What would KORUS bring?

Ozlem Yaylaci* and Serge Shikher†

Department of Economics
Suffolk University

Abstract

This paper uses a computable model of trade to forecast the effects of the U.S.-Korea free trade agreement on the manufacturing sector. The model uses the Eaton-Kortum methodology to explain intra-industry trade instead of the usual Armington assumption and. It is parameterized using 2005 data for 15 industries and 53 countries. The results show that implementing KORUS would increase the U.S. manufacturing exports to Korea by 56.9% and Korean manufacturing exports to the U.S. by 18.9%. It would also increase manufacturing employment by 26,500 jobs in Korea and 34,200 jobs in the U.S. In addition, KORUS would lead to significant changes in the patterns of trade and production. The U.S. and Korea would increase their specialization in the industries where they have strong technological comparative advantages. Finally, KORUS would increase welfare in both countries, but only modestly: by 0.27% in Korea and 0.013% in the U.S.

JEL codes: F1

Keywords: Korea-US free trade agreement, KORUS, specialization, comparative advantage, employment, computable models, trade policy

1 Introduction

First signed in June 30, 2007, and updated in December 2010, The Republic of Korea and the United States free trade agreement, KORUS FTA, is still waiting for approval of the U.S. and Korean legislatures. The U.S. and Korea are each other's major trade partners and a free-trade agreement between them can substantially alter their trade volumes and patterns. The purpose of this paper is to forecast the changes in manufacturing trade, output, employment, and welfare as the result of KORUS. The innovation of this paper relative to the existing literature is that it uses the Eaton and Kortum (2002) methodology to model trade flows as opposed to the Armington assumption used by the previous studies. The Eaton-Kortum methodology combines the elements of the Ricardian and gravity models and focuses on productivities and trade costs in explaining the pattern and volume of trade.

Korea is the world's 14th largest economy with $1 trillion GDP and 49 million consumers.[1] Therefore it is a very attractive export destination for trading countries, and the U.S. competes with countries like China, Japan, and the E.U. in order to get a share of Korean imports. Although

*Email: ozlem.yaylaci@suffolk.edu

†Email: serge.shikher@suffolk.edu

[1] Data from the World Bank's WDI database and the U.S. CIA's The World Factbook.

each country keeps its place as one of the major trading partners of the other, the U.S. share in Korean imports has decreased during the past few years. In 2000, the U.S. was the second largest exporter of merchandise goods to Korea after Japan, with a share of 18 % of the Korean imports. In 2008, the U.S. has fallen to the fourth place after China, Japan, and the European Union-25, supplying approximately 9% of total Korean imports. Over the period 2000-2008, the U.S. exports to Korea grew by only $9 billion, while the Korean import market expanded 170%, from $160 billion to $433 billion (Schott, 2009). KORUS is expected to give a solid boost to the U.S.-Korea bilateral trade.

Previous studies of the potential effects of KORUS include Choi and Schott (2001), USITC (2001,2010), DeRosa and Gilbert (2004), Lee and Lee (2005), Zhuang and Koo. (2006), Schott, Bradford and Moll (2006), and Kiyota and Stern (2007). These studies have been summarized in USITC (2010). All of these studies - regardless of model, base year, and liberalization scenario - estimate that KORUS will significantly increase U.S.-Korea trade, increase U.S. exports to Korea, in both percentage and value terms, by more than the U.S. imports from Korea, and very modestly increase the U.S. and Korea's welfare.[2]

The model used in this paper is an extension of the Eaton and Kortum (2002) model of trade to multiple industries. In addition to producing final goods, industries supply each other with intermediate goods. This creates forward and backward linkages between industries in the sense of Hirschman (1958). These linkages mean that price changes in one industry affect costs of production and output in other industries.

The model makes industry the central unit of analysis, similar to the traditional empirical trade literature. Other significant features of the model, which come from using the Eaton and Kortum's methodology, are producer heterogeneity within industry, two-way trade, transportation costs, and endogenous prices. As in the Ricardian model, countries have different technologies and trade with each other to exploit their competitive advantages. As in gravity model, distance between countries is an obstacle to international trade and creates a wedge between goods prices in different countries. Allowing for producer heterogeneity within industries makes two-way trade a natural outcome of the model.

The model is estimated for 15 manufacturing industries in 53 countries in 2005. The paper uses a two-step procedure for estimating industry-level technology parameters, taking into account inter-industry trade in intermediate goods. These parameters are measures of technology derived from international competitiveness.

The model makes it possible to simulate changes in trade costs and see the effects of these changes on prices, costs of production, employment, specialization, and welfare. The simulation results show how technology, trade costs, and industry linkages interact to determine the complex pattern of trade and specialization.

The model of this paper focuses on industry as the unit of observation and analysis and has implications for specialization, which connects it to the literature that studies the determinants of specialization.[3] However, while the traditional literature on specialization considers each industry having a homogeneous technology, the model of this paper allows for producer heterogeneity within industries.

[2] Of course, this similarity is aided by the fact that these studies used very similar models. For example, five of the studies used the GTAP model.

[3] See for example Leamer (1984). Most of this literature focuses on factor endowment differences as the determinants of specialization, whereas this paper focuses on the differences of technology.

The model explicitly incorporates trade costs and uses them to explain the home bias in consumption and cross-country price differentials. Therefore, it is well suited to study the effects of changes in trade costs, such as trade wars or trade liberalizations. By comparison, the traditional computable models of trade are based on the Armington (1969) assumption which uses demand-side parameters to explain the pattern of trade (including the home bias) instead of trade costs.

The model also explicitly incorporates technological differences across industries and countries. It is an extension of the Ricardian model, so technology and technological comparative advantage play important roles in the model. Therefore, the model is particularly suitable for a study of how technological change is propagated around the world through trade.

Kehoe (2005) and Shikher (2010) have analyzed the performance of the computable models of trade based on the Armington assumption in forecasting the effects of NAFTA and found that the forecasts were significantly off the mark in two aspects: (a) the overall predicted increases in trade were much smaller than the actual and (b) the industry-level changes in bilateral trade they forecasted turned out to have little correlation with the actual post-NAFTA changes.[4] At the same time, Shikher (2010) has shown that a model of trade based on the Eaton-Kortum methodology can make accurate forecasts of NAFTA (based on the information available in 1989).

The simulation results show that implementing KORUS would increase U.S. exports to Korea by 56.9% and Korean exports to the U.S. by 18.9%. Therefore, similar to other studies of KORUS we find that the U.S. exports to Korea would increase more than the U.S. imports from Korea. Also, as the result of KORUS the manufacturing employment would grow in both countries: it would increase by 26,500 jobs in Korea and 34,200 jobs in the U.S.

