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Keywords: Linked Input-Output Tables, Two-state Calibration, Tariff Elimination,

JEL classification: D57, D58, F24

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Japan–Korea Trade Liberalization Revisited: The Role of Armington Elasticities

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Abstract

The elasticity of substitution between foreign and domestic products, i.e., Armington elasticity, is measured by way of two-state calibration according to the temporally distant observations of the market shares, and associated price changes. Along with the sector-wise multifactor CES elasticity estimated using the linked input-output tables, we integrate domestic production of the two countries (Japan and the Republic of Korea) with bilateral trades and construct a bilateral general equilibrium model. Thereupon, we perform an economic assessment of trade liberalization between the two countries.

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1. Introduction

When the Japan–Korea FTA (Free Trade Agreement) was gaining momentum in the late 90's, the two governments agreed to conduct a joint research on bilateral FTA with IDE (Institute of Developing Economies, JETRO, Japan) and KIEP (Korea Institute for International Economic Policy, Korea). While Cheong [3] reports on the source of inconsistency between the simulation results provided by the two institutions, the key parameters (elasticities) of the previous models that lie behind the study [e.g., 12, 10] were adopted but not adapted to reflect the regional characteristics. KIEP's report was also showing that: 1) Japan–Korea FTA would potentially worsen Korea's welfare level as well as the trade balance against Japan; 2) Korea's heavy and chemical industries can receive a serious damage and hence harm Korea's industrial structure. This study is intended to reexamine these propositions.

Recently, Kim et al. [7] developed a general equilibrium framework with per-sector multifactor CES elasticities estimated using two-state cost share observations based on linked input-output tables. Current study is intended to extend this framework in such ways to incorporate substitution between domestic and imported factor inputs with respect to the Armington elasticity, and to

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endogenize product-wise international trades between two countries. In this study we show particularly that the Armington elasticity, i.e., the constant substitution elasticity between domestic and imported (foreign) products, can be calibrated so as to replicate the observed binary market shares with respect to the price changes between the two temporally distant states.

Armington elasticity is an essential component of trade policy analysis. Previous works concerning economic assessment of trade liberalization schemes [e.g., 5, 12, 16, 13] have used CGE (Computable General Equilibrium) models based on the GTAP (Global Trade Analysis Project) database. While these models make use of the empirically estimated elasticities observed in the literature, the estimates for aggregated inputs and those based on time series data tend to show lower elasticities than the otherwise [9]. Notwithstanding, Armington elasticities can be quite large, concerning the indifferences between goods of the same classification but from different countries.

From another perspective, Saito [14] was concerned with the separability of foreign products i.e., distinction between inter- and intra-group Armington elasticities.[1] The inter-group elasticity is the elasticity of substitution between the basket of domestic products and that of imports as a whole, whereas the intra-group elasticity is the elasticity of substitution between the basket of imports from one foreign country and that from another. The estimates of inter-group elasticities were larger for intermediate inputs sectors, whereas the intra-group elasticities were significantly lower. In the same vein, Feenstra et al. [4] studied the elasticity of substitution between domestic and foreign goods (i.e., macro elasticity), and between varieties of foreign goods (i.e., micro elasticity) and basically found the opposite; the micro Armington elasticity was significantly larger than the macro Armington elasticity.

Our approach is different from the previous studies in two aspects. First of all, all elasticities are measured originally (not adopted from elsewhere) based upon latest possible government published statistics i.e., the linked input–output tables, and the UN Comtrade database. Specifically, we construct our model using two temporally distant state observations in these databases rather than conducting time series analysis, as we are interested in shorter term and sector-wise policy implications such as of a tariff liberalization scheme.

Moreover, the Armington elasticities are measured by way of a methodology which we call *two-state calibration*. That is, we measure two-input Armington elasticities according to the two temporally distant observations of market shares and the corresponding price changes (i.e., deflators). Figure 1 illustrates the nesting structure in one country. Specifically, we first evaluate the compound price of each factor input w_{Ci} using the domestic w_{Di} and foreign w_{Fi} factor input prices (which are observable) by CES aggregation whose (macro Armington) elasticity being calibrated via two temporally distant observations of the domestic-foreign market shares. We then calibrate the micro Armington elasticity via w_{Fi} and the partner country's domestic price $w_{Di}^{(P)}$ while utiliz-

[1] We hereafter use produt, factor input, and commodity interchangeably. We also use sector and industry interchangeably.

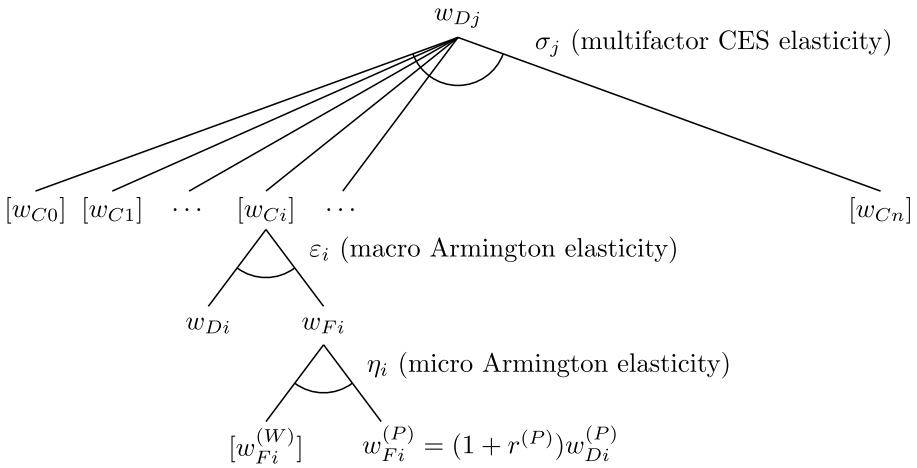

Figure 1: The nesting structure and the Armington elasticities.

ing the two temporally distant observations of the partner-non-partner (rest of the world) market shares. In this way, and based upon 2000–2005 data for Japan and Korea, we construct a multi-sectoral (395 for Japan and 350 for Korea) general equilibrium model with endogenized bilateral trades, in contrast to the previous (above mentioned) studies with uncomparably limited variety of sectors and commodities.

The remainder of this paper is organized as follows. In the next Section 2, we introduce the basics of the two-state calibration of the CES elasticity parameters, i.e., macro and micro Armington elasticities, and the multifactor CES elasticity estimation via the two-state observations of per-factor cost shares. In Section 3, we apply the protocols using linked input–output tables for Japan and the Republic of Korea and the UN Comtrade database. In Section 4 we integrate the domestic and the trade modules and construct a bilateral general equilibrium model in the dual (price system), and then project it onto the quantitative system, for welfare analysis. In Section 5 study the Japan–Korea trade liberalization scheme based upon the bilateral general equilibrium model. Section 6 provides concluding remarks.

2. Model

2.1. Macro Armington Elasticity

We perform two-point calibration of per-product Armington elasticities. Assume that foreign and domestic commodities are to some extent substitutes with constant elasticity of substitution (CES). Then, a *composite* product (index i omitted) price in a country can be evaluated by using the CES aggregate of foreign and domestic product prices as follows:

$$w_C = \left(\alpha(w_D)^{\phi} + (1-\alpha)\,(w_F)^{\phi}\right)^{1/\phi} \equiv A\,(w_D, w_F) \tag{1}$$

where, w_C is the composite price of a product in a country concerned; w_F is the price of imported foreign product (including tariff); w_D is the price of domestic product. The functional parameters are α (the share parameter) and $\varepsilon = 1 - \phi$ (the macro Armington elasticity). By taking derivatives we have:

$$s_D = \frac{\partial w_C}{\partial w_D}\frac{w_D}{w_C} = \alpha\left(\frac{w_D}{w_C}\right)^{\phi} \qquad s_F = \frac{\partial w_C}{\partial w_F}\frac{w_F}{w_C} = (1-\alpha)\left(\frac{w_F}{w_C}\right)^{\phi} \tag{2}$$

where s_D and s_F denote market shares of the domestic and imported products, respectively.

Below we show that ϕ can be measured (calibrated) by way of two temporally distant market share observations i.e., the reference market shares (s_D^0, s_F^0) and the current market shares (s_D^1, s_F^1), along with corresponding price changes in the domestic and imported products. In this regard we standardize prices at the reference state (as unity) and denote the current prices for the domestic and imported products by (p_D, p_F). Then, at the reference state the following must be true.

$$s_D^0 = \alpha \qquad s_F^0 = (1-\alpha) \tag{3}$$

At the current state, on the other hand, following equations must hold:

$$s_D^1 = s_D^0\left(\frac{p_D}{p_C}\right)^{\phi} \qquad s_F^1 = s_F^0\left(\frac{p_F}{p_C}\right)^{\phi} \tag{4}$$

We can solve (4) for macro Armington elasticity $\varepsilon = 1 - \phi$ as follows:

$$1 - \varepsilon = \phi = \frac{\ln s_D^1 - \ln s_F^1 - \left(\ln s_D^0 - \ln s_F^0\right)}{\ln p_D - \ln p_F} \tag{5}$$

Hence, the compound factor deflator p_C can be evaluated by the following formula:

$$p_C = p_D\left(\frac{s_D^1}{s_D^0}\right)^{1/\phi} = p_F\left(\frac{s_F^1}{s_F^0}\right)^{1/\phi} \tag{6}$$

2.2. Micro Armington Elasticity

Let there be N countries from which the product is imported. The aggregated foreign import product price w_F must be a function of all imported product prices $w_F^{(k)}$ from countries $k \in N$, such that,

$$w_F = B\left(w_F^{(1)}, w_F^{(2)}, \cdots, w_F^{(N)}\right) = B\left(w_F^{(P)}\right)$$

As we are concerned with bilateral trades in this study, we shall assume that the foreign product price is dependent only on product price of the partner country $w_F^{(P)}$, while we assume all prices of products from ROW (the rest of the world) $k \neq P$ remain unchanged at unity i.e., $w_F^{(k)} = 1$. We

assume that B is CES with factor inputs of partner country and of the rest of the world as follows:

$$w_F = B\left(w_F^{(P)}\right) = \left(\beta\left(w_F^{(P)}\right)^{\rho} + (1-\beta)\left(w_F^{(W)}\right)^{\rho}\right)^{1/\rho} \tag{7}$$

where $\eta = 1-\rho$ is the micro Armington elasticity. Here, we use (W) to indicate ROW.

In order to measure the micro Armington elasticity $\eta = 1-\rho$, we first evaluate the share parameter β by the following identities concerning the reference state:

$$s_F^{0(P)} = \beta \qquad\qquad s_F^{0(W)} = (1-\beta) \tag{8}$$

Further, let us note that this micro Armington elasticity replicates the market share of the current state:

$$s_F^{1(P)} = s_F^{0(P)}\left(\frac{p_F^{(P)}}{p_F}\right)^{\rho} \qquad\qquad s_F^{1(W)} = s_F^{0(W)}\left(\frac{p_F^{(W)}}{p_F}\right)^{\rho} \tag{9}$$

By applying Euler's homogeneous function theorem upon (7) and evaluating at the current state, the price change (deflator) of the aggregated ROW products $p_F^{(W)}$ can be solved by the following equation:

$$p_F = s_F^{1(P)}p_F^{(P)} + s_F^{1(W)}p_F^{(W)} \tag{10}$$

Parenthetically, the in-bound price of k country product $w_F^{(k)}$ can be evaluated by way of domestic price within that country $w_D^{(k)}$ as follows:

$$w_F^{(k)} = \frac{(1+r_M)\left(1+r_S^{(k)}\right)\left(1+r_T^{(k)}\right)}{\left(1+r_M^{(k)}\right)} w_D^{(P)} \equiv \left(1+r^{(k)}\right) w_D^{(k)} \tag{11}$$

where $r_M^{(k)}$, r_S, and r_T represent miscellaneous tax (levied at the country k), shipping cost (insurance and freight) rate and tariff rate, respectively, and we call $(1+r^{(k)})$ the barrier factor for products of country k. By plugging (11) into (10) the aggregated ROW product deflator $p_F^{(W)}$ can be obtained by way of the following formula:

$$p_F^{(W)} = \frac{p_F - s_F^{1(P)}p_F^{(P)}}{s_F^{1(W)}} \qquad\qquad p_F^{(P)} = \frac{1+r^{1(P)}}{1+r^{0(P)}} p_D^{(P)} \equiv \theta^{(P)} p_D^{(P)} \tag{12}$$

where, we denote by $\theta^{(P)}$ the *barrier coefficient* for the imported products from the partner country.

Now, the micro Armington elasticity η can be obtained by the following formula:

$$1-\eta=\rho=\frac{\ln s_F^{1(P)}-\ln s_F^{1(W)}-\left(\ln s_F^{0(P)}-\ln s_F^{0(W)}\right)}{\ln p_F^{(P)}-\ln p_F^{(W)}} \tag{13}$$

Moreover, we note that in regard to (11), (7) can be written as follows:

$$w_F=B\left(w_F^{(P)}\right)=B\left(\theta^{(P)}w_D^{(P)}\right) \tag{14}$$

2.3. Multifactor CES Elasticity

Assume that production for an industry j (index omitted) is carried out under constant-returns multifactor CES (constant elasticity of substitution) production whose unit cost function is of the following form:

$$w_D=z^{-1}\left(\sum_{i=0}^{n}\lambda_i\left(w_{Ci}\right)^{\gamma}\right)^{1/\gamma} \tag{15}$$

Here, w_{Ci} is the ith factor (i.e., compound of imported and domestic) price; $\lambda_i>0$ is the share parameter where $\sum\lambda_i=1$; $1-\gamma=\sigma$ is the multifactor CES elasticity of substitution; z denotes the productivity level. Kim et al. [7] showed that the elasticity parameter γ can be estimated along with the productivity gain z by regressing the growth of per-factor cost shares against the growth of factor prices. The cost share of the ith input s_i can be determined in regard to Shephard's lemma, by differentiating (15):

$$s_i=\frac{\partial w_D}{\partial w_{Ci}}\frac{w_{Ci}}{w_D}=\lambda_i\left(z\frac{w_D}{w_{Ci}}\right)^{-\gamma} \tag{16}$$

By taking the logarithm of both sides we have:

$$\ln s_i=\ln\lambda_i-\gamma\ln z+\gamma\ln\left(w_{Ci}/w_D\right)$$

As we observe two temporally distant values for cost shares (a_i^0 and a_i^1), factor prices (1 and p_{Ci}) and unit cost of output as prices (1 and p_{Di}), we find two identities regarding the data:

$$\ln a_i^0=\ln\lambda_i-\gamma\ln z^0+\gamma\ln\left(1/1\right)+u_i^0 \tag{17}$$

$$\ln a_i^1=\ln\lambda_i-\gamma\ln z^1+\gamma\ln\left(p_{Ci}/p_D\right)+u_i^1 \tag{18}$$

where we assume that u_i^0 and u_i^1 are identically and normally distributed disturbance terms. Subtraction result in the following regression equation:

$$\ln\left(a_i^1/a_i^0\right) = -\gamma \ln\left(z^1/z^0\right) + \gamma \ln\left(p_{Ci}/p_D\right) + u_i^1 - u_i^0 \tag{19}$$

A sector specific multifactor CES elasticity γ can be estimated by simple regression of (19).

3. Measurement

3.1. Macro Armington Elasticities

A set of linked input–output tables includes sectoral transaction in both nominal and real terms. Hence, it provides the temporally distant observations of per-factor cost shares as well the commodity price changes in terms of deflators. In addition, a set of linked input–output tables provides the deflators for the imported commodities. That is to say, the data that we need for two-state calibration of the macro Armington elasticities i.e., $(s_{Di}^0,\, s_{Fi}^0)$, $(s_{Di}^1,\, s_{F_i}^1)$, $(p_{Di},\, p_{Fi})$ are all available in this database. In this study, we use the 1995–2000–2005 linked input–output tables for both Japan [11] and Korea [2], and chose 2000 as the reference state and 2005 as the current state.

In Figures 2 and 3 we display the two-state calibrated commodity-wise macro Armington elasticities $\varepsilon_i = 1 - \phi_i$ using the above mentioned databases via (5). Note that the macro Armington elasticities are fairly large in magnitude (green and red) indicating substitutability in both countries, while negative elasticities (red and blue) are observed in some cases. Also note that domestic deflators p_{Di} and foreign deflators p_{Fi} are more correlated in Japan (correlation coefficient = 0.830) while less so in Korea (correlation coefficient = 0.624).

3.2. Micro Armington Elasticities

In order to calibrate the micro Armington elasticity according to the formula (13) we need reference and current observations of the partner and the ROW market shares within the foreign factor inputs i.e., $(s_F^{0(P)},\, s_F^{0(W)})$ and $(s_F^{1(P)},\, s_F^{1(W)})$ for each commodity. We use relevant international trade data [15] of the 6-digit HS code (spanning over 6376 commodities) converted into the linked input-output commodity classification, in order to obtain the market share of the partner country with respect to that of the ROW, in two (2000 and 2005) periods. [2] The deflators for partner country and ROW factor inputs $(p_F^{(P)},\, p_F^{(W)})$ can be obtained via (12) under relevant tariff rate etc., included in the assessment of partner country product deflators.

In Figures 4 and 5 we display the two-state calibrated commodity-wise micro Armington elasticities $\eta_i = 1 - \rho_i$ using the above mentioned databases via (13). Note that the micro Armington

[2] Although international input-output tables provide trade data between two countries, variety of sectors and commodities are limited. (e.g., 76 intermediate sectors for Asian international input-output tables published by IDE).

elasticities are fairly large in magnitude (green and red) indicating substitutability in both countries, while negative elasticities (red and blue) are observed in some cases. Also note that partner country deflators $p_{Fi}^{(P)}$ and ROW deflators $p_{Fi}^{(W)}$ are not so correlated in Korea (correlation coefficient = 0.222) and even less so in Japan (correlation coefficient = 0.145). Furthermore, we note that the correlations between macro and micro Armington elasticities were very weak in both countries i.e, correlation coefficient = 0.0005 in Japan and = 0.0016 in Korea.

3.3. Multifactor CES Elasticities

The linked input–output tables, however, do not include deflators for primary factor (i.e., labor and capital) and therefore, we use the quality-adjusted price indices compiled by JIP [6] for Japan and by KIP [8] for Korea in order to inflate the primary factor inputs observed as nominal values. Hence, observations for both the dependent variables (cost shares as input–output coefficients (a_{ij}^0, a_{ij}^1) and independent variables (deflator ratios p_{Ci}/p_{Dj} for estimating regression equation (19) become available with sufficient capacity in terms of degrees of freedom, as we verify that there are $n+1$ inputs, namely, $i = 0, 1, \cdots, n$ and n outputs namely, $j = 1, \cdots, n$ for an input–output table.

Figure 6 displays the estimated CES elasticity (i.e., $\sigma_j = 1 - \gamma_j$) with respect to the statistical significance of γ_j i.e., the slope of the regression equation (19) in terms of the P-value in Japan. Figure 7 is the version for Korea. Note that CES elasticities are statistically significant (P-value < 0.1) for 176 out of 395 sectors for Japan whereas 174 sectors are significant out of 350 sectors in Korea. The results of the estimations are summarized in the Appendix, Tables 8 and 9 for Japan and Korea, respectively. We indicate the statistical significance of the estimate by ***(0.01 level), **(0.05 level), and *(0.1 level), along the estimated elasticities.

