Global Trade Analysis Project
https://www.gtap.agecon.purdue.edu/

This paper is from the
GTAP Annual Conference on Global Economic Analysis
https://www.gtap.agecon.purdue.edu/events/conferences/default.asp

Agricultural and Macroeconomic Impact of Rising Imported Grain Prices on Taiwan

Hsing-Chun Lin[*]

Associate Professor, Department of Applied Economics, National Chiayi University,
E-mail address: hclin@mail.ncyu.edu.tw

Duu-Hwa Lee

Assistant Professor, Department of Applied Economics at National Ocean University,
E-mail: au4218@email.au.edu.tw

Sheng-Ming Hsu

Ph. D. Student, Department of Agricultural Economics, National Taiwan University,
E-mail address: d97627003@ntu.edu.tw

Li-Chen Chou

Ph. D. Student, Department of Economics, National Chengchi University,
E-mail address: S0951347@mail.ncyu.edu.tw

Ching-Cheng Chang

Research Fellow, Institute of Economics, Academia Sinica, and Professor, Department
of Agricultural Economics, National Taiwan University,
Email: emily@econ.sinica.edu.tw

Shih-Shun Hsu

Professor, Department of Agricultural Economics, National Taiwan University,
E-mail address: m577@ntu.edu.tw

[*] Corresponding author.   Associate Professor, Department of Applied Economics, National Chiayi University. 580 Sinmin Road, Chiayi, 600, Taiwan. E-mail: hclin@mail.ncyu.edu.tw.
Tel: 886-5-2732858. Fax: 886-5-2732853. Residual errors are ours alone.

ABSTRACT

During the recent hike of oil price, we saw the OPEC oil price reached USD $130 per barrel by the end of July 2008. Developed countries dramatically increased the bio-fuel production to reduce the reliance on the oil import. With the recent shortage of crop harvests, the demands for corn, sugarcane, and rape spiked. The rising international shipping costs also drove the commodity prices higher. The grain prices are the greatest concerns of Taiwanese residents. For example, the prices of wheat in 2007; and the corn and soybean in 2008 reached their highest in the last decade. The hiking prices seriously impacted the Taiwanese farming industry as well as its consumer prices as both of them are highly dependent of the imported foods and crops. Using Input-Output Model and Computable General Equilibrium Model, this study estimates the impacts of imported grain prices on Taiwanese Macroeconomics and consumer price index. Assuming the food prices are fully transferable, the Input-Output Model shows the import prices of corn, soybean and wheat increased 30%, 1% and 40% under scenario one (the growth rate of 2004-2007 as the base year); 75%、60%、35% under scenario two (the growth rate of 2004-2008 as the base year); 85%、75%、65% under scenario price three (the growth rate of 2004-2017 as the base year). The impacts of corn price on consumer prices and weighted average domestic prices are higher than those of soybean and wheat prices. Computable General Equilibrium Model shows the same results that the impact of corn's prices is higher than those of soybean and wheat, but the ratio is smaller than the result using the Input-Output analysis. That's due to the adjustment of demand-supply side, therefore potion of the impacts absorbed by producer in weighted average consumer price index.

Keywords：Imported Grain Prices, Input-Output Model, Computable General Equilibrium Model, Price

I.   Introduction

The main impact imported grain prices is the flowing international grain price, and there are several reasons volatility international grain price in resent years, first of all, the demand increasing but poor harvest leading to decreasing produce and reserves of the whole world, and then the supple is limited. For example, resulted with high temperatures and drought which cut production to climate in Australia, Canada, Argentina, Europe and other major producing, dairy prices hit successive record highs (Wen, 2006). According to the latest data of food balance sheet (2008) in council of agriculture (COA), the degree of food self-sufficiency in Taiwan(32.7% in 2008) is low than Japan (40% in 2005) for 7.3%. While the degree of grain self-sufficiency is 21.7%, 78% of grain must depend on import in Taiwan. Thus, the price rising in imported grain will bring the price of domestic bulk commodity up.

Secondly, the developed economic countries like the United States and the European Union, for environment protested and concerned less dependent on petroleum, they try to increase using the bio-energy, shaping demand of corn, sugar cane, rape. Plenty of farms to cultivate corn instead of producing wheat and soybeans, resulted that insufficient supply of livestock and poultry feed. According to estimate of the Earth Policy Institute, now 116 corn-based ethanol refineries in the United States available, 80 under construction, 11 under extension, and 200 listed in the plan to build. Those refineries corn harvest can be put into production in September 2008. Agricultural economics experts from University of Illinois pointed out that the United States in 2007, approximately 11% (2.15 billion Poole) is used to put into the production of ethanol, 27% of the corn into ethanol production in 2008, and 17% of soybeans used to produce biomass diesel fuel. According to the COA website published by the import and export customs of agricultural statistics, the corn in September 2006 be maintained at below 150 dollars per ton (CIF), and up by more than 45% to 220 dollars per ton within a year.

The third factor increasing international grain price is rise the price of international freight, resulting huge upward transportation cost and the price of import grain in Taiwan. From the latter of 2004 the international freight began at a rally, in October 2004 freight from the U.S. Gulf to East Asia is about 57 dollars per ton and in the end of 2004 up to 73dollars per ton, stabilized around at 60 dollars per ton in 2005, after nearly a year fluctuates between 35-40 dollars per ton. However, since August 2006, the international freight started to rise, until July-August 2007 more than 90

dollars per ton, up within a year more than doubled. Due to international shipping is higher than the rise of grain price increases, it also led to freight in the grain trade in the rising proportion of the freight for the price impact is also becoming increasingly prominent.

Since these grains (including corn, soybeans, wheat) in international prices increasing, would impact that highly dependent on imports of these raw materials such as, Taiwan's domestic consumer prices, consumer prices and livestock, edible oils & fats by-product and the flour industry, further more on downstream industries. Therefore, we try to through Input-Output (I-O) Model and Computable General Equilibrium (CGE) Model to explore, in which I-O model analysis partial equilibrium and in short-term, estimated the direct and indirect effects of changes in import prices on domestic prices. CGE model analysis general equilibrium and in long-term, it is estimated the influence in changing import price to domestic price and other macroeconomic variables.

Thus, by collected data on prices of imported grain projections, respectively, associated with I-O model and CGE model to estimate cereal import prices changing, the effect on livelihood and Taiwan's macroeconomic, associated with agriculture and upstream and downstream industries is main point to approach the resulted way of Taiwan. The different of two approaches is I-O model not allow instead of within factors or produces, also not existing the rule of supply-demand and price regulating. The assumptions: the relationship of input-output is constant and price of commodities can transfer from upstream to downstream. The CGE model is a function of supply-demand with flexible, allowing the existence of alternative relationships, and must take into account demand-side response and resources for the adjustment of supply and demand effects, so for the range of impact to commodities price would be more relaxed.

This study is divided into six parts, the first is introduction. Secondly we examine the international grain prices and changing imported grain price of Taiwan in recent years. Thirdly we briefly discuss some literature review to explore the analysis of fluctuations in grain prices and prices of agricultural products subject to a different estimation methods and models. Section fourth using of I-O model estimates the price effect on Taiwan by changing imported grain price. In section fifth, using CGE model to estimate the effect on Taiwan macroeconomic and price level by changing imported grain price including model and data introduce, we estimate the shock on macroeconomic and industry level. In the last we conclude and recommend.

Ⅱ. Fluctuation in Price of Imported Grain in Recent Years

2.1 Fluctuation in Price of International Grain

Wheat, soybeans and corn are the most frequent three international trades of agricultural products. The major wheat producing countries including the Soviet Union, the United States, India, France, Germany, China, Canada, and Australia and so on. Before disintegrated, Soviet Union was the world's largest wheat producer, and then China became the first. Productions from U.S. were relatively stable and keep in the third place, but it is the world's largest exporting country. Exports accounted for about two-thirds annual production, Canada was the second-largest exporter. The main use of wheat, mostly from the food manufacturing, in comparison to other crops, wheat make to animal feed is not much. Since most of wheat as food ingredients, demand-side conditions relative to the supply-side is more stable and positive relationship with the personal income scenario. The major importing countries of wheat are Japan, India, China, Eastern Europe, and Australia, when these countries enhance national income or crop failure, wheat will be a large number of needs. In recent years, due to unusual weather led to a shortage of wheat, resulting in international wheat market price of the highest in nearly 10 years, world wheat stocks fell to its lowest in 25 years.

The U. S. is the world's largest country of soybean production, more than half of global production, producing area mainly concentrated in the southern Great Lakes, therefore high degree of concern about climatic conditions there to obtain soybean futures. Brazil, China and Argentina are also major soybean producers excluded the U.S. soybean production of China is self-sufficiency, thus a major exporter of soybeans are in the United States, Brazil and Argentina.

Corn is one of the most widely distributed crops, the largest corn acreage is in North America, and then secondly is Asia, Africa and Latin America, corn is the third most important food crop of the planting area and output. The U. S. is the largest producer and exporter. Nearly 65% of the corn was used as feed, which is the important basis for developing animal husbandry. Corn is one of the most important food in the world, especially in Africa, Latin America and so on, now about one-third of people in the world as the main food.

High oil prices and bio-fuels favored in recent years, many countries have begun

to construct fuel ethanol plant of the corn to produce, which is the direct cause of rising corn prices. Due to rising international crude oil prices, the U. S. encourages the use of bio-fuels from the policy side. In January 2007 the U. S. President had announced their support for the production of the automotive industry can use the flex-fuel vehicles, but also you can use pure gasoline or gasoline containing ethanol mixture, the federal government intends to decrease 10% gasoline consumption in 10 years. The development of biomass energy, at present still corn-based ethanol, making the U.S. demand for corn increased significantly.

The U. S. related businesses have been analyzed (Huang, 2007), as long as the international crude oil prices above 55 dollars per barrel, corn ethanol fuel produce would on the economic principle. In the case of crude oil continued to mine the underground oil reserves would reduce not increase, the OPEC can not be substantial increase and international crude oil prices is remain at or above 60 dollars per barrel. Thus, in the future, under the trend of high oil prices, corn and soybeans will maintain a high price trend.