At the same time, there would be significant changes in the patterns of trade and production in Korea and the U.S. There would be big increases in trade in the Food, Textile, Rubber, and Machinery industries. There would be a large loss of employment in the Korean Food industry and a large gain in the Korean Textile industry. The mirror image of this change would occur in the U.S. In many machinery industries, there would be employment gains in both countries. In general, the U.S. and Korea would increase their specialization in the industries where they have strong technological comparative advantages. The simulation also shows that the trade liberalization brought by KORUS would modestly increase welfare in both countries: 0.27% in Korea and 0.013% in the U.S.

This paper is organized as follows. Section 2 describes the model. Section 3 explains the procedure for obtaining model parameters, including the industry technology parameters. Section 4 describes the data. Section 5 discusses the estimated distance and technology parameters. Section 6 explains the simulations and presents their results. Section 7 concludes.

2 Model

There are N countries and J industries. The focus on the empirical application of this model is on the manufacturing industries. The first $J-1$ industries produce manufacturing products, while the last industry produces nonmanufactures. Subscripts i and n refer to countries while subscripts j and m refer to industries.

As in the Ricardian and Eaton-Kortum models, labor is the only factor of production. Labor is mobile across industries, but not across countries. The industry cost function is

[4] The main reason why the Armington-based models significantly underpredicted the effects of NAFTA is that the Armington elasticities they employed (~2-3) were too small. See Ruhl (2008) for an analysis of this issue.

$$c_{ij} = w_i^{\beta_j} \rho_{ij}^{1-\beta_j}, \tag{1}$$

where w_i is the wage, ρ_{ij} is the price of the intermediate goods, and β_j is the share of labor. It is assumed that industries mix intermediate inputs in a Cobb-Douglas fashion, so the price of inputs ρ_{ij} is a Cobb-Douglas function of industry prices:

$$\rho_{ij} = \prod_{m=1}^{J} p_{im}^{\eta_{jm}} = \prod_{m=1}^{J-1} p_{im}^{\eta_{jm}}, \tag{2}$$

where η_{jm} is the share of industry m goods in the input of industry j, such that $\sum_{m=1}^{J} \eta_{jm} = 1$, $\forall j$. The second equality in equation (2) holds because following Eaton and Kortum (2002) we assume that (at least some of) nonmanufacturing output can be traded costlessly and use it as the numeraire: $p_{iJ} \equiv 1$. Note that industries that make manufacturing goods can use nonmanufacturing intermediate goods.[5]

Intra-industry production, trade, and prices are modeled using the framework of Eaton and Kortum (2002). Each industry $j < J$ has a continuum of goods indexed by $l \in [0, 1]$ and produced with its own productivity $z_{nj}(l)$. These productivities are the result of the R&D process and probabilistic, drawn independently from the Fréchet distribution with parameters $T_{ij} > 0$ and $\theta > 1$. The cdf of this distribution is $F_{ij}(z) = e^{-T_{ij} z^{-\theta}}$.[6] Consumers have CES preferences over the continuum of goods within an industry with the elasticity of substitution $\sigma > 0$.

The price of each good l of industry j produced in country i and delivered to country n is $p_{nij}(l) = c_{ij} d_{nij} / z_{ij}(l)$, where d_{nij} is the Samuelson's ("iceberg") transportation cost.[7] The distribution of prices p_{nij} is described by the following cdf: $G_{nij}(p) = 1 - F_{ij}(c_{ij} d_{nij}/p) = 1 - e^{-T_{ij}(c_{ij} d_{nij})^{-\theta} p^{\theta}}$.

Country n consumers buy from the lowest-cost supplier, so the price of good l in country n is $p_{nj}(l) = \min\{p_{nij}(l), i = 1, ..., N\}$. The distribution of p_{nj} is $G_{nj}(p) = 1 - \prod_{i=1}^{N} [1 - G_{nij}(p)] = 1 - e^{-\Phi_{nj} p^{\theta}}$, where $\Phi_{nj} = \sum_{i=1}^{N} T_{ij} (c_{ij} d_{nij})^{-\theta}$ summarizes technology, input costs, and transport costs around the world.

The exact price index for the within-industry CES objective function is

$$p_{nj} = \gamma \left[\sum_{i=1}^{N} T_{ij} (d_{nij} c_{ij})^{-\theta} \right]^{-1/\theta}, \tag{3}$$

where $\gamma \equiv \Gamma((\theta + 1 - \sigma)/\theta)^{1/(1-\sigma)}$ is a constant.[8]

[5] The assumption of tradability of the nonmanufacturing output means that the wages w_n in each country are given by the productivity in nonmanufacturing and the (numeraire) price of the nonmanufacturing good deflated by the price of the bundle of intermediates used in producing this good.

[6] Kortum (1997) and Eaton and Kortum (1999) provide microfoundations for this approach. Parameter T_{ij} governs the mean of the distribution, while parameter θ, which is common to all countries and industries, governs the variance. The support of the Fréchet distribution is $(0, \infty)$.

[7] To receive \$1 of product in country n requires sending $d_{nij} \geqslant 1$ dollars of product from country i. By definition, domestic transport costs are set to one: $d_{nnj} \equiv 1$. Trade barriers result in $d_{nij} > 1$. Note that trade costs are not restricted to be symmetric (d_{nij} can be different from d_{inj}). Waugh (2007) studies the effects of the asymmetry of trade costs.

[8] It follows from $p_{nj} = \left[\int_0^1 p_{nj}(l)^{1-\sigma} dl\right]^{1/(1-\sigma)} = \left[\int_0^\infty p_{nj}^{1-\sigma} dG_{nj}(p)\right]^{1/(1-\sigma)} = E\left[P_{nj}^{1-\sigma}\right]^{1/(1-\sigma)} = \gamma \Phi_{nj}^{-1/\theta}$. The last equality follows from a known statistical result (see Eaton and Kortum (2002)).

Parameter T_{ij} represents industry-level productivity and, therefore, determines the comparative advantage across industries. For example, country n has a comparative advantage in industry j if $T_{nj}/T_{nm} > T_{ij}/T_{im}$.[9] Parameter θ determines the comparative advantage across goods within an industry. Lower value of θ means more dispersion of productivities among producers, leading to stronger forces of within-industry comparative advantage.

