector 2: Mining and quarrying	-9.33
Sector 3: Food manufacturing	-14.83
Sector 4: Textile industry	-17.22
Sector 5: Saw mills and food products	-12.98
Sector 6: Paper industries and printing	-8.87
Sector 7: Rubber, chem & petroleum indust	-7.55
Sector 8: Non-metallic products	-8.14
Sector 9: Metal, metal prod & indust	-14.76
Sector 10: Other manufacturing	-19.76
Sector 11: Public utilities	-9.13
Sec 12: Construction+ Sec16: Others	-34.38
Sector 13: Trade	-17.53
Sector 14: Transport and communication	-18.28
Sector 15: Services	-11.27
Sector 17: Royal Project Foundation	0.00
m-sector 1: Importers of agriculture	-0.15
m-sector 2: Importers of mining	-2.37
m-sector 3: Importers of food manufact	-0.63
m-sector 4: Importers of textiles	-0.25
m-sector 5: Importers of wood products	-0.30
m-sector 6: Importers of paper	-0.34
m-sector 7: Importers of rubb, chem, petro	-0.36
m-sector 8: Importers of non-metalic prod	-0.48
m-sector 9: Importers of matalic products	-0.42
m-sector 10: Importers of other manufact	-0.27
m-sector 11: Importers of utilities	-0.15
m-sector 14: Importers of trans and telecom	0.00
m-sector 15: Importers of services	0.00
m-sector 16: Importers of others	-0.04
HH1: Poorest decile	-11.46
HH2: Second poorest decile	-11.61
HH3: Third poorest decile	-11.90
HH4: Fourth poorest decile	-11.82
HH5: Lowest middle decile	-11.67
HH6: Lower middle decile	-11.85
HH7: Higher middle decile	-11.44
HH8: Highest middle decile	-11.55
HH9: Second richest decile	-11.09

Table 5.12: (Continued)

Sector	Results
HH10: Richest decile	-9.33
ENT: Institutions	-6.42
GOV: Government	-4.53
MARGIN: Transaction costs	-17.76
TAX: Taxation	-4.53
GDP Growth	-7.62
Inflation	-7.57

Source: Simulation using KS-CGE model Type IV in Matlab.

When the intermediate costs from the food manufacturing sector (sector 3) rises by 10% and the government raises the funding to the RPF by 45.15%, the results show that it will help to neutralize the economy of the RPF. However, the RPF will be the only sector will benefit from the increasing government funding. The agricultural sector (sector 1) and the food manufacturing sector (sector 3) will still be in recession of around 9% and 15% respectively.

The results of scenario 13, production cost of sector1 (agriculture) and sector 3 (food manufacturing) increase by 10% will be presented in the following table.

Table 5.13: Scenario 13: Production cost of sector1 (agriculture) and sector 3 (food manufacturing) increase by 10% at the same time

Sector	Results
Sector 1: Agriculture	-20.42
Sector 2: Mining and quarrying	-20.89
Sector 3: Food manufacturing	-33.24
Sector 4: Textile industry	-38.57
Sector 5: Saw mills and food products	-29.07
Sector 6: Paper industries and printing	-19.86
Sector 7: Rubber, chem & petroleum indust	-16.92
Sector 8: Non-metallic products	-18.22
Sector 9: Metal, metal prod & indust	-33.06
Sector 10: Other manufacturing	-44.24
Sector 11: Public utilities	-20.44
Sec 12: Construction+ Sec16: Others	-77.08
Sector 13: Trade	-39.30
Sector 14: Transport and communication	-40.92
Sector 15: Services	-25.25

Table 5.13: (Continued)

