

**An Economy-wide Analysis
of Impacts of Avian Flu Pandemic on Taiwan**

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ABSTRACT

This study analyzes the potential consequences of an outbreak of avian influenza (H5N1) on Taiwan's macro economy and individual industries. Both the Input-Output (IO) Analysis Model and Computable General Equilibrium (CGE) Model are used to simulate the possible damage brought by lowering domestic consumption, export, and labor supply. The simulation results indicates that if the disease is confined within the poultry sector, then the impact on real GDP is around -0.01%~-0.14%. Once it becomes a human-to-human pandemic, the IO analysis suggests that the potential impacts on real GDP would be as much as -3.69%~-5.97% while labor demand would decrease 4.05%~5.73%. In the CGE analysis, which allows for resource mobility and substitutions through price adjustments, the real GDP and labor demand would contract 2.39%~3.83% and 1.25%~1.49%, respectively, and bringing down consumer prices by 2.52%~4.55%. As for the individual sector, the outbreak will not only damage the poultry sector and its upstream and downstream industries, but also affect the service sectors including wholesale, retail, trade, air transportation, hotels, restaurants, as well as healthcare services. These results can be used to support public investment in animal disease control programs and strengthen the international cooperation and surveillance in reducing the spread of the disease.

Keywords: Avian Flu Pandemic, Input-output Model, Computable General Equilibrium Model

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1. Introduction

The avian flu is an infectious disease of birds caused by type A strains of the influenza virus. As for the human cases in H5N1, the first confirmed case of this epidemic wave was found in Vietnam in December 2003. In May 2006, the world's first instance of human-transmitted avian influenza was discovered in Indonesia. It has now spread to some parts of Europe, Africa, and Central Asia. Until January 9, 2007, there were 263 confirmed cases. Reporting countries include Azerbaijan, Cambodia, China, Djibouti, Egypt, Indonesia, Iraq, Thailand, Turkey and Vietnam. H5N1 virus caused serious systemic disease in these patients. Among these patients, 157 have died. Most patients were children and young adults, with unknown reasons.

The emerging threat of a pandemic of unprecedented proportion due to the spread of the H5N1 avian flu has become a global concern. In comparison to the three pandemics occurred in the previous century (i.e., the 1918 Spanish flu which claimed the lives of 40-50 million people worldwide in less than a year; the Asian flu in 1957 which caused an estimated 2 million deaths; and the Hong Kong flu in 1968 which took 1 million lives), the genetic makeup of the H5N1 strain is predicted to stand at a daunting total of 2 to 7.4 million deaths according to the World Health Organization (WHO)'s estimate. The social and economic ramifications could be equally catastrophic. Up till January 2007, a total of 265 confirmed human cases of H5N1 avian flu have been reported to WHO, of which 159 were fatal.

As the avian influenza has turned from poultry-to-human to human-to-human infection, its level of impact and spreading time would be far greater than the previous outbreak of Severe Acute

Respiratory Syndrome (SARS) in 2003¹. The WHO (2006) predicted that at the height of the influenza outbreak, 7 million people around the world could die. The World Bank estimated that a human-to-human infection of the avian flu would cause economic losses of US\$2 trillion. Verbiest and Castillo (2004) stated that the short-term GDP would be trimmed by 0.5% and long-term 1.2% to 1.5%. Bloom et al., (2005) discovered that the virus would cause a drop of 2.3% in Asia's demand-side GDP, 0.3% decline in supply-side GDP, as well as 6.5% plunge in long-term GDP. Mckibbin and Sidorenko (2006) estimated that a highly pathogenic infection of avian influenza would cause 1.01 million deaths in the U.S., 710 million worldwide, and GDP would fall 3% globally. The U.S. Congressional Budget Office (2005, 2006) predicted that the U.S. would experience a 5% drop in GDP, accumulate US\$670 billion in losses, and have 2 million fatalities. Buetre et al. (2006) estimated that a mid-pathogenic outbreak would cause a 6.8% downfall in Australia's GDP and a GDP drop of 3.0% to 6.8% for countries elsewhere. The degree of impact is found to be greater for developing countries than the developed ones. The most devastated sectors include traffic and transportation services and tourism related activities, and the demand for health and medical services would skyrocket.