The Eaton-Kortum (EK) framework makes it possible to derive expressions for the industry-level bilateral trade volumes. The probability that a producer from country i has the lowest price in country n for good l is $\pi_{nij} \equiv \Pr\left[p_{nij}(l) \leqslant \min\left\{p_{nsj}(l); s \neq i\right\}\right] = \int_0^\infty \prod_{s\neq i}\left[1 - G_{nsj}(p)\right] dG_{nij}(p) = T_{ij}\left(\gamma c_{ij} d_{nij}/p_{nj}\right)^{-\theta}$. Since there is a continuum of goods on the interval $[0,1]$, this probability is also the fraction of industry j goods that country n buys from i. It is also the fraction of n's expenditure spent on industry j goods from i: X_{nij}/X_{nj}, where X_{nij} is the spending of country n on industry j goods produced in country i and X_{nj} is the total spending in country n on industry j goods.[10] Therefore,

$$\pi_{nij} \equiv \frac{X_{nij}}{X_{nj}} = T_{ij}\left(\frac{\gamma d_{nij} c_{ij}}{p_{nj}}\right)^{-\theta}. \tag{4}$$

The market clearing equation is obtained as follows. We have $w_i L_{ij} = \beta_j Q_{ij} = \beta_j \sum_{n=1}^{N} X_{nij} = \beta_j \sum_{n=1}^{N} \pi_{nij} X_{nj} = \beta_j \sum_{n=1}^{N} \pi_{nij}\left(Z_{nj} + Y_{nj}\right)$, where Z_{nj} is the spending on intermediate goods and Y_{nj} is the spending on final goods made by industry j. Following EK, it is assumed that each country spends a constant proportion of its income on goods from each industry, $\alpha_j = Y_{nj}/Y_n$. We also have

$$Z_{nj} = \textstyle\sum_m Z_{nmj} = \sum_m \eta_{mj} M_{nm} = \sum_m \dfrac{\eta_{mj}\left(1-\beta_m\right)}{\beta_m} w_n L_{nm},$$

where Z_{nmj} is the spending by industry m on intermediate goods made by industry j and M_{nm} is the amount that industry m spends on all intermediate inputs. Therefore, the market clearing equation is

$$w_i L_{ij} = \beta_j \sum_{n=1}^{N} \pi_{nij}\left(\left(\sum_{m=1}^{J-1} \frac{\eta_{mj}\left(1-\beta_m\right)}{\beta_m} w_n L_{nm}\right) + \alpha_j Y_n\right), \tag{5}$$

where the consumption of manufactures by the nonmanufacturing industry is treated as final rather than intermediate consumption.

The model is given by equations (1)-(5). In the model, β_j, η_{mj}, γ, θ, α_{nj}, w_i, d_{nij}, T_{ij}, and Y_n are the parameters, and p_{nj}, c_{nj}, π_{nij}, and L_{nj} are the endogenous variables.

The first step to solving the model is solving for the production costs using equations (1), (2), and (3). Solving for costs requires solving a system of $N \times (J-1)$ equations. For example, in our case, there are 53 countries and 15 manufacturing industries, so there will be $53 \times 15 = 795$ equations with 795 unknowns.[11] Once costs are solved for, π_{nij} can be calculated from (4) and industry employments L_{ij} can be solved from (5).

[9] Note that parameter T is not the same as total factor productivity (TFP). T is an exogenous parameter of the Fréchet distribution. TFP, on the other hand, is endogenous and represents the average productivity of the firms actually operating in an industry.

[10] This is true because conditional on the fact that country i actually supplies a particular good, the distribution of the price of this good is the same regardless of the source i.

[11] This system of equations is easily solved using numerical methods in Matlab.

Combining (1), (2), and (3), we obtain the equation for costs:

$$c_{ij} = w_i^{\beta_j} \prod_{m=1}^{J-1} \left[\gamma^{-\theta} \sum_{n=1}^{N} T_{nm} \left(d_{inm} c_{nm} \right)^{-\theta} \right]^{-\frac{\eta_{jm}\left(1-\beta_j\right)}{\theta}}. \tag{6}$$

Taking logs of this equation we obtain

$$\log c_{ij} = \beta_j \log w_i + \left(1-\beta_j\right) \log \gamma - \frac{1-\beta_j}{\theta} \sum_{m=1}^{J-1} \left(\eta_{jm} \log \sum_{n=1}^{N} T_{nm} d_{inm}^{-\theta} c_{nm}^{-\theta} \right), \tag{7}$$

which is easier to solve numerically than (6).

3 Obtaining model parameters

The model of parametrized following a procedure first described in Shikher (2004).[12] The parameters are obtained as follows. Labor shares β_j are obtained from output and value added data. Industry shares η_{im} are obtained from input-output tables. Demand parameters α_j are calculated from production and trade data, as explained in Section 3.2. Wages w_i and country incomes (GDPs) Y_n are taken directly from data. The data sources are described in Section 4.

Parameter θ is taken from EK, where it is estimated to be 8.28.[13] Trade costs d_{nij} and technology parameters T_{ij} are estimated using the methodology described in Section 3.1. The estimated values are discussed in Section 5.

3.1 Technology and trade costs

The methodology for estimating T_{ij} and d_{nij} is similar to Eaton and Kortum's, but modified to account for multiple industries. Specifically, the price of inputs ρ_{ij} is now an index of industry prices p_{ij} and cannot be substituted out in the manner used by EK.

From (4):

$$\frac{\pi_{nij}}{\pi_{nnj}} = \frac{X_{nij}}{X_{nnj}} = \frac{T_{ij}}{T_{nj}} d_{nij}^{-\theta} \left(\frac{c_{ij}}{c_{nj}} \right)^{-\theta}. \tag{8}$$

Let's define $S_{ij} \equiv T_{ij} c_{ij}^{-\theta}$ as a measure of international competitiveness of industry j of country i. Taking logs of (8) and using the definition of S_{ij} we get

$$\log \frac{X_{nij}}{X_{nnj}} = -\theta \log d_{nij} + \log S_{ij} - \log S_{nj}. \tag{9}$$

As in EK, trade costs are proxied by

$$\log d_{nij} = d_{kj} + b_j + l_j + f_j + m_{nj} + \delta_{nij}, \tag{10}$$

where d_{kj} $(k = 1, ..., 6)$ is the effect of distance lying in the kth interval, b_j is the effect of common border, l_j is the effect of common language, f_j is the effect of belonging to the same free trade

[12] A similar procedure is followed by Levchenko and Zhang (2011).

[13] They also obtain a second estimate of 3.6, but 8.28 is their preferred estimate since $\theta = 3.6$ results in unreasonably high trade costs.

area, m_{nj} is the overall destination effect, and δ_{nij} is the sum of geographic barriers that are due to all other factors. Note that all trade costs are industry-specific. Also note that by definition $\log d_{iij} \equiv 0$.