4. Analysis

4.1. Bilateral Equilibrium

First we calibrate the share parameters according to the current state, while using the multifactor CES elasticities and the Armington (CES) elasticities estimated and calibrated via the procedures discussed in the earlier sections. Below we write down the system of unit cost functions with $n+1$ factor (n intermediate and one primary) inputs calibrated under the current share parameters:

$$
\begin{aligned}
\pi_{D1} &= z_1^{-1}\left(a_{01}(\pi_{C0})^{\gamma_1} + a_{11}(\pi_{C1})^{\gamma_1} + \cdots + a_{n1}(\pi_{Cn})^{\gamma_1}\right)^{1/\gamma_1} \\
\pi_{D2} &= z_2^{-1}\left(a_{02}(\pi_{C0})^{\gamma_2} + a_{12}(\pi_{C1})^{\gamma_2} + \cdots + a_{n2}(\pi_{Cn})^{\gamma_2}\right)^{1/\gamma_2} \\
&\vdots \\
\pi_{Dn} &= z_n^{-1}\left(a_{0n}(\pi_{C0})^{\gamma_n} + a_{1n}(\pi_{C1})^{\gamma_n} + \cdots + a_{nn}(\pi_{Cn})^{\gamma_n}\right)^{1/\gamma_n}
\end{aligned}
$$

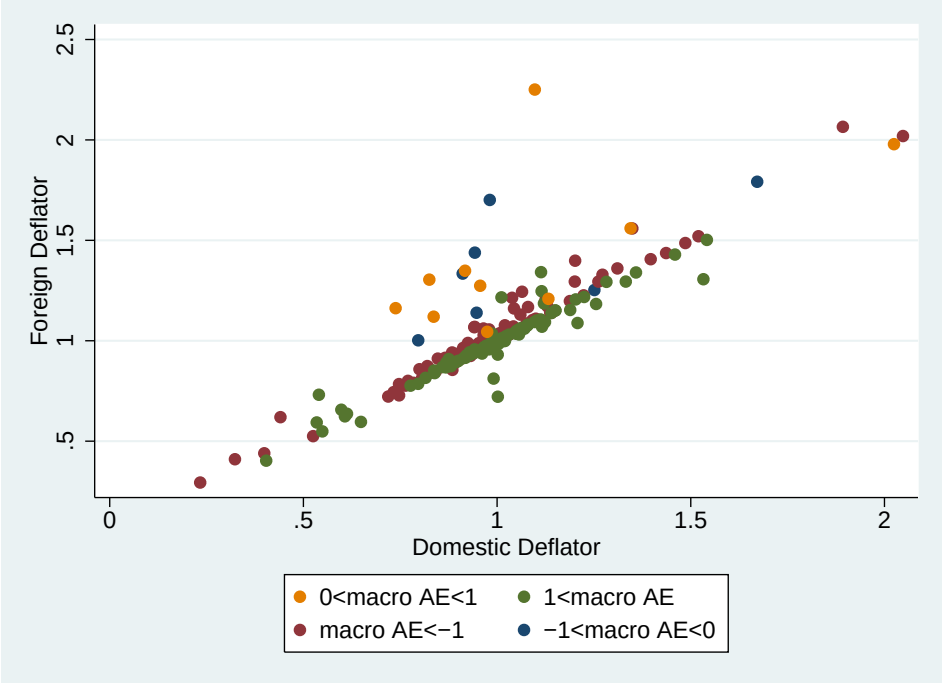

Figure 2: Foreign and domestic price changes (deflators) and the macro Armington elasticity (Japan).

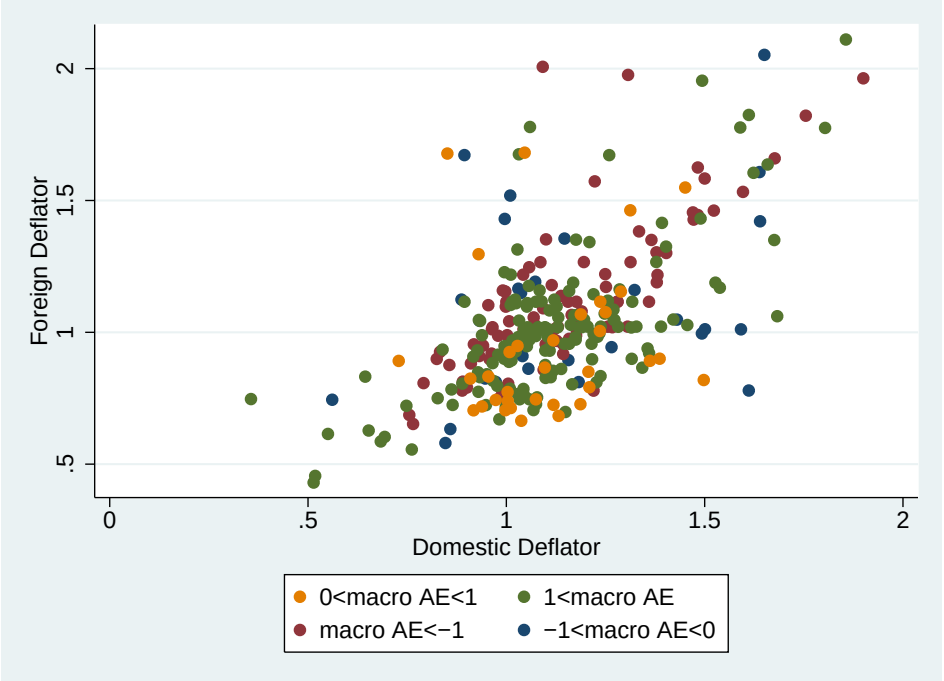

Figure 3: Foreign and domestic price changes (deflators) and the macro Armington elasticity (Korea).

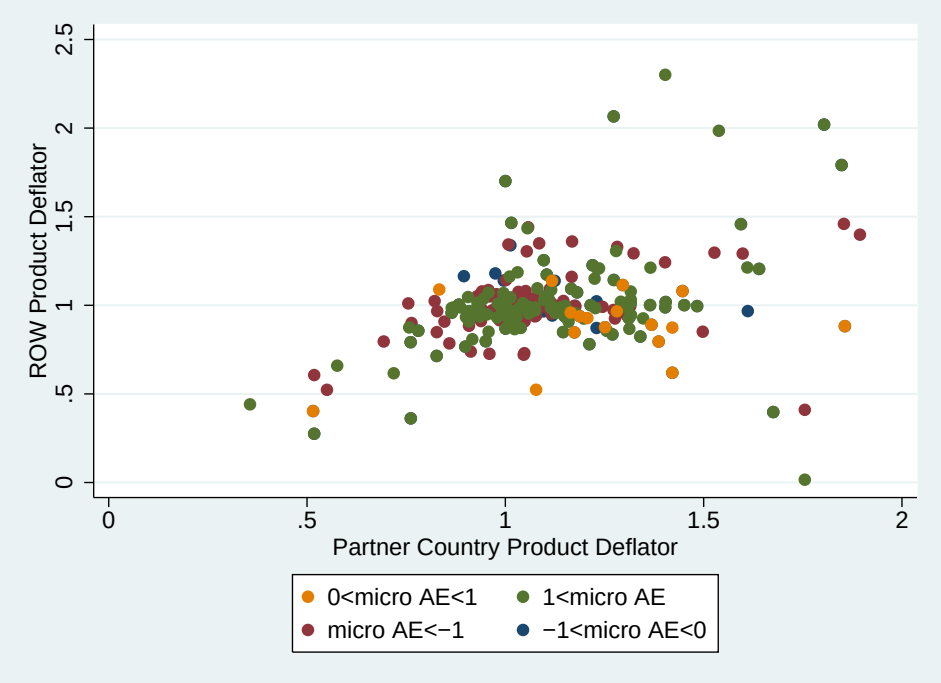

Figure 4: Partner country and ROW price changes (deflators) and the micro Armington elasticity (Japan).

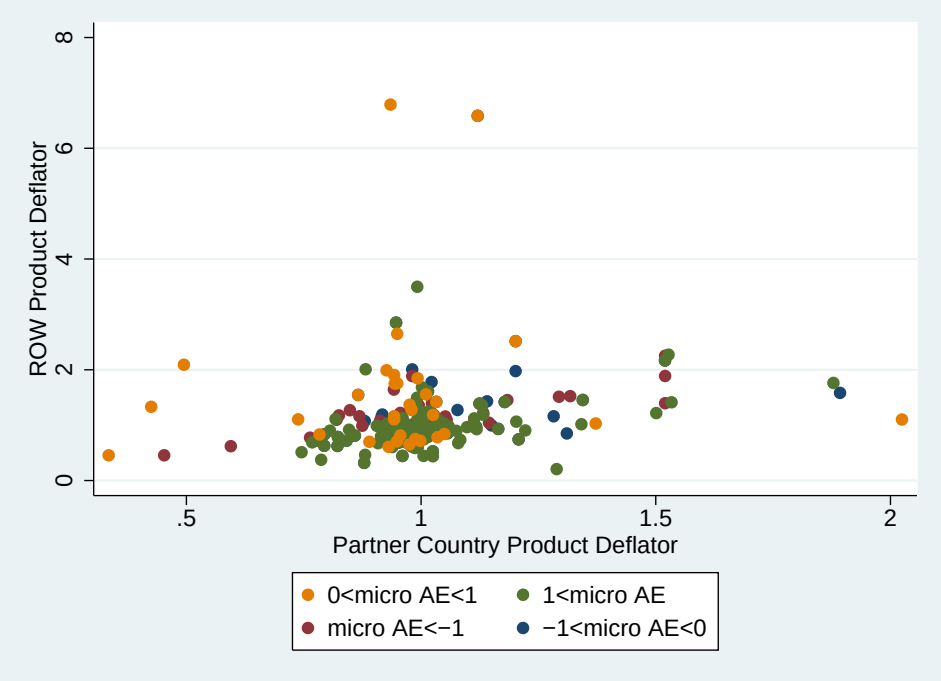

Figure 5: Partner country and ROW price changes (deflators) and the micro Armington elasticity (Korea).

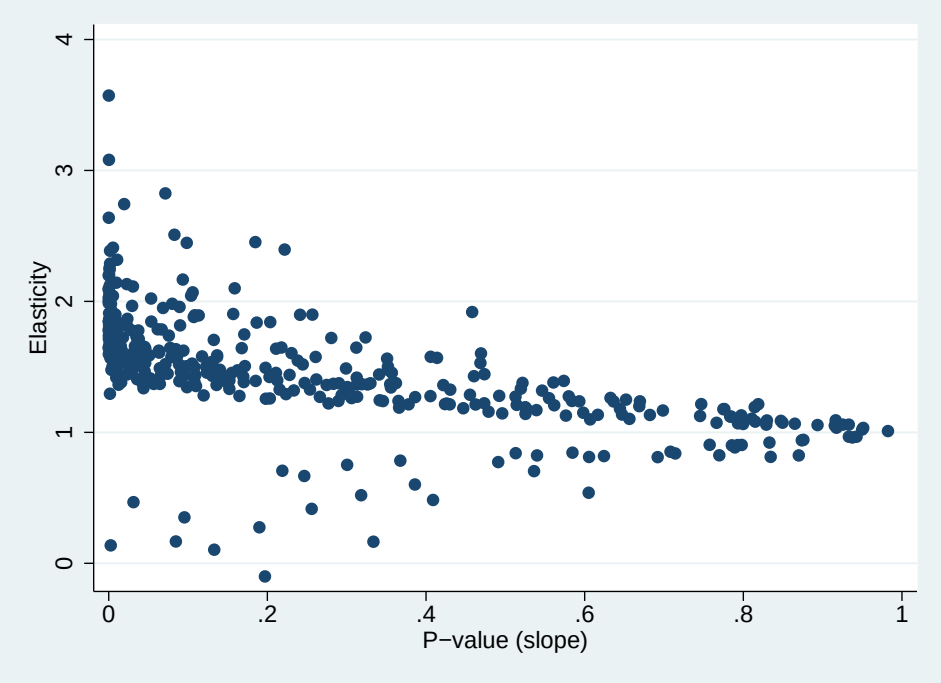

Figure 6: The estimated CES elasticity with respect to the statistical significance (Japan).

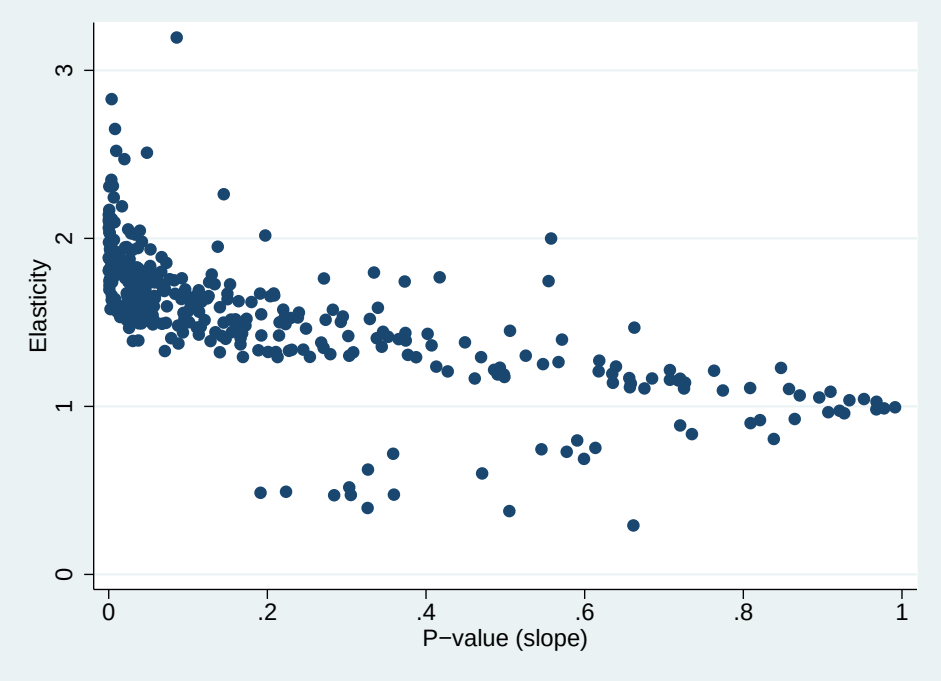

Figure 7: The estimated CES elasticity with respect to the statistical significance (Korea).

Here, π_{Di} and π_{Ci} denote equilibrium price (deflator) standardized at the current state under the productivity change z for domestic and compound products, respectively; and a_{ij} is the current cost share (hence, we redefine $a_{ij} = a^1_{ij}$) of the ith factor for the jth sector.

We may verify that the current state (i.e., $z_1 = \cdots = z_n = 1$) is replicated by the current equilibrium price which is standardized at unity (i.e., $\pi_{C0} = \pi_{C1} = \cdots = \pi_{Cn} = 1$, and $\pi_{D0} = \pi_{D1} = \cdots = \pi_{Dn} = 1$), as we take $\sum_{i=0}^{n} a_{ij} = 1$ for all j, into account. For convenience, we shall hereafter use the following row-vector mapping expression:

$$\boldsymbol{\pi}_D = H\left(\boldsymbol{\pi}_C, \mathbf{z}\right) = H\left(A\left(\boldsymbol{\pi}_D, \boldsymbol{\pi}_F\right), \mathbf{z}\right)$$

We write down below the domestic modules for both countries (Japan and Korea):

$$\boldsymbol{\pi}_D^{(J)} = H^{(J)}\left(A^{(J)}\left(\boldsymbol{\pi}_D^{(J)}, \boldsymbol{\pi}_F^{(J)}\right), \mathbf{z}^{(J)}\right) \qquad \boldsymbol{\pi}_D^{(K)} = H^{(K)}\left(A^{(K)}\left(\boldsymbol{\pi}_D^{(K)}, \boldsymbol{\pi}_F^{(K)}\right), \mathbf{z}^{(K)}\right) \tag{20}$$

The trade modules between the two countries are as follows:

$$\boldsymbol{\pi}_F^{(J)} = B^{(J)}\left(\boldsymbol{\pi}_D^{(K)}\left\langle\boldsymbol{\theta}^{(J)}\right\rangle\right) \qquad \boldsymbol{\pi}_F^{(K)} = B^{(K)}\left(\boldsymbol{\pi}_D^{(J)}\left\langle\boldsymbol{\theta}^{(K)}\right\rangle\right) \tag{21}$$

Note that the elasticity parameters of the functions ($H^{(J)}$, $H^{(K)}$) are estimated by way of regression equation (19), while those of the functions ($A^{(J)}$, $A^{(K)}$), and ($B^{(J)}$, $B^{(K)}$) are obtained by way of two-state calibration (5) and (13), respectively. All the share parameters are calibrated to the current state i.e., $\boldsymbol{\pi}_D^{(J)} = \boldsymbol{\pi}_F^{(J)} = \boldsymbol{\pi}_D^{(K)} = \boldsymbol{\pi}_F^{(K)} = \mathbf{1}$ under $\mathbf{z}^{(J)} = \mathbf{z}^{(K)} = \mathbf{1}$. The barrier constraint must also be at unity i.e., $\boldsymbol{\theta}^{(J)} = \boldsymbol{\theta}^{(K)} = \mathbf{1}$ at the current state by definition.[3] The angle brackets indicate diagonalization. Given any productivity change in both countries ($\mathbf{z}^{(J)}$, $\mathbf{z}^{(K)}$), and barrier factor change ($\boldsymbol{\theta}^{(J)}$,$\boldsymbol{\theta}^{(K)}$), we can solve for equilibrium prices ($\boldsymbol{\pi}_D^{(J)}$, $\boldsymbol{\pi}_D^{(K)}$) and ($\boldsymbol{\pi}_F^{(J)}$, $\boldsymbol{\pi}_F^{(K)}$), via (20) and (21).

4.2. Welfare

According to (16) the projected cost share, which we denote as a'_{ij} can be evaluated by the following identity:

$$a'_{ij} = a_{ij}\left(z_j \pi_j / \pi_i\right)^{-\gamma_j} \tag{22}$$

where, $i = 0, 1, \cdots, n$ and $j = 1, \cdots, n$. In this study we measure welfare gain by way of the technical coefficients evaluated by the above equation (22). Given a final demand n column vector $\mathbf{f}$ the sum of primary factor inputs ℓ can be calculated by the following input-output analysis.

[3]The barrier constraint θ is the ratio between the barrier factors $1 + r$ including tariff, freight cost etc., for two temporally distant states, as defined in (12).

Below we display the quantitative balance in two states, current and ex post:

$$\ell = \mathbf{a}_0 \left[\mathbf{I} - \mathbf{A}\right]^{-1} \mathbf{f} \qquad\qquad \ell' = \mathbf{a}_0' \left[\mathbf{I} - \mathbf{A}'\right]^{-1} \mathbf{f}' \tag{23}$$

Note that ($\mathbf{A}$, $\mathbf{A}'$) are $n \times n$ matrices that consist of (a_{ij}, a'_{ij}), while ($\mathbf{a}_0$, $\mathbf{a}'_0$) are n row vector that consist of (a_{0j}, a'_{0j}).

In order to measure the welfare gain, we use $\mathbf{f}$ of the current state as the direction vector, and let the scalar ω of $\mathbf{f}\omega$ to maximize, given a fix amount of ℓ. In that event ω must be calculated as follows:

$$\omega = \frac{\ell}{\mathbf{a}_0' \left[\mathbf{I} - \mathbf{A}'\right]^{-1} \mathbf{f}} \tag{24}$$

In that event, the differences between current and ex post output vector $\Delta\mathbf{y} = \mathbf{y}' - \mathbf{y}$ must be evaluated as follows:

$$\Delta\mathbf{y} = \mathbf{y}' - \mathbf{y} = \left[\mathbf{I} - \mathbf{A}'\right]^{-1} \mathbf{f}\omega - \left[\mathbf{I} - \mathbf{A}\right]^{-1} \mathbf{f} \tag{25}$$

Thus, we evaluate $\Delta\mathbf{y}$ as the welfare gain ex post of any given policy intervention upon ($\boldsymbol{\theta}^{(J)}$, $\boldsymbol{\theta}^{(K)}$) and/or any change upon ($\mathbf{z}^{(J)}$, $\mathbf{z}^{(K)}$).[4]

5. Simulations

5.1. Tariff Rates

For tariff rates, customs duties-imported values ratios are adopted. We referred the UNCTAD Trade Analysis Information System (TRAINS) raw data. However, we found the tariff rates from the TRAINS overestimate[5] custom duties of linked input-output tables. Thus, we chose customs duties-imported values ratios calculated based on linked input-output tables. These ratios can underestimate tariff rates if some goods are imported from FTA ratified countries. However, only few FTA came into effect in 2005 (e.g., Japan-Singapore EPA in 2002, Japan- Mexico EPA in 2005 and Korea-Chile FTA in 2004). The tariff rates of Japan and Korea are displayed in Figure 8 and 9. The tariff rates for agricultural and processed food sectors are higher than manufacturing and service sectors in both countries.[6] In general, agricultural tariff rates keep higher level to protect domestic agriculture.