According to the observation of Food and Agriculture Policy Research Center (FAPRI) (see Table 1) the U.S. wheat export prices (FOB) from 122 U.S. dollars in 2000 up to 314 dollars per metric ton (or 158%) in 2007, in the same period, Canada and Australia, a little rise about 125% and 96%, while Europe rise as high as 192%. International wheat prices hit a new record high in 2007, mainly because the demand for growth in emerging economies and the main producing area (Australia, Canada, etc.) of the climate anomalies in the past two years, resulting in a substantial decrease in production.

Second, Table 1 shows that soybean prices have been effect by the development of biomass energy ripple, 175 dollars per metric ton in 2000 up to 390 dollars in 2007, increasing nearly 123%, but ease and gradually decreased thereafter. The FAPRI observed corn prices go up until 2008, and then gradually falls down. The demand of international demand led the corn's price from 89 dollars per metric ton climbing to 198 dollars, up to twice, but after 2008 gradually decreased.

Overall, the international cereal prices had occurred a huge rise in volatility in 2003, and then place on the restoration of original price, but in the second half of 2005 started to rise. Compared to wheat, corn and soybeans in the year of 2006-2007 and 2004-2005, corn rise hugest among the three, more than 50%, followed by wheat, with an average rise of 20% as above, soybeans rise above 10%.

2.2 The Volatility of Taiwan＇s Imported Grain Price

Figure 1 shows the effect on volatility of imported grain price. Taiwan depends on imported grain, and imported price effected on volatility of international grain price, besides is international sea freight. In general, the demand for grain is stable in the international market; the main factor effect on volatility of international grain price is supply-side, in particular for main grain producer such as: the U. S., Brazil, Argentina, China, and so on.

Secondly, the volatility of international sea freight is associated affect on Taiwan's import grain prices. According to the forecasts of Drewry Shipping Consultants, the gross-Pacific container traffic routes accounted for 54.6% of the three major routes, showing the gross-Pacific route for the main focal point of world trade. The main trade in Taiwan is export, shipping to the U. S. and Europe are 80% loading rate, but only 50% loading rate return to Taiwan, the freight space of the lower prices significantly. Coupled with forward goods are mostly manufactured goods and semi-finished goods, while the return trip was a lower freight of raw materials, in order to solve the lower return empty cabinet, allowing the return of the freight has been greatly affected.

According to this study, contact the company of several maritime customs information obtained, although the bulk shipping freight continued soared high in recent years, but it is estimated that 70% of Taiwan's imports on grains have been used container transportation, on one hand the mobility of container freight is large, on the other hand is relatively low cost than bulk vessels, for the mainly reason is improve the inadequate volume of U.S. imports-line issues, and make the route two-way cargo tending to balanced, so the return freight costs are still relatively low, in order to reduce return the proportion of empty cabinets. Coupled with container transportation of grain from port to processing plants on the domestic policy is freeze on oil prices. Therefore, the domestic prices of imported grain imports are mainly effect on the international grain market; with increases of freight relationship is not significant.

Table 2 shows the customs data on the volatility of Taiwan's imported price. On average, the import price of corn in 2007 than in 2005 rose about 50%, wheat rose nearly 42%, and soybeans rose about 20%, these gains shown in Table 1 with the international trend is very consistent, and also confirmed that so far to the end of 2008,

the rising international freight rates for domestic bulk grain has not the impact on import prices. In recent years, the volume of soybean Taiwan imported is more than 95% from the U.S., and the volume of imports is rising up since March 2008, due to resolution of the Fair Trade Commission on March 13, 2008, allowing the TTET Union Corporation, Uni-President Enterprises, Great Wall Enterprise and Taiwan oil industry joint procurement contract on the importation of soybeans shipping vessel, as soybean import price changes, since the price increase huge in 2007 and 2008, during 10 years (1996 to 2007) the highest price in 2004 prices of imports 11.58 NT dollars/kg, compared to2004- 2007, soybean prices are up just 0.4%, but in 2008 is 18.10 NT dollars/kg, therefore, from 2004 to 2008 soybean import price growth reached 56.3%. As for the volatility of corn and wheat import price, although in 2004 the price is still higher than between 1996 and 2006 the highest price, but for 2007 and 2008 import prices rose even more, therefore, from 2004 to 2007, import prices of corn and wheat to grow 26.2 % and 37.5%, respectively, from 2004 to 2008 growth of 71.8% and 32.4%.

III. Literature

In recent years, most literature use time series analysis to explore the issue of grain price fluctuations. For example Light and Shevlin (1998) addressed the impacts when U.S. grain prices rise on the domestic in 1996. They show that the food price inflation is greater than core inflation during 1996-1997, but not easy to assess the cereals demand for exports and the food productions in domestic. In the other way, they found the data indicates a steady growth in grain prices during the 1960s to the 1990s. Compared with the past price fluctuation, the impact of price is lower than other years in 1996, this phenomenon indicates that the agricultural productions have sufficient information in response to price fluctuation.

Pauw *et al.* (2007) explored the influence of consumer demand of low-income consumers in South-Africa by grain price volatility. This study suggested the agricultural price policy should be toward lower prices with upgrading product technical and efficient to increase the competitions of commodities in the future, thereby improve the development of overall economy, environment and agriculture.

More and more cross-price analysis appears in literature with the development of agricultural trade liberalization. For instance: Ghoshray (2007) used Granger casual analysis to test the relation of wheat price between U.S and Canada by the database from July 1991 to June 2005 monthly export price. Empirical results support that the

price have long-term correlation between two countries, the wheat price adjusted due to the price change in Canada. There is also a significant affection by difference wheat quality which resulted from Canada abolished the Western Canadian Grain Transportation Act.

In addition, there are some researches confer the agricultural price impact in macroeconomic with Input-Output model or Computational General Equilibrium model. Hansen *et al.* (1993) tried to explain the international oil price fluctuations on the U.S. agricultural price shocks. First, in order to estimate the impact of macroeconomic, they set up an I-O model which includes energy inputs of agricultural and other industries and its direct and indirect costs. Second, discuss three kinds of scenarios (the World Trade price-fixing; the inflow of foreign funds; fixed and floating exchange rate system) by CGE model.

Empirical analysis found a high intensity of energy usage in U.S because the mainly agricultural production by the large-scale mechanized farming. The study concluded the same results with I-O model and CGE model when the rise in oil prices caused a significant impact on agriculture.

This study also indicated that a decrease in production will not bring revenues larger than costs. But the formation of shrinking demand due to high prices will be adjusted through a floating exchange rate system, and then raise the incomes of farmers. The policy in response to high oil prices on the trade policy should be more important than the agricultural subsidies, farmers profits will increase due to currency devaluation. If the Government adopt a protectionist policy on agricultural exports and rural incomes will cause harm.

In the reference about CGE model, Arndt et al. (2008) set international crude oil prices and grain prices as a negative impact on trade and using CGE model to estimate. They found that improvement of agricultural productivity can ensure that domestic does not has the impact of high grain prices and oil prices.

In Taiwan, labor cost in agriculture is high but the dependence of energy is relatively small. Therefore, this article will use I-O model and CGE model to conduct empirical analysis. The impacts of import oil price for domestic agricultural output price is smaller than industrial, electricity, transportation and so on, but still has a direct impact on fertilizer and feed costs. The agriculture and related industries would be affected when the price of import grains rises.

IV. Input-Output Analysis

4.1 Input-Output Model

According to Miller and Blair (1985), I-O model can divide into demand side and cost side. Cost side I-O model can calculate the impact effect of output prices through Input-Output Table. This model usually applied to interpret the industry which has higher forward linkage. For example petroleum refinery products, electricity, water and so on. The outputs of these industries are usually in the middle materials or labors input. The output will derive higher price when the cost increases.

Cost side IO model includes two assumptions: there is no substitution between producer and purchaser; the firms can adjust the output price by the ratio of input usage. The latter one indicates producer can implement fully transfer price strategy. Therefore, the price effect may over-estimate.

According to the relationship between inputs and outputs of industries, aggregate revenue equals to input cost. Input cost involves primary and intermediate inputs. We can represent the relevance of total revenue and input cost as:

$$p_j \times q_j = w_{1j} \times p_1 + w_{2j} \times p_2 + \cdots + w_{nj} \times p_n + v_j \tag{1}$$

$p_j \times q_j$ is j-th total revenue; p_j and q_j mean output price and quantity.

$w_{ij} \left(i = 1, \cdots, n \right)$ mean the quantities of intermediate input and v_j is primary input. When equation (1) is divided by q_j, sector price is decided by input price and input coefficient:

$$p_j = \frac{w_{1j}}{q_j} \times p_1 + \frac{w_{2j}}{q_j} \times p_2 + \cdots + \frac{w_{nj}}{q_j} \times p_n + \frac{v_j}{q_j} \tag{2}$$

$$p_j = a_{1j} \times p_1 + a_{2j} \times p_2 + \cdots + a_{nj} \times p_n + \overline{y}_j \tag{3}$$

In equation (3) $a_{ij} = \frac{w_{ij}}{q_j} (i = 1, \cdots, n)$ is input coefficient. $\overline{y}_j = \frac{v_j}{q_j}$ mean the ratio of primary input. We can use matrix to transfer equation (3) to price vector:

$$P = (I - A')^{-1} \bar{Y} \tag{4}$$

A is input coefficient matrix, assume A is fixed then we can derive the change of price:

$$\Delta P = (I - A')^{-1} \cdot \Delta \bar{Y} \tag{5}$$

We can separate cost side I-O model into import price model and domestic output price model. Import price model can explain the effect of domestic goods price when import price increases. Because Taiwan Input-Output Table contains domestic goods and import goods, we can solve input coefficient domestic input coefficient and import input coefficient:

$$a_{ij} = d_{ij} + m_{ij} \tag{6}$$

d_{ij} is input coefficient of domestic goods, and m_{ij} is input coefficient of import

coefficient. Therefore price effect can represent by the price of domestic and import goods:

$$P^d = D' \cdot P^d + M \cdot P^m + \bar{Y} \tag{7}$$

P^d is vector price of domestic goods; P^m is vector price of import goods. D' is the transpose input coefficient matrix of domestic and M' is the input coefficient matrix of import. We can also calculate the vector price of domestic goods: .

$$P^d = (I - D')^{-1} \cdot (M' \cdot P^m + \bar{Y}) \tag{8}$$

Assume the ratio of primary input unchanged, i.e., $\Delta \bar{Y} = 0$. We can find the impact when import price changes on domestic output price. This impact can indicate as follows:

$$\Delta P^d = (I - D')^{-1} \cdot M' \cdot \Delta P^m \tag{9}$$

4.2 Data Resource

In this paper, using I-O Model to analyzing associated with the import grain price and the cost behind in other industries. First of all, according to I-O model establishment of the General of Budget, Accounting and Statistics (DGBAS), executive Yuan, R.O.C. 2001 Input Output Tables (see Table 4), in the initial agricultural sector (cereals crops, pigs and other livestock) as well as among the intermediate inputs in secondary agro-processing sector (edible oils and fats and byproduct, flour, fodder, other food

products), annual cereal is NT$ 43.8 billion in total expenditures. Among these feed grains sector for the maximum expenditures is 17.5 billion, while edible oils and fats and byproduct sector as a second for 14 billion.