As in EK, equations (9) and (10) are combined to obtain the estimating equation for S_{ij} and trade costs:

$$\log \frac{X_{nij}}{X_{nnj}} = -\theta d_{kj} - \theta b_j - \theta l_j - \theta f_j + D_{ij}^{exp} + D_{nj}^{imp} - \theta \delta_{nij}, \tag{11}$$

where $D_{ij}^{exp} = \log S_{ij}$ is the exporter dummy and $D_{nj}^{imp} = -\theta m_{nj} - \log S_{nj}$ is the importer dummy. The overall destination effect is calculated as $m_{nj} = -(1/\theta)\left(D_{nj}^{exp} + D_{nj}^{imp}\right)$. When estimating (11) the following normalization is used: $D_{us,j}^{exp} = D_{us,j}^{imp} = 0$. Consequently, the estimation produces the relative competitiveness measures $S_{ij}/S_{us,j}$.

Taking logs of the definition of the (relative) competitiveness measure S_{ij} we have

$$\log \frac{S_{ij}}{S_{us,j}} = \log \frac{T_{ij}}{T_{us,j}} - \theta \log \frac{c_{ij}}{c_{us,j}}. \tag{12}$$

Note that to get technology parameters T_{ij} from S_{ij}, it is necessary to strip both wages and prices from S_{ij} (unlike the EK where only wages needed to be stripped). From (4), we have

$$\frac{X_{iij}}{X_{ij}} = T_{ij} \left(\frac{\gamma c_{ij}}{p_{ij}} \right)^{-\theta}$$

from which we get

$$\log \frac{X_{iij}/X_{ij}}{X_{us,us,j}/X_{us,j}} = \log \frac{T_{ij}}{T_{us,j}} - \theta \log \frac{c_{ij}}{c_{us,j}} + \theta \log \frac{p_{ij}}{p_{us,j}}. \tag{13}$$

Subtracting (12) from (13), we obtain the expression for industry prices. We then combine that expression with (2) to get the expression for input prices:

$$\log \frac{\rho_{ij}}{\rho_{us,j}} = \frac{1}{\theta} \sum_{m=1}^{J-1} \eta_{jm} \left(\log \frac{X_{iim}/X_{im}}{X_{us,us,m}/X_{us,m}} - \log \frac{S_{im}}{S_{us,m}} \right).$$

Finally, combining equations (12) and (1) with the above equation and rearranging, we get the expression for the technology parameters:

$$\log \frac{T_{ij}}{T_{us,j}} = \log \frac{S_{ij}}{S_{us,j}} + \theta \beta_j \log \frac{w_i}{w_{us}} + \left(1 - \beta_j\right) \sum_{m=1}^{J-1} \eta_{jm} \left(\log \frac{X_{iim}/X_{im}}{X_{us,us,m}/X_{us,m}} - \log \frac{S_{im}}{S_{us,m}} \right). \tag{14}$$

This suggests a two-step procedure for estimating the technology parameters. First, the gravity equation (11) is estimated to obtain exporter dummies $S_{ij}/S_{us,j}$. Then these estimates are used to calculate technology parameters $T_{ij}/T_{us,j}$ according to (14).

3.2 Demand share parameters

The demand share parameters α_m are calculated from the production and trade data as follows. By definition, $Z_{nm} + Y_{nm} = X_{nm}$. In addition, $X_{nm} = Q_{nm} - EX_{nm} + IM_{nm}$ and $Z_{nm} = \sum_j p_{nm} M_{njm} = \sum_j \rho_{nj} M_{nj} \eta_{jm} = \sum_j \eta_{jm} (1 - \beta_j) Q_{nj}$. Therefore, α_{nm} are calculated as

$$\alpha_{nm} = \frac{1}{Y_n} \left(Q_{nm} - EX_{nm} + IM_{nm} - \sum_{j=1}^{J-1} \eta_{jm} (1 - \beta_j) Q_{nj} \right) \tag{15}$$

Then, α_m are calculated as the averages of α_{nm} across the countries in the dataset.

4 Data

The model is parametrizes using 2005 data for 15 industries and 53 countries. The industries are based on the 2-digit ISIC rev. 3 classification and are described in Table 1. The countries included in the dataset can be seen in Table 3.

Sectoral output data comes from the United Nation's Industrial Statistics database (INDSTAT2-2010, Rev.3). The corresponding bilateral trade data is obtained from the COMTRADE database of the UN which uses the 4-digit SITC (Rev. 1) classification. Using a concordance, the 4-digit SITC Revision 1 trade data was aggregated to the 2-digit ISIC data. Missing data was filled from nearby years. The gravity data (distance, common border, common language, currency union, regional trade agreements) comes from the Gravity Database compiled by CEPII. The distance is divided into 6 intervals, as in EK: [0,375), [375,750), [750,1500), [1500,3000), [3000,6000), and [6000,maximum). Data on the existing tariffs between the U.S. and Korea come from WITS online database of the World Bank.

Imports from home X_{iij} are calculated as output minus exports, and spending X_{ij} is calculated as output minus exports plus imports. Labor's share in output, β_j, is calculated as the average of the labor shares of the countries in our dataset. Parameters α_j and β_j are presented in Table 1. The data for industry shares η_{jm} is obtained from the OECD input-output tables. The values of η_{jm} used in the model and shown in Table 2 are the averages of η_{jm}'s of the countries in the OECD dataset (they are very similar).[14] Table 2 shows the forward and backward linkages between industries.

5 Estimated trade costs and technology parameters

The trade costs d_{ni} and technology parameters T_{ij} are estimated following the methodology described in Section 3.1. The average estimated trade costs (averaged across country pairs and industries) is 2.84, which is equivalent to 184% ad-valorem tariff.[15] The average (across country

[14] In the data, in addition to intermediate and final goods, there are also investment goods. Since there is no investment in the model, investment goods are treated as intermediate goods.

[15] Anderson and van Wincoop (2004) roughly estimate the average international trade cost between rich OECD countries to be around 1.7 (excluding local distribution margins, see pp. 692-693). This is lower than the (non-weighted) average trade cost of 2.84 estimated in this paper. However, our dataset includes many less-developed countries that have much higher trade costs than the rich OECD countries. If these countries are excluded from the dataset, the average trade cost for the remaining rich OECD countries is 1.76, which is much closer to the number reported in Anderson and van Wincoop (2004).

pairs) trade costs in each industry are listed in Table 1. The smallest average trade costs are in the machinery and textile industries and the largest are in the petroleum, paper, and wood industries.