The above literatures revealed that the economic impact of the avian influenza could be massive. Taiwan has adopted a precautionary measure of setting up nets around all pig and poultry farms nationwide to prevent wild birds from passing the flu virus to hogs and poultry. By the end of March 2007, nets will have been set up at nearly 85 percent of the farms. Meanwhile, the National Health Research Institute has been working on developing a bird flu vaccine since August 2005 and has collected H5N1 culture samples from patients in Vietnam for the development of a vaccine. Although the Bureau of Animal and Plant Health Inspection and Quarantine (BAPHIQ)

¹ SARS is a pneumonia-like illness which has claimed around 800 lives globally out of some 8,000 infected cases, mostly in China, Hong Kong, Taiwan and Singapore.

that Taiwan is currently a H5N1-free country, the fact that it is the pathway of migratory birds and the possibility of smuggling poultry from China could seriously threaten the H5N1 free status.

Therefore early prevention of the virus is needed in order to diminish its possible detrimental effects on the economy. Because the avian influenza has exerted a full-scale impact on an entire country, it appears suitable to examine the issue via a full set of economic models for short-term and long-term analysis. The purpose of this study is to evaluate the impact of avian influenza on Taiwan's economy. Both the Input-Output (IO) Analysis and Computable General Equilibrium (CGE) Models are used to simulate the possible damage brought by lowering domestic consumption, export, and labor supply in an *ex ante* basis. The next section briefly reviews the model structures and database. The third section provides scenario specifications. Simulation results are compared in the fourth section followed by the conclusions.

2. Analytical Framework

2.1 Input-output Analysis

This study measures the direct and indirect impacts of avian flu using the multipliers from the 2004 Input-Output (IO) Table of Taiwan. According to Miller and Blair (1985), the direct and indirect effects of the demand and supply shocks on each sector are obtained by computing the Leontief Inverse Matrix. The effects of demand shocks are calculated based on a demand-side IO Model as follows:

$$X = Z + F = AX + F, \quad (1)$$

where X is a vector of total output, Z is the intermediate demand matrix, F is a vector of final demand including household consumption, investment, government expenditure and net export, and A is the input-output (or technical) coefficients matrix.

Assuming that the input-output coefficients are fixed and $(I - A)$ is nonsingular, the unique

solution of total output is :

$$X = (I - A)^{-1} F, \quad (2)$$

where $(I - A)^{-1}$ is the Leontief matrix. Given a final demand (F) by the economy, Equation (2) calculates for each sector the gross output necessary to cover both the final demand and the corresponding intermediate demands arising from other sectors. Let $B = (I - A)^{-1}$, then the element of B , b_{ij} , denotes how many units of good i should be purchased directly and indirectly to satisfy one unit of final demand for good j .

The effects of supply shocks are calculated according to the supply-side IO model in which total output is equal to the value of its inputs in each industry as follows:

$$X' = Z' + V \quad (3)$$

where X' is transposed matrix of X , Z' is the matrix of intermediate input flows and V is the primary input matrix (i.e., the value-added matrix) including compensation of employees, operating surplus, depreciation, and indirect taxes.

Assuming that the output sale distribution coefficients are fixed, the total output transposed matrix is

$$X' = V(I - B)^{-1}, \quad (4)$$

where B represent the matrix of allocation coefficients and $B = \hat{x}^{-1}Z'$ with $\hat{x}$ the diagonal matrix of output values x_j . Equation (4) depicts the summation of the direct and indirect effects resulting from a primary input vector.