Sector	Results
Sector 17: Royal Project Foundation	-29.69
m-sector 1: Importers of agriculture	-0.33
m-sector 2: Importers of mining	-5.32
m-sector 3: Importers of food manufact	-1.42
m-sector 4: Importers of textiles	-0.55
m-sector 5: Importers of wood products	-0.67
m-sector 6: Importers of paper	-0.76
m-sector 7: Importers of rubb, chem, petro	-0.81
m-sector 8: Importers of non-metalic prod	-1.09
m-sector 9: Importers of matalic products	-0.94
m-sector 10: Importers of other manufact	-0.61
m-sector 11: Importers of utilities	-0.33
m-sector 14: Importers of trans and telecom	0.00
m-sector 15: Importers of services	0.00
m-sector 16: Importers of others	-0.09
HH1: Poorest decile	-25.68
HH2: Second poorest decile	-26.01
HH3: Third poorest decile	-26.66
HH4: Fourth poorest decile	-26.50
HH5: Lowest middle decile	-26.16
HH6: Lower middle decile	-26.55
HH7: Higher middle decile	-25.64
HH8: Highest middle decile	-25.89
HH9: Second richest decile	-24.86
HH10: Richest decile	-20.90
ENT: Institutions	-14.38
GOV: Government	-10.16
MARGIN: Transaction costs	-39.80
TAX: Taxation	-10.16
GDP Growth	-17.07
Inflation	-16.91

Source: Simulation using KS-CGE model Type IV in Matlab.

The effects of rising of intermediate costs in both the agricultural sector (sector 1) and the food manufacturing sector (sector 3) by 10% will be enormous. The RPF's economy will be under severe recession by the drop of around 30%. A similar effect will occur to both agricultural and food manufacturing sector too. Their economies will fall around 20% and 33% respectively. All household deciles will be badly affected with around 20% to 27% of the shrinkage of their income. The tax and

government budget will be reduced by 10%. GDP growth will be minus 17% at the same time that a deflation of around 17% will affect in the Thai economy.

The results of scenario 14, production cost of sector 1: agricultural and sector 3: food manufacturing increase by 10% and increased Government funding by 7.89% will be presented in the following table.

Table 5.14: Scenario 14: Production cost of sector 1 (agriculture) and sector 3 (food manufacture) increase by 10% and government funding increases by 7.89%

Sector	Results
Sector 1: Agriculture	-20.41
Sector 2: Mining and quarrying	-20.89
Sector 3: Food manufacturing	-33.23
Sector 4: Textile industry	-38.56
Sector 5: Saw mills and food products	-29.07
Sector 6: Paper industries and printing	-19.86
Sector 7: Rubber, chem & petroleum indust	-16.92
Sector 8: Non-metallic products	-18.22
Sector 9: Metal, metal prod & indust	-33.06
Sector 10: Other manufacturing	-44.23
Sector 11: Public utilities	-20.43
Sec 12: Construction+ Sec16: Others	-77.07
Sector 13: Trade	-39.30
Sector 14: Transport and communication	-40.92
Sector 15: Services	-25.25
Sector 17: Royal Project Foundation	-27.79
m-sector 1: Importers of agriculture	-0.33
m-sector 2: Importers of mining	-5.32
m-sector 3: Importers of food manufact	-1.42
m-sector 4: Importers of textiles	-0.55
m-sector 5: Importers of wood products	-0.67
m-sector 6: Importers of paper	-0.76
m-sector 7: Importers of rubb, chem, petro	-0.81
m-sector 8: Importers of non-metalic prod	-1.09
m-sector 9: Importers of matalic products	-0.94
m-sector 10: Importers of other manufact	-0.61
m-sector 11: Importers of utilities	-0.33
m-sector 14: Importers of trans and telecom	0.00
m-sector 15: Importers of services	0.00
m-sector 16: Importers of others	-0.09
HH1: Poorest decile	-25.67
HH2: Second poorest decile	-26.01

Table 5.14: (Continued)

Sector	Results
HH3: Third poorest decile	-26.65
HH4: Fourth poorest decile	-26.49
HH5: Lowest middle decile	-26.16
HH6: Lower middle decile	-26.55
HH7: Higher middle decile	-25.64
HH8: Highest middle decile	-25.89
HH9: Second richest decile	-24.86
HH10: Richest decile	-20.90
ENT: Institutions	-14.38
GOV: Government	-10.16
MARGIN: Transaction costs	-39.80
TAX: Taxation	-10.16
GDP Growth	-17.07
Inflation	-16.91

Source: Simulation using KS-CGE model Type IV in Matlab.

These results show that the increasing government funding of 7.89% cannot help the Royal Project Foundation to restore its economy. The RPF will fall around 28% while the agricultural sector (sector 1) and food manufacturing sector (sector 3) will also fall around 20% and 33% respectively.