[4]Note that $|\Delta\mathbf{y}| = \Delta$GDP by definition.

[5]For example, if we apply Korean tariff rates from the TRAINS, customs duties collected on imported goods from Japan will be greater than whole customs duties in Korea.

[6]For examples, 62nd sector (refined sake, 59.0%) ranked the highest and the second highest rate is 18th sector (Beef cattle, 22.5%). On the other hand, the highest tariff rate is shown in 5th sector (vegetables, 53.6%) and 6th sector (fruits, 37.4%) ranked in the second highest in Korea.

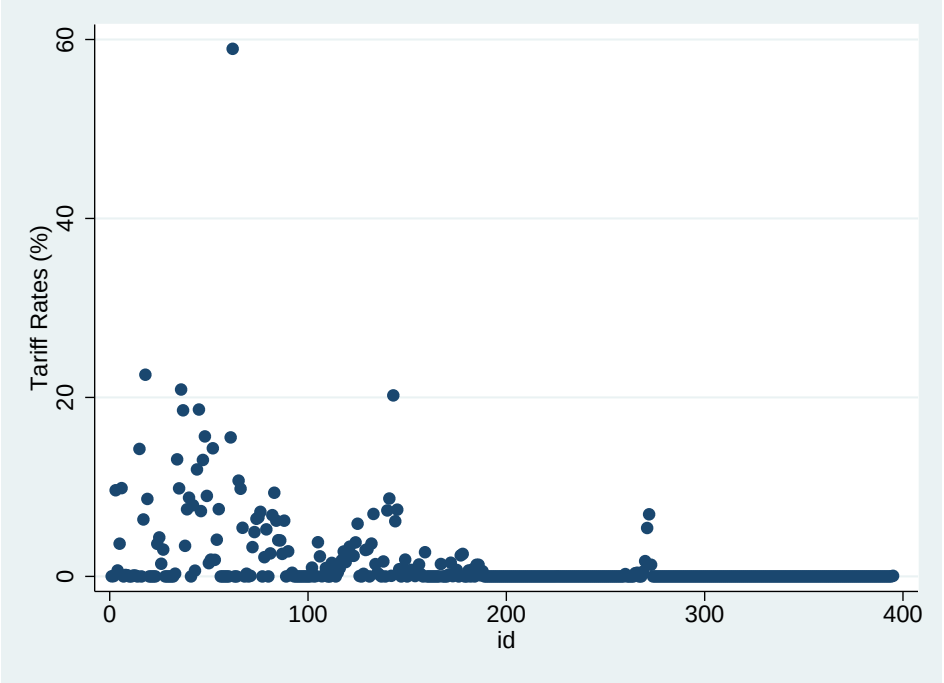

Figure 8: Sectoral initial tariff rates in Japan (2005).

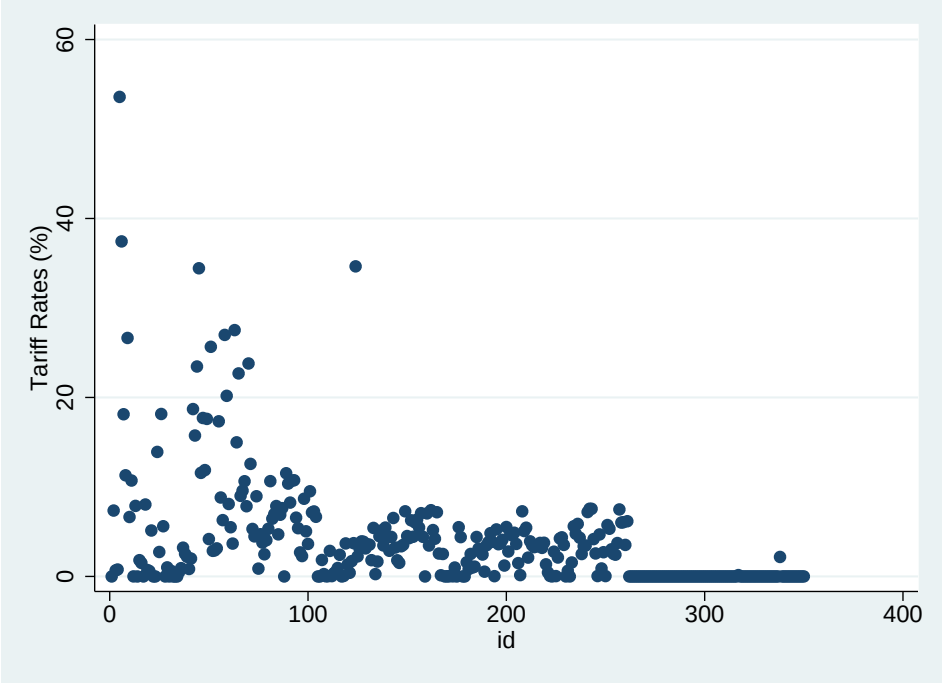

Figure 9: Sectoral initial tariff rates in Korea (2005).

5.2. The Effects of Bilateral Trade Liberalization

In this subsection, we assume the tariff rates decreased to zero or halved. Table 1 shows changes in GDP, demand of domestic products in domestic market and bilateral trade values. Seven scenarios are suggested in this table. First, tariff eliminated or reduced by 50 percent for all sectors, second, excluding agricultural sectors, third, excluding agriculture and processed food, and the last is tariff rates cut in half for agriculture and tariff abolition for the other sectors. In general, the stronger tariff rates liberalized, the greater GDP gained.

The sign of GDP and bilateral trade values between Japan and Korea show positive for all cases in Table 1. It exhibits an interesting feature. In Korea, the results of all tariff liberalization scenarios show a rise in domestic intermediate inputs and imports from Japan. Instead of expanding bilateral trade, imported products from rest of the world are reduced. On the other hand, Japan's results are different from Korea (e.g., a decline of domestic intermediate inputs in scenarios 1 through 3, imports decreased from other countries in scenarios 4 and 7, and both reduction in scenarios 5 and 6). The result of simulations indicates Korea's trade dependence on Japan will be growing when the Japan-Korea FTA gets completed.

The trade-to-GDP ratio indicates the relative importance of international trade in the economy of a country. This is calculated by dividing the aggregating value of trade (i.e., the sum of imports and exports) over the GDP. In general, the ratio tends to have a lower value in huge countries which have large economies and populations such as the United States. Japan recorded low values that 13.1% of the exports-to-GDP ratio and 11.3% of imports-to-GDP ratio in 2005. However, Korea has a high level of dependence on trade since it achieved a very rapid economic growth through its export-driven policy. It shows 36.1% of the former ratio and 33.2% of the latter in 2005. Korea was ranked 9th (i.e., 69.3% of the trade-to-GDP ratio) in the world and Japan was 29th (i.e., 24.4% of the trade-to-GDP ratio) in 2005. Trade liberalization can bring some minor dangers. If a nation's economy is heavily relied on trade, it is easily influenced by overseas such as the global financial turmoil or economic crisis of foreign countries. The simulations signify that Japan-Korea FTA wrought high Korea's trade dependence on Japan which implies Japan's domestic and international situation will have far-reaching economic effects for Korea.

5.3. Changes of Sectoral Trade Values

Sectoral changes of GDP by 7 scenarios are demonstrated in Figures 10 through 13. Figures 10 and 11 display tariff elimination of Korea and Japan, whereas Figures 12 and 13 mean halved tariff. As mentioned in the previous subparagraph, big and wide tariff cuts bring out huge GDP growth. In Japan, remarkable sectors which have distinguished GDP are concentrated on agricultural sector (e.g., 34th sector, slaughtering and meat processing, 63 BJPY; 18th sector, beef cattle, 29 BJPY; 69th sector, feeds, 24 BJPY; 16th sector, fowls and broilers, 20 BJPY; 17th sector, hogs, 10 BJPY in scenario 1).

Table 1: Changes of GDP and Bilateral Trade Values By Tariff Liberalization

Scenario	Korea	(BKRW)	Japan	(BJPY)
1. Tariff eliminated for all sectors	ΔGDP	3,026	ΔGDP	244
	ΔDomestic intermediate inputs	8	ΔDomestic intermediate inputs	−2,920
	ΔImported products (Japan)	5,512	ΔImported products (Korea)	1,629
	ΔImported products (ROW)	−2,445	ΔImported products (ROW)	1,589
2. Tariff halved for agriculture and tariff eliminated for the others	ΔGDP	2,943	ΔGDP	243
	ΔDomestic intermediate inputs	163	ΔDomestic intermediate inputs	−2,873
	ΔImported products (Japan)	5,011	ΔImported products (Korea)	1,624
	ΔImported products (ROW)	−2,197	ΔImported products (ROW)	1,545
3. Tariff eliminated excluding agriculture	ΔGDP	2,910	ΔGDP	241
	ΔDomestic intermediate inputs	225	ΔDomestic intermediate inputs	−2,836
	ΔImported products (Japan)	4,770	ΔImported products (Korea)	1,621
	ΔImported products (ROW)	−2,053	ΔImported products (ROW)	1,509
4. Tariff eliminated excluding agriculture and food products	ΔGDP	2,579	ΔGDP	59
	ΔDomestic intermediate inputs	470	ΔDomestic intermediate inputs	218
	ΔImported products (Japan)	2,518	ΔImported products (Korea)	269
	ΔImported products (ROW)	−398	ΔImported products (ROW)	−426
5. Tariff halved for all sectors	ΔGDP	1,377	ΔGDP	51
	ΔDomestic intermediate inputs	57	ΔDomestic intermediate inputs	−115
	ΔImported products (Japan)	2,174	ΔImported products (Korea)	922
	ΔImported products (ROW)	−849	ΔImported products (ROW)	−748
6. Tariff halved excluding agriculture	ΔGDP	1,344	ΔGDP	49
	ΔDomestic intermediate inputs	126	ΔDomestic intermediate inputs	−100
	ΔImported products (Japan)	1,931	ΔImported products (Korea)	919
	ΔImported products (ROW)	−709	ΔImported products (ROW)	−762
7. Tariff halved excluding agriculture and food products	ΔGDP	1,273	ΔGDP	23
	ΔDomestic intermediate inputs	163	ΔDomestic intermediate inputs	85
	ΔImported products (Japan)	1,123	ΔImported products (Korea)	123
	ΔImported products (ROW)	−9	ΔImported products (ROW)	−185

Changes of domestic intermediate inputs and imported products from the partner country are listed in Tables 2 for Korea and Table 3 for Japan. Tables exhibit aggregated changes of 7 kinds of scenarios that are categorized by agriculture[7], processed food[8], mining, energy[9], durable manufacturing, non-durable manufacturing, services and the others[10]. Changes of specific sectors (i.e., 395 for Japan and 350 for Korea) are also demonstrated in Figures 14 through 27. All scenarios in Table 2 show increased domestic intermediate inputs and bilateral trade net values of energy and non-durable manufacturing in Korea. The signs of agriculture, food and manufacturing depend on the types of scenario. Finally, it shows reduction of services and others in all scenarios. Table 3 signifies the results of Japan. Agriculture and durable manufacturing have both positive values in all situations. Mining and energy show very small values. Lastly, Domestic services and the others decreases in place of increase in bilateral trade.

Figures 14 and 15 display sector-wise changes of bilateral trade net values and domestic intermediate inputs of scenario 1. In Korea, the top 5 biggest bilateral trade surplus (i.e., differences

[7]Agriculture, forestry and fishing.

[8]Food, beverages and tobacco products.

[9]Coal, crude petroleum, natural gas, refined petroleum products, electrictity and gas supply.

[10]Construction, water supply, wholesale and retail trade, accommodation and food services, transportation, communications and broadcasting, finance and insurance, real estate and business services, public administration and defense, education, health and social work, other services and nonclassifiable activities.

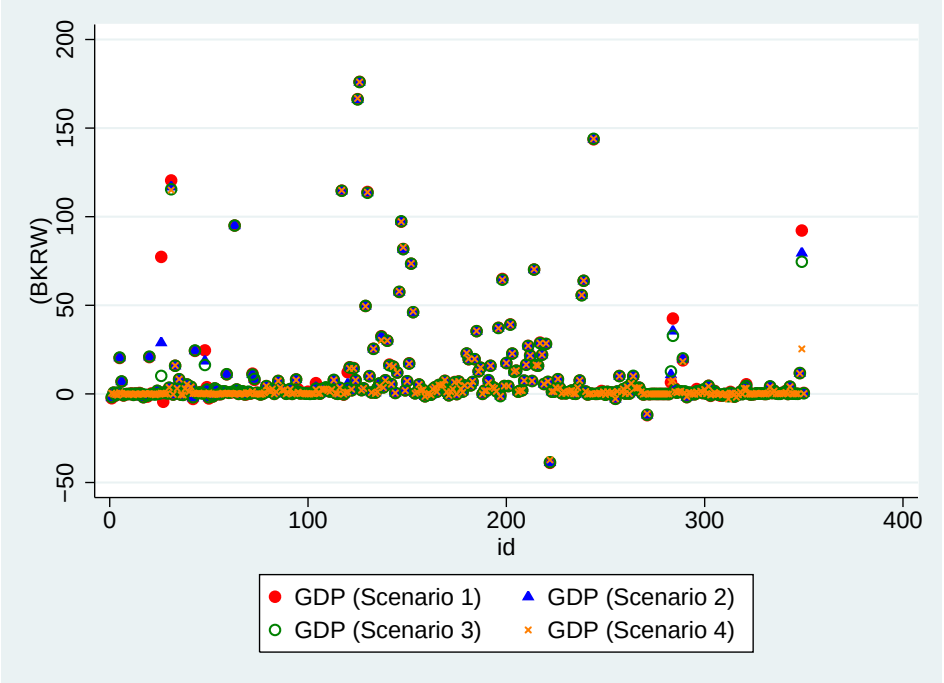

Figure 10: GDP changes of Korea, Scenario 1 through 4 (tariff eliminated).

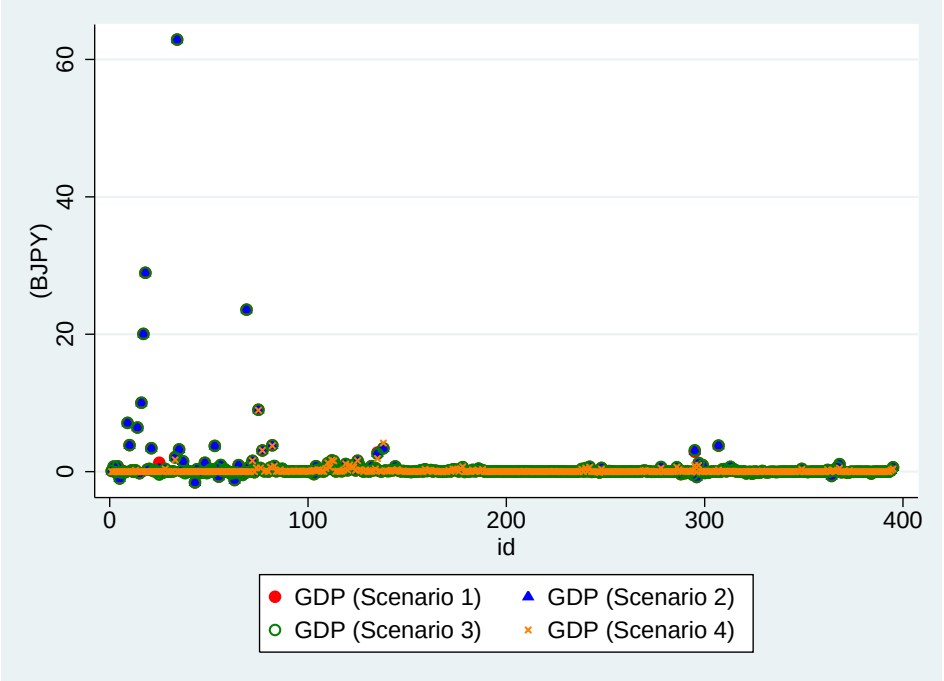

Figure 11: GDP changes of Japan, Scenario 1 through 4 (tariff eliminated).

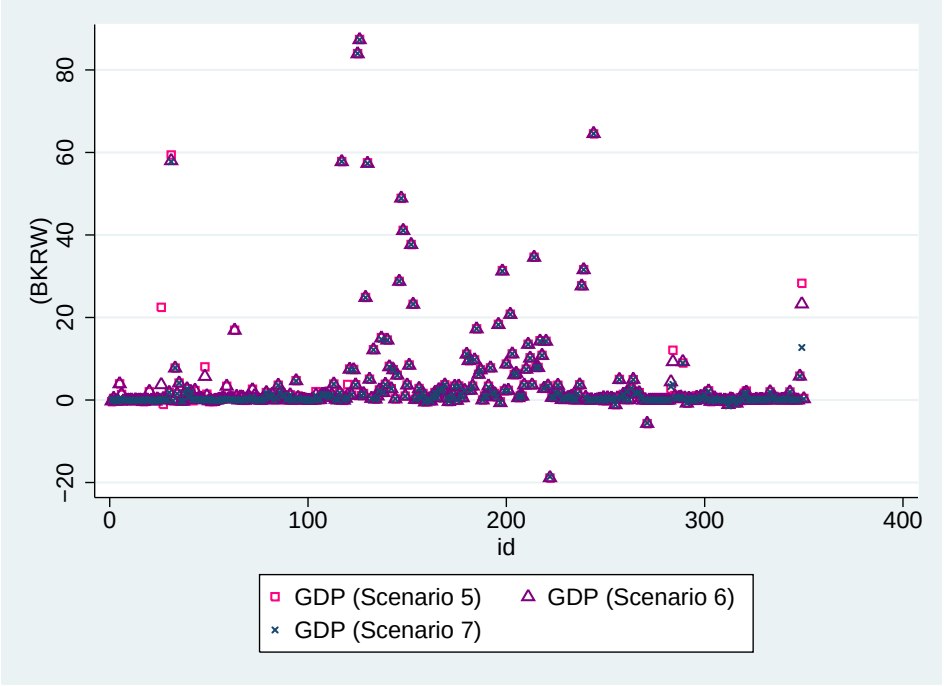

Figure 12: GDP changes of Korea, Scenario 5 through 7 (tariff halved).