Secondly, Table 4 shows that grain milling sector is the greatest demand in the middle of the seven crops, these are accounted for 62% for the proportion of intermediate inputs, total input (or GDP) accounting for 50%, in other words, output of flour for each 1 NT dollar which grain spending about 50%. The seven crops accounted for edible oils and fats and by-product of the proportion of intermediate inputs sector for about 60%, accounted 50% for total input in the sector. Feed sector accounted for more than 30% in the middle of the proportion of demand, and the proportion of total input is 30%.

This study evaluates the impact of macroeconomic and price level with 2004 Taiwan Input Output Table developed by DGBAS. Because 2004 Taiwan I-O Table is an extensive table, some cereal crops like corn combine with other sector. Therefore we need to redistribute the products of cereal crops. We divide the cereal crops into wheat, sweet potato, corn, soybeans, groundnuts, other coarse grains crops and coarse grains crop byproduct. Table 5 shows the comparison of sectors.

This study estimates the domestic outputs by sharing the demand of new sectors in horizontal then we distinguish the structure of input cost. We use the absolute number of 2004 Taiwan I-O Table as control variable and recalculate the imports and exports of new sectors in customs statistics.

4.3 Simulation Results

Base on 2004 Taiwan I-O Table, we set three scenarios. Compare with 2007 price level in Taiwan, scenario 1 sets the price of corn imports, soybean and wheat rise 30%, 1% and 40% separately. In scenario 2 we analyze the difference between 2004 and 2008 imported grain price and set the price of corn imports, soybean and wheat rise 75%, 60% and 35%. Finally we set the price of corn imports, soybean and wheat rise 85%, 75% and 65% in scenario 3 according to the prediction of FARRI. Table 3 shows all three kinds of contextual setting and definition.

Table6 indicates the price effects of these scenarios. Table6 shows the impact effect on the weighted average domestic sales prices and consumer prices by imported grain prices. These impacts include direct and indirect effect. Indirect effect represents

the cross effects between weighted average domestic sales and consumer price level after the change of grain price.

Compare with three imported grain under the assumption of scenario 1, the impact of consumer price of corn is larger than wheat and soybean, even though the change of price in corn is smaller than wheat (because the industrial coefficient of corn is larger than others). Estimation indicates the highest domestic sales were 0.0629% and consumer price rises 0.0795%.

Observe these scenarios, the estimation of scenario 1 indicates the weighted average domestic sales prices will rise 0.0284%, 0.0248% and 0.0461% and consumer prices rise 0.0449%, 0.0393% and 0.0730% when the price of wheat increases 40%, 35% and 65%. The weighted average domestic sales prices will rise 0.0629%, 0.1572% and 0.1782% and consumer prices rise 0.0166%, 0.0415% and 0.0470% when the price of corn increases 30%, 75% and 85%. The main factor of these impacts is that the price increase of corn will change slaughtering and food sector through feed sector.

In scenario 2 we find when the price of imported soybean rises 60%, the weighted average domestic sales prices will rise 0.1158% and consumer price will increase 0.1578%. The change of price in corn is smaller than soybean but the impact of consumer price of corn is larger than soybean.

Table 6 also shows that the indirect effect is larger than direct effect due to the household in Taiwan consume wheat indirectly by flour oatmeal. When the price of imported wheat rises 40%, 35% and 65% separately, domestic products price increases 0.0284%, 0.0248% and 0.0461%. Indirect effect of consumer price increases 0.0449%, 0.0393% and 0.0730%. These impacts usually bear by downstream industries.

The indirect effect of domestic sales will increase 0.0433%, 0.1081% and 0.1226% when imported corn price rises 30%, 75% and 85%, the main result affects downstream industry like feed. The indirect effect of consumer price will rise 0.0644%, 0.1610% and 0.1824% separately, the main impact comes from feed due to the ratio of consumer behavior in Taiwan is higher in food industry. Therefore we find a high indirect effect.

The indirect effect of domestic sales will increase 0.0792% and 0.1524% when

imported soybean price rises 60% in scenario 2, the main result affects downstream industry like edible oil & fat by-products sector. In the other way, the impact of consumer price may comes from edible oil & fat by-products sector affects slaughtering sector indirectly.

Table 7-1, Table7-2 and Table7-3 indicates the output price effects of downstream when all kinds of imported grain price rise. Because I-O model can add, for example, in Table 7-2 we can observe feed price is the largest impact (20.82%) when corn price increases 75%. Hogs price effect is the second one, the price of other livestock product rises 5.95%, slaughtering and meat-product price rises 5.7%. In the other hand, the price effect of edible oil & fat by-product sector is the largest (33.06%) when the price of imported soybean rises 60%. The price effect of flour sector is the largest (16.48%) when the price of imported wheat rises 35%. Above description indicates the grain is the main product factor in these sectors. In addition, the price of imported grain also affects some products price in food processing sector like canned, frozen foods and baked foods.

V. Computable General Equilibrium Analysis

Input-Output model is a kind of partial equilibrium analysis, it could through correlation coefficient of the industries, calculated rise in grain prices of imports effects using of the intermediate elements of cost increases, but not reflecting the needs of the middle elements or substitution on consumers' demand for final products, while the impact of rising prices for consumer's demand cannot be fully passed on the effects, these cannot be reflected in the I-O model, and no way to calculate the effect on GDP growth rate, or for is private consumption and investment, therefore, must rely on general equilibrium analysis. This paper is assumed the several possible scenarios for the price variation on Taiwan's grain imports, using the 2004 edition of Taiwan's Computable General Equilibrium Model (TAIGEM) to analyze the impact on import of grain price increases for Taiwan in general prices, economic growth, import and export, employment and industrial level.

5.1 Model and Data

The general equilibrium analysis is conducted by using a multi-sectoral, single region, computable general equilibrium model of Taiwan's economy (hereafter TAIGEM) derived from the Australian ORANI model (Dixon et al, 1982). TAIGEM distinguishes 167 sectors and 167 commodities. The model database is compiled from

the 161-sector Use Table of the 2004 Taiwan's Input-Output tables.

To evaluate the environmental policy, TAIGEM is extended to "TAIGEM-E" to include energy substitution and electricity generation technology bundle mechanisms. The basic model concept follows the traditional neo-classical school assumptions. It uses a full simultaneous equation system to describe the macro and industrial economy. Representative households are assumed to maximize utility under budget constraints. Firms maximize profit and, subject to production possibility function, decide what kind of commodities they want to produce. When the economy reached its demand-supply equilibrium, the market would clear. To simplify the complexity associated with nonlinear models, Johansen (1960)'s method is adopted to transform nonlinear level equations to linear percentage change form. A detailed description is available in Dixon et al (1982), Parmenter (1995) and Dixon and Rimmer (2002).

Like the ORANI model, the supply structure of TAIGEM-E allows for each industry to produce a mixture of all the commodities, using domestic and imported commodities, labor of several types, land, capital, energy of several types and other costs as inputs. Moreover, the conversion of undifferentiated commodities into goods destined for export and those for local use is governed by a constant elasticity of transformation (CET) functional form. It all depends on the related price and elasticity of transformation. The multi-input, multi-output production specification is kept manageable by a series of weakly separability assumptions, as illustrated by the nested structure shown in Fig. 2.

The input demand of industry production is formulated by a five-level nested structure, and the production decision-making of each level is independent. Assuming cost minimization and technology constraint at each level of production, producers will make optimal input demand decisions. At the top level, commodity composites and a primary-factor composite are combined using a Leontief production function. Consequently, their demand is in direct proportion to the industry activity. At the second level, each commodity composite has a constant elasticity of substitution (CES) functional form of domestic goods and the imported equivalent under the Armington assumption[1]. Energy and primary-factor composites are also a CES aggregation of energy composites and primary-factor composites.

At the third level, the primary-factor composite is a CES aggregation of labor, land, and capital, while the energy composite is a CES aggregation of coal products, oil products, natural gas products, and electricity. At the fourth level, the labor

---

[1] Armington's assumption implies imperfect substitution between domestic production and imports of the same commodity Armington (1969).

composite is a CES aggregation of managers, professional specialists, white collar, technical, workers, and unskilled workers; while the coal products composite is a CES aggregation of coal and coal products; oil products is a CES aggregation of gasoline, diesel oil, fuel oil, and kerosene; the natural gas products is a CES aggregation of refinery gas, gas, and natural gas. At the bottom level the energy composite is a CES aggregation of domestic and imported goods.

There are many types of energy models and they can be classified into two types: top-down and bottom-up models. Top-down models are excellent in capturing interactions with other sectors of the economy, but bottom-up models achieve much realism in modeling the alternatives in energy production technology. Initially, TAIGEM-E is a top-down model, but later incorporates the "technology bundle" approach into the power sector2 and becomes a hybrid top-down and bottom-up model. The technology bundle approach allows the power generating sector to substitute different technologies in response to changes in their relative prices/costs. By modeling energy-intensive industries as such, TAIGEM-E restricts the substitution to known technologies, thereby preventing technically infeasible combinations of inputs being chosen as model solutions. While retaining the extensive interaction with other sectors through the top-down settings, TAIGEM-E moves further toward the more realistic representation of the overall economy.

The technology bundle approach is illustrated in Fig. 2 where ten known technologies are used to generate electricity, namely hydro, stream turbine-oil, stream turbine-coal, stream turbine-gas, combined cycle-oil, combined cycle-gas, gas turbine-oil, gas turbine-gas, diesel, and nuclear. All electricity generated from these technologies is transferred to the end-use electricity sector. The output of the electricity sector is a constant ratio of elasticity of substitution, homothetic (CRESH) aggregate of each technology, and this aggregation method requires fixed proportions of intermediate inputs, with the exception of energy inputs and primary factors.