In this article, we will measure the total economic effects of an avian flu outbreak from both the demand-side and supply-side model. The demand-side model reflects domestic consumers' reluctance to eat poultry meat in the bird-to-bird phase, and then demand for travel and tourism

would also be affected if the outbreak has evolved into the bird-to-human or human-to-human phases. International trade may also be affected because foreign customers cancel their orders in the human-to-human cases. The supply-side model refers to the culling of poultry, factory shut-downs due to culling, workers getting ill or under quarantine which prevent them from working, and import/export disruptions.

2.2 Computable General Equilibrium (CGE) Model

Because the IO model overlooks the price response and resource adjustment mechanism, i.e., prices and resource endowments are fixed, it can only be used as a short-term assessment and the results will be upward biased. To reflect the price repercussion effects and market adjustment mechanism of the economy, a single-country multi-sectoral CGE model (Johansen , 1960; Scarf, 1967) of Taiwan is used to simulate how an economy might react to changes in external factors like a disease outbreak. This model is originated from the Australian ORANI school in Monash University (Dixon et al., 1982). The Taiwan CGE model distinguishes 170 sectors, 6 types of labor, 8 types of margins, and 184 commodities. The model database is compiled from the 160-sector Use Table of the 2001 Input-Output Tables.

The model uses a full simultaneous equations system to describe the macro economy as well as individual industries. Based on the conventional neo-classical school assumptions, all economic agents are assumed to follow optimal behaviors. Firms minimize cost and are subject to production functions. Representative households maximize utility and are subject to budget constraints. Like the ORANI model, the supply structure of the Taiwan CGE model 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. The multi-input, multi-output production specification is kept manageable using a series of weak assumptions, as illustrated by the nested structure.

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. The input demand of industry production is formulated by a five-level nested structure, and the production decision-making of each level is independent. By assuming cost minimization and technology constraint at each level of production, producers will make optimal input demand decisions. When the economy reaches its demand-supply equilibrium, the market is cleared. 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).

The CGE models are descended from the input-output models pioneered by Leontief, but they pay special attention to market clearing conditions and price determinations. The CGE models allow prices to affect demand and supply simultaneously, but the IO models assume that all prices are fixed. Thus, the IO models is useful in calculating the short-run policy impacts of an economy, while the CGE models encompass market equilibrium effect in both the input and output markets so that an intermediate or long-run policy impacts can be portrayed. They are complementary in this context. This study will adopt both models to evaluate the short-run and long-run impacts of avian flu on Taiwan.

3. Data processing and scenarios design

The database used by this study was based on Taiwan's Input-Output (IO) Tables which spanned 161 sectors in 2004. The poultry and livestock sectors are further disaggregated to facilitate the sector-specific evaluations on the impact of avian influenza. Please refer to Table 1 for the sector specifications.

As the highly pathogenic influenza case has not yet been found in Taiwan, several simulation

scenarios are proposed in an *ex-ante* basis. In accordance with the WHO's pandemic alert, the pandemic can be classified into 01, 02, A1, A2, B and C classes as illustrated in Table 2. A scale of 0 indicates that H5- and H7-type pandemic has been identified in the area and the confirmed poultry-to-human cases have been reported abroad. It is further classified into high (02) and low (01) phases. Class A1 denotes confirmed cases abroad, while A2, B and C represent local poultry-to-human or infection from abroad, human-to-human infections, and large-scale epidemic, respectively.

The scenario design is based on shock configuration focusing on both the demand and supply sides of the market. On the demand side, the impact on local consumption is evaluated according to the negative influence during the 2003 SARS epidemic on local industries. If the epidemic situation is classified as 01 (i.e., the low-pathogenic avian flu is confirmed in the domestic poultry sector), poultry consumption would fall by 30%. If the epidemic situation rises to 02 class, then poultry consumption would be reduced by 70%. The upstream and downstream business would lose NT\$10 billion, while poultry export would lose NT\$700 million. The government expenditure from culling infected birds would range from NT\$350 million to NT\$410 million. These projections are provided by the experts in the Council of Agriculture.