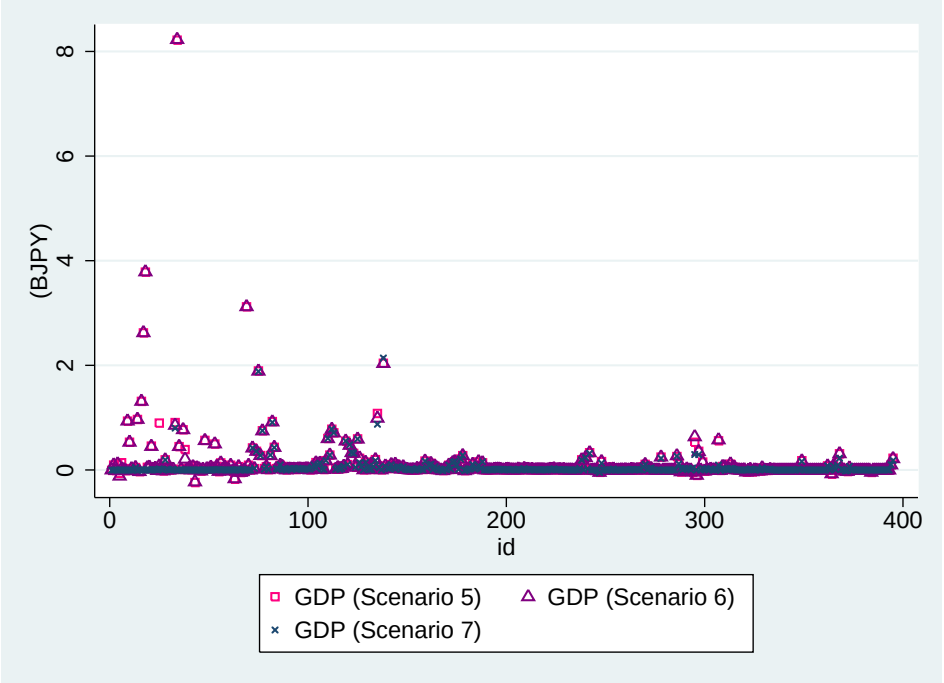

Figure 13: GDP changes of Japan, Scenario 5 through 7 (tariff halved).

between exports and imports) industries are 42nd sector (slaughtering and meat processing, 6955 BKRW), 43rd sector (poultry slaughtering and processing, 6241 BKRW), 81st sector (woolen fabrics, 877 BKRW), 21st sector (other animals, 354 BKRW) and 99th sector (other leather products, 351 BKRW) in Figure 14. Table 4 also lists bilateral trade values of selected sectors. If we observe the largest bilateral trade deficit sectors, 63rd sector (canned or cured fruits and vegetables, 759 BKRW), 244th sector (motor vehicle engines, chassis, bodies and parts, 735 BKRW), 26th sector (Fishing, 708 BKRW), 48th sector (salted, dried and smoked seafoods, 377 BKRW) and 53rd sector (raw sugar, 350 BKRW).

On the other hand, Figure 15 and Table 5 report the results of Japan. The top 5 biggest bilateral trade surplus are shown in 247th sector (internal combustion engines for motor vehicles and parts, 59 BJPY), 48th sector (bottled or canned vegetables and fruits, 59 BJPY), 49th sector (preserved agricultural foodstuffs other than bottled or canned, 57 BJPY), 248th sector (motor vehicle parts and accessories, 53 BJPY) and 25th sector (fisheries, 49 BJPY). Finally, the top 5 bilateral trade deficit industries are 34th sector (slaughtering and meat processing, 1191 BJPY), 75th sector (woolen fabrics, hemp fabrics and other fabrics, 152 BJPY), 65th sector (other liquors, 148 BJPY), 145th sector (miscellaneous leather products, 61 BJPY) and 240th sector (liquid crystal element, 45 BJPY). It is not surprising that food products are highly ranked. Excluding food products, motor vehicle engines, chassis, bodies and parts is the only distinguished imports from Japan in Korea which ranked in the top 5. However, Japan's remarkable increase of imported products includes manufacturing such as fabric, leather products and liquid crystal element.

Scenario 5 exemplifies the case of halved tariff rates in Figures 22 and 23, which reflect less than half of the results of scenario 1 in Figures 14 and 15. On the other hand, the results of scenarios 3 in Tables 2 and 3 signify that agricultural sectors are not affected by tariff abolition of other industries. In the same manner, scenarios 4 implies domestic and imported food products are not changed in both countries. Interestingly, if tariff rates are cut in half excluding agriculture (i.e., scenario 6) or excluding food products (i.e., scenario 7), domestic market share of agricultural sectors of food industries are influenced by tariff cuts.

Agricultural sector is the most sensitive item on the negotiating table for free trade talks. Generally, Korean agriculture is regarded as the biggest victim of free trade. Especially, scenario 1 (i.e., the complete tariff elimination) signifies the biggest reduction of Korean agriculture. Both domestic intermediate inputs and bilateral trade net values exhibit negative sign. Scenarios 2 and 5 (i.e., halved tariff for agricultural sector) show negative domestic intermediate inputs of agriculture. However, bilateral trade net values are expanded in these cases. Tariff elimination of agriculture does not seem favorable to Korean agricultural industries, though it brings positive effects on Japanese agriculture. However, processed food industries show the completely opposite result. Excluding scenarios 4 and 7 (i.e., food products tariff uneliminated), food products tariff liberalization brings huge bilateral trade surplus for Korea and deficit for Japan.

Manufacturing is accounted as one of the greatest beneficiaries of Japan-Korea FTA. Both

Table 2: Changes of Sectoral Domestic Inputs and Bilateral Trade Values (Korea).

Scenario	Δ Domestic intermediate inputs (BKRW)		ΔBilateral trade values (net) with Japan (BJPY)	
1. Tariff eliminated for all sectors	Agriculture	-213	Agriculture	-233
	Processed food	-245	Processed food	11,878
	Mining	9	Mining	-2
	Energy	118	Energy	292
	Durable manufacturing	58	Durable manufacturing	-2,360
	Non-durable manufacturing	1,198	Non-durable manufacturing	1,423
	Services and the others	-918	Services and the others	-220
2. Tariff halved for agriculture and tariff eliminated for the others	Agriculture	-23	Agriculture	229
	Processed food	-278	Processed food	11,858
	Mining	8	Mining	-2
	Energy	113	Energy	292
	Durable manufacturing	51	Durable manufacturing	-2,357
	Non-durable manufacturing	1,197	Non-durable manufacturing	1,422
	Services and the others	-906	Services and the others	-215
3. Tariff eliminated excluding agriculture	Agriculture	53	Agriculture	444
	Processed food	-292	Processed food	11,850
	Mining	8	Mining	-2
	Energy	110	Energy	291
	Durable manufacturing	49	Durable manufacturing	-2,356
	Non-durable manufacturing	1,197	Non-durable manufacturing	1,422
	Services and the others	-901	Services and the others	-213
4. Tariff eliminated excluding agriculture and food products	Agriculture	1	Agriculture	1
	Processed food	8	Processed food	-7
	Mining	8	Mining	-2
	Energy	109	Energy	454
	Durable manufacturing	42	Durable manufacturing	-2,452
	Non-durable manufacturing	1,190	Non-durable manufacturing	2,399
	Services and the others	-888	Services and the others	-220
5. Tariff halved for all sectors	Agriculture	-66	Agriculture	47
	Processed food	-21	Processed food	7,490
	Mining	4	Mining	-1
	Energy	58	Energy	132
	Durable manufacturing	2	Durable manufacturing	-1,128
	Non-durable manufacturing	622	Non-durable manufacturing	622
	Services and the others	-543	Services and the others	-118
6. Tariff halved excluding agriculture	Agriculture	10	Agriculture	265
	Processed food	-34	Processed food	7,480
	Mining	4	Mining	-1
	Energy	56	Energy	132
	Durable manufacturing	-0	Durable manufacturing	-1,127
	Non-durable manufacturing	621	Non-durable manufacturing	621
	Services and the others	-531	Services and the others	-115
7. Tariff halved excluding agriculture and food products	Agriculture	1	Agriculture	1
	Processed food	4	Processed food	-4
	Mining	4	Mining	-1
	Energy	55	Energy	247
	Durable manufacturing	-2	Durable manufacturing	-1,239
	Non-durable manufacturing	620	Non-durable manufacturing	1,232
	Services and the others	-519	Services and the others	-126

countries exhibits an expansion in domestic intermediate inputs in all simulations, though only scenario 7 led to a very tiny decrease in Korea. For durable manufacturing, bilateral trade values describe deficit of Korea, simultaneously surplus of Japan. However, non-durable manufacturing represents the exact opposite results. Figures 20 and 21 illustrate scenario 4 that tariff abolition excluding agriculture and food products. The top 5 bilateral trade net surplus obtained sectors

Table 3: Changes of Sectoral Domestic Inputs and Bilateral Trade Values (Japan).

Scenario	Δ Domestic intermediate inputs (BKRW)		ΔBilateral trade values (net) with Japan (BJPY)	
1. Tariff eliminated for all sectors	Agriculture	84	Agriculture	57
	Processed food	151	Processed food	-1,177
	Mining	0	Mining	0
	Energy	0	Energy	-13
	Durable manufacturing	50	Durable manufacturing	327
	Non-durable manufacturing	203	Non-durable manufacturing	-237
	Services and the others	-3,410	Services and the others	6
2. Tariff halved for agriculture and tariff eliminated for the others	Agriculture	79	Agriculture	23
	Processed food	152	Processed food	-1,182
	Mining	0	Mining	0
	Energy	0	Energy	-13
	Durable manufacturing	49	Durable manufacturing	317
	Non-durable manufacturing	203	Non-durable manufacturing	-237
	Services and the others	-3,357	Services and the others	6
3. Tariff eliminated excluding agriculture	Agriculture	70	Agriculture	9
	Processed food	153	Processed food	-1,185
	Mining	0	Mining	0
	Energy	1	Energy	-13
	Durable manufacturing	49	Durable manufacturing	312
	Non-durable manufacturing	202	Non-durable manufacturing	-236
	Services and the others	-3,312	Services and the others	6
4. Tariff eliminated excluding agriculture and food products	Agriculture	0	Agriculture	-0
	Processed food	-1	Processed food	2
	Mining	0	Mining	0
	Energy	1	Energy	-12
	Durable manufacturing	45	Durable manufacturing	240
	Non-durable manufacturing	209	Non-durable manufacturing	-232
	Services and the others	-36	Services and the others	5
5. Tariff halved for all sectors	Agriculture	18	Agriculture	18
	Processed food	120	Processed food	-717
	Mining	0	Mining	0
	Energy	0	Energy	-6
	Durable manufacturing	45	Durable manufacturing	141
	Non-durable manufacturing	49	Non-durable manufacturing	-126
	Services and the others	-347	Services and the others	3
6. Tariff halved excluding agriculture	Agriculture	10	Agriculture	5
	Processed food	121	Processed food	-721
	Mining	0	Mining	0
	Energy	0	Energy	-6
	Durable manufacturing	45	Durable manufacturing	134
	Non-durable manufacturing	49	Non-durable manufacturing	-125
	Services and the others	-324	Services and the others	3
7. Tariff halved excluding agriculture and food products	Agriculture	0	Agriculture	-0
	Processed food	-1	Processed food	1
	Mining	0	Mining	0
	Energy	0	Energy	-6
	Durable manufacturing	43	Durable manufacturing	124
	Non-durable manufacturing	50	Non-durable manufacturing	-124
	Services and the others	-8	Services and the others	2

in Korea are mostly textile and apparel products in Table 6. For example, 81st sector (woolen fabrics, 1402 BKRW), 99th sector (other leather products, 558 BKRW), 97th sector (luggage and handbags, 547 BKRW), 83rd sector (silk and hempen fabrics, 380 BKRW) and 91st sector (textile wearing apparels and clothing accessories, 290 BKRW) are included. By contrast, most bilateral

Table 4: Remarkable Sectors of Korea, Scenario 1.

id	Sector	Δ Bilateral Exports (BKRW)	Δ Bilateral Imports (BKRW)	Δ Bilateral Trade Values (BKRW)
42	Slaughtering and meat processing	6,951	-4	6,955
43	Poultry slaughtering and processing	6,909	668	6,241
81	Woolen fabrics	880	4	877
21	Other animals	366	11	354
99	Other leather products	351	0	351
53	Raw sugar	-0	350	-350
48	Salted, dried and smoked seafoods	2	380	-377
26	Fishing	27	735	-708
244	Motor vehicle engines, chassis, bodies and parts	-1	734	-735
63	Canned or cured fruits and vegetables	16	775	-759

Table 5: Remarkable Sectors of Japan, Scenario 1.

id	Sector	Δ Bilateral Exports (BKRW)	Δ Bilateral Imports (BKRW)	Δ Bilateral Trade Values (BKRW)
247	Internal combustion engines for motor vehicles and parts	59	-0	59
48	Bottled or canned vegetables and fruits	64	5	59
49	Preserved agricultural foodstuffs (other than bottled or canned)	57	-0	57
248	Motor vehicle parts and accessories	53	-0	53
25	Fisheries	54	5	49
240	Liquid crystal element	3	47	-45
145	Miscellaneous leather products	0	62	-61
65	Other liquors	0	148	-148
75	Woolen fabrics, hemp fabrics and other fabrics	0	152	-152
34	Slaughtering and meat processing	7	1,198	-1,191

trade deficit appeared industries are durable manufacturing in Korea. The top 5 sectors[11] are 244th sector (motor vehicle engines, chassis, bodies and parts, 735 BKRW), 256th sector (toys and games, 232 BKRW), 226th sector (miscellaneous electronic components, 189 BKRW), 210th sector (metal molds and industrial patterns, 184 BKRW) and 198th sector (parts of general-purposed machinery and equipment, 136 BKRW). Similarly, Table 7 reports Japan's bilateral trade net values. The top 5 bilateral trade surplus gained sectors are 247th sector (internal combustion engines for motor vehicles and parts, 45 BJPY), 248th sector (motor vehicle parts and accessories, 40 BJPY), 197th sector machinery and equipment for construction and mining, 30 BJPY), 207th sector (metal molds, 21 BJPY) and 265th sector (toys and games, 15 BJPY). In the same vein, the top 5 bilateral trade deficit industries in Japan are 75th sector (woolen fabrics, hemp fabrics and other fabrics, 151 BJPY), 145th sector (miscellaneous leather products, 61 BJPY) and 240th sector (liquid crystal element, 45 BJPY), 82nd sector (woven fabric apparel, 35 BJPY), and 110th sector (petrochemical basic products, 18 BJPY).

Table 2 reports a reduction of domestic intermediate inputs and bilateral trade net values for whole simulations in Korea. Observing this phenomenon through Figures 14 to 27, negative

[11] 350th sector (nonclassifiable activities, 190 BKRW) is excluded in Table 6.

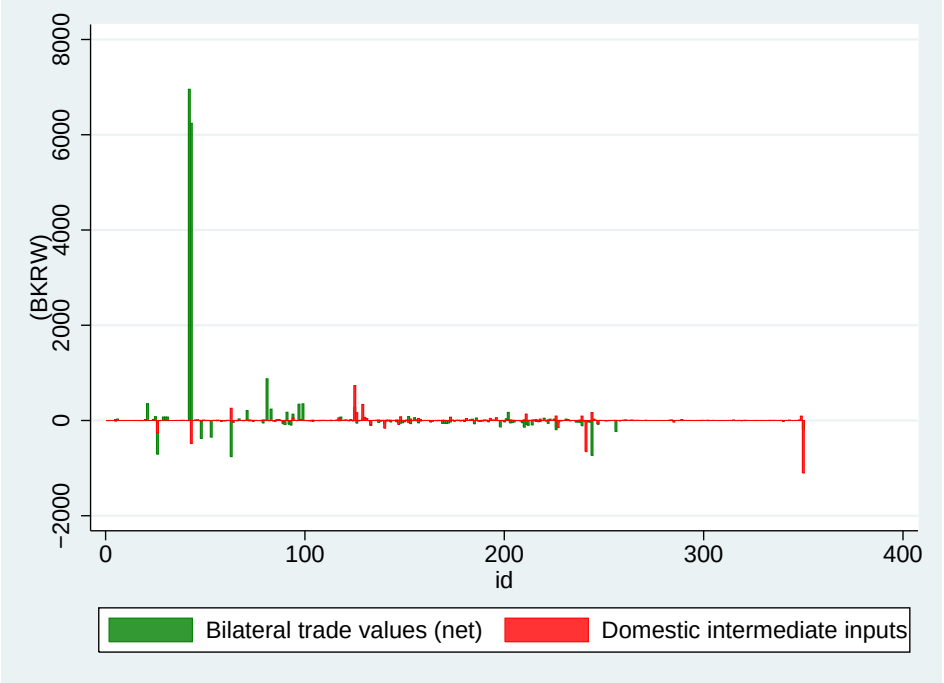

Figure 14: Scenario 1 Korea (tariff eliminated for all sectors).

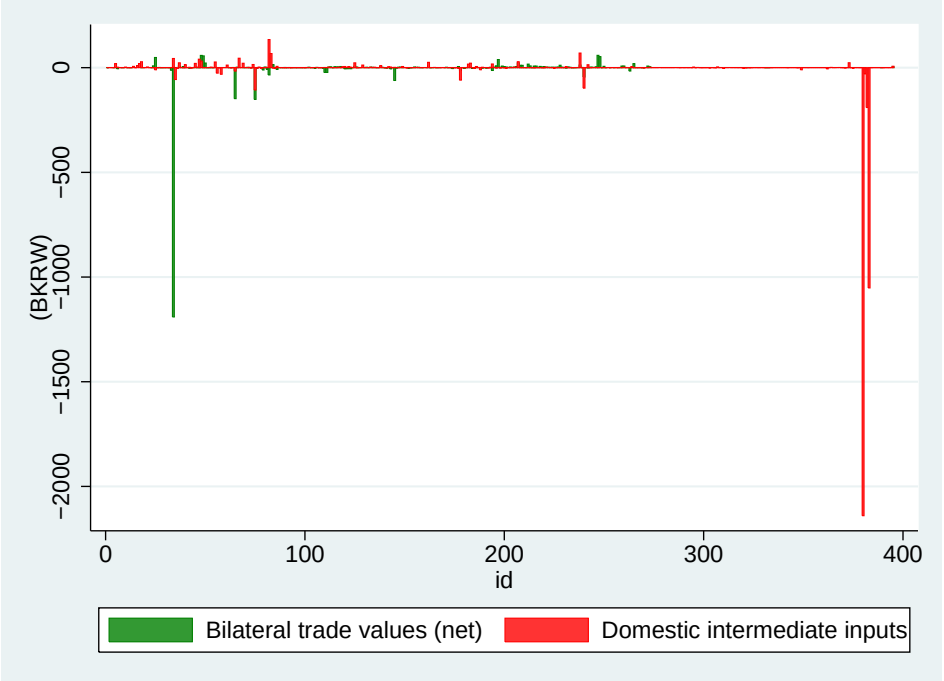

Figure 15: Scenario 1 Japan (tariff eliminated for all sectors).

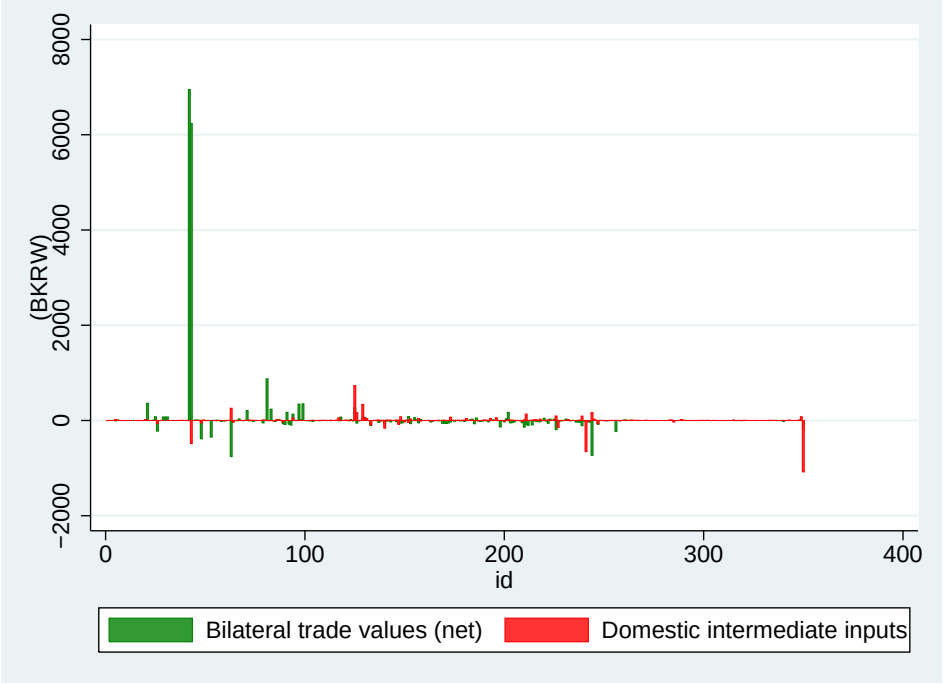

Figure 16: Scenario 2 Korea (tariff halved for agriculture and tariff eliminated for the others).