Finally, the simulations are conducted by using the GEMPACK software. The results are separated into macroeconomic and sector-specific results.

5.2 Simulation Results

I-O table of Taiwan is based on the TAIGEM is made by DGBAS in 2004, and subdivide other common crops (002) sector to several parts, total is 167 sectors. Parameter value and flexibility values (such as the elasticity of substitution, income elasticity) in model are from I-O model and other industries related research reports,

---

[2] The technology bundle approach is derived from the MEGABARE model (ABARE, 1996).

and according to the specific structure of CGE model database to fixe and integration.

According to table 2, we set scenario 1 which 2007 domestic imported grain compared to 2004, imported corn, soybeans, wheat prices rise up 30%, 1%, and 40%. In scenario 2, the 2008 domestic imported grain compared to 2004, imported corn, soybeans, wheat prices rise up 75%, 60%, and 35%.In scenario 3, FAPRI predicts 2017 international grain compared to 2004, imported corn, soybeans, and wheat price rise up 85%, 75%, and 65%. Imitate the effect on domestic industries and macro economy by three scenarios.

5.2.1 Macroeconomic Results

Table 8 shows the effect on macro economy by increasing imported grain price. Result shows that in scenario 1, corn price rise up 30% leading real GDP decrease 0.032%, soy bean price rise up 1% leading real GDP decrease 0.001%, if all of three prices increase, it makes real GDP decreasing 0.059%; in scenario 2, corn price rise up 75% leading real GDP decreasing 0.08%, wheat price rise up 35% leading real GDP decreasing 0.02%, if all of three prices increase, it makes real GDP decreasing 0.17%, in scenario 3, if all of three prices increasing, it makes real GDP decreasing 0.217%.

In employment, effect on economy turns weak and negative shark on output is less, and consider three imported grain price increasing, three scenarios will lead labor demand less by 0.103%, 0.3%, and 0.382% and the employment less by 11,344、 33,042 and 42,073 persons counted by Taiwan employment in Jan. 2010.

For the final demand, if consider three imported grain prices increasing at the same time, in three scenarios the investment decreases by 0.124%, 0.37%, and 0.464%. Export volume decreases 0.082%, 0.25%, and 0.316% by imported grain price rise up leading produce cost and output price raise up which leading export competitiveness decreasing. Export decreasing by 20%-70% on feed, flour, edible oils and fats by-product and other related industries, and import volume decreasing by 0.029%, 0.1% and 0.125%.

5.2.2 Price Results

Calculated CPI by domestic sales price weighted average in TAIGEM model. Domestic sales price is in the same way by I-O model which using value of each

domestic industry be weighed and then adding by each sector price, import and export prices by each sector input value and output value to be weighed and then counted. Otherwise, in CGE model the GDP price is counted by each sector of final demand in home consumers, government consumers, and investment.

In table 8 shows that the results of 3 scenarios, imported grain price rising up, CPI would rise up 0.125%-0.483% by industries cost transform and add the burden of consumers. The domestic sale price rises up 0.075%-0.302%, import and export price rise up 0.146%-0.579% and0.021% -0.081%, and GDP price rises up 0.017%-0.063%. In all, the imported grain price rising up to our economy is quite negative attack and pressure by inflation is starting showing up.

5.2.3 Sector-specific Results

From table 9 to table 13 show that the vary percentage of each sector in output, import, exports and employment. The sectors are choosing by middle and downstream relating with grain industries, the main sectors are agriculture and food manufacture etc.

In agriculture and food manufacture show that three grains price in the same scenario (scenario 1, 2, and 3), domestic industries in edible oil & fat by-products sector(-2.55％～-34.25％), flour sector(-11.89％～-21.02％), and feed(-6.66％～-23.95％)got much more attacks, particularly in imported wheat, corn and soybeans price increasing. Domestic fodder price is higher than foreign but the product cost is same, it means that domestic related fodder industries not have international competitive, so when the imported grain price increasing leading not only domestic output decreasing but also export, the decreasing vary is large than industries in other livestock sector(-3.03％～-91.58％),fish sector(-22.15％～-36.78％),and floor sector (-19.06％～-67.69％), in table 10. Table 11 shows that the imported proportion of fodder and flour industries rise up that flour sector (9.95%~62.08%) and feed sector (1.23%~27.45%).

Otherwise, table 12 shows employment rate decreasing by imported grain price rise up, in agriculture particularly in hogs(-2.14%~-8.38%), other livestock(-1.35%~-6.1%), employment decreasing in food manufacture focus on edible oil & fat by-products sector(-3.59％～-48.28％)、flour sector(-18.49％～-32.69％)、feed sector (-11.06％～-39.76％).

17

VI. Conclusion

In this article is collected prediction of the imported grain price, using the latest version of I-O model and CGE model, separating to 167 sectors, and then imitating the increasing of imported grain price effect on Taiwan's macro economy, consumer price, and each agric-industry production. Although the decreasing of imported grain price recently, the demand of grain will increase in the future, therefore, we also consider other international paper about prediction of imported grain price, like the FAPRI forecast source in 2009-2017, is imitated by scenario 3.

The result of I-O model appears that under the assumption in not concern the substituted effect within factors and products and price can perfectly transfer, 3 scenarios in this article sets, when the increase prices on imported wheat, corn, and soy bean at the same time will result rise domestic sales price up 0.093%-0.369% and consumer price rise up 0.127%-0.496%. Within three grains the effect on domestic price corn is much higher than wheat and soy bean. If consider the reaction of market demand and adjusting on sources demand-supply, parts of charge would be absorbed by producers, thus, we also using CGE model to estimate, the result appears that the domestic sales price rises up 0.075%-0.302% and consumer price rises up 0.125%-0.483%.

The main reason for the differences results with two models, I-O model is partial equipment model under assumption not concern the substitution effect between factors and produces and price can perfectly transfer. CGE model is complete general equipment assumption than the reaction on market demand and adjusts on resource demand-supply and partial price effect would absorb by producers instead of completely transfer, thus, when assumption of the variation on imported grain price is same, the domestic price effect in I-O model would stronger than CGE model. Therefore, in this article we using two models estimate and compare at the same time to react the adjust process in the actual short-term and long period, and in difference economic condition would effect on different domestic price.

Secondly, although I-O model cannot confer the effect on actual economic growth, but we can observe in CGE model, under the assumption fixed real wage but labor can shift within each sectors in mid and long term, in three scenarios we set in this article, three imported grain price increasing at the same time will cause real GDP less 0.059%-0.217%, employment less 0.103%-0.382%. Compared with the whole

industries, the effect from increasing imported grain price on agriculture is notable, especially in livestock sector. And it may possibility increase produce in domestic fodder sector such as corn and soybean sectors due to rising imported grain price, but in side of employment, the origin input structure in each sector is difference, the employment on fodder, edible oils and fats by-product, flour sectors would suffer much more attack. Therefore, if imported grain price keeps increasing, it must be raised up the burden on agriculture and livestock sectors, we suggest that the agricultural authorities should review the problem about produce and sale on grain in order to raise benefit on origin farmers.

Reference

Armington P.S., 1969. A Theory of Demand for Products Distinguished by Place of Production, IMF Staff Papers 16,159–178.

Arndt, C., R. Benfica, N. Maximiano, A .M. D. Nucifora, and J. T. Thurlow, 2008. "Higher Fuel and Food Prices: Impacts and Responses for Mozambique," *Agricultural Economics*, 39, 497-511.

Directorate-General of Budget Accounting and Statistics, 2007. "2004 Taiwan Input-Output Table" Taipei, Taiwan: Executive Yuan.

Dixon P.B. and M.T. Rimmer, 2002. *Dynamic General Equilibrium Modeling for Forecasting and Policy: a Practical Guide and Documentation of MONASH*, Amsterdam: North-Holland.

Dixon P.B., B.R. Parmenter, J. Sutton and D.P. Vincent, 1982. *ORANI: A MultisectoralModel of the Australian Economy*, Amsterdam: North-Holland.

Ghoshray, A., 2007. "An Examination of the Relationship Between U.S. and Canadian Durum Wheat Prices," *Canadian Journal of Agricultural Economics*, 55, 49-62.

Hanson, K., S. Robinson, and G. Schluter, 1993. "Sectoral Effects of a World Oil Price Shock：Economy-wide Linkages to the Agricultural Sector," *Journal of Agricultural and Resource Economics*, 18, 1, 96-116.

Huang, C. L., 2007. "The Impacts and Strategies of Livestock Products Marketing When Feed Price Changes," *Agricultural Policy and Environment 182*, 59-63.

Li, P. C., 2002. "The Economic Impacts of Increased Government Spending: A Comparison of Input-Output Model and Computable General Equilibrium Model," *Agriculture and Economics* 28, 71-95.

Light, J. and T. Shevlin, 1998. "The 1996 Grain Price Shock: How Did It Affect Food Inflation?" *Monthly Labor Review*, August.

Miller, R. E. and P. D. Blair, 1985. *Input-Output Analysis: Foundations and Extensions* , Prentice Hall, Englewood Cliffs, New Jersy.

Parmenter B.R., 1995. "Forecasting and Policy Analysis with the MONASH Model", Paper prepared for the International Symposium on Economic Modeling, Bologna, Italy.

Pauw, K, S. McDonald, and C. Punt, 2007. "Agricultural Efficiency and Welfare in South Africa," *Development Southern Africa*, 24, 2, 309-333.

Rose, A., 1995. "Input-Output Economics and Computable General Equilibrium Models," *Structural Change and Economic Dynamics*, 6, 295-304.

The International Food Policy Research Institute, 2008. "U.S. and Word Agricultural Outlook," from
http://www.fapri.iastate.edu/outlook2008/text/OutlookPub2008.pdf

United Stated Department of Agriculture, 2007. "World Agricultural Supply and Demand estimates," U.S   form
http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1194

United Stated Department of Agriculture, 2008. "USDA Agricultural Projections to 2016," U.S form
http://www.ers.usda.gov/Publications/OCE071/

Wen, Z. K., 2006. "The Record Highest Price of Wheat and the Related Impact," *Agricultural Policy and Environment* 171, 64-68.