For the 02 level, the substitutions between poultry and non-poultry meat are taken into consideration. The elasticities of substitution between different kinds of meat are extrapolated from the historical data during the food and mouth outbreak in 1997. Based on the Food Balance Sheet, it is found that the substitution ratio between poultry and pork is 0.43, i.e., a 1% reduction of pork consumption will increase 0.43% of poultry consumption. However, during an avian flu outbreak, hogs will also be subject to infections and the reverse substitution between poultry and pork might not happen. The Council of Agriculture predicts that consumers would feel safer to consume more seafood or beef rather than pork. Therefore, we assume that 50 percent of reduction in poultry

meat will be substituted by beef and seafood while only 10 percent will be replaced by pork.

For sectors other than poultry, we use the 2003 SARS outbreak as our benchmark to design their demand shock parameters. In class A, we assume that the consumption decline would be equivalent to the 2003 SARS outbreak. The decline in consumption in class B would be equivalent to the double of SARS while class C is five times that of SARS.

As for the supply-side impact, as employees could be hospitalized or absent from contracting the virus, industrial outputs would be lowered. The FluAid 2.0 software² is used to calculate the number of fatality and the number of person hospitalized and out-patient visits. The gross attack rates³ of 15%, 25%, 35%, and 45% are assumed as inputs to FluAid 2.0 based on the estimates from the Center for Disease Control of the Department of Health. The productivity parameters in each sector which are endogenous in the model can be solved using the historical simulation method and they are the benchmark of setting the productivity shocks in the forecast closure for the avian flu outbreak.

This study also takes into account the possible effects on business sales due to their efforts in improving or alleviating the outbreak. From Taiwan's SARS experience, environmental sanitary services would benefit the most, followed by medical instrument and apparatus, medicine, face mask, and synthetic detergent and washing industries. We also hypothesize that the export demand in the A2 and B class would be 2% and 4% lower than the baseline, respectively, while 6%-12% reductions

² FluAid is a software designed by the CDC of the U.S. to provide a range of estimates of impact in terms of deaths, hospitalizations, and outpatient visits due to pandemic influenza. The software does not use Monte-Carlo methodologies to provide ranges of estimates. Instead, it requires that the user supply minimum and maximum estimates of some inputs (e.g., rates of death per 1,000 population). These data are then used by the program to provide estimates of the minimum and maximum impact of an influenza pandemic. The major limitation of FluAid is that it cannot provide any description of how a pandemic may spread through a geographic region over time. More detailed descriptions of the characteristics of the software can be found in the website: <http://www.cdc.gov/flu/tools/fluaid/#section05>.

³ Gross attack rate is the percentage of population that becomes clinically ill due to influenza.

are assumed in class C.

4. Results

4.1 Results of IO Analysis

Simulation results of the IO modeling are shown in Table 3. Scenarios 1 through 6 revealed that the negative economic effect in the event of the pandemic ranges from -0.024% to -5.92% in total outputs. The effects on real GDP and employment are -0.014% to -5.97% and -0.023% to -5.73%, respectively. Thus, the bird-to-bird phase does not pose any major threat to the economy except a few sectors, but the human-to-human phases are considered to be very serious for the economy as a whole.

The effect of avian influenza on the industry-specific GDP is illustrated in Table 4. In the 01 and 02 classes, the agricultural service sector suffers the most, followed by the chicken, finance and animal feeds. Fishery sector will benefit due to the substitution effect in consumption. For the C class of human epidemic, the wholesale sector will be the most severely impacted sector, dipping in a range of NT\$57.83 billion to NT\$66.46 billion, followed by the retailing and foreign trade. The largest beneficiary will be environmental sanitary services, rising in the range of NT\$13.94 billion to NT\$13.35 billion, followed by the medicine, hospital services, sanitary and cosmetics sectors. Labor demand will decrease from a minimum of 130,000 to a maximum of 500,000 people and create a huge demand for unemployment relief payment.