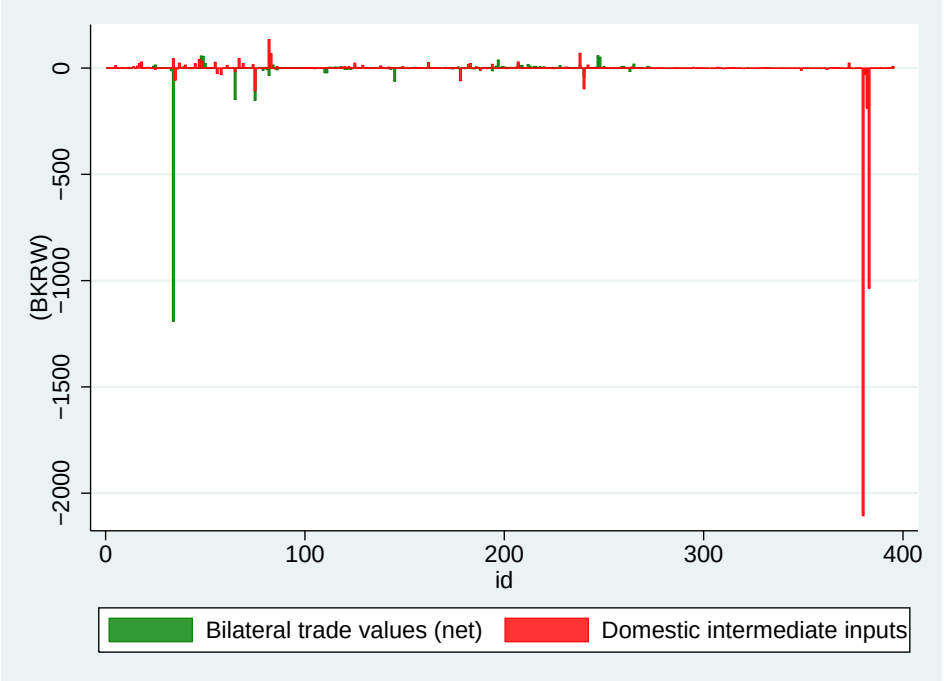

Figure 17: Scenario 2 Japan (tariff halved for agriculture and tariff eliminated for the others).

Table 6: Remarkable Sectors of Korea, Scenario 4.

id	Sector	Δ Bilateral Exports (BKRW)	Δ Bilateral Imports (BKRW)	Δ Bilateral Trade Values (BKRW)
81	Woolen fabrics	1,406	4	1,402
99	Other leather products	559	0	558
97	Luggage and handbags	549	2	547
83	Silk and hempen fabrics	377	-3	380
91	Textile wearing apparels and Clothing accessories	314	24	290
198	Parts of general-purposed machinery and equipment	-0	136	-136
210	Metal molds and industrial patterns	-120	64	-184
226	Misc. electronic components	12	201	-189
256	Toys and games	1	232	-232
244	Motor vehicle engines, chassis, bodies and parts	-1	734	-735

Table 7: Remarkable Sectors of Japan, Scenario 4.

id	Sector	Δ Bilateral Exports (BKRW)	Δ Bilateral Imports (BKRW)	Δ Bilateral Trade Values (BKRW)
247	Internal combustion engines for motor vehicles and parts	45	-0	45
248	Motor vehicle parts and accessories	40	-0	40
197	Machinery and equipment for construction and mining	30	-0	30
207	Metal molds	4	-17	21
265	Toys and games	15	0	15
110	Petrochemical basic products	-17	0	-18
82	Woven fabric apparel	2	37	-35
240	Liquid crystal element	2	47	-45
145	Miscellaneous leather products	0	61	-61
75	Woolen fabrics, hemp fabrics and other fabrics	0	151	-151

bilateral trade net values are induced by the following Korean sectors: 314th sector (market research and management consultancy), 317th sector (computer softwares development and supply), 321st sector (miscellaneous business services), 340th sector (miscellaneous amusement and recreation services) and 350th sector (nonclassifiable activities). On the other hand, Table 3 lists the results of Japan. The following industries get positive bilateral trade values: 331st sector (image information production and distribution industry), 333rd sector (publication), 373rd sector (other business services), 389th sector (photographic studios) and 395th sector (activities not elsewhere classified).

Overall, scenarios 4 and 7 (i.e., tariff liberalization excluding agriculture and food products) look well balanced. Table 2 implies these cases bring an expansion in domestic intermediate inputs and balanced bilateral trade between two countries. Scenario 4 shows 2174 BKRW (approximately 271 BJPY) of increased imported products from Japan in Korea. Coincidently, Japan's imports rise from Korea displays similar value, 269 BJPY (2502 BKRW). Scenario 7 also indicates bilateral trade of two countries are balanced that the former of 1123 BKRW (121 BJPY) and the latter of 123 BJPY (1144 BKRW). Scenario 7 applied half tariff cuts that its results exhibit half level of scenario 4. Figures 14 through 27 also demonstrate two scenarios affect wider range of sectors, while the other examples bring about a food products centralized impact.

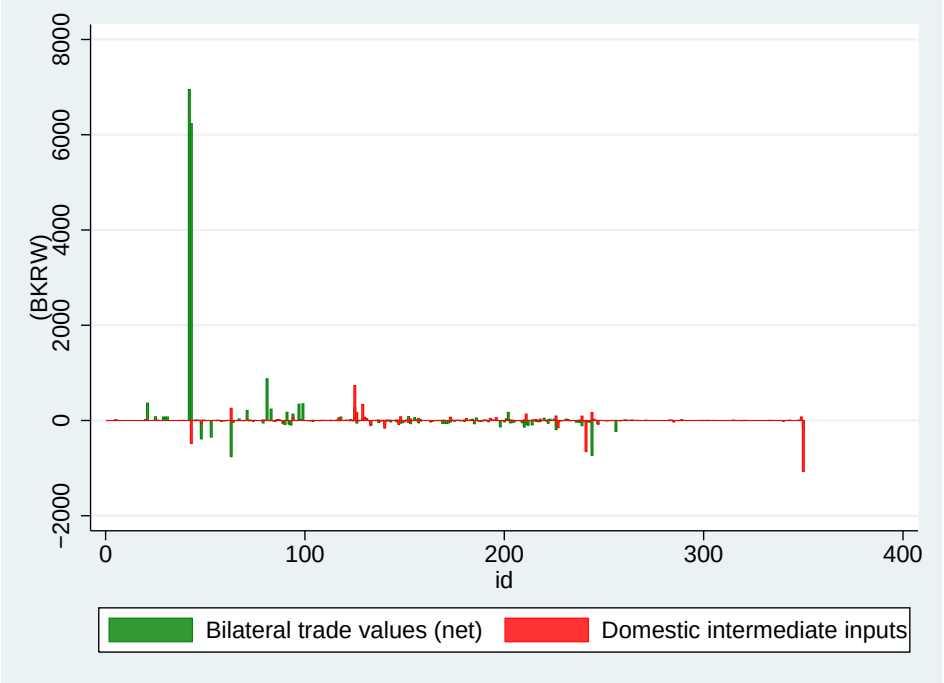

Figure 18: Scenario 3 Korea (tariff eliminated excluding agriculture).

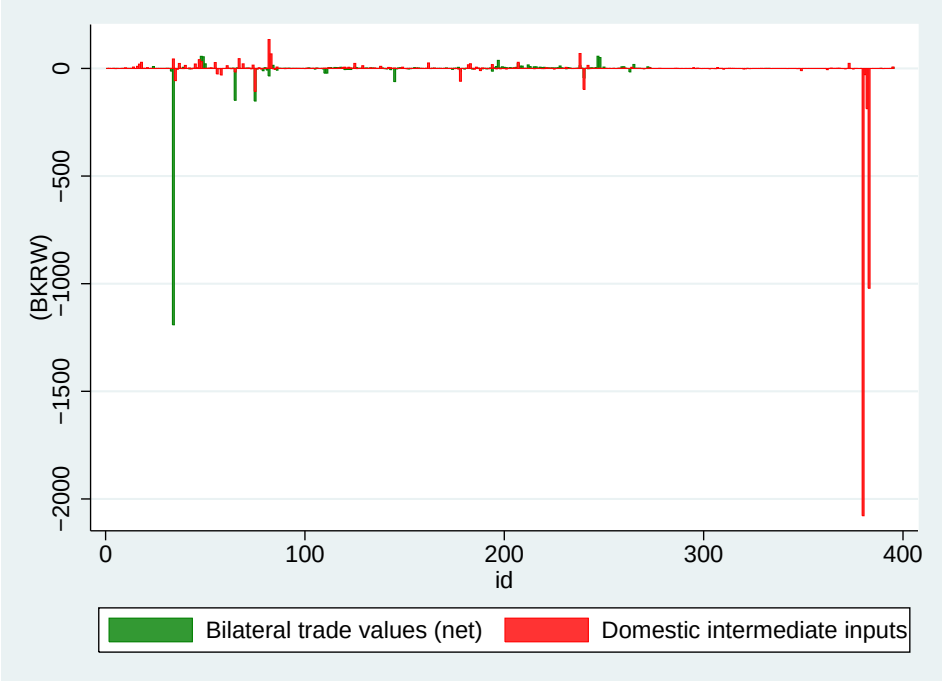

Figure 19: Scenario 3 Japan (tariff eliminated excluding agriculture).

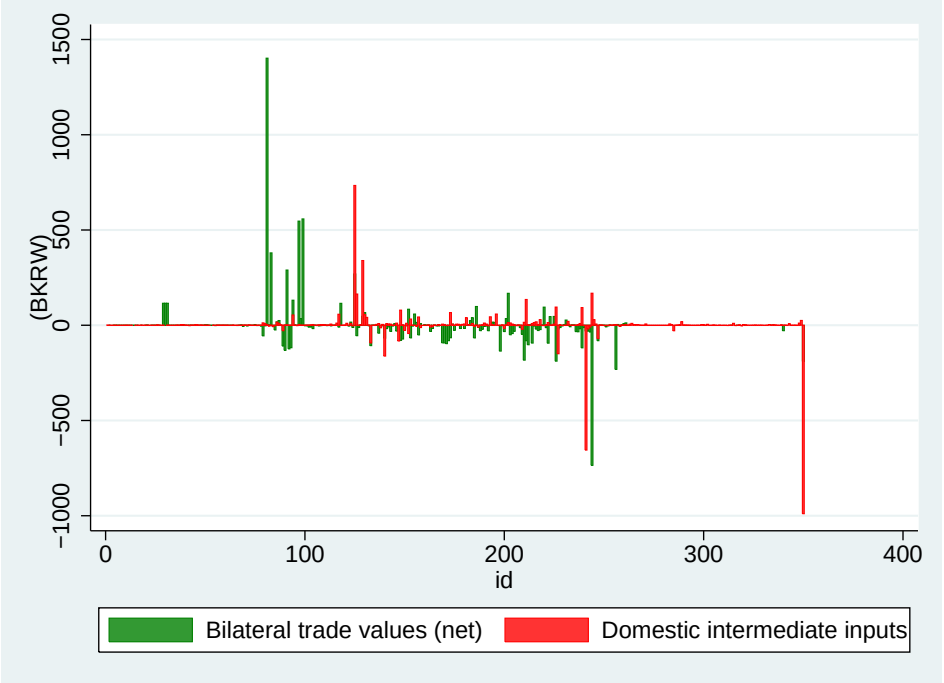

Figure 20: Scenario 4 Korea (tariff eliminated excluding agriculture and food products).

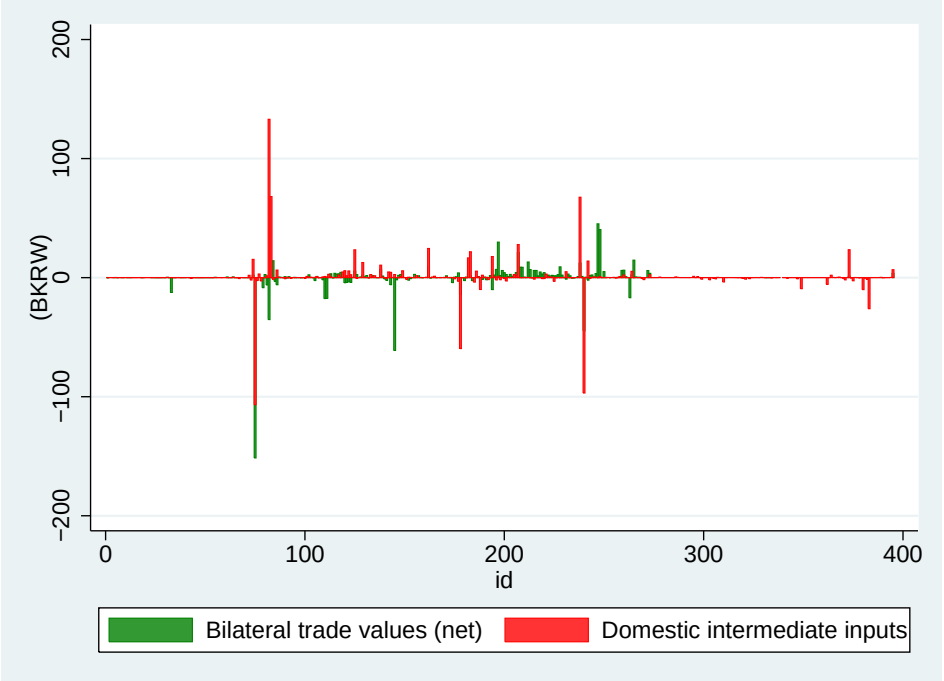

Figure 21: Scenario 4 Japan (tariff eliminated excluding agriculture and food products).

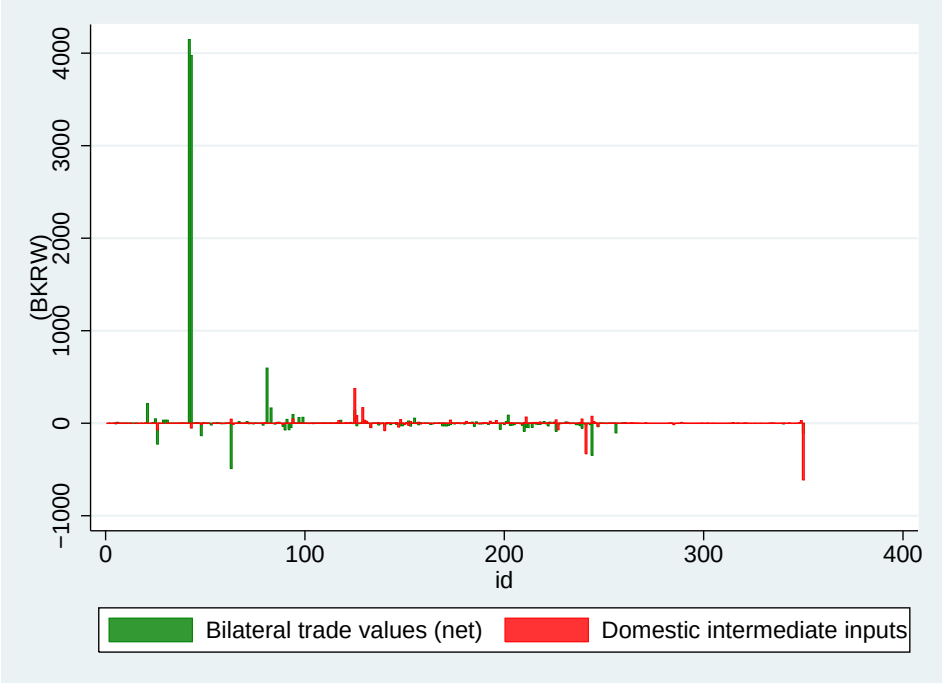

Figure 22: Scenario 5 Korea (tariff halved for all sectors).

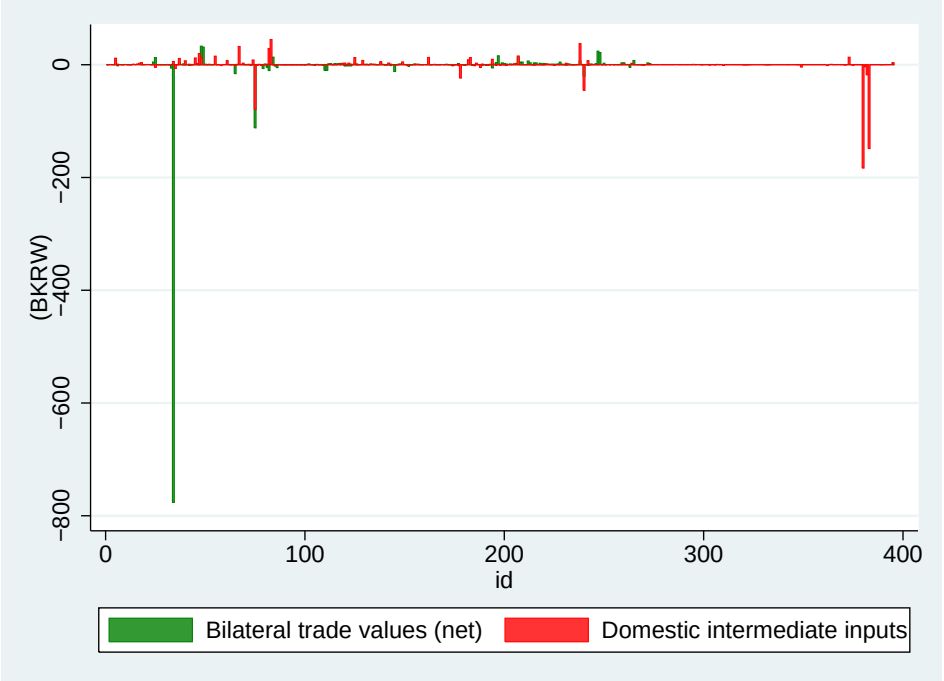

Figure 23: Scenario 5 Japan (tariff halved for all sectors) .

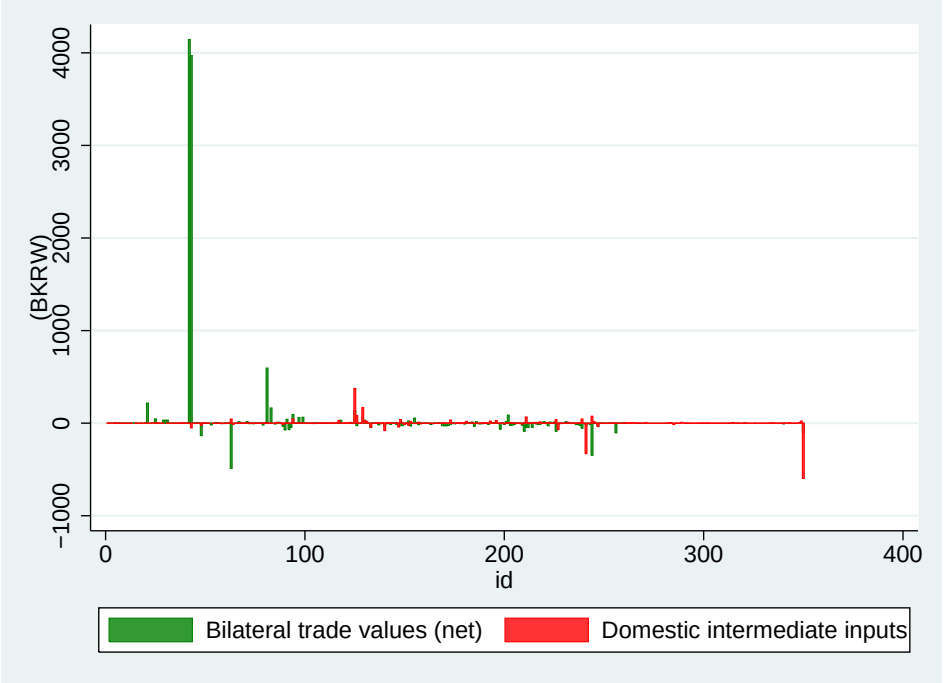

Figure 24: Scenario 6 Korea (tariff halved excluding agriculture).