Table 1　The Change of Major International Grain Price and the Prediction of FAPRI in 2000-2017

Unit: dollars；%

Year	Corn		Soybean		Wheat			
	U.S.FOB Gulf	CIF Rotterdam	Illinois Processor	CIF Rotterdam	U.S.FOB Gulf	Canadian Wheat Board	AWB Limited Export Quote	European Union Market
2000	89	110	175	200	122	132	155	109
2001	93	113	176	203	126	140	158	108
2002	105	125	217	267	158	158	185	102
2003	116	138	302	323	156	150	183	146
2004	98	123	220	277	150	148	174	137
2005	106	128	219	261	173	149	234	135
2006	159	181	235	288	208	185	225	185
2007	198	228	390	496	314	296	303	318
2008	195	232	395	506	251	263	253	270
2009	194	231	374	478	248	259	249	252*
2010	188	225	379	483	247	258	247	239
2011	191	227	375	478	250	260	250	236
2012	193	229	381	484	252	262	252	232
2013	196	233	384	487	257	265	256	230
2014	196	233	388	491	259	266	258	231
2015	197*	234*	388	490	261	267	260	232
2016	195	233	390*	492*	263	268	261	233
2017	195	232	387	487	264*	269*	262*	235
2001~2007 growth rate	112.90	101.77	121.59	144.33	149.21	111.43	91.77	194.44
2001~2008 growth rate	109.68	105.31	124.43	149.26	99.21	87.86	60.13	150.00
The highest predicted growth rate during 2004~ 2017	101.02	90.24	77.27	77.62	76.00	81.76	50.58	83.94
2004~2017 growth rate	98.98	88.62	75.91	75.81	76.00	81.76	50.57	71.53
2004~2017 average growth rate	93.80		75.86		69.96			
Scenario 3 condition	85		75		65			

Data resource: FAPRI (2009), Agricultural Outlook, pp.49.
Note: * represents the highest predicted price during 2009-2017.
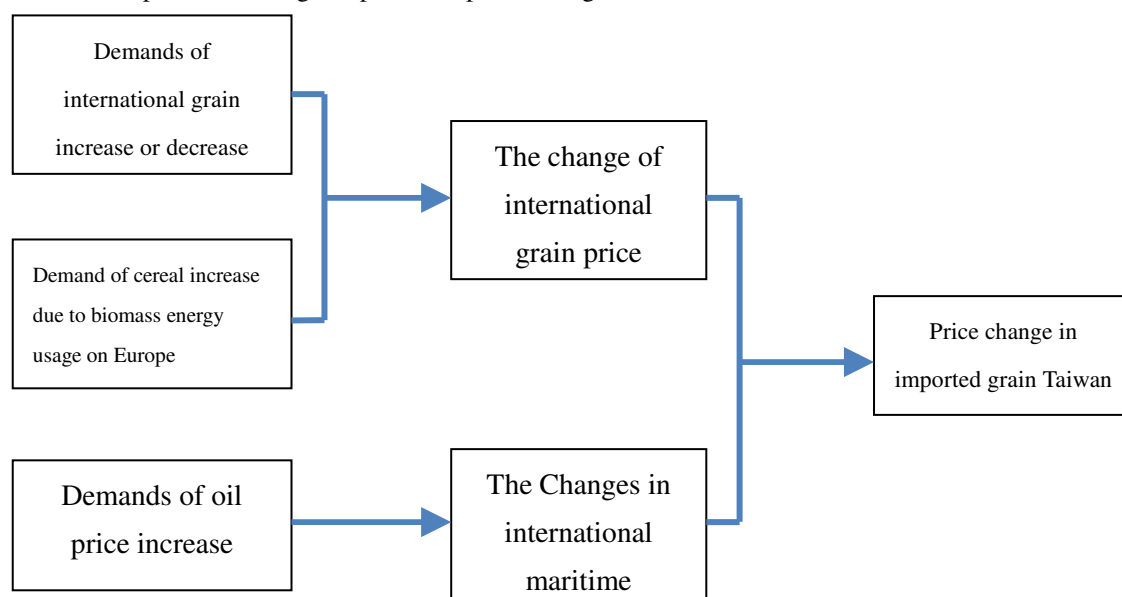
Figure 1　The Factors Affect the Price Change of Imported Grain

Table 2　Variation of Taiwan's Imported Grain Price in 1996-2007

Unit：NT$ dollar /kilogram；%

Year	Price			Yearly growing rate		
	corn	soybean	wheat	corn	soybean	wheat
1996	5.37	8.70	7.13			
1997	4.22	8.92	6.13	-21.4	2.5	-14.0
1998	4.47	9.13	6.42	5.9	2.4	4.7
1999	3.60	7.14	5.54	-19.5	-21.8	-13.7
2000	3.58	6.76	5.28	-0.6	-5.3	-4.7
2001	3.83	6.97	5.78	7.0	3.1	9.5
2002	4.06	7.33	5.92	6.0	5.2	2.4
2003	4.64	9.30	6.32	14.3	26.9	6.8
2004	**5.64**	**11.58**	**7.13**	**21.6**	**24.5**	**12.8**
2005	4.68	9.31	6.90	-17.0	-19.6	-3.2
2006	4.87	8.68	7.45	4.1	-6.8	8.0
2007	**7.12**	**11.62**	**9.80**	**46.2**	**33.9**	**31.6**
2008	**9.69**	**18.10**	**16.57**	**36.1**	**84.7**	**69.1**
Inflation rate in 2004~2007				**26.2**	**0.4**	**37.5**
Scenario 1				30.0	1.0	40.0
Inflation rate in 2004~2008				**71.8**	**56.3**	**32.4**
Scenario 2				75.0	60.0	35.0

Sources：Imported volume and value of imports based on the Council of Agriculture Web site
http://agrapp.coa.gov.tw/TS2/ts/ts021A00.htm. Import prices = (import value / volume
of imports) * NT dollar's exchange rate. The exchange rate is based on the central
bank's annual average exchange rates.

Table 3　The Description of Scenarios Setting

Unit：%

Scenarios	Inflation rate of price			Description
	Corn	Soybean	Wheat	
Scenario 1	30	1	40	the prices of imports by the Council of Agriculture announced in 2007 (value of imports / import volume * NT$ dollar's exchange rate) relative to the rate of price inflation in 2004.
Scenario 2	75	60	35	the prices of imports by the Council of Agriculture announced in 2008 (value of imports / import volume * NT$ dollar's exchange rate) relative to the rate of price inflation in 2004.
Scenario 3	85	75	65	By FAPRI projected prices in 2017 relative to 2004 average growth rate of the price setting.

Table 4   2001 Compared the Industry Association Table and Energy Expenditure of
Crop and Livestock   Unit：NT$ Million；%

	Cereal crops	Hogs	Other livestock	Edible oils and fats	Flour	Feed	Other food	Total
Wheat	7	0	10	0	5,782	104	0	5,903
Sweet potato	61	212	117	0	0	0	23	413
Corn	148	543	81	794	419	14,935	328	17,248
Soybean	11	0	10	12,935	1	1,765	574	15,296
Groundnut	319	0	0	350	0	0	181	850
Other cereals crops	66	0	107	0	453	435	595	1,656
Cereal crop byproduct	569	260	1,315	0	0	257	0	2,401
Total	1,181	1,015	1,640	14,079	6,655	17,496	1,701	43,767
The proportion of total intermediate input (%)	19.47	1.69	3.41	59.35	62.02	36.94	3.23	17.61
The proportion of total input (%)	11.14	1.61	2.82	50.22	50.19	32.07	2.31	14.53

Sources：Based on the industry association of Directorate-General of Budget, Accounting and Statistics,
Executive Yuan, R.O.C collated.

Table 5   The new sub-table industry sectors and 2004 Taiwan's Associated with
Industrial Sector Classification

Originally in 2004 Taiwan's industrial sectors associated with the table	Subdivided by this paper
002 Cereal crops	162 Wheat 163 Sweet potato 164 Corn 165 Soybean 166 Groundnut 167 Other cereals crops 168 Cereal crop by-product

Note：In this paper retained the industrial sector numbers 002 and added 7 sectors numbers from
162-168, actual numbers are 167.

Table 6   The Impact Effect on the Weighted Average Domestic Sales Prices and
Consumer Prices by Imported Grain Prices   Unit：%

Variation of imported price		Domestic sales prices			Consumer Prices		
		Direct effect	Indirect effect	Total effect	Direct effect	Indirect effect	Total effect
Scenario1							
Corn	30%	0.0196	0.0433	0.0629	0.0151	0.0644	0.0795
Soybean	1%	0.0006	0.0013	0.0019	0.0001	0.0025	0.0026
Wheat	40%	0.0091	0.0193	0.0284	-	0.0449	0.0449
Total		0.0293	0.0639	0.0932	0.0152	0.1118	0.1270
Scenario 2							
Corn	75%	0.0491	0.1081	0.1572	0.0377	0.1610	0.1987
Soybean	60%	0.0366	0.0792	0.1158	0.0054	0.1524	0.1578
Wheat	35%	0.0080	0.0168	0.0248	-	0.0393	0.0393
Total		0.0937	0.2041	0.2978	0.0431	0.3527	0.3958
Scenario 3							
Corn	85%	0.0556	0.1226	0.1782	0.0428	0.1824	0.2252
Soybean	75%	0.0457	0.0990	0.1447	0.0067	0.1906	0.1973
Wheat	65%	0.0148	0.0313	0.0461	-	0.0730	0.0730
Total		0.1161	0.2529	0.3690	0.0495	0.4460	0.4955

Sources：The Result is calculated by I-O Model

Table 7-1　The Impact of Industrial Outputs due to the Imported Grain Price Increases：Scenario 1