The estimated mean productivity draws for each industry j and country i, measured by $T_{ij}^{1/\theta}$, are presented in Table 3. The mean productivity draws are measured relative to the United States. Table 4 shows the rankings of countries in each industry according to their mean productivity draw (i.e. "state of technology"). The U.S. has the highest or second-highest state of technology in all industries. Other developed countries have top rankings as well while the least developed countries are at the bottom of the rankings. Korea has the 8th place according to the cross-industry average of industry rankings (shown in the last column of Table 4). It is ahead of such countries as Spain, Australia, and Sweden. The cross-industry average rankings tell us about the countries' absolute advantages.

It is also interesting to look at the cross-industry differences of Korea's mean productivity draws. These cross-industry differences tell us about Korea's comparative advantages relative to the United States. These comparative advantages in turn affect the pattern of trade between the U.S. and Korea.

We can see that Korea has strong technological comparative advantages in Rubber, Textile, Metals, Electrical and communications equipment, and Transport. For example, in the Rubber industry Korea's mean productivity draw is 0.99 of the U.S. mean productivity draw. Korea has the technological comparative disadvantage (relative to the U.S.) in the Food, Wood, Petroleum products, and Medical equipment. For example, in the Food industry Korea's mean productivity draw is only 0.63 of the U.S.'s.

6 Counterfactual simulations

The model will now be used to simulate the effects of the U.S.-Korea free-trade agreement. This simulation will reduce the trade costs between the two countries by the amounts of tariffs currently in place. The estimated trade costs between the U.S. and Korea are presented in Tables 5 and 6. The current tariff data is from the WITS database and presented in Table 7.

Table 5 shows that the current trade costs for the U.S. exports to Korea vary between 29% in the Medical equipment industry and 177% in the Wood industry. For comparison, we also show trade costs for the Japanese, Chinese, and German exports to Korea. We also show the average (across all countries) trade costs for sending goods to Korea.

The costs for the U.S. exports are higher than the costs for the Japanese exports (except in the Transport industry), which is reasonable since Japan is much closer to Korea than the U.S. The trade costs for the U.S. exports are lower than the trade costs for the average country exporting to Korea.

The current trade costs for the Korean exports to the U.S. (shown in Table 6) are lower than the costs for the U.S. exports to Korea in all industries except for the Rubber and Medical equipment industries. The trade costs for the Korean exports to the U.S. are generally higher than the trade costs for the Japanese exports for the U.S. and average-country exports to the U.S.

Despite the fact that the trade costs for the U.S. exports to Korea tend to be higher than the trade costs for the Korean exports to the U.S., the total manufacturing trade costs between the two countries are nearly equal at about 55-60%. This is because currently the bulk of the U.S. exports to Korea is in industries where the trade costs are relatively low (e.g. the Rubber and Machinery industries). Figure 1 shows the evolution of the total manufacturing trade costs between the two countries (data is from Yaylaci (2011)). These trade costs are estimated using the same methodology that was used to estimated the trade costs in this paper. The figure shows that the costs for the U.S. manufacturing exports to Korea used to be much higher, 253% in 1963. However, the cost of bringing the U.S. manufacturing goods to Korea has been steadily falling over the years: to below 150% in the 1970s, below 100% in the 1980s, below 80% in the 1990s, to around 60% since 1998. At the same time, the cost of bringing Korean manufacturing goods to the U.S. has increased, from about 20% in the early 1960s to about 55% in 2005.[16]

Table 7 shows the existing tariff levels between Korea and the US. We can see that the Food industry is the most protected industry in Korea, with 49% tariff. This at least partly explains the high overall trade costs for the U.S. Food exports to Korea. Interestingly, the Food industry is the also the industry where Korea has the greatest technological comparative disadvantage relative to the United States (as shown in Tables 3 and 4).

The existing U.S. tariff levels are generally much lower than the Korean levels. The Food and Textile industries in the U.S. are relatively more protected than the other industries.

To simulate the effects of KORUS the trade costs between the U.S. and Korea will be reduced in each industry by the amount of the existing tariff.[17] At the same time, all the other parameters, including the trade costs between all the other country pairs will remain the same. The model will solve for the new equilibrium trade flows, industry price levels p_{nj}, and employments L_{nj}. The results of the simulations are presented in Tables 8-11. We will focus on the effects on trade, employment (industry and total manufacturing), specialization, and welfare. Specialization will be measured by the proportion of industry employment in total manufacturing employment. Since the model assumes full employment and fixed labor forces in each country, the workers who lose their jobs in manufacturing move to the nonmanufacturing sector. While there is no unemployment in the model, the number of manufacturing jobs is an interesting variable to track given the importance that policy-makers often place on it. The welfare will be measured by the real income $W_n = Y_n / \prod_j p_{nj}^{\alpha_j}$. Changes in variables will be measured with respect to their baseline 2005 values.

Tables 8 and 9 show that, consistent with other studies of KORUS, the U.S. exports to Korea would increase more than the U.S. imports from Korea as the result of KORUS. Also, the effects on Korea's total exports and imports would be greater than the effect on the U.S.'s, given the relative sizes of the two economies. The Korea's manufacturing imports are predicted to rise by 5.18% and its exports by 4.34%. The U.S. manufacturing imports are predicted to rise by 0.38% and its exports by 2.14%. The total world trade is expected to increase by 0.18%. The last column of Table 9 shows that the U.S. manufacturing exports to Korea would go up by 56.9% while the Korean manufacturing exports to the U.S. would increase by 18.9%.[18]

Table 9 also shows that the effects of KORUS would vary significantly across industries. Clearly, industries where the existing tariffs are higher would experience greater increases in trade. In addition, changes in trade would be determined by technological comparative advantages and trade costs with other countries.

For example, the greatest growth is predicted to occur in the U.S. Food exports to Korea. This occurs because the Korean Food industry is currently heavily protected by tariffs and because the

[16] Remember that these international trade cost are measured relative to domestic trade costs, which have also been changing over the decades. Rising trade cost for U.S. imports in this case means that it is rising relative to the U.S. domestic trade costs.

[17] This is consistent with previous studies (listed in the Introduction) that forecasted the effects of NAFTA.

[18] These numbers are greater than what has been generally predicted by the previous studies. This is consistent with the comment made in the Introduction about the current Armington-based models.

U.S. has a strong comparative advantage in that industry.

Table 10 shows the effects of KORUS on the U.S. and Korean manufacturing employments. Both countries are predicted to gain manufacturing jobs. Korea is predicted to gain 0.97% while the U.S. 0.26%. This translates into about 26,500 additional manufacturing jobs in Korea and 34,200 additional manufacturing jobs in the U.S.