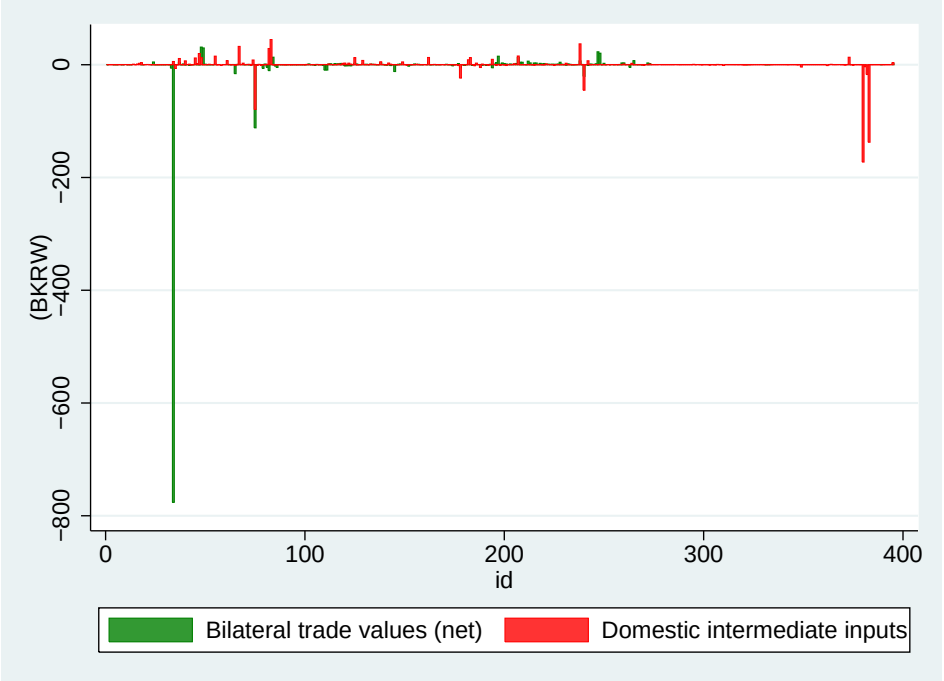

Figure 25: Scenario 6 Japan (tariff halved excluding agriculture).

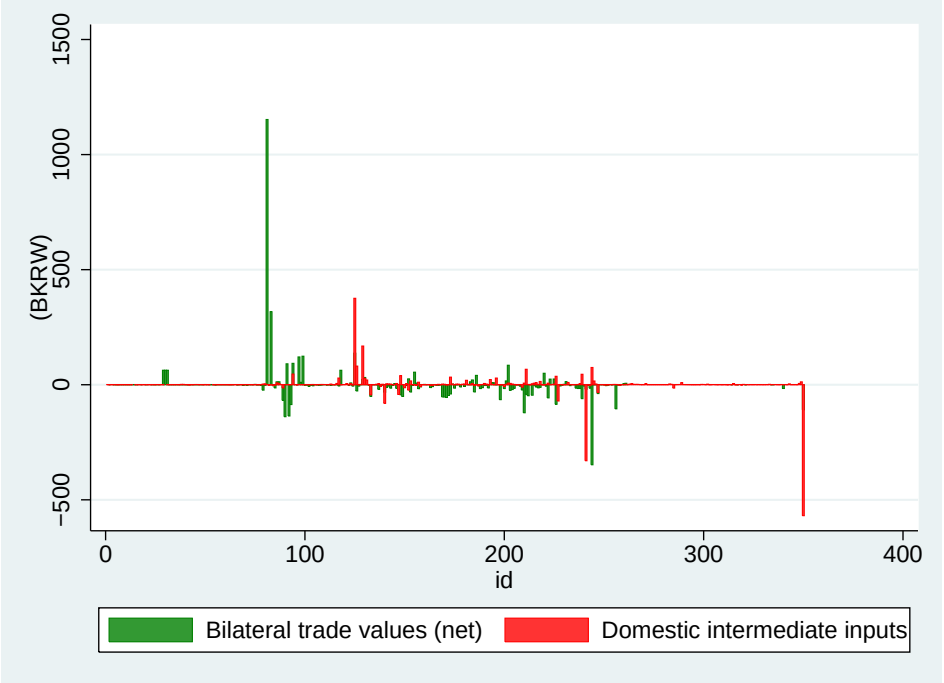

Figure 26: Scenario 7 Korea (tariff halved excluding agriculture and food products).

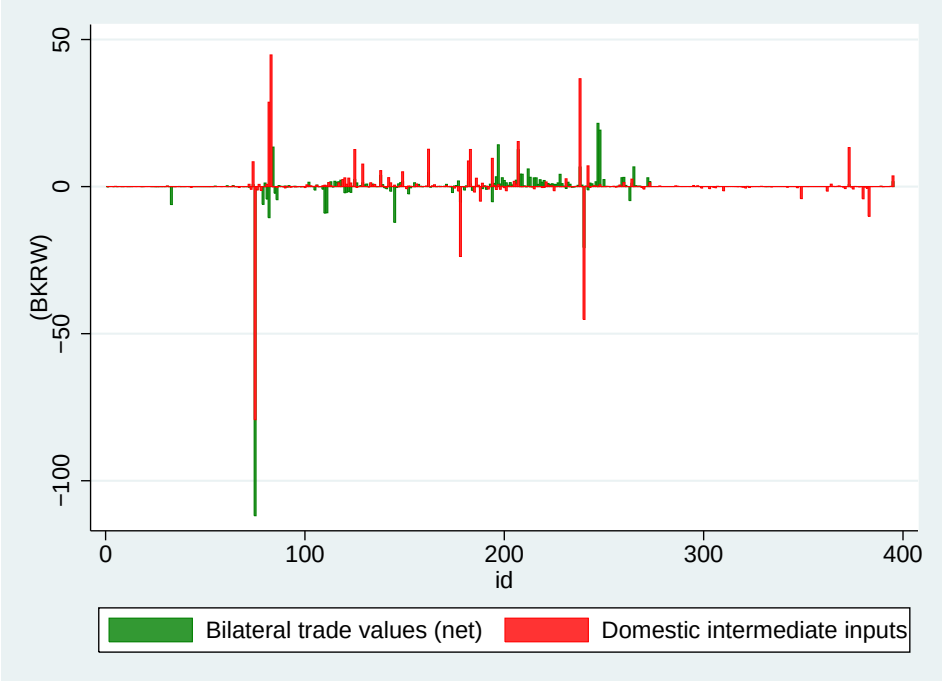

Figure 27: Scenario 7 Japan (tariff halved excluding agriculture and food products).

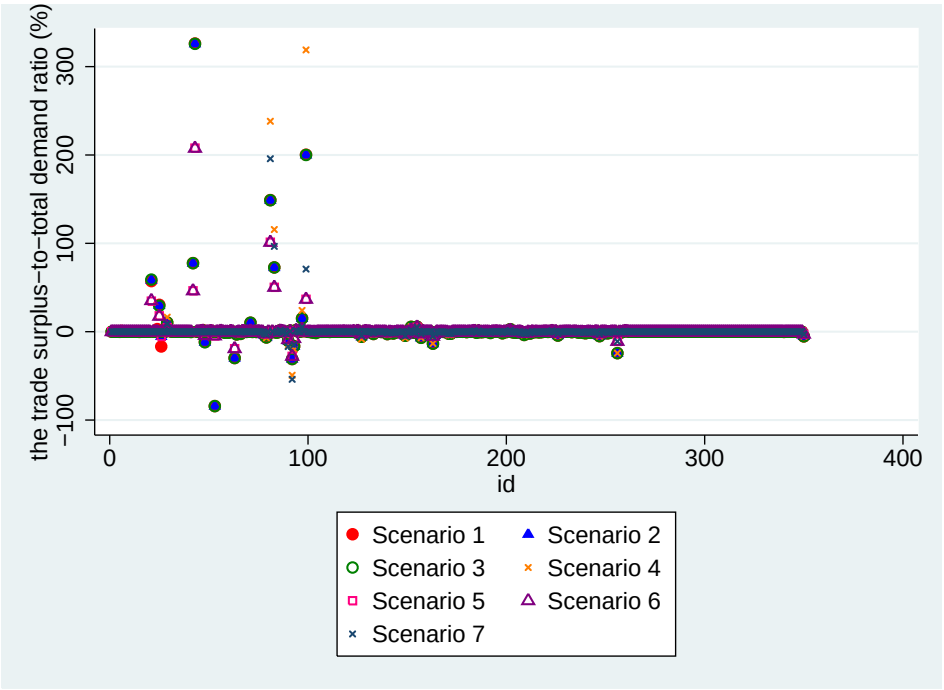

Figure 28: Trade Surplus-to-Total Demand Ratio of Korea.

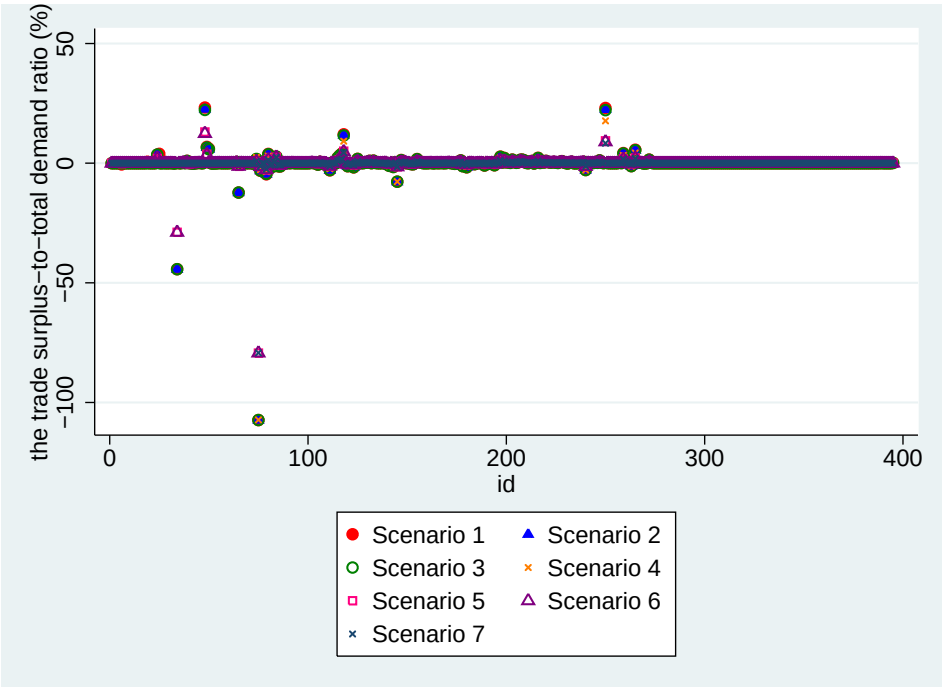

Figure 29: Trade Surplus-to-Total Demand Ratio of Japan.

5.4. Initial Tariff Rates and Changes of Trade Values

Figure 28 and 29 demonstrate the bilateral trade surplus-to-total demand ratio in Korea and Japan. If it has a bilateral trade surplus, it is located in positive domain in figures. Naturally, negative area means trade deficit. In Figure 28, drastic changes are concentrated on food products, textile and fabric. Figure 29 show smaller scale of changes than Figure 28, focused on durable manufacturing rather than the former. In this sub-paragraph, we take scenario 4 to observe industrial feature since it seems well-balanced though the others show excessive changes of food products. In Figure 28, some textile and fabric sectors record ratio over 100%, for examples, 99th sector (other leather products, 318.9%), 81st sector (woolen fabrics, 238.2%) and 83rd sector (silk and hempen fabrics, 115.7%). Tariff liberalization brings them a dramatic increase. On the other hand, the top 5 biggest industries in Figure 29 are 250th sector (ships (except steel ships), 17.7%), 118th sector (synthetic dyes, 9.2%), 265th sector (toys and games, 4.3%), 259th sector (camera, 3.2%) and 117th sector (plasticizers, 3.2%).

BOK [1] analyzed import inducement effects using 1995 and 1998 input-output tables, bilateral trading data of intermediate products between Korea and Japan. According to this report, footwear, textile and fabric have relatively high import induced effects in Japan. On the other hand, computer and office machines, electrical and electronics equipment, semiconductor devices and telecommunication apparatuses show stronger import induced effects in Korea. These sectors display extremely tiny negative or positive values between -1% and 1% in Figures 28 and 29. It implies their bilateral trade net values are unlikely to change drastically regardless of FTA in effect. Since the initial tariff rates of these sectors are very low, tariff abolition seems quite difficult to cause huge fluctuations. Unless they take price declined intermediate inputs by tariff cuts to product, their price is hard to drop. Figures 8 and 9 show tariff rates of textile and fabric sectors (e.g., 5.1%–11.5%) are higher than electronics industry. The demand for Korean textile and fabric products increases in Japan, since its price falls by knocking down tariff barrier.

6. Concluding Remarks

As regards the primary motivation of this study questioning the previous propositions, namely, 1) Japan–Korea FTA would potentially worsen Korea's welfare level as well as the trade balance against Japan; and 2) Korea's heavy and chemical industries can receive a serious damage and hence harm Korea's industrial structure, we provided an economic assessment using the model we constructed using later data. Specifically, both countries can potentially benefit from the FTA, while Korea is more than ten times advantageous than Japan is. The trade balance, however, will not be one-sided. Korea will increase the import of fish from Japan while Japan will increase the import of meat from Korea. The previous proposition was right in that Japan will increase export of heavy industry intermediate products to Korea, but at the same time, our model indicates that Korea will increase export of final manufactured goods to Japan.

The model we constructed in this study, although the measured elasticities reflect the regional characteristics and is potent of multi-sectoral analyses, we must keep in mind that we are still far away from covering the reality. Specifically, the model is still static and hence, capital accumulation and depreciation is neglected. Moreover, we omit consumption (representative utility) function so that the welfare gain must be a crude estimate. Nonetheless, at the same time, applications and extensions of the framework could be immense, considering the extensibility in terms of regional and dynamical perspectives.

Appendix

Table 8: CES Elasticities and Productivity Growths (Japan 2000–2005)

id	sector	Elasticity	TFPg	Obs.
1	Rice	1.838	0.094	70
2	Wheat, barley and the like	2.825 *	0.081	58
3	Potatoes and sweet potatoes	1.648	0.005	61
4	Pulses	1.919	−0.150	53
5	Vegitables	1.842	0.108	76
6	Fruits	1.580	−0.166	70
7	Sugar crops	2.100	−0.120	55
8	Crops for beverages	1.130	−1.250	47
9	Other edible crops	1.898	−0.005	46
10	Crops for feed and forage	3.081 ***	−0.211 ***	56
11	Seeds and seedlings	1.577	−0.024	73
12	Flowers and plants	1.092	−0.887	73
13	Other inedible crops	1.375	−0.069	66
14	Dairy cattle farming	1.725	0.275 *	76
15	Hen eggs	2.453	0.179 **	58
16	Fowls and broilers	2.167 *	0.336 ***	55
17	Hogs	0.824	−1.200	69
18	Beef cattle	2.447 *	−0.029	71
19	Other livestock	1.881	0.118 *	70
20	Veterinary service	1.240	−0.179	77
21	Agricultural services (except veterinary service)	1.214	−0.190	96
22	Silviculture	−0.100	−0.176 **	88
23	Logs	0.539	0.526	71
24	Special forest products (inc. hunting)	1.530	0.368 *	63
25	Fisheries	1.642 ***	−0.014	90
26	Marine culture	1.752 **	0.092	90
27	Inland water Culture	1.377	0.043	82
28	Metallic ores	1.641 ***	−0.800 ***	80
29	Materials for ceramics	0.967	3.521 **	96
30	Gravel and quarrying	1.474	−0.037	96
31	Crushed stones	1.073	−1.313 **	93
32	Other non-metallic ores	1.327	0.891 ***	73
33	Coal mining , crude petroleum and natural gas	1.848 ***	−0.278 ***	87
34	Slaughtering and meat processing	1.121	0.245	74
35	Processed meat products	1.384	−0.019	95
36	Bottled or canned meat products	1.237	0.337	87

Continued.

id	sector	Elasticity	TFPg	Obs.
37	Dairy farm products	1.525	0.206 **	100
38	Frozen fish and shellfish	1.982 *	0.484 ***	78
39	Salted, dried or smoked seafood	1.319	0.296	90
40	Bottled or canned seafood	1.275	0.115	83
41	Fish paste	1.536	−0.008	101
42	Other processed seafood	1.423	0.375 **	100
43	Grain milling	1.216	0.115	70
44	Flour and other grain milled products	1.425	0.450 ***	82
45	Noodles	1.657 **	0.144	106
46	Bread	1.640 **	−0.023	109
47	Confectionery	1.783 ***	0.076	119
48	Bottled or canned vegetables and fruits	1.180	−0.371	86
49	Preserved agricultural foodstuffs (other than bottled or canned)	1.375	0.297 **	96
50	Sugar	1.525 **	−0.050	81
51	Starch	1.404	0.355 **	73
52	Dextrose, syrup and isomerized sugar	1.443 **	0.117 **	76
53	Vegetable oils and meal	1.216	0.608 ***	105
54	Animal oils and fats	1.426	−0.140	75
55	Condiments and seasonings	1.271	0.065	112
56	Prepared frozen foods	1.478	0.217	100
57	Retort foods	1.505 *	−0.001	90
58	Dishes, sushi and lunch boxes	1.778 **	0.155 **	114
59	School lunch (public) **	1.193	0.090	73
60	School lunch (private) *	1.569	−0.454 **	42
61	Other foods	1.273	0.378 *	109
62	Refined sake	1.056	−1.533	89
63	Beer	1.455	−0.004	89
64	Whiskey and brandy	2.509 *	−0.077	86
65	Other liquors	1.904	−0.092	95
66	Tea and roasted coffee	1.361	0.670 ***	89
67	Soft drinks	1.605	0.189	95
68	Manufactured ice	1.034	0.690	61
69	Feeds	1.236	1.379 **	105
70	Organic fertilizers, n.e.c.	0.520	−0.587 ***	79
71	Tobacco	1.563	0.403 **	99
72	Fiber yarns	1.786 *	−0.103	92
73	Cotton and staple fiber fabrics (inc. fabrics of synthetic spun fibers)	1.120	−1.057 **	78
74	Silk and artificial silk fabrics (inc. fabrics of synthetic filament fibers)	1.237	−0.766 ***	79
75	Woolen fabrics, hemp fabrics and other fabrics	0.825	−0.698	77
76	Knitting fabrics	0.904	0.891 *	86
77	Yarn and fabric dyeing and finishing (processing on commission only)	1.036	−1.464	107
78	Ropes and nets	1.454	−0.154	92
79	Carpets and floor mats	0.704	0.652 ***	83
80	Fabricated textiles for medical use	1.397	−0.113	66
81	Other fabricated textile products	1.502 *	0.182 **	116
82	Woven fabric apparel	1.579 *	−0.066	99
83	Knitted apparel	2.022 *	−0.087	105
84	Other wearing apparel and clothing accessories	1.787 *	−0.276 ***	107
85	Bedding	1.429	−0.231	89
86	Other ready-made textile products	1.366	−0.006	99
87	Timber	1.263	0.325	77

Continued.