Unit: %

The change rate of import prices	Corn 30%	Soybean 1%	Wheat 40%	Total
Rice, sugar cane, and other special use crops	0.12	-	0.01	0.13
Fruits, vegetables and other horticultural crops	0.07	-	-	0.07
Hogs	3.04	0.05	0.16	3.25
Other livestock	2.38	0.07	0.18	2.63
Fish	0.78	0.01	0.04	0.83
Slaughtering and meat-product	2.28	0.04	0.13	2.45
Edible oils and fats and by-product	1.02	0.55	-	1.57
Flour	0.58	-	18.84	19.42
Rice and sugar	0.02	-	-	0.02
Feed	8.33	0.10	0.35	8.78
Canned, frozen food and other seasonings	0.24	0.08	1.51	1.83
Dairy Products	0.72	0.02	0.11	0.85
Sugar Confectionery & Bakery Products	0.23	-	1.86	2.09
Other food	0.53	-	0.93	1.46
Beverages and tobacco	0.02	-	0.33	0.35
Textiles and clothing products	0.01	-	0.07	0.08
Wood, leather and articles thereof	0.15	-	0.08	0.23
Paper, paper products and printing	-	-	0.12	0.12
Chemicals	0.03	-	0.01	0.04
New sub-sections				
Wheat	0.01	-	10.00	10.01
Sweet potato	-	-	-	-
Corn	0.14	-	-	0.14
Soybean	-	0.14	-	0.14
Groundnut	-	-	-	-
Other cereals crops	0.07	-	-	0.07
Cereal crop byproduct	0.05	-	0.07	0.12

Data Resource：The calculations were estimated by I-O model

Table 7-2　The Impact of Industrial Outputs due to the Imported Grain Price Increases：Scenario 2

Unit: %

The change rate of import prices	Corn 75%	Soybean 60%	Wheat 35%	Total
Rice, sugar cane, and other special use crops	0.28	0.18	-	0.46
Fruits, vegetables and other horticultural crops	0.19	0.22	-	0.41
Hogs	7.60	2.95	0.14	10.69
Other livestock	5.95	4.02	0.16	10.13
Fish	1.95	0.55	0.03	2.53
Slaughtering and meat-product	5.70	2.62	0.12	8.44
Edible oils and fats and by-product	2.56	33.06	-	35.62
Flour	1.45	0.01	16.48	17.94
Rice and sugar	0.03	0.03	-	0.06
Feed	20.82	5.72	0.31	26.85
Canned, frozen food and other seasonings	3.90	4.25	1.33	9.48
Dairy Products	1.80	1.33	0.10	3.23
Sugar Confectionery & Bakery Products	0.58	1.01	1.63	3.22
Other food	1.34	1.40	0.82	3.56
Beverages and tobacco	0.06	0.04	0.28	0.38
Textiles and clothing products	0.04	0.03	0.05	0.12
Wood, leather and articles thereof	0.37	0.17	0.08	0.62
Paper, paper products and printing	0.01	-	0.13	0.14
Chemicals	0.15	0.32	0.01	0.48
New sub-sections				
Wheat	0.02	0.01	8.75	8.78
Sweet potato	0.01	0.01	-	0.02
Corn	0.36	0.01	-	0.37
Soybean	0.01	8.58	-	8.59
Groundnut	0.01	0.01	-	0.02
Other cereals crops	0.01	0.01	-	0.02
Cereal crop byproduct	0.18	0.18	0.06	0.42

Data Resource：The calculations were estimated by I-O model

Table 7-3 The Impact of Industrial Outputs due to the Imported Grain Price Increases- Scenario 3

Unit: %

The change rate of import prices	Corn 85%	Soybean 75%	Wheat 65%	Total
Rice, sugar cane, and other special use crops	0.32	0.23	0.01	0.56
Fruits, vegetables and other horticultural crops	0.22	0.28	-	0.50
Hogs	8.64	3.69	0.26	12.59
Other livestock	6.74	5.03	0.30	12.07
Fish	2.21	0.68	0.06	2.95
Slaughtering and meat-product	6.46	3.27	0.22	9.95
Edible oils and fats and by-product	2.90	41.32	-	44.22
Flour	1.64	0.02	30.61	32.27
Rice and sugar	0.03	0.03	-	0.06
Feed	23.60	7.15	0.57	31.32
Canned, frozen food and other seasonings	4.42	5.32	2.47	12.21
Dairy Products	2.04	1.67	0.19	3.90
Sugar Confectionery & Bakery Products	0.66	1.26	3.03	4.95
Other food	1.51	1.75	1.52	4.78
Beverages and tobacco	0.06	0.05	0.53	0.64
Textiles and clothing products	0.45	0.03	0.11	0.59
Wood, leather and articles thereof	0.01	0.21	0.13	0.35
Paper, paper products and printing	0.01	-	0.22	0.23
Chemicals	0.16	0.52	0.02	0.70
New sub-sections				
Wheat	0.02	0.02	16.25	16.29
Sweet potato	0.01	0.01	-	0.02
Corn	0.40	0.01	-	0.41
Soybean	0.01	10.72	-	10.73
Groundnut	0.01	0.01	-	0.02
Other cereals crops	0.01	0.01	-	0.02
Cereal crop byproduct	0.20	0.23	0.11	0.54

Data Resource：The calculations were estimated by I-O model
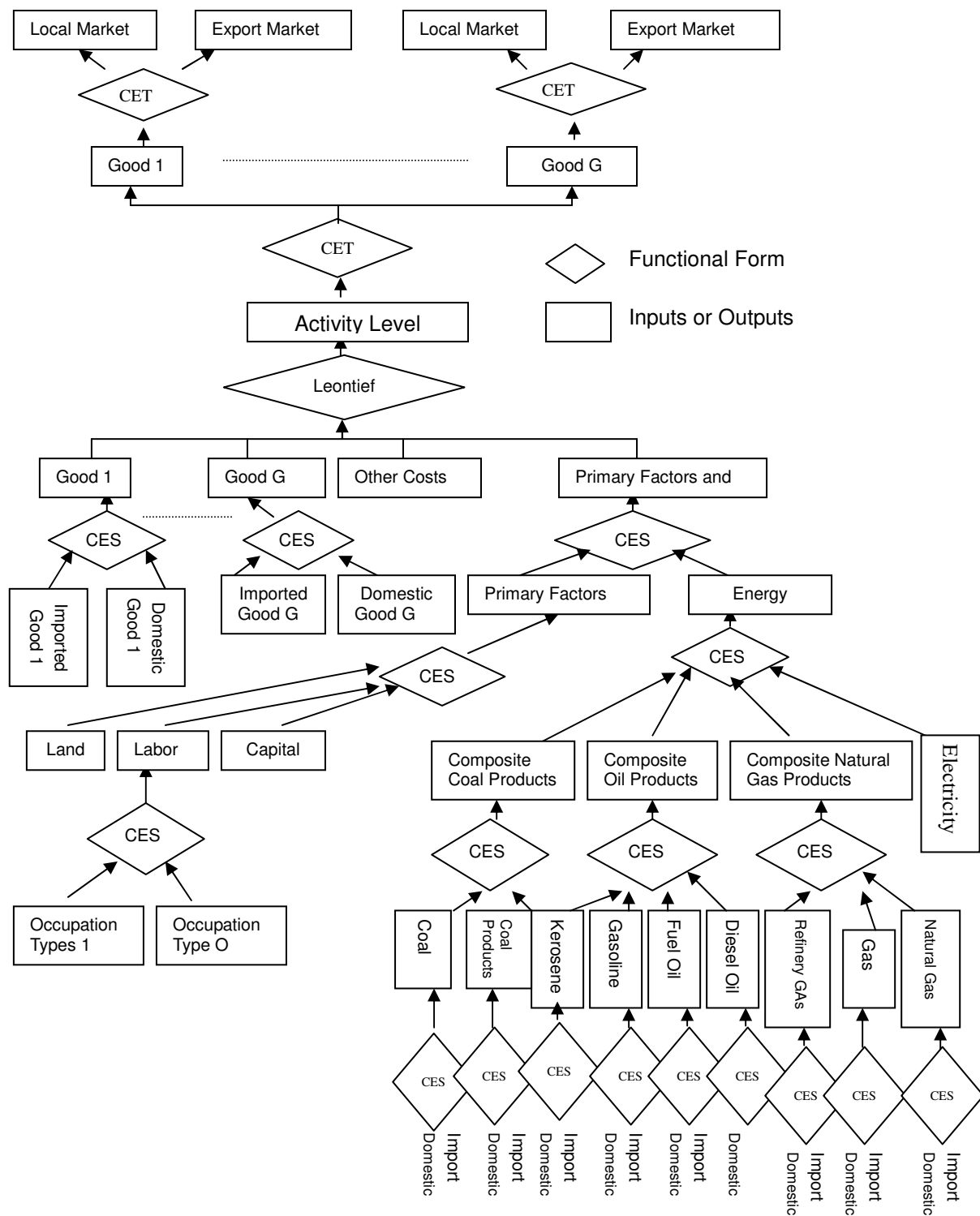
Figure 2　Production Structure of TAIGEM-E

Table 8   The Impact of Taiwan's Variable from CGE Simulations

Unit:%

Scenario 1			
Variable	Corn+30%	Soybean+1%	Wheat+40%	Total
Real GDP	-0.032	-0.001	-0.026	-0.059
Labor	-0.053	-0.002	-0.047	-0.103
GDP deflator	-0.004	0.001	0.020	0.017
CPI	0.063	0.003	0.059	0.125
Investment	-0.072	-0.002	-0.049	-0.124
Indirect tax	0.017	0.002	0.091	0.110
WPI	0.039	0.002	0.034	0.075
Import price	0.098	0.003	0.045	0.146
Export price	0.011	0.000	0.010	0.021
Import Quantity	-0.017	-0.001	-0.011	-0.029
Export Quantity	-0.042	-0.002	-0.038	-0.082
Trade condition	-0.001	0.000	0.000	-0.001

Scenario 2			
Variable	Corn+75%	Soybean +60%	Wheat+35%	Total
Real GDP	-0.080	-0.070	-0.020	-0.170
Labor	-0.130	-0.120	-0.040	-0.300
GDP deflator	-0.010	0.030	0.020	0.040
CPI	0.160	0.170	0.050	0.380
Investment	-0.180	-0.140	-0.040	-0.370
Indirect tax	0.040	0.100	0.080	0.220
WPI	0.085	0.091	0.111	0.286
Import price	0.240	0.180	0.040	0.470
Export price	0.030	0.030	0.010	0.060
Import Quantity	-0.040	-0.050	-0.010	-0.100
Export Quantity	-0.110	-0.110	-0.030	-0.250
Trade condition	0.000	0.000	0.000	0.000