The greatest employment changes would occur in the Food and Textile industries. In Korea, the Food industry would lose nearly 13% of jobs while the Textile industry would gain 8.25% of jobs. In the U.S., the Food industry would gain nearly 1% of jobs while the Textile industry would lose about 0.5% of jobs.

These employment changes are related to the changes in specialization that would occur in the two countries and are shown in Table 11. When the trade barriers are reduced, specialization according to comparative advantage grows. Korea has a comparative disadvantage in the Food industry. Correspondingly, the Food industry would shrink there while it would grow in the U.S. Korea has a comparative advantage in the Textile industry, so the Textile industry would grow there and shrink in the U.S. Similarly, Korea has a comparative advantage in the Rubber industry. So, it would grow in Korea and shrink (in share) in the U.S.

The last column of Table 11 shows the predicted changes in welfare. Korea is predicted to gain about 0.27% while the U.S. about 0.013%. These changes are small and typical of studies of free-trade agreements.

7 Conclusion

This paper uses a computable model of trade to forecast the effects of the U.S.-Korea free trade agreement on the manufacturing sector. The model used in this paper is different from the models used in previous papers on this topic - it uses the Eaton-Kortum methodology to explain intra-industry trade instead of the usual Armington assumption. The model is parameterized using 2005 data for 15 industries and 53 countries. In particular, the paper estimates industry-level technology parameters and trade costs.

The simulation results show that implementing KORUS would increase U.S. exports to Korea by 56.9% and Korean exports to the U.S. by 18.9%. Therefore, similar to other studies of KORUS we find that the U.S. exports to Korea would increase more than the U.S. imports from Korea. Also, as the result of KORUS the manufacturing employment would grow in both countries: it would increase by 26,500 jobs in Korea and 34,200 jobs in the U.S.

At the same time, there would be significant changes in the patterns of trade and production in Korea and the U.S. There would be big increases in trade in the Food, Textile, Rubber, and Machinery industries. There would be a large loss of employment in the Korean Food industry and a large gain in the Korean Textile industry. The mirror image of this change would occur in the U.S. In many machinery industries, there would be employment gains in both countries. In general, the U.S. and Korea would increase their specialization in the industries where they have strong technological comparative advantages.

The trade liberalization brought by KORUS would increase welfare in both countries, but only modestly. The simulation predicts a welfare increase of 0.27% in Korea and 0.013% in the U.S. In summary, KORUS is predicted to benefit both countries in terms of total manufacturing employment, trade, and welfare. The majority of industries are predicted to gain jobs, though several industries are predicted to lose jobs.

References

Anderson, J. E. and van Wincoop, E. (2004). Trade costs, *Journal of Economic Literature* **42**(3): 691–751.

Armington, P. S. (1969). A theory of demand for products distinguished by place of production, *IMF Staff Papers* **16**(1): 159–78.

Choi, I. and Schott, J. J. (2001). Free trade between Korea and the United States?, *Institute for International Economics (IIE) mimeo* .

DeRosa, D. A. and Gilbert, J. P. (2004). Technical appendix: Quantitative estimates of the economic impacts of u.s. bilateral free trade agreements., *in* J. J. Schott (ed.), *Free Trade Agreements: U.S. Strategies and Priorities*, IIE, pp. 383–417.

Eaton, J. and Kortum, S. (1999). International technology diffusion: Theory and measurement, *International Economic Review* **40**: 537–570.

Eaton, J. and Kortum, S. (2002). Technology, geography, and trade, *Econometrica* **70**(5): 1741–1779.

Hirschman, A. O. (1958). *The Strategy of Economic Development*, Yale University Press, New Haven, CT.

Kehoe, T. J. (2005). An evaluation of the performance of applied general equilibrium models of the impact of NAFTA, *in* T. J. Kehoe, T. N. Srinivasan and J. Whalley (eds), *Frontiers in Applied General Equilibrium Modeling*, Cambridge University Press.

Kiyota, K. and Stern, R. M. (2007). Economic effects of a Korea-U.S. free trade agreement, *Special Studies Series No. 4, Korea Economic Institute of America* .

Kortum, S. (1997). Research, patenting, and technological change, *Econometrica* **65**: 1389–1419.

Leamer, E. E. (1984). *Sources of International Comparative Advantage*, MIT Press, Cambridge, MA.

Lee, J. and Lee, H. (2005). Feasability and economic effects of a Korea-U.S. FTA, *Korean Institute for International Economic Policy, NRCS Joint Research Series on FTA Issues No. 05-05-02* .

Levchenko, A. A. and Zhang, J. (2011). The evolution of comparative advantage: Measurement and welfare implications, *NBER Working Paper No. 16806* .

Ruhl, K. (2008). The international elasticity puzzle, *Manuscript, University of Texas* .

Schott, J. J. (2009). FTAs and the future of US-Korean trade relations, *Peterson Institute for International Economics mimeo* .

Schott, J. J., Bradford, S. C. and Moll, T. (2006). Negotiating the Korea-United States free trade agreement, *Policy Briefs in International Economics, No. PB06-4* .

Shikher, S. (2004). Putting industries into the Eaton-Kortum model, *Manuscript, Suffolk University* .

Shikher, S. (2010). Predicting the effects of NAFTA: Now we can do it better!, *Journal of International and Global Economic Studies, forthcoming* .

U.S. International Trade Commission (2001). U.S.-Korea FTA: The economic impact of establishing a free trade agreement between the United States and the Republic of Korea, *USITC Publication 3452* .

U.S. International Trade Commission (2010). U.S.-Korea free trade agreement: Potential economy-wide and selected sectoral effects, *US International Trade Commission, Investigation No: TA-2104-24* .

Waugh, M. E. (2007). International trade and income differences, *Manuscript, Univesity of Iowa* .

Yaylaci, O. (2011). Evolution of trade costs, *Suffolk University mimeo* .

Zhuang, R. and Koo., W. W. (2006). Implications of the Korea-U.S. free trade agreement: A general equilibrium approach.