4.2 Results of CGE Analysis

The simulated results of avian influenza on Taiwan's overall economy are summarized in Table 5. Scenarios 1 through 6 reveal that the negative economic effect is not as strong as those obtained from the IO modeling. For example, the decline in real GDP will range from -0.0052% to -3.83% while the IO model predicts a reduction of -0.014% to -5.97%. The larger impact from the latter

reflects the short-run results because the IO model is primarily based on a set of fixed technical coefficients and prices. The results from the CGE model is medium-term in nature because it embeds in an economy the neoclassical traditions where prices are allowed to change in response to market forces and resources are reallocated accordingly to the price signals. The large discrepancy between the two sets of predictions highlights the sensitivity of model selections.

The impact of avian influenza on industrial GDP is detailed in Table 6. The CGE model predicts that in the 01 and 02 cases, the poultry sector suffers the most, followed by the banking/credit sector. The fishery sector will benefit with a positive effect of NT\$892 million to NT\$2.235 billion. In the class C scenarios, the retailing sector will become the most severely impacted sector, dipping NT\$43.519 billion, followed by the retailing and aviation transportation. The largest beneficiary will be once again the environmental sanitary services, rising NT\$21.776 billion, followed by the medical healthcare and sanitary products. Given the escalation of the pandemic, the negative impact on the overall economy in both modeling exercises are generally consistent. However, the effect of IO model will be greater than that of CGE, which is consistent with the previous literature.

5. Conclusions

The avian influenza is not only a devastating disease in the poultry sector, but also a potential source of future human influenza pandemics and could affect the entire economy. This study provides a comprehensive impact assessment of an avian flu outbreak in Taiwan with focus on the inter-sectoral linkage effect. Two analytical tools are adopted: the IO model provides a short-term estimate and the CGE provides a longer-term prediction. In comparison to the estimates from the World Bank and Asian Development Bank, the degree of negative impacts is considered to be milder and lower in Taiwan than in the other Asian economies. This study recommends that all responsive

measures should be based on a comprehensive set of evaluations in which potential Pareto improvements and magnitude of the difference between gains and losses are made.

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Table 1. Sectoral Specification of the IO model

Sector Classified in 2001 IO Table		Sectors in this study	
009	Other Livestock	162	Cattle
		163	Eggs
		164	Chickens
		165	Other poultry
		166	Other Livestock
017	Other Livestock	167	Pork
		168	Beef
		169	Other meat
		170	Other Slaughtering & By-Products

Table 2. Scenario Design for different epidemic situation of avian flu in Taiwan

Unit: billions NT dollars

[illegible]

7. Consumption						
Medicines				NT 0.77	NT 1.54	NT 3.86
Medical Instrument				NT 1.48	NT 2.95	NT 7.38
Gauze masks				NT 0.09	NT 0.19	NT 0.46
Synthetic detergents and				NT 0.08	NT 0.16	NT 0.39
Washing						
Environmental Sanitary				NT 4.71n	NT 9.23	NT 23.57
Services						
8. Export				-2%	-4%	(1) infection rate 15 %: -6% (2) infection rate 25 %:-8% (3) infection rate 35 %: -10% (4) infection rate 35 %: -12%
9. Supply reduction						(1) infection rate 15%: GDP NT -42.9 (2) infection rate 25%: GDP NT -71.5 (3) infection rate 35%: GDP NT -100.1 (4) infection rate 45%: GDP NT -128.7

Table 3. The Macroeconomic Impacts of Avian Flu in Taiwan using IO model

Unit : %											
	01		02		A1	A2	B	C			
	Lower	Upper	Lower	Upper				Infection	Infection	Infection	Infection
	Limit	Limit	Limit	Limit				ratio 15%	ratio 25%	ratio 35%	ratio 45%
Export						-2	-4	-6	-8	-10	-12
Output	-0.024	-0.05	-0.17	-0.23	-0.04	-1.04	-2.03	-3.59	-4.37	-5.14	-5.92
GDP	-0.014	-0.03	-0.10	-0.14	-0.05	-0.88	-1.70	-3.69	-4.45	-5.21	-5.97
Employment	-0.023	-0.05	-0.16	-0.22	-0.07	-1.04	-1.99	-4.05	-4.61	-5.17	-5.73
Net Indirect Tax	-0.034	-0.07	-0.24	-0.33	-0.06	-1.51	-2.95	-5.72	-6.62	-7.51	-8.41

Source: Simulation results of this article.