Scenario 3			
Variable	Corn+85%	Soybean +75%	Wheat+65%	Total
Real GDP	-0.089	-0.086	-0.042	-0.217
Labor	-0.151	-0.154	-0.077	-0.382
GDP deflator	-0.012	0.042	0.033	0.063
CPI	0.179	0.208	0.097	0.483
Investment	-0.204	-0.180	-0.080	-0.464
Indirect tax	0.047	0.124	0.148	0.319
WPI	0.111	0.136	0.056	0.302
Import price	0.277	0.228	0.074	0.579
Export price	0.030	0.035	0.016	0.081
Import Quantity	-0.048	-0.058	-0.018	-0.125
Export Quantity	-0.120	-0.135	-0.061	-0.316
Trade condition	-0.002	-0.002	-0.001	-0.004

Data Resource：The calculations were estimated by CGE model

Table 9　The Percentage Change in Outputs of Various Industries of the CGE
Model Simulation Results

Unit:%

Variable	Scenario 1				Scenario 2				Scenario 3			
	Corn +30％	Soybean +1％	Wheat +40％	Total	Corn +75％	Soybean +60％	Wheat +35％	Total	Corn +85％	Soybean +75％	Wheat +65％	Total
Paddy rice	-0.043	-	-0.025	-0.068	-0.110	-	-0.020	-0.130	-0.123	0.002	-0.041	-0.161
Sugarcane	-0.137	-0.006	-0.288	-0.431	-0.340	-0.350	-0.250	-0.940	-0.388	-0.434	-0.468	-1.290
Fruit	-0.030	-0.001	-0.046	-0.078	-0.070	-0.080	-0.040	-0.200	-0.084	-0.104	-0.075	-0.263
Vegetables	-0.032	-0.002	-0.075	-0.109	-0.080	-0.100	-0.070	-0.250	-0.090	-0.129	-0.122	-0.342
Hogs	-0.394	-0.008	-0.052	-0.454	-0.990	-0.460	-0.050	-1.500	-1.117	-0.581	-0.085	-1.783
Other livestock	-0.624	-0.018	-0.076	-0.718	-1.560	-1.080	-0.070	-2.700	-1.769	-1.345	-0.123	-3.237
Fish	-0.836	-0.011	-0.072	-0.918	-2.090	-0.630	-0.060	-2.790	-2.367	-0.793	-0.116	-3.276
Slaughtering & by-product	0.109	0.002	0.019	0.130	0.270	0.130	0.020	0.420	0.309	0.158	0.031	0.499
Edible oils & fats by-product	-2.018	-0.377	-0.151	-2.546	-5.050	-22.630	-0.130	-27.810	-5.719	-28.285	-0.245	-34.248
Flour	-0.760	-0.011	-11.119	-11.889	-1.900	-0.640	-9.730	-12.270	-2.153	-0.803	-18.068	-21.023
Rice	-0.041	-	-0.025	-0.065	-0.100	-	-0.020	-0.120	-0.116	0.006	-0.040	-0.150
Sugar	-0.162	-0.007	-0.353	-0.523	-0.410	-0.420	-0.310	-1.130	-0.460	-0.520	-0.574	-1.554
Feed	-6.275	-0.076	-0.311	-6.661	-15.690	-4.540	-0.270	-20.490	-17.778	-5.670	-0.505	-23.953
Canned food	-0.258	-0.004	-0.133	-0.395	-0.650	-0.230	-0.120	-0.990	-0.731	-0.290	-0.217	-1.238
Frozen food	-0.067	-0.002	-0.108	-0.177	-0.170	-0.140	-0.090	-0.400	-0.189	-0.179	-0.176	-0.543
Other spices	-0.074	-0.036	-1.213	-1.323	-0.180	-2.190	-1.060	-3.440	-0.209	-2.737	-1.971	-4.917
Dairy	-0.782	-0.024	-0.151	-0.957	-1.960	-1.430	-0.130	-3.520	-2.216	-1.790	-0.246	-4.252
Wine	-0.050	-0.002	-0.359	-0.410	-0.130	-0.090	-0.310	-0.530	-0.142	-0.113	-0.583	-0.838
Smoke	-0.047	-0.002	-0.032	-0.080	-0.120	-0.100	-0.030	-0.250	-0.132	-0.129	-0.052	-0.313
Textile and Apparel	-0.060	-0.003	-0.062	-0.124	-0.150	-0.160	-0.050	-0.360	-0.169	-0.197	-0.101	-0.467
Leather	-0.001	-0.001	-0.008	-0.010	-	-0.050	-0.010	-0.060	-0.002	-0.068	-0.013	-0.083
Pulp and Paper	-0.037	-0.002	-0.175	-0.214	-0.090	-0.090	-0.150	-0.340	-0.105	-0.117	-0.285	-0.506
Paper products	-0.049	-0.002	-0.088	-0.139	-0.120	-0.130	-0.080	-0.330	-0.138	-0.158	-0.144	-0.440
Chemical Fertilizers	0.053	-0.002	-0.049	0.002	0.130	-0.130	-0.040	-0.040	0.151	-0.164	-0.079	-0.092
Wheat	-0.525	-0.009	26.054	25.520	-1.310	-0.550	22.800	20.930	-1.487	-0.692	42.337	40.158
Sweet potato	-0.096	-0.002	-0.021	-0.119	-0.240	-0.130	-0.020	-0.390	-0.272	-0.166	-0.034	-0.472
Corn	10.036	-	-0.085	9.951	25.090	0.010	-0.070	25.020	28.435	0.006	-0.137	28.304
Soybean	-0.036	0.371	-0.040	0.295	-0.090	22.260	-0.040	22.140	-0.103	27.829	-0.065	27.661
Groundnut	-0.321	-0.051	-0.220	-0.592	-0.800	-3.060	-0.190	-4.060	-0.909	-3.831	-0.357	-5.097
Other Cereals crops	-0.156	-0.003	-0.174	-0.333	-0.390	-0.180	-0.150	-0.720	-0.441	-0.225	-0.283	-0.949
Cereal Crop by-product	-0.457	-0.009	-0.061	-0.527	-1.140	-0.520	-0.050	-1.720	-1.296	-0.648	-0.100	-2.044

Data Resource：The calculations were estimated by CGE model

Table 10　The Percentage Change in Exports of Various Industries of the CGE
Model Simulation Results

Unit:%

Variable	Scenario 1				Scenario 2				Scenario 3			
	Corn +30%	Soybean +1%	Wheat +40%	Total	Corn +75%	Soybean +60%	Wheat +35%	Total	Corn +85%	Soybean +75%	Wheat +65%	Total
Paddy Rice	-0.171	-0.006	-0.045	-0.222	-0.430	-0.380	-0.040	-0.850	-0.485	-0.477	-0.073	-1.034
Sugarcane	-0.131	-0.003	0.096	-0.038	-0.330	-0.160	0.080	-0.410	-0.370	-0.205	0.156	-0.420
Fruit	-9.540	-0.266	-0.751	-10.558	-23.850	-15.980	-0.660	-40.490	-27.030	-19.979	-1.221	-48.230
Vegetables	-1.528	-0.020	-0.119	-1.667	-3.820	-1.190	-0.100	-5.110	-4.330	-1.483	-0.193	-6.006
Hogs	1.349	0.038	1.032	2.419	3.370	2.260	0.900	6.530	3.823	2.822	1.677	8.321
Other livestock	-1.898	-1.150	0.019	-3.028	-4.740	-68.990	0.020	-73.720	-5.377	-86.237	0.031	-91.582
Fish	-0.719	0.001	-21.429	-22.147	-1.800	0.070	-18.750	-20.480	-2.038	0.082	-34.822	-36.778
Slaughtering & by-product	-0.068	0.004	0.016	-0.047	-0.170	0.270	0.010	0.110	-0.192	0.332	0.026	0.166
Edible oils & fats by-product	0.139	0.006	0.434	0.580	0.350	0.390	0.380	1.120	0.394	0.485	0.706	1.584
Flour	-18.069	-0.203	-0.790	-19.062	-45.170	-12.170	-0.690	-58.030	-51.196	-15.207	-1.283	-67.686
Rice	-1.044	-0.018	-0.532	-1.593	-2.610	-1.080	-0.470	-4.150	-2.957	-1.347	-0.864	-5.169
Sugar	-0.163	-0.006	-0.224	-0.394	-0.410	-0.380	-0.200	-0.990	-0.462	-0.477	-0.364	-1.304
Feed	-0.125	-0.138	-4.337	-4.600	-0.310	-8.270	-3.790	-12.370	-0.355	-10.333	-7.047	-17.735
Canned Food	-2.836	-0.089	-0.491	-3.416	-7.090	-5.330	-0.430	-12.850	-8.035	-6.662	-0.798	-15.495
Frozen Food	-0.248	-0.010	-1.406	-1.664	-0.620	-0.580	-1.230	-2.430	-0.702	-0.731	-2.285	-3.717
Other Spices	-0.189	-0.009	-0.171	-0.368	-0.470	-0.520	-0.150	-1.140	-0.535	-0.646	-0.277	-1.458
Dairy	-0.077	-0.003	-0.075	-0.156	-0.190	-0.210	-0.070	-0.470	-0.220	-0.261	-0.122	-0.602
Wine	0.008	-0.001	-0.002	0.005	0.020	-0.040	-	-0.020	0.022	-0.050	-0.003	-0.031
Smoke	-0.008	-	-0.309	-0.317	-0.020	-0.020	-0.270	-0.310	-0.022	-0.022	-0.502	-0.546
Textile and Apparel	-0.028	-0.002	-0.095	-0.125	-0.070	-0.090	-0.080	-0.250	-0.080	-0.118	-0.155	-0.353
Leather	-0.055	-0.001	-0.007	-0.063	-0.140	-0.080	-0.010	-0.220	-0.157	-0.101	-0.011	-0.269
Pulp and Paper	-42.797	0.001	0.331	-42.465	-106.990	0.060	0.290	-106.640	-121.260	0.081	0.538	-120.639
Paper products	1.115	0.029	1.407	2.550	2.790	1.710	1.230	5.730	3.158	2.139	2.287	7.584
Chemical Fertilizers	2.507	0.043	0.024	2.574	6.270	2.580	0.020	8.870	7.102	3.229	0.039	10.370

Data Resource：The calculations were estimated by CGE model

Table 11 The Percentage Change in Imports of Various Industries of the CGE
Model Simulation Results