Table 1 Description of industries, values of parameters α_j and β_j, and average estimated trade costs

Num.	Name	Description	ISIC Rev.3	α_j	β_j	Average trade costs*
1	Food	Food products, beverages and tobacco	15+16	0.088	0.127	180%
2	Textile	Textiles, textile products, leather and footwear	17+18+19	0.026	0.211	165%
3	Wood	Wood and products of wood and cork	20	0.007	0.184	228%
4	Paper	Pulp, paper, paper products, printing and publishing	21+22	0.017	0.195	243%
5	Petroleum products	Coke, refined petroleum products and nuclear fuel	23	0.046	0.052	259%
6	Chemicals	Chemicals	24	0.020	0.139	146%
7	Rubber	Rubber & plastics products	25	0.016	0.193	186%
8	Nonmetals	Other non-metallic mineral products	26	0.018	0.203	224%
9	Metals	Basic metals	27	0.009	0.133	175%
10	Metal products	Fabricated metal products, except machinery & equip.	28	0.018	0.226	208%
11	Machinery, other	Office, accounting, computing, and other machinery	29+30	0.046	0.207	133%
12	Machinery, e&c	Electrical machinery, communication equipment	31+32	0.052	0.182	139%
13	Medical	Medical, precision & optical instruments	33	0.009	0.246	148%
14	Transport	Transport equipment	34+35	0.047	0.172	188%
15	Other	Other manufacturing (incl. furniture)	36+37	0.019	0.210	136%

*Average trade costs across all country pairs

Table 2 Industry shares in intermediate goods

	Food	Textile	Wood	Paper	Petroleum products	Chemicals	Rubber	Nonmetals	Metals	Metal products	Machinery, other	Machinery, e&c	Medical	Transport	Other
Food	**0.227**	0.019	0.003	0.008	0.002	0.016	0.004	0.004	0.002	0.003	0.003	0.002	0.003	0.003	0.005
Textile	0.003	**0.440**	0.007	0.008	0.001	0.006	0.027	0.006	0.002	0.005	0.004	0.005	0.009	0.011	0.060
Wood	0.003	0.002	**0.300**	0.015	0.001	0.003	0.004	0.009	0.003	0.006	0.004	0.003	0.003	0.005	0.129
Paper	0.033	0.016	0.019	**0.403**	0.003	0.024	0.023	0.026	0.006	0.011	0.012	0.014	0.018	0.010	0.029
Petroleum prod.	0.008	0.010	0.014	0.011	**0.091**	0.055	0.017	0.037	0.027	0.010	0.007	0.008	0.005	0.006	0.013
Chemicals	0.018	0.105	0.051	0.063	0.040	**0.393**	0.339	0.056	0.027	0.034	0.021	0.043	0.039	0.023	0.055
Rubber	0.023	0.019	0.015	0.020	0.004	0.026	**0.158**	0.017	0.005	0.017	0.028	0.038	0.051	0.042	0.048
Nonmetals	0.007	0.003	0.010	0.002	0.002	0.008	0.009	**0.193**	0.012	0.010	0.008	0.015	0.025	0.010	0.013
Metals	0.003	0.004	0.009	0.005	0.004	0.011	0.018	0.026	**0.408**	0.354	0.136	0.098	0.058	0.091	0.100
Metal products	0.015	0.009	0.028	0.007	0.005	0.014	0.022	0.023	0.039	**0.171**	0.092	0.044	0.044	0.064	0.049
Machinery, other	0.008	0.012	0.015	0.017	0.009	0.015	0.020	0.029	0.025	0.036	**0.247**	0.040	0.044	0.059	0.018
Machinery, e&c	0.002	0.003	0.004	0.005	0.002	0.004	0.009	0.006	0.009	0.017	0.098	**0.366**	0.159	0.047	0.013
Medical	0.001	0.001	0.001	0.002	0.001	0.002	0.002	0.001	0.002	0.003	0.010	0.011	**0.170**	0.013	0.002
Transport	0.002	0.006	0.003	0.002	0.001	0.003	0.006	0.005	0.005	0.010	0.017	0.009	0.008	**0.343**	0.007
Other	0.002	0.009	0.009	0.007	0.001	0.003	0.006	0.006	0.026	0.007	0.005	0.005	0.005	0.009	**0.093**
Manuf.	0.356	0.658	0.488	0.575	0.168	0.582	0.663	0.445	0.598	0.694	0.692	0.702	0.640	0.736	0.635
Nonmanuf.	0.644	0.342	0.512	0.425	0.832	0.418	0.337	0.555	0.402	0.306	0.308	0.298	0.360	0.264	0.365
Total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Table 3 Mean productivity draws for each country and industry,relative to the U.S., $T^{1/\theta}$