Table 4. The Sectoral Impacts of Avian Flu in Taiwan using IO model

Unit : NT million dollars														
Epidemic		01		02		Epidemic		A1	A2	B	C			
classes						classes								
Sectors		Lower Limit	Upper Limit	Lower Limit	Upper Limit	Sectors					Infection ratio 15%	Infectio n ratio 25%	Infectio n ratio 35%	Infection ratio 45%
Positive Impacts														
						Environmental Sanitary Services								
012	Fishery Product	451	902	1,027	2,078	153	Medicines	-33	2,704	5,306	13,938	13,743	13,547	13,352
008	Hogs	60	121	136	276	061	Synthetic Detergents and Washing Preparations and Cosmetics	-1	296	598	3,877	3,832	3,786	3,741
167	Pork	15	30	34	70	063	Pesticides and Herbicides	-23	21	40	214	158	102	47
162	Beef	13	19	30	5	062		-2	13	25	100	82	64	47
Negative Impacts														
164	Chicken	-723	-1,447	-3,454	-5,244	120	Wholesaling	-31	-12,691	-19,906	-57,834	-60,613	-63,392	-66,456
010	Agricultural Service	-378	-760	-1,880	-2,848	121	Retailing	-54	-12,597	-25,146	-55,546	-59,183	-62,819	-66,171
135	Finance	-177	-357	-1,069	-1,533	122	International Trade	-44	-10,344	-20,678	-45,023	-48,363	-51,703	-55,043
120	Wholesaling	-141	-286	-1,266	-1,656	135	Finance	-435	-6,345	-12,309	-23,525	-27,544	-31,563	-35,582
121	Retailing	-127	-256	-743	-1,074	102	Semi-conduct	-1	-6,966	-13,930	-20,910	-27,869	-34,827	-41,786
022	Feed	-103	-207	-796	-1,062	125	Food & Beverage Services	-13	-4,415	-8,829	-21,886	-21,986	-22,085	-22,184
						124	Hotel Service	-2,123	-2,143	-4,434	-10,685	-10,700	-10,715	-10,729
						139	Real Estate Services	-140	-2,316	-4,434	-9,807	-10,675	-11,543	-12,412
						113	Electricity	-82	-1,811	-3,578	-6,128	-7,560	-8,991	-10,422
						104	Electronic Components & Parts	-2	-2,875	-5,749	-8,567	-11,470	-14,373	-17,276
						065	Petroleum Refining	-85	-2,397	-4,747	-7,913	-9,932	-11,952	-13,971
						127	Other Land Transportation	-34	-1,794	-3,572	-6,770	-7,858	-8,947	-10,036
						134	Telegram & Telephone	-133	-1,776	-3,453	-7,079	-7,955	-8,831	-9,708
						069	Plastic Products	-17	-1,524	-3,018	-4,854	-6,221	-7,588	-8,955
						129	Air Transportation	-893	-922	-1,845	-4,574	-4,594	-4,614	-4,634
						131	Traveling Service	-894	-935	-1,872	-4,645	-4,668	-4,691	-4,714

Source: Simulation results of this article.