The results of scenario 15, production cost of sector 1 (agriculture) and sector 3 (food manufacturing) increase by 10% and find the government funding that would neutralize the negative impact will be presented in the following table.

Table 5.15: Production cost of sector 1 (agriculture) and sector 3 (food manufacture) increase by 10% and the study will find the government funding that would neutralize the negative impact

Sector	Results
Sector 1: Agriculture	-20.38
Sector 2: Mining and quarrying	-20.85
Sector 3: Food manufacturing	-33.17
Sector 4: Textile industry	-38.49
Sector 5: Saw mills and food products	-29.02
Sector 6: Paper industries and printing	-19.83
Sector 7: Rubber, chem & petroleum indust	-16.89
Sector 8: Non-metallic products	-18.18
Sector 9: Metal, metal prod & indust	-33.00

Table 5.15: (Continued)

Sector	Results
Sector 10: Other manufacturing	-44.15
Sector 11: Public utilities	-20.40
Sec 12: Construction+ Sec16: Others	-76.93
Sector 13: Trade	-39.21
Sector 14: Transport and communication	-40.84
Sector 15: Services	-25.20
Sector 17: Royal Project Foundation	0.00
m-sector 1: Importers of agriculture	-0.33
m-sector 2: Importers of mining	-5.31
m-sector 3: Importers of food manufact	-1.41
m-sector 4: Importers of textiles	-0.55
m-sector 5: Importers of wood products	-0.67
m-sector 6: Importers of paper	-0.76
m-sector 7: Importers of rubb, chem, petro	-0.81
m-sector 8: Importers of non-metalic prod	-1.08
m-sector 9: Importers of matalic products	-0.93
m-sector 10: Importers of other manufact	-0.61
m-sector 11: Importers of utilities	-0.33
m-sector 14: Importers of trans and telecom	0.00
m-sector 15: Importers of services	0.00
m-sector 16: Importers of others	-0.09
HH1: Poorest decile	-25.63
HH2: Second poorest decile	-25.96
HH3: Third poorest decile	-26.61
HH4: Fourth poorest decile	-26.45
HH5: Lowest middle decile	-26.11
HH6: Lower middle decile	-26.50
HH7: Higher middle decile	-25.59
HH8: Highest middle decile	-25.84
HH9: Second richest decile	-24.81
HH10: Richest decile	-20.86
ENT: Institutions	-14.35
GOV: Government	-10.13
MARGIN: Transaction costs	-39.71
TAX: Taxation	-10.13
GDP Growth	-17.04
Inflation	-16.91

Source: Simulation using KS-CGE model Type IV in Matlab.

The government needs to increase supporting fund to the Royal Project Foundation by 122.5% to neutralize the negative impact from the rising production cost of food manufacturing sector. It should be noticed that the increasing

government funding will help just for the RPF sector. Other sectors such as agriculture (sector 1) and food manufacturing (sector 3) will still be under recession due to their increasing prices.

5.5 Conclusions

This chapter used the Computable General Equilibrium model (CGE) to analyze the impact of the Royal Project Foundation (RPF) on the nationwide economy of Thailand. It used the national Social Accounting Matrix (SAM) of Thailand provided by NESDB in 2010 as the database.

Scenarios in this analysis included the expansionary government subsidy into the RPF sector, increase of the sales of RPF products to external markets, increase of sales to households, rising labor cost, and rising production costs, and the compensation from the government to neutralize the negative impacts caused by the rising labor cost.

The analysis yields the major conclusions:

1. An increasing of government funding to the RPF by 10% will boost the economy of RPF by 3.36%. The overall economy will grow around 0.004%.
2. Increasing exports of RPF products will lead to slower growth of the RPF than in the case of stable demand. This is because supply of the RPF products in domestic market will be reduced thus their prices will be increased and lead to less consumption.
3. Domestic sales are preferable to exports. This is because the supply of RPF products will still be in domestic market. Their prices will increase a little bit due to the demand-driven effect.
4. Increasing labor cost of 10% will reduce the economy of the RPF by 6.5%. The increase of the labor cost by 19.52% which reflects the Raising Income Policy of the government will drop the RPF's economy by 11.3%. In the latter case, the overall GDP growth will fall by around 6.5%.
5. The increasing government funding by 7.89% which reflects the realistic increasing funding in the following year cannot compensate the negative effect of the

increasing labor cost by 19.52% on the RPF. The sector will still drop by around 9%.