Unit:%

Variable	Scenario 1				Scenario 2				Scenario 3			
	Corn +30%	Soybean +1%	Wheat +40%	Total	Corn +75%	Soybean +60%	Wheat +35%	合計	Corn +85%	Soybean +75%	Wheat +65%	Total
Paddy Rice	-0.075	-0.002	-0.057	-0.134	-0.190	-0.140	-0.050	-0.370	-0.213	-0.171	-0.092	-0.476
Sugarcane	-1.912	-0.097	-4.663	-6.672	-4.780	-5.830	-4.080	-14.690	-5.418	-7.283	-7.577	-20.278
Fruit	0.067	0.003	0.011	0.080	0.170	0.150	0.010	0.330	0.189	0.193	0.017	0.399
Vegetables	0.056	0.001	-0.062	-0.005	0.140	0.070	-0.050	0.160	0.158	0.088	-0.101	0.145
Hogs	-28.490	-0.798	-8.604	-37.892	-71.230	-47.890	-7.530	-126.640	-80.723	-59.856	-13.981	-154.560
Other livestock	1.001	0.027	0.044	1.072	2.500	1.640	0.040	4.180	2.835	2.054	0.071	4.960
Fish	0.229	0.003	-0.011	0.221	0.570	0.190	-0.010	0.750	0.648	0.235	-0.018	0.865
Slaughtering & by-product	-0.205	-0.006	-0.170	-0.380	-0.510	-0.380	-0.150	-1.040	-0.580	-0.472	-0.275	-1.327
Edible oils & fats by-product	-0.552	0.612	-0.335	-0.275	-1.380	36.740	-0.290	35.070	-1.564	45.924	-0.545	43.815
Flour	-0.673	-0.022	19.100	18.405	-1.680	-1.350	16.710	13.680	-1.908	-1.684	31.038	27.446
Rice	-0.008	-0.001	-0.015	-0.024	-0.020	-0.060	-0.010	-0.090	-0.023	-0.071	-0.024	-0.119
Sugar	-0.189	-0.007	-0.364	-0.560	-0.470	-0.410	-0.320	-1.210	-0.537	-0.519	-0.592	-1.647
Feed	9.466	0.100	0.379	9.945	23.670	6.010	0.330	30.010	26.822	7.513	0.615	34.950
Canned Food	0.318	0.006	0.172	0.496	0.800	0.380	0.150	1.320	0.901	0.471	0.279	1.651
Frozen Food	0.056	0.003	0.067	0.125	0.140	0.160	0.060	0.350	0.157	0.196	0.108	0.461
Other Spices	0.006	0.040	1.181	1.228	0.010	2.420	1.030	3.460	0.017	3.020	1.920	4.957
Dairy	0.638	0.021	0.056	0.714	1.590	1.230	0.050	2.880	1.807	1.541	0.091	3.439
Wine	0.076	0.003	0.352	0.431	0.190	0.210	0.310	0.700	0.216	0.258	0.572	1.045
Smoke	0.048	0.003	0.054	0.105	0.120	0.160	0.050	0.320	0.137	0.196	0.088	0.420
Textile and Apparel	0.017	0.001	0.028	0.046	0.040	0.080	0.020	0.140	0.048	0.097	0.045	0.190
Leather	-0.016	-0.001	-0.018	-0.035	-0.040	-0.070	-0.020	-0.120	-0.045	-0.086	-0.030	-0.161
Pulp and Paper	-0.040	-0.002	-0.028	-0.069	-0.100	-0.100	-0.020	-0.220	-0.112	-0.125	-0.045	-0.281
Paper products	-0.028	-0.001	-0.005	-0.034	-0.070	-0.030	-	-0.100	-0.078	-0.038	-0.009	-0.125
Chemical Fertilizers	0.065	-0.002	-0.052	0.010	0.160	-0.100	-0.050	0.010	0.183	-0.129	-0.085	-0.032
Wheat	-0.922	-0.014	-12.286	-13.222	-2.300	-0.830	-10.750	-13.880	-2.612	-1.035	-19.965	-23.612
Sweet potato	-0.349	-0.011	-0.061	-0.422	-0.870	-0.680	-0.050	-1.610	-0.988	-0.850	-0.100	-1.938
Corn	-6.673	-0.071	-0.462	-7.206	-16.680	-4.270	-0.400	-21.360	-18.906	-5.337	-0.751	-24.994
Soybean	-2.243	-0.325	-0.225	-2.794	-5.610	-19.520	-0.200	-25.330	-6.355	-24.405	-0.366	-31.126
Groundnut	-0.672	-0.120	-0.489	-1.281	-1.680	-7.180	-0.430	-9.290	-1.904	-8.973	-0.795	-11.672
Other Cereals crops	-1.518	-0.025	-3.845	-5.388	-3.790	-1.510	-3.360	-8.670	-4.301	-1.885	-6.248	-12.433
Cereal Crop by-product	-1.237	-0.023	-0.074	-1.334	-3.090	-1.400	-0.060	-4.550	-3.505	-1.744	-0.120	-5.369

Data Resource：The calculations were estimated by CGE model

Table 12　The Percentage Changes in Employment Levels of Industries by CGE Model Simulation

Unit:%

Variable	Scenario 1				Scenario 2				Scenario 3			
	Corn +30%	Soybean +1%	Wheat +40%	Total	Corn +75%	Soybean +60%	Wheat +35%	合計	Corn +85%	Soybean +75%	Wheat +65%	Total
Paddy Rice	-0.069	-	-0.040	-0.109	-0.170	-	-0.040	-0.200	-0.195	0.003	-0.065	-0.257
Sugarcane	-0.172	-0.007	-0.362	-0.542	-0.430	-0.440	-0.320	-1.190	-0.488	-0.546	-0.588	-1.623
Fruit	-0.041	-0.002	-0.064	-0.107	-0.100	-0.110	-0.060	-0.270	-0.116	-0.143	-0.104	-0.364
Vegetables	-0.050	-0.003	-0.119	-0.172	-0.130	-0.160	-0.100	-0.390	-0.142	-0.203	-0.193	-0.538
Hogs	-1.854	-0.036	-0.246	-2.136	-4.630	-2.190	-0.220	-7.030	-5.252	-2.732	-0.400	-8.383
Other livestock	-1.177	-0.034	-0.143	-1.353	-2.940	-2.030	-0.120	-5.090	-3.334	-2.534	-0.232	-6.100
Fish	-1.359	-0.017	-0.116	-1.492	-3.400	-1.030	-0.100	-4.530	-3.850	-1.289	-0.189	-5.328
Slaughtering & by-product	0.157	0.003	0.028	0.188	0.390	0.180	0.020	0.600	0.445	0.227	0.045	0.717
Edible oils & fats by-product	-2.845	-0.532	-0.213	-3.590	-7.110	-31.900	-0.190	-39.200	-8.061	-39.872	-0.346	-48.279
Flour	-1.181	-0.017	-17.289	-18.487	-2.950	-1.000	-15.130	-19.080	-3.347	-1.249	-28.095	-32.691
Rice	-0.078	-	-0.047	-0.124	-0.190	0.010	-0.040	-0.230	-0.220	0.011	-0.076	-0.285
Sugar	-0.196	-0.008	-0.426	-0.631	-0.490	-0.500	-0.370	-1.360	-0.555	-0.627	-0.693	-1.875
Feed	-10.415	-0.125	-0.515	-11.056	-26.040	-7.530	-0.450	-34.020	-29.509	-9.411	-0.838	-39.758
Canned Food	-0.301	-0.005	-0.156	-0.462	-0.750	-0.270	-0.140	-1.160	-0.854	-0.339	-0.253	-1.446
Frozen Food	-0.091	-0.003	-0.147	-0.241	-0.230	-0.200	-0.130	-0.550	-0.257	-0.244	-0.239	-0.740
Other Spices	-0.134	-0.066	-2.207	-2.408	-0.340	-3.980	-1.930	-6.250	-0.381	-4.981	-3.586	-8.948
Dairy	-1.199	-0.037	-0.232	-1.467	-3.000	-2.200	-0.200	-5.390	-3.396	-2.744	-0.376	-6.517
Wine	-0.081	-0.002	-0.578	-0.661	-0.200	-0.150	-0.510	-0.850	-0.228	-0.182	-0.939	-1.350
Smoke	-0.088	-0.003	-0.060	-0.151	-0.220	-0.190	-0.050	-0.470	-0.249	-0.243	-0.098	-0.589
Textile and Apparel	-0.071	-0.003	-0.074	-0.147	-0.180	-0.190	-0.060	-0.430	-0.200	-0.234	-0.120	-0.554
Leather	-0.001	-0.001	-0.012	-0.014	-	-0.080	-0.010	-0.090	-0.003	-0.096	-0.019	-0.118
Pulp and Paper	-0.063	-0.003	-0.300	-0.366	-0.160	-0.160	-0.260	-0.580	-0.179	-0.201	-0.488	-0.868
Paper products	-0.077	-0.003	-0.139	-0.219	-0.190	-0.200	-0.120	-0.510	-0.217	-0.250	-0.226	-0.693
Chemical Fertilizers	0.077	-0.003	-0.071	0.003	0.190	-0.190	-0.060	-0.060	0.219	-0.238	-0.115	-0.133
Wheat	-1.050	-0.018	52.108	51.040	-2.620	-1.110	45.590	41.860	-2.974	-1.385	84.675	80.317
Sweet potato	-0.269	-0.006	-0.059	-0.334	-0.670	-0.370	-0.050	-1.100	-0.762	-0.467	-0.096	-1.325
Corn	27.520	-	-0.232	27.288	68.800	0.010	-0.200	68.610	77.972	0.017	-0.377	77.613
Soybean	-0.091	0.928	-0.100	0.737	-0.230	55.660	-0.090	55.340	-0.257	69.572	-0.163	69.152
Groundnut	-0.721	-0.115	-0.494	-1.329	-1.800	-6.880	-0.430	-9.120	-2.043	-8.606	-0.802	-11.451
Other Cereals crops	-0.407	-0.008	-0.456	-0.870	-1.020	-0.470	-0.400	-1.890	-1.152	-0.588	-0.740	-2.480
Cereal Crop by-product	-1.018	-0.019	-0.137	-1.174	-2.550	-1.150	-0.120	-3.820	-2.885	-1.443	-0.222	-4.550

Data Resource：The calculations were estimated by CGE model