Table 5. The Macroeconomic Impacts of Avian Flu in Taiwan using CGE model

Unit : %											
	01		02		A1	A2	B	C1	C2	C3	C4
	Lower Limit	Upper Limit	Lower Limit	Upper Limit							
Real GDP	-0.0052	-0.0104	-0.08	-0.09	-0.04	-0.64	-1.29	-2.39	-2.88	-3.38	-3.83
Employment	-0.0256	-0.0513	-0.09	-0.15	-0.08	-0.23	-0.45	-1.25	-1.34	-1.44	-1.49
Export	0.0718	0.1433	0.28	0.45	-0.11	-0.61	-1.22	-1.68	-2.53	-3.38	-4.26
Import	0.0682	0.1361	0.27	0.43	-0.09	-0.90	-1.79	-2.52	-3.64	-4.76	-5.91
GDP inflation	-0.08	-0.15	-0.29	-0.47	0.07	-0.82	-1.65	-2.52	-3.20	-3.89	-4.55
CPI	-0.08	-0.15	-0.29	-0.46	0.07	-0.81	-1.63	-2.46	-3.15	-3.83	-4.49
Export price	-0.03	-0.06	-0.10	-0.16	0.02	-0.30	-0.61	-0.95	-1.20	-1.45	-1.69

Source: Simulation results of this article.

Table 6. The Sectoral Impacts of Avian Flu in Taiwan using CGE model

Epidemic classes	unit : NT million dollars								
	01	02	A1	A2	B	C1	C2	C3	C4
Positive Impacts									
012 Fishery Products	892	2,235							
162 Beef	0	5							
154 Environmental Sanitary Services			-28	2,981	5,842	14,835	14,865	14,895	21,776
061 Medicines			-45	830	1,665	5,391	5,791	6,190	9,510
063 Synthetic Detergents and Washing Preparations and Cosmetics	18	40	-9	154	306	681	711	742	1,914
062 Pesticides and Herbicides	1	8	-2	56	110	244	256	267	362
Negative Impacts									
122 Retailing	99	-803	-354	-8,026	-16,049	-40,428	-41,296	-42,168	-43,519
121 Wholesaling	-250	-898	-350	-7,902	-15,795	-42,013	-42,016	-42,024	-43,045
123 International Trade			-261	-7,341	-14,676	-35,249	-36,681	-38,117	-40,178
126 Food & Beverage Services	24	-352	-218	-1,942	-3,881	-8,649	-10,311	-11,996	-13,682
103 Semi-conduct			-421	-1,877	-3,749	-5,116	-7,869	-10,626	-13,498
136 Finance	-524	-2,017	-499	-1,474	-2,948	-6,692	-7,800	-8,912	-10,049
104 Electronic Components & Parts			-145	-1,122	-2,243	-3,110	-4,588	-6,068	-7,615
065 Petroleum Refining	-97	-401	-158	-893	-1,787	-2,859	-3,914	-4,970	-6,004
140 Real Estate Services			-89	-851	-1,699	-4,184	-4,590	-4,997	-5,858
132 Traveling Service	-62	-254	-894	-896	-1,788	-4,476	-4,482	-4,487	-4,492
130 Air Transportation	-52	-312	-692	-949	-1,382	-3,669	-3,682	-3,714	-3,747
114 Electricity	-186	-754	-76	-540	-1,081	-1,669	-2,346	-3,024	-3,618
125 Hotel Service	-6	-21	-24	-563	-1,126	-1,736	-2,280	-2,823	-3,368
135 Telegram & Telephone	-587	-2,436	-122	-522	-1,044	-2,419	-2,630	-2,841	-2,984
128 Other Land Transportation			-124	-352	-705	-1,893	-2,209	-2,527	-2,976
069 Plastic Products			-84	-391	-781	-1,181	-1,745	-2,310	-2,866
138 Insure	-28	-764	-17	-446	-892	-1,203	-1,637	-2,071	-2,383
130 Services Incidental to Transport			-112	-256	-512	-1,080	-1,301	-1,523	-1,781
123 Commodity Brokerage			-79	-196	-392	-758	-946	-1,135	-1,300
127 Railroad Vehicle Transportation			-22	-166	-331	-747	-896	-1,049	-1,202

Source: Simulation results of this article.