6. The sufficient increase of the government funding to the RPF is 37.80% in the case of increasing labor cost by 19.52%. It is equal to around THB143 million. This huge amount is because the rising labor cost affects not only the RPF but also all production sectors which in turns sell their products to the RPF as intermediate inputs.
7. Agricultural cost is very crucial to the RPF. Its effect is more severe than that of increasing labor cost. A 10% increase of the cost will lead to the fall of the RPF's economy by 20%. This huge amount is due to the fact that agricultural costs affect other production sectors and especially the living cost which in turn affect the labor cost.
8. The increasing of government funding by 7.89% apparently does not compensate for the increasing agricultural cost by 10%. The RPF will suffer from the recession of around 18%.
9. The Government needs to increase the funding to the RPF by 73% to neutralize the negative impact from the rising intermediate costs of agricultural sector by 10%. This is almost twice the funding that needed to mitigate the effect of the increasing labor cost.
10. The increasing cost in food manufacturing by 10% will shrink the economy of the RPF by 13.3%. The effect is slightly less than that of the increasing cost in agricultural sector but around twice the effect of the increasing labor cost.
11. The RPF will still suffer of adrop of its economy by around 11% after receiving the increasing government funding of 19.52%.
12. It needs an increase by around 45.5% of the government funding to neutralize the negative effect of the increasing cost in food manufacturing by 10%. This rate lies between the rates that are necessary for the compensation for the increasing labor cost and agricultural cost.
13 When both agricultural and food manufacturing costs rise by 10% at the same time, the RPF's economy will drop by around 30%. The effect is more server than in case of single rising in either agricultural cost or food manufacturing cost.

14. The rising government funding of 7.89% will not be able to compensate the negative effect of the increasing costs of both agriculture and food manufacturing by 10%. The foundation's economy will still fall by around 28%.
15. The amount of government funding must rise at least 1.23 times of the previous amount to neutralize the negative effect of the rising costs of both agriculture and food manufacturing by 10%.

In conclusion, the RPF relies heavily on increasing government funding. However, this funding seems not insufficient in many situations that negatively affect the economy of the RPF. The most severe case is the rising of both agricultural and food manufacturing costs. Between them, the rising of agricultural cost is much more severe than the rising of food manufacturing cost. The increasing labor cost is also critical to the economy of the RPF but its effect is less important than those of the increasing agricultural and food manufacturing costs. Therefore, the government should not only focus on direct assistance to the RPF by its expansionary funding but also the indirect support by monitoring and somehow controlling the costs in agricultural and food manufacturing sectors and labor cost to gradually increase them, rather than letting them increase sharply without any prior warning signal or even attempting to issue some policies to radically increase these costs.

5.6 Further studies

This study induces a number of further studies that might be conducted in the future. Some of them are listed below.

Study 1: The developed techniques can be applied to various innovative products especially agro-industrial products. For example, yogurt produced from buffalo milk and snacks produced from some Shiitake mushroom are new to the domestic market in Thailand.

Study 2: Apart of innovative agro-industrial products, the estimation of S-curve following the methods used in this study can be applied to the diffusion of other products such as subscribers of mobile phones and broad-band internet.

Study 3: The Social Accounting Matrix (SAM) and Computable General Equilibrium (CGE) analysis can be constructed and done for other foundations especially The Foundation of the Promotion of Supplementary Occupations and Related Techniques of Her Majesty Queen Sirikit of Thailand.

Study 4: The linkage between Feta cheese and the Thai economy via the contribution of the cheese product to the Royal Project Foundation's income. This is a potential study when the sales of the cheese rise significantly in the future. It should be noted that the CGE analysis is not sensitive to a small number of sales. Therefore, raising the final demand for the cheese when it is at the introduction stage of the product life cycle may not yield a clear impact of the product on the nationwide economy. However, when the sales are large enough, around more than THB10 million a year, then the CGE analysis may analyze the effect of the product on the Thai economy.

Study 5: The estimations of time-varying parameters in both of the Bass model and logistic function are big challenges. These studies will overcome the barrier of the assumption of constant parameter over time and reflect realities better than the time-invariant ones. The difficulties of the estimation of such the time-invariant parameters are challenging for forecasting with limited information.