id	sector	Elasticity	TFPg	Obs.
88	Plywood	1.706 **	−0.127	84
89	Wooden chips	1.624 *	−0.351 ***	62
90	Other wooden products	1.728 ***	−0.039	158
91	Wooden furniture and fixtures	2.042 ***	0.000	143
92	Wooden fixtures	1.277	0.172	112
93	Metallic furniture and fixture	1.778 **	0.100	122
94	Pulp	2.743 **	−0.022	102
95	Paper	1.346	0.010	114
96	Paperboard	1.376	−0.079	108
97	Corrugated cardboard	1.326	−0.414	82
98	Coated paper and building (construction) paper	1.213	−0.064	108
99	Corrugated card board boxes	1.222	−0.284	89
100	Other paper containers	1.133	−0.127	96
101	Paper textile for medical use	1.443	−0.102	104
102	Other pulp, paper and processed paper products	1.547 **	0.032	123
103	Printing, plate making and book binding	1.548	0.084	125
104	Chemical fertilizer	1.624 *	0.004	111
105	Industrial soda chemicals	1.167	0.415	94
106	Inorganic pigment	1.612 **	0.222 ***	102
107	Compressed gas and liquefied gas	1.592 *	0.039	79
108	Salt	0.813	−1.071	73
109	Other industrial inorganic chemicals	1.674 ***	0.017	114
110	Petrochemical basic products	1.817 *	−0.217	87
111	Petrochemical aromatic products (except synthetic resin)	1.368	0.267	83
112	Aliphatic intermediates	1.460 *	0.209 **	107
113	Cyclic intermediates	1.780 ***	0.364 ***	103
114	Synthetic rubber	1.498	0.182	98
115	Methane derivatives	1.207	0.082	82
116	Oil and fat industrial chemicals	1.575 *	0.042	89
117	Plasticizers	2.289 ***	−0.156 ***	82
118	Synthetic dyes	1.900 ***	0.155 ***	95
119	Other industrial organic chemicals	1.645 *	0.109	116
120	Thermo-setting resins	1.066	2.440 ***	104
121	Thermoplastics resins	1.210	0.846 ***	99
122	High function resins	0.852	−0.128	96
123	Other resins	0.943	−1.422	94
124	Rayon and acetate	0.961	3.763 **	86
125	Synthetic fibers	1.635 *	−0.070	97
126	Medicaments	1.958 *	0.127	133
127	Soap, synthetic detergents and surface active agents	1.064	−0.930	111
128	Cosmetics, toilet preparations and dentifrices	1.588 *	0.068	103
129	Paint and varnishes	1.738 ***	0.036	123
130	Printing ink	1.362	0.227 *	100
131	Photographic sensitive materials	1.628 **	0.275 **	104
132	Agricultural chemicals	1.327	−0.019	92
133	Gelatin and adhesives	1.371	0.110	119
134	Other final chemical products	1.801 ***	0.041	148
135	Petroleum refinery products (inc. greases)	1.422	1.403 ***	98
136	Coal products	1.966 **	0.602 ***	89
137	Paving materials	1.240	−0.187	89
138	Plastic products	1.445	−0.093	167

Continued.

id	sector	Elasticity	TFPg	Obs.
139	Tires and inner tubes	1.518 *	0.066	100
140	Rubber footwear	1.576	−0.256	105
141	Plastic footwear	2.005 ***	−0.098 **	106
142	Other rubber products	1.733 ***	0.047	123
143	Leather footwear	0.922	0.819	95
144	Leather and fur skins	0.811	0.241	87
145	Miscellaneous leather products	1.368	−0.273 **	119
146	Sheet glass and safety glass	1.022	0.233	107
147	Glass fiber and glass fiber products, n.e.c.	1.791 ***	−0.006	104
148	Other glass products	2.040 ***	−0.058	105
149	Cement	1.607 **	−0.006	101
150	Ready mixed concrete	0.885	0.773 *	88
151	Cement products	1.262	−0.105	116
152	Pottery, china and earthenware	2.203 ***	−0.077	117
153	Clay refractories	1.652 ***	−0.025	107
154	Other structural clay products	1.511 **	0.003	105
155	Carbon and graphite products	1.332	−0.046	104
156	Abrasive	1.388 *	0.021	124
157	Miscellaneous ceramic, stone and clay products	1.470 ***	0.000	145
158	Pig iron	1.530 **	−0.678 *	167
159	Ferro alloys	1.588	−0.818	83
160	Crude steel (converters)	2.639 ***	−0.382 ***	97
161	Crude steel (electric furnaces)	1.867 **	−0.229	94
162	Hot rolled steel	2.124 ***	−0.207	95
163	Steel pipes and tubes	0.967	−9.225 *	96
164	Cold-finished steel	1.454	0.271	95
165	Coated steel	1.986 ***	−0.001	98
166	Cast and forged steel	1.010	29.152 ***	83
167	Cast iron pipes and tubes	1.807 **	−0.105	88
168	Cast and forged materials (iron)	2.089 ***	−0.030	131
169	Iron and steel shearing and slitting	2.318 **	−0.264 *	81
170	Other iron or steel products	1.345 *	0.229	79
171	Copper	2.143 ***	−0.467	75
172	Lead and zinc (inc. regenerated lead)	1.343	0.647 *	83
173	Aluminum (inc. regenerated aluminum)	1.059	−3.167	80
174	Other non-ferrous metals	0.167 *	−0.536	149
175	Electric wires and cables	1.575 ***	0.044	119
176	Optical fiber cables	1.636 **	−0.361 ***	113
177	Rolled and drawn copper and copper alloys	1.811 **	−0.164	81
178	Rolled and drawn aluminum	1.739 *	−0.062	84
179	Non-ferrous metal castings and forgings	1.602 **	−0.037	121
180	Nuclear fuels	1.039	3.563 **	51
181	Other non-ferrous metal products	2.132 **	−0.551 **	86
182	Metal products for construction	1.499 **	0.036	134
183	Metal products for architecture	1.145	0.187	122
184	Gas and oil appliances and heating and cooking apparatus	1.558 ***	0.066	131
185	Bolts, nuts, rivets and springs	1.770 ***	−0.065	130
186	Metal containers, fabricated plate and sheet metal	1.784 ***	0.100 **	132
187	Plumber's supplies, powder metallurgy products and tools	1.597 ***	0.054	126
188	Other metal products	1.770 ***	0.084 *	143
189	Boilers	1.650 **	0.214 ***	118

Continued.

id	sector	Elasticity	TFPg	Obs.
190	Turbines	1.653 **	0.790 ***	117
191	Engines	1.861 ***	−0.030	127
192	Conveyors	1.406 **	−0.008	136
193	Refrigerators and air conditioning apparatus	1.385	0.400 ***	140
194	Pumps and compressors	2.100 ***	0.082 **	127
195	Machinists' precision tools	1.269	0.475 ***	126
196	Other general industrial machinery and equipment	1.370 *	0.117	138
197	Machinery and equipment for construction and mining	1.261	−0.273	129
198	Chemical machinery	1.529 **	−0.177 **	130
199	Industrial robots	1.509 **	−0.123	122
200	Metal machine tools	1.456	−0.241 *	127
201	Metal processing machinery	1.650 ***	−0.195 ***	126
202	Machinery for agricultural use	1.565 **	0.026	140
203	Textile machinery	2.242 ***	−0.167 ***	136
204	Food processing machinery and equipment	1.589 ***	−0.112 *	122
205	Semiconductor making equipment	1.453 **	0.096	140
206	Other special machinery for industrial use	1.651 ***	0.023	144
207	Metal molds	1.864 ***	0.031	125
208	Bearings	1.633 ***	0.081	112
209	Other general machines and parts	1.659 ***	−0.018	141
210	Copy machine	1.240	−0.539 ***	130
211	Other office machines	1.136	0.528	131
212	Machinery for service industry	1.377 **	−0.238 **	127
213	Rotating electrical equipment	1.462 ***	−0.172 **	125
214	Transformers and reactors	1.521 *	−0.127	122
215	Relay switches and switchboards	1.257	−0.079	139
216	Wiring devices and supplies	1.790 ***	−0.022	126
217	Electrical equipment for internal combustion engines	1.492 **	−0.023	128
218	Other electrical devices and parts	1.382 **	−0.253 ***	140
219	Applied electronic equipment	1.446 **	0.158 *	131
220	Electric measuring instruments	1.370 *	−0.393 ***	126
221	Electric bulbs	1.561 **	0.124 *	101
222	Electric lighting fixtures and apparatus	0.812	0.277	123
223	Batteries	1.587 **	−0.362 ***	127
224	Other electrical devices and parts	2.014 ***	0.109	123
225	Household air-conditioners	1.259	0.491 **	148
226	Household electric appliances (except air-conditioners)	1.337 **	0.177	151
227	Video recording and playback equipment	2.003 ***	0.769 ***	134
228	Electric audio equipment	1.391 *	0.397 ***	144
229	Radio and television sets	0.939	−7.175 **	123
230	Wired communication equipment	2.198 ***	−0.237 ***	148
231	Cellular phones	1.141	3.126	145
232	Radio communication equipment (except cellular phones)	1.354	−0.283 **	147
233	Other communication equipment	0.752	−0.322 *	139
234	Personal Computers	1.448 *	0.634	124
235	Electronic computing equipment (except personal computers)	1.643 ***	0.249	124
236	Electronic computing equipment (accessory equipment)	1.887 ***	0.406 ***	130
237	Semiconductor devices	1.501	0.024	122
238	Integrated circuits	1.245	−0.824	124
239	Electron tubes	1.787 ***	0.000	114
240	Liquid crystal element	2.256 ***	1.252 **	114

Continued.

id	sector	Elasticity	TFPg	Obs.
241	Magnetic tapes and discs	1.506	0.357	119
242	Other electronic components	1.692 ***	−0.078	150
243	Passenger motor cars	1.653 **	−0.147 *	121
244	Trucks, buses and other cars	1.478	0.278 ***	123
245	Two-wheel motor vehicles	1.091	−0.187	97
246	Motor vehicle bodies	1.609 *	−0.152	123
247	Internal combustion engines for motor vehicles and parts	1.805 ***	0.007	129
248	Motor vehicle parts and accessories	1.714 ***	0.132 **	150
249	Steel ships	1.418 ***	0.317 ***	155
250	Ships (except steel ships)	0.824	−0.470	140
251	Internal combustion engines for vessels	1.849 ***	0.038	113
252	Repair of ships	1.364 **	0.245 ***	140
253	Rolling stock	1.822 ***	−0.285 ***	136
254	Repair of rolling stock	1.683 ***	−0.056	115
255	Aircrafts	1.712 **	−0.107	119
256	Repair of aircrafts	1.647	−0.312 **	60
257	Bicycles	1.706	−0.244 **	111
258	Other transport equipment	1.980 ***	−0.092	138
259	Camera	0.667	−0.247	113
260	Other photographic and optical instruments	0.467 **	−0.018	125
261	Watches and clocks	1.483 ***	−0.333 ***	119
262	Professional and scientific instruments	1.278	−0.012	118
263	Analytical instruments, testing machine, measuring instruments	0.841	−0.002	149
264	Medical instruments	0.137 ***	−0.061	149
265	Toys and games	1.150	0.761 *	133
266	Sporting and athletic goods	1.606 ***	0.073	133
267	Musical instruments	1.192	0.182	112
268	Audio and video records, other information recording media	1.530 **	−0.127 *	93
269	Stationery	1.069	−0.341	125
270	Jewelry and adornments	1.128	0.612 **	172
271	"Tatami" (straw matting) and straw products	1.603	−0.340 *	67
272	Ordnance	1.393	0.218	122
273	Miscellaneous manufacturing products	1.639 ***	0.065	178
274	Residential construction (wooden)	1.431	0.134	153
275	Residential construction (non-wooden)	1.184	0.253	157
276	Non-residential construction (wooden)	1.158	0.125	149
277	Non-residential construction (non-wooden)	1.292	0.131	159
278	Repair of construction	1.214	0.184	144
279	Public construction of roads	0.845	−0.417	153
280	Public construction of rivers, drainages and others	1.059	0.384	153
281	Agricultural public construction	1.950 *	0.066	142
282	Railway construction	0.707	−0.445 ***	146
283	Electric power facilities construction	0.784	−0.035	148
284	Telecommunication facilities construction	1.279	0.129	138
285	Other civil engineering and construction	0.905	−0.687	150
286	Electricity	1.490 *	−0.054	96
287	Private power generation	1.059	−4.159	78
288	Gas supply	1.643	0.126	91
289	Steam and hot water supply	0.104	0.179	53
290	Water supply	1.320	−0.036	96
291	Industrial water supply	1.125	0.941 *	62

Continued.

id	sector	Elasticity	TFPg	Obs.
292	Sewage disposal **	1.701 ***	−0.017	84
293	Waste management services (public) **	1.488	−0.654 ***	87
294	Waste management services (private)	1.437	0.215 *	87
295	Wholesale trade	1.383	−0.164 *	119
296	Retail trade	1.397	−0.507 ***	114
297	Financial service	0.351 *	0.283 ***	99
298	Life insurance	1.052	1.146	86
299	Non-life insurance	0.903	−2.847 ***	79
300	Real estate agencies and managers	0.901	−0.158	81
301	Real estate rental service	0.275	−0.201 **	84
302	House rent	0.839	−0.061	87
303	Railway transport (passengers)	2.028 ***	−0.044	110
304	Railway transport (freight)	1.910 ***	0.153 ***	99
305	Bus transport service	0.819	0.713 **	86
306	Hired car and taxi transport	0.416	0.113	84
307	Road freight transport(exceptSelf-transport by private cars)	1.200	−0.553 **	91
308	Ocean transport	1.116	1.607	101
309	Coastal and inland water transport	1.239	−0.651 ***	103
310	Harbor transport service	1.103	−0.776 ***	94
311	Air transport	1.502	0.271 **	103
312	Consigned freight forwarding	−0.718 **	−0.240 *	91
313	Storage facility service	1.592 **	−0.408 ***	103
314	Packing service	1.317	−0.136	101
315	Facility service for road transport	1.099	−0.143	85
316	Port and water traffic control **	1.088	−0.526	83
317	Services relating to water transport	1.519	−0.269 **	84
318	Airport and air traffic control (public) **	1.423	−0.099	86
319	Airport and air traffic control (industrial)	1.134	−0.611 **	82
320	Services relating to air transport	1.189	−0.062	108
321	Travel agency and other services relating to transport	0.165	−0.015	73
322	Postal service and mail delivery	1.444	0.372 *	90
323	Fixed telecommunication	0.773	0.613 **	101
324	Mobile telecommunication	1.899	−0.156	73
325	Other services relating to communication	2.410 ***	0.016	63
326	Public broadcasting	1.170	−0.445 *	88
327	Private broadcasting	1.082	−1.626 ***	91
328	Cable broadcasting	1.104	−1.598 ***	81
329	Information services	1.439	0.028	98
330	Internet based services			
331	Image information production and distribution industry	1.660 **	−0.206 **	117
332	Newspaper	1.508 **	0.006	97
333	Publication	1.450 *	0.027	103
334	News syndicates and private detective agencies	1.397 *	−0.052	72
335	Public administration (central) **	1.597 ***	0.219 ***	217
336	Public administration (local) **	1.220	−0.314 **	124
337	School education (public) **	1.893	−0.017	106
338	School education (private) *	1.721	−0.564 ***	107
339	Social education (public) **	1.846 *	−0.232 ***	91
340	Social education (private, non-profit) *	1.381	−0.387	76
341	Other educational and training institutions (public) **	1.366	−1.675 ***	90
342	Other educational and training institutions (profit-making)	1.732 **	0.079	72

Continued.

id	sector	Elasticity	TFPg	Obs.
343	Research institutes for natural science (pubic) **	2.069	−0.765 ***	88
344	Research institutes for cultural and social science (public) **	2.044	−0.923 ***	62
345	Research institutes for natural sciences (private, non-profit) *	1.393	−2.078 ***	59
346	Research institutes for cultural and social science (private,non-profit) *	1.215	−5.071 ***	47
347	Research institutes for natural sciences (profit-making)	2.114 **	−0.854 ***	91
348	Research institutes for cultural and social science (profit-making)	2.396	−0.227 **	50
349	Research and development (intra-enterprise)	1.465 **	−0.318 ***	124
350	Medical service (public)	1.843 ***	−0.091 **	151
351	Medical service (non-profit foundations, etc.)	1.853 ***	−0.027	152
352	Medical service (medical corporations, etc.)	1.724 **	0.140 **	154
353	Health and hygiene (public) **	1.504 ***	0.029	89
354	Health and hygiene (profit-making)	1.513 **	0.056	92
355	Social insurance (public) **	1.285	−0.283 **	68
356	Social insurance (private, non-profit) *	1.362	−0.197 **	68
357	Social welfare (public) **	1.500 ***	−0.201 ***	140
358	Social welfare (private, non-profit) *	1.477 ***	−0.072	141
359	Social welfare (profit-making)	1.295 ***	0.238 ***	141
360	Nursing care (In-home)	1.566 ***	−0.100 **	151
361	Nursing care (In-facility)	1.654 ***	0.083 **	157
362	Private non-profit institutions serving enterprises	1.588 *	−0.450 ***	89
363	Private non-profit institutions serving households, n.e.c. *	1.413 *	0.227 ***	103
364	Advertising services	1.925 ***	0.017	101
365	Goods rental and leasing (except car rental)	1.074	−2.026	111
366	Car rental and leasing	1.442	0.199	76
367	Repair of motor vehicles	1.432 *	−0.058	112
368	Repair of machine	1.592 **	−0.164 *	143
369	Building maintenance services	1.272	−0.248	80
370	Judicial, financial and accounting services	1.178	0.526	78
371	Civil engineering and construction services	1.576	−0.172	90
372	Worker dispatching services	1.493	0.379 ***	79
373	Other business services	2.067 ***	0.275 ***	120
374	Movie theaters	0.484	−0.122	74
375	Performances (except otherwise claasified), theatrical comranies	1.287	0.137	106
376	Amusement and recreation facilities	1.334	−0.125	100
377	Stadiums and companies of bicycle, horse, motorcar and motorboat races	1.748	−0.311 ***	103
378	Sport facility service, public gardens and amusement parks	1.639	−0.195 *	114
379	Other amusement and recreation services	1.250	−0.725 **	103
380	General eating and drinking places (except coffee shops)	1.221	−0.121	146
381	Coffee shops	1.179	−0.339 *	137
382	Eating and drinking places for pleasures	1.282	−0.104	145
383	Accommodations	1.784 ***	−0.096 **	159
384	Cleaning	1.658 **	−0.104 *	86
385	Barber shops	1.647 ***	−0.152 ***	84
386	Beauty shops	1.436 *	−0.133	89
387	Public baths	1.474 *	−0.210 **	92
388	Other cleaning, barber shops, beauty shops and public baths	1.177	−1.286 **	88
389	Photographic studios	1.503	−0.397 ***	96
390	Ceremonial occasions	1.418	0.304 **	152
391	Miscellaneous repairs, n.e.c.	0.602	0.106	114
392	Supplementary tutorial schools, instruction services for arts	1.378	−0.107	110
393	Other personal services	1.894	−0.161 **	111

Continued.

id	sector	Elasticity	TFPg	Obs.
394	Office supplies	2.387 ***	−0.023	27
395	Activities not elsewhere classified	3.572 ***	0.043	177

Table 9: CES Elasticities and Productivity Growths (Korea 2000–2005)

id	sector	Elasticity	TFPg	Obs.
1	Unmilled rice	0.396	0.171	78
2	Barley	1.797	0.269	59
3	Wheat	1.768	0.651 **	25
4	Misc. cereals	0.377	−0.323	46
5	Vegetables	1.213	−0.397	101
6	Fruits	1.044	−7.771 **	90
7	Pulses	1.743	0.311	49
8	Potatoes	1.087	−1.196	46
9	Oleaginous crops	1.587	−0.470 **	46
10	Cultivated medicinal herbs	0.806	2.091 **	58
11	Other edible crops	2.510 **	−0.147	54
12	Cotton and hemp	1.028	1.235	22
13	Horticultural specialities	2.017	0.067	101
14	Natural rubber			
15	Seeds and seedlings	0.688	−0.658 *	95
16	Other Inedible crops	0.292	1.229 *	16
17	Dairy farming	0.486	−0.375 **	117
18	Beef cattle	0.518	−0.961 **	119
19	Pigs	0.492	−0.779 **	120
20	Poultry and birds	0.988	−18.367 **	122
21	Other animals	0.730	−0.854	102
22	Operation of timber tracts	0.471	−0.003	92
23	Raw timber	0.601	0.170	46
24	Edible forest products	0.753	0.326	74
25	Misc. forest products	1.209	−0.644	68
26	Fishing	1.302	0.227	160
27	Aquaculture	1.137	1.180 ***	126
28	Agriculture, forestry and fishing related services	1.626	−0.838 ***	131
29	Anthracite	2.312 ***	0.114	128
30	Bituminous coal			
31	Crude petroleum and Natural gas			
32	Iron ores	1.786	−0.064	78
33	Copper ores			
34	Lead and zinc ores	1.999	−0.245	7
35	Misc. non-ferrous metal ores	2.263	0.440 ***	48
36	Sand and gravel	2.472 **	−0.201	109
37	Crushed and broken stone abd Other bulk stones	1.742 *	−0.045	116
38	Limestone	1.621	0.054	122
39	Materials for ceramics	1.934 *	0.039	113
40	Crude salt	1.740	0.320 ***	91
41	Misc. non-metallic minerals	2.244 ***	0.176	104
42	Slaughtering and meat processing	1.165	0.498	101
43	Poultry slaughtering and processing	1.398	0.202	91
44	Prepared meat products	1.656	0.266 **	138

Continued.

id	sector	Elasticity	TFPg	Obs.
45	Dairy products	1.981 **	0.151 *	140
46	Canned seafoods	1.229	1.518 *	106
47	Frozen fish and seafoods	1.746	−1.466 ***	98
48	Salted, dried and smoked seafoods	3.196 *	0.085	94
49	Misc. processed seafoods	1.469	0.975 ***	109
50	Polished rice	1.237	0.530	92
51	Polished barley	1.104	−0.510	69
52	Flour and cereal preparations	1.762	−0.517 **	98
53	Raw sugar			
54	Refined sugar	1.576	−0.233	97
55	Starches	2.191 **	−0.143 *	98
56	Glucose, glucose syrup and maltose	1.638	0.109	106
57	Bakery and confectionery products	1.801 *	0.213 **	170
58	Noodles	1.230	0.695 **	131
59	Seasonings	1.656 *	0.029	149
60	Soy sauce ad bean paste	1.691	0.025	123
61	Animal and marine fats and oils	1.158	1.153 *	103
62	Vegetable fats and oils, and processed edible refined oil	1.575	0.091	123
63	Canned or cured fruits and vegetables	1.750 *	−0.041	135
64	Coffee and tea	1.596	−0.297 **	125
65	Ginseng products	1.696 *	0.082	100
66	Malt and yeast	1.656	−0.114	86
67	Bean curd and Misc. foodstuffs	1.590	0.184	158
68	Ethyl alcohol for beverages	1.643	0.077	104
69	Blended and distilled sojoo	1.648	−0.039	117
70	Beer	0.959	−6.113 ***	106
71	Other liquors	1.727	0.011	124
72	Soft drinks and Manufactured ice	1.272	0.434	137
73	Prepared livestock feeds	1.738 *	0.057	150
74	Tobacco products	1.951	−0.544 **	98
75	Woolen yarn	1.419	0.577 ***	109
76	Cotton yarn	1.037	−0.436	123
77	Silk and hempen yarn	0.995	−2.992	82
78	Regenerated fiber yarn	1.406	1.283 ***	82
79	Synthetic fiber yarn	1.932 **	−0.071	120
80	Thread and other fiber yarns	1.919 ***	−0.010	110
81	Woolen fabrics	1.463	−0.019	110
82	Cotton fabrics	1.169	−0.743 *	123
83	Silk and hempen fabrics	2.030 **	0.194	106
84	Regenerated fiber fabrics	1.526	0.276	100
85	Synthetic fiber fabrics	1.876 **	0.092	124
86	Other fiber fabrics	1.432	−0.114	116
87	Knitted fabrics	1.947 **	0.062	107
88	Fiber bleaching and dyeing	1.943 **	0.053	115
89	Knitted wearing apparels	1.264	−0.436	124
90	Knitted clothing accessories	2.349 ***	0.095	112
91	Textile wearing apparels and Clothing accessories	0.982	3.826	137
92	Leather wearing apparels	1.836 *	0.108	104
93	Fur and Fur wearing apparels	1.331	0.481 ***	121
94	Textile products and Misc. textile products	1.660	−0.227	154
95	Cordage, rope, and fishing nets	1.437	0.034	111

Continued.

id	sector	Elasticity	TFPg	Obs.
96	Leather	1.828 **	0.256 **	125
97	Luggage and handbags	2.170 ***	0.152 ***	114
98	Footwear	1.860 ***	−0.146 *	127
99	Other leather products	1.889 *	0.018	87
100	Lumber	2.054 **	−0.092	101
101	Plywood	1.778 **	−0.071	118
102	Reconstituted and densified wood	1.660	−0.363 **	113
103	Wooden products for construction	1.903 ***	−0.175 **	110
104	Wooden containers and Other wooden products	2.046 **	0.213 **	120
105	Pulp	1.065	1.991	108
106	Newsprint	1.757 *	−0.098	115
107	Printing paper	1.670 *	−0.111	138
108	Other raw paper and paperboard	1.824 ***	0.039	146
109	Corrugated paper and solid fiber boxes	1.652 **	−0.047	115
110	Paper containers	1.922 ***	0.100	128
111	Stationery paper and office paper	1.495 *	0.024	121
112	Other paper products	1.623 **	0.050	156
113	Printing	1.579 ***	0.072	139
114	Reproduction of recorded media	1.977 ***	0.115 *	132
115	Coal briquettes	1.450	0.939	74
116	Coke and other coal products	1.338	0.015	119
117	Naphtha	1.649 *	−0.687 **	117
118	Gasoline and Jet oil	1.724 **	−0.252	123
119	Kerosene	1.672	−0.286	122
120	Light oil	1.380	−0.220	122
121	Heavy oil	1.671	−0.359	121
122	Liquefied petroleum gas	1.414	−0.041	121
123	Lubricants	1.764 *	0.163	127
124	Misc. petroleum refinery products	1.822 *	−0.014	123
125	Petrochemical basic products	1.381	0.605	121
126	Petrochemical intermediate products and Other basic organic chemicals	1.878 **	0.035	159
127	Coal chemicals	0.475	−0.549	105
128	Industrial gases	1.727	−0.047	120
129	Basic inorganic chemicals	1.307	0.282	157
130	Synthetic resins	1.854 *	0.318 **	151
131	Synthetic rubber	1.503	0.561 **	116
132	Regenerated cellulose fibers	1.324	0.123	95
133	Synthetic fibers	1.742 **	−0.065	124
134	Nitrogen compounds	1.763 **	0.019	110
135	Fertilizers	1.696 *	0.173	138
136	Pesticides and other agricultural chemicals	1.548	0.183	130
137	Medicaments	2.037 ***	0.198 ***	171
138	Cosmetics and dentifrices	1.949 **	0.249 **	161
139	Soap and detergents	1.481	0.261 *	147
140	Dyes, pigments, and tanning materials	1.435	0.503 **	141
141	Paints, varnishes, and allied products	1.731 **	0.108	151
142	Printing ink	2.029 ***	0.185 **	123
143	Adhesives, gelatin and sealants	1.901 **	−0.032	139
144	Explosives and fireworks products	1.638 **	−0.162	135
145	Recording media and Photographic chemical products	1.857 ***	0.023	138
146	Misc. chemical products	1.572 **	0.244 **	168

Continued.

id	sector	Elasticity	TFPg	Obs.
147	Primary plastic products	1.657	0.232 *	151
148	Industrial plastic products	1.654 **	0.003	163
149	Household articles of plastic material	1.754 **	0.020	120
150	Tires and tubes	1.474	−0.198	140
151	Rubber products	1.759 ***	−0.030	150
152	Sheet glass and primary glass products	1.991 ***	0.081	125
153	Industrial glass products	2.102 ***	0.282 **	165
154	Household glass products and others	1.931 ***	0.136 *	132
155	Pottery	1.520 *	0.178	151
156	Refractory ceramic products	1.337	−0.107	142
157	Clay products for construction	1.786 **	0.280 **	136
158	Cement	2.081 ***	0.065	150
159	Ready mixed concrete	2.111 ***	0.010	128
160	Concrete blocks, bricks, and other concrete products	1.833 ***	0.185 ***	140
161	Lime, gypsum, and plaster products	1.774 *	0.287 ***	130
162	Cut stone & stone products	1.363	0.192	130
163	Asbestos and mineral wool products	1.740 **	0.209 **	141
164	Abrasives	1.644 *	0.069	138
165	Asphalts	1.559	0.167	121
166	Misc. nonmetallic minerals products	1.687 *	0.143	136
167	Pig iron	1.392 **	0.390	134
168	Ferroalloys	0.835	−1.514	108
169	Steel ingots and semifinished products	0.887	−2.765 **	140
170	Steel rods and bars	1.650 *	0.123	124
171	Section steel	1.532 **	0.319 *	117
172	Rails and wires	1.155	1.237	127
173	Hot rolled steel plates and sheets	0.624	−0.703	135
174	Steel pipe and tubes, except foundry iron pipe and tubes	1.053	4.196	138
175	Cold rolled steel sheet, strip, and bars	0.745	−0.302	143
176	Iron foundries and foundry iron pipe and tubes	1.852 ***	−0.014	148
177	Forgings	2.116 ***	−0.295 **	118
178	Coated steel plates	1.252	−0.014	140
179	Misc. primary iron and steel products	1.672	0.187	113
180	Copper ingots	0.797	−1.792 *	120
181	Aluminium ingots	1.763 *	0.362 ***	120
182	Lead and zinc ingots	1.295	1.134 ***	132
183	Gold and silver ingots	2.829 ***	−0.191 **	108
184	Other nonferrous metal ingots	1.701 *	−0.061	117
185	Primary copper products	1.535	−0.086	130
186	Primary aluminium products	1.518	0.239 *	140
187	Other nonferrous metal casting and forgings, and primary nonferrous metals	1.529	0.176	125
188	Metal products for construction	1.831 **	0.012	130
189	Metal products for structure	1.516	0.186	146
190	Metal tanks and reservoirs for equipment	1.293	−0.013	125
191	Metal cans, barrels, and drums	1.639 *	0.152	128
192	Handtools	1.141	−0.116	141
193	Bolts, nuts, screws, rivets, and washers	1.674 **	−0.173	135
194	Fabricated wire products	1.474	−0.437 **	144
195	Fastening metal products	1.695 **	0.028	133
196	Treatment and coating of metals and Misc. fabricated metal products	1.713 **	−0.066	167
197	Internal combustion engines and turbines	1.634 ***	0.057	152

Continued.

id	sector	Elasticity	TFPg	Obs.
198	Parts of general-purposed machinery and equipment	1.406	0.224	154
199	Conveyors and conveying equipment	1.665 **	−0.117	161
200	Air-conditioning equipment and industrial refrigeration equipment	1.514 **	0.202	159
201	Boiler, Heating apparatus and cooking appliances	1.616 **	0.265 **	160
202	Pumps and compressors	1.595 **	−0.025	154
203	Misc. machinery and equipment of general purpose	1.427	0.146	171
204	Metal cutting type machine tools	1.208	−0.411	157
205	Metal forming machine tools	1.294	−0.223	153
206	Agricultural implements and machinery	1.660 ***	0.114	151
207	Construction and mining machinery	1.567 **	0.019	152
208	Food processing machinery	1.581 **	0.274 ***	139
209	Textile machinery	1.488 *	0.190	161
210	Metal molds and industrial patterns	1.659 **	0.162	148
211	Misc. machinery and equipment of special purpose	0.718	0.324	178
212	Motors and generators	1.747 ***	0.177 **	157
213	Electric transformers	1.815 ***	0.079	146
214	Capacitors and rectifiers, Electric transmission and distribution equipment	1.562 **	−0.013	163
215	Insulated wires and cables	1.784 ***	−0.098	165
216	Batteries	1.389	0.269	147
217	Electric lamps and electric lighting fixtures	1.582 **	−0.074	156
218	Misc. electric equipment and supplies	1.492 *	0.075	151
219	Electron tubes	1.695 ***	0.382 **	155
220	Digital display	1.095	0.708	155
221	Semiconductor devices	1.511 **	0.359	158
222	Integrated circuits	1.190	0.343	163
223	Electric resistors and storage batteries	2.063 ***	0.576 ***	152
224	Electric coils, transformers	1.334	0.448 ***	138
225	Printed circuit boards	1.540 **	0.347	156
226	Misc. electronic components	1.402	0.497 *	166
227	Television	1.470	0.840 **	146
228	Electric household audio equipment	2.123 ***	0.559 ***	147
229	Other audio and visual equipment	1.596 *	0.396 *	160
230	Line telecommunication apparatuses	1.645 **	0.111	157
231	Wireless telecommunication and broadcasting apparatuses	1.501	0.915	159
232	Computer and peripheral equipment	1.630 **	0.605	162
233	Office machines and devices	1.543 *	0.320 **	150
234	Household refrigerators	1.762 ***	0.212 ***	148
235	Household laundry equipment	1.467 **	0.398 ***	141
236	Other household electrical appliances	1.441 *	0.050	156
237	Medical instruments and supplies	1.817 ***	0.258 **	163
238	Regulators and Measuring and analytical instruments	1.603 **	0.258 **	163
239	Photographic and optical instruments	2.092 ***	0.686 ***	161
240	Watches and clocks	1.609 **	0.613 ***	143
241	Passenger automobiles	1.638 ***	0.342 ***	151
242	Buses and vans	1.720 ***	0.201 ***	148
243	Trucks and Motor vehicles with special equipment	1.807 ***	0.228 ***	150
244	Motor vehicle engines, chassis, bodies and parts	1.218	0.314	184
245	Trailers and containers	1.420	0.373 **	131
246	Steel ships	1.513 **	−0.207	177
247	Other ships	1.815 ***	−0.297 **	162
248	Ship repairing and ship parts	1.811 ***	0.146 **	147

Continued.

id	sector	Elasticity	TFPg	Obs.
249	Railroad vehicles and parts	1.532 **	0.169	153
250	Aircraft and parts	1.237	−0.055	155
251	Motorcycles and parts	1.672 **	0.089	144
252	Bicycles and parts and misc. transportation equipment	1.882 ***	0.388 ***	128
253	Wood furniture	1.481 *	0.447 ***	161
254	Metal furniture	1.523 **	0.005	142
255	Other furniture	1.107	−0.200	162
256	Toys and games	1.175	−0.066	157
257	Sporting and athletic goods	1.726 *	−0.065	155
258	Musical instruments	1.494 **	−0.015	151
259	Pens, pencils, and other artists' materials	1.740 ***	0.150 *	141
260	Jewelry and plated ware	1.563	0.400 **	120
261	Misc. manufacturing products	1.441	0.124	192
262	Hydroelectric power generation	1.422	0.376 *	109
263	Fire power generation	0.918	−2.199 *	119
264	Nuclear power generation	0.925	7.064 ***	122
265	Other generation	1.490	0.374	94
266	Manufactured gas supply	1.195	4.041 ***	109
267	Steam and hot water supply	1.445	0.437 ***	101
268	Water supply	1.653 **	0.296 **	120
269	Residential building construction	0.974	−4.666 **	174
270	Non-residential building construction	1.166	−0.196	178
271	Building repairs	1.114	0.336	164
272	Road construction	1.374 *	0.020	175
273	Railroad construction	1.406 *	−0.047	166
274	Breakwater, pier, and harbor construction	1.107	−0.064	156
275	Airport construction	1.190	−0.192	154
276	Dam, levee, and flood control project construction	1.348	0.180	158
277	Water main line and drainage project construction	1.294	−0.020	165
278	Land clearing and reclamation, and irrigation project construction	1.511 *	0.006	163
279	Land leveling and athletic field construction	1.322	−0.109	169
280	Electric power plant construction	1.330 *	−0.132	167
281	Communications line construction	1.576 **	0.002	155
282	Misc. construction	1.110	−3.617 ***	170
283	Wholesale and Retail trade	0.901	1.883 *	145
284	Restaurants	1.166	0.550	177
285	Accommodation	1.619 **	0.088	128
286	Railroad passenger transport	2.521 ***	−0.190 *	131
287	Railroad freight transport	1.422	0.621 ***	117
288	Road passenger transport	1.916 **	0.316 **	127
289	Road freight transport	1.944 **	0.368 ***	127
290	Coastal and inland water transport	1.585 **	0.242 ***	130
291	Oceangoing transport	1.444	1.626 ***	136
292	Air transport	1.442	0.703 ***	153
293	Supporting land transport activities	1.525 **	0.526 ***	122
294	Supporting water transport activities	1.600 **	0.019	121
295	Supporting air transport activities	2.141 ***	0.343 ***	104
296	Cargo handling	1.821 **	−0.390 ***	118
297	Warehousing and storage	1.499	−0.155	126
298	Other services incidental to transportation	1.400	−0.553 **	117
299	Postal services	1.521	−0.950 ***	112

Continued.

id	sector	Elasticity	TFPg	Obs.
300	Telecommunications	1.596 *	−0.237 *	119
301	Broadcasting	0.965	−2.958	119
302	Central bank and banking institutions, Non-bank depository institutions	1.828 **	0.301 ***	116
303	Other financial brokerage institutions	1.623	0.418 ***	104
304	Life insurance	1.634 *	−0.013	102
305	Non-life insurance	1.557 *	0.255 *	103
306	Services auxiliary to finance and insurance	1.529	−0.020	105
307	Owner-occupied housing	−3.820	0.118	5
308	Renting and subdividing of real estate	1.565 *	−0.238 *	119
309	Services related to real estate	2.023 **	−0.083	87
310	Research institutes(public)	1.578 **	−0.086	178
311	Research institutes(private, non-profit, commercial)	1.523 **	0.527 ***	148
312	Research and experiment in enterprise	1.390 **	−0.540 ***	221
313	Legal and accounting services	1.302	0.169	83
314	Market research and management consultancy	1.324	0.228	91
315	Advertising services	1.141	3.545 ***	121
316	Architectural engineering services	1.600 **	−0.054	139
317	Computer softwares development and supply	1.293	0.194	111
318	Computer related services	1.322	0.999 ***	107
319	Renting of machinery and goods	1.311	−0.795 ***	129
320	Cleaning and disinfection services	1.514	0.063	100
321	Misc. business services	1.355	−0.603 **	125
322	Public government	0.473	−0.702 ***	201
323	Local government	1.216	1.349 **	210
324	Education (public)	1.879 ***	−0.236 **	165
325	Education (private, non-profit)	1.497 *	−0.533 ***	144
326	Education (commercial)	1.618 *	0.466 ***	123
327	Medical and health services(public)	2.112 ***	−0.007	134
328	Medical and health services(Private, non-profit)	1.929 ***	−0.053	137
329	Medical and health services (commercial)	2.309 ***	0.018	156
330	Social work activities(public)	2.096 ***	0.133	117
331	Social work activities(other)	1.694 **	0.251 **	133
332	Sanitary services(public)	1.658 *	0.198	126
333	Sanitary services(commercial)	1.392	0.050	125
334	Newspapers	1.878 ***	−0.056	114
335	Publishing	1.494 **	0.131	120
336	Library, museum and similar recreation related services(public)	1.777 ***	0.123	129
337	Library, museum and similar recreation related services(other)	1.501	0.082	131
338	Motion picture, Theatrical producers, bands, and entertainers	1.597 ***	0.156 *	147
339	Sports organizations and sports facility operation	1.582 **	0.274 **	140
340	Misc. amusement and recreation services	1.802 ***	0.513 ***	149
341	Business and professional organizations	2.651 ***	0.347 ***	91
342	Other membership organizations	1.800 **	0.240 **	110
343	Motor repair services	1.369	0.396 ***	140
344	Other personal repair services	1.885 ***	−0.238 ***	143
345	Laundry and cleaning services	1.521	0.362 **	87
346	Barber and beauty shops	1.517	−0.037	89
347	Personal services	1.937 ***	−0.120 *	120
348	Office supplies			
349	Business consumption expenditures			
350	Nonclassifiable activities			

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