Country	Food	Textile	Wood	Paper	Petroleum products	Chemicals	Rubber	Nonmetals	Metals	Metal products	Machinery, other	Machinery, e&c	Medical	Transport	Other
Australia	0.862	0.829	0.779	0.763	0.560	0.809	0.719	0.734	0.921	0.746	0.754	0.760	0.764	0.738	0.785
Austria	0.713	0.735	0.839	0.818	0.483	0.714	0.693	0.840	0.812	0.802	0.767	0.775	0.709	0.738	0.771
Brazil	0.795	0.665	0.691	0.572	0.618	0.654	0.608	0.631	0.808	0.509	0.560	0.584	0.441	0.631	0.499
Bulgaria	0.432	0.430	0.387	0.316	0.264	0.439	0.324	0.330	0.487	0.309	0.351	0.364	0.284	0.314	0.332
Chile	0.735	0.533	0.725	0.522	0.388	0.634	0.499	0.422	0.794	0.428	0.429	0.419	0.360	0.446	0.459
China	0.610	0.684	0.648	0.522	0.707	0.606	0.527	0.617	0.703	0.531	0.506	0.594	0.422	0.522	0.581
Colombia	0.610	0.531	0.407	0.434	0.490	0.474	0.443	0.444	0.615	0.345	0.352	0.390	0.288	0.370	0.399
Costa Rica	0.605	0.457	0.446	0.362	0.262	0.442	0.415	0.358	0.440	0.382	0.442	0.564	0.356	0.351	0.376
Czech Republic	0.518	0.538	0.537	0.530	0.377	0.550	0.532	0.609	0.649	0.542	0.533	0.558	0.443	0.585	0.521
Denmark	0.828	0.815	0.774	0.754	0.471	0.760	0.676	0.772	0.655	0.766	0.776	0.716	0.771	0.639	0.821
Ecuador	0.607	0.420	0.480	0.344	0.607	0.414	0.394	0.353	0.462	0.354	0.339	0.350	0.271	0.374	0.362
Ethiopia	0.418	0.330	0.276	0.214	0.000	0.388	0.232	0.265	0.418	0.197	0.167	0.183	0.151	0.231	0.212
Finland	0.606	0.757	0.870	0.930	0.420	0.752	0.762	0.745	0.842	0.766	0.802	0.920	0.720	0.651	0.721
France	0.872	0.921	0.881	0.850	0.696	0.891	0.848	0.911	0.895	0.837	0.830	0.879	0.817	0.907	0.840
Germany	0.874	0.948	0.972	0.946	0.802	0.915	0.932	1.001	0.975	0.967	0.959	0.960	0.938	0.974	0.895
Greece	0.675	0.715	0.541	0.588	0.338	0.608	0.588	0.605	0.708	0.607	0.549	0.596	0.466	0.515	0.613
Hungary	0.532	0.568	0.524	0.483	0.401	0.574	0.519	0.510	0.578	0.514	0.545	0.645	0.468	0.556	0.546
Iceland	0.659	0.669	0.510	0.474	0.396	0.638	0.543	0.467	0.656	0.576	0.648	0.616	0.549	0.535	0.632
India	0.554	0.577	0.460	0.406	0.441	0.576	0.478	0.484	0.640	0.420	0.387	0.443	0.315	0.462	0.419
Indonesia	0.577	0.538	0.548	0.446	0.451	0.461	0.443	0.441	0.499	0.355	0.368	0.453	0.278	0.394	0.448
Iran	0.549	0.527	0.335	0.319	0.786	0.478	0.404	0.422	0.544	0.348	0.353	0.392	0.292	0.409	0.399
Ireland	0.812	0.639	0.632	0.699	0.403	0.873	0.629	0.605	0.603	0.725	0.826	0.777	0.756	0.556	0.863
Israel	0.640	0.750	0.686	0.630	0.393	0.767	0.729	0.716	0.661	0.743	0.687	0.754	0.661	0.541	0.724
Italy	0.815	0.988	0.849	0.812	0.666	0.813	0.821	0.928	0.893	0.866	0.859	0.826	0.762	0.775	0.849
Japan	0.655	0.877	0.707	0.834	0.738	0.863	0.986	0.897	1.004	0.865	0.920	0.940	0.918	1.056	0.940
Jordan	0.321	0.381	0.282	0.303	0.319	0.498	0.289	0.289	0.458	0.279	0.289	0.313	0.237	0.311	0.305
Kazakhstan	0.404	0.352	0.244	0.254	0.889	0.419	0.246	0.242	0.618	0.228	0.261	0.285	0.213	0.290	0.242
Kenya	0.517	0.371	0.399	0.287	0.319	0.375	0.291	0.300	0.429	0.269	0.261	0.308	0.225	0.297	0.289
Korea	**0.633**	**0.956**	**0.640**	**0.781**	**0.566**	**0.770**	**0.989**	**0.815**	**0.933**	**0.807**	**0.799**	**0.932**	**0.708**	**0.936**	**0.808**
Malaysia	0.670	0.670	0.680	0.535	0.596	0.573	0.607	0.528	0.631	0.517	0.569	0.666	0.451	0.506	0.621
Mauritius	0.435	0.516	0.386	0.332	0.228	0.337	0.363	0.322	0.400	0.335	0.303	0.385	0.314	0.346	0.360
Mexico	0.569	0.572	0.464	0.491	0.462	0.621	0.511	0.523	0.619	0.523	0.529	0.573	0.458	0.543	0.529
Netherlands	0.901	0.888	0.835	0.851	0.682	0.857	0.866	0.827	0.866	0.838	0.837	0.804	0.824	0.757	0.845
New Zealand	0.827	0.684	0.654	0.634	0.389	0.627	0.565	0.542	0.698	0.679	0.632	0.642	0.592	0.574	0.620
Norway	0.711	0.753	0.702	0.780	0.620	0.768	0.696	0.657	0.818	0.752	0.739	0.773	0.740	0.718	0.726
Peru	0.514	0.461	0.349	0.288	0.269	0.466	0.313	0.334	0.618	0.278	0.280	0.302	0.232	0.293	0.302
Philippines	0.525	0.493	0.460	0.385	0.293	0.454	0.451	0.395	0.454	0.384	0.442	0.532	0.359	0.431	0.453
Poland	0.581	0.562	0.596	0.529	0.393	0.581	0.515	0.566	0.648	0.512	0.506	0.558	0.426	0.532	0.518
Portugal	0.571	0.699	0.776	0.577	0.304	0.573	0.569	0.606	0.549	0.609	0.547	0.592	0.419	0.532	0.562
Russia	0.522	0.454	0.555	0.466	1.038	0.596	0.415	0.418	0.769	0.356	0.389	0.412	0.336	0.482	0.357
Slovakia	0.407	0.520	0.504	0.470	0.262	0.471	0.466	0.471	0.592	0.431	0.435	0.517	0.384	0.478	0.452
Slovenia	0.431	0.646	0.620	0.551	0.250	0.584	0.600	0.574	0.619	0.568	0.513	0.547	0.494	0.508	0.560
South Africa	0.707	0.676	0.612	0.580	0.653	0.663	0.586	0.597	0.854	0.541	0.577	0.566	0.427	0.618	0.558
Spain	0.815	0.872	0.850	0.770	0.633	0.793	0.797	0.893	0.854	0.786	0.736	0.772	0.648	0.787	0.756
Sweden	0.676	0.710	0.815	0.882	0.487	0.767	0.770	0.728	0.854	0.809	0.794	0.847	0.731	0.819	0.738
Tanzania	0.457	0.364	0.347	0.235	0.287	0.282	0.254	0.278	0.392	0.208	0.225	0.253	0.168	0.277	0.253
Trinidad and Tobago	0.442	0.426	0.429	0.387	0.496	0.590	0.474	0.377	0.715	0.401	0.371	0.424	0.368	0.381	0.386
Turkey	0.654	0.738	0.518	0.477	0.480	0.586	0.585	0.637	0.676	0.561	0.516	0.578	0.392	0.612	0.566
UK	0.850	0.906	0.793	0.866	0.766	0.861	0.821	0.860	0.893	0.846	0.837	0.836	0.833	0.848	0.849
Ukraine	0.463	0.395	0.389	0.311	0.417	0.461	0.320	0.317	0.670	0.290	0.323	0.355	0.237	0.392	0.305
Uruguay	0.594	0.539	0.452	0.367	0.406	0.449	0.418	0.368	0.479	0.337	0.319	0.356	0.300	0.371	0.365
USA	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**
Vietnam	0.543	0.510	0.439	0.328	0.384	0.376	0.393	0.389	0.421	0.345	0.302	0.373	0.232	0.392	0.395

Table 4 Rankings of countries in each industry according to their technology parameters
(countries are sorted by the cross-industry average rank shown in the last column)

Country	Food	Textile	Wood	Paper	Petroleum products	Chemicals	Rubber	Nonmetals	Metals	Metal products	Machinery, other	Machinery, e&c	Medical	Transport	Other	Av of ranks
USA	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**1**	**1.27**
Germany	3	4	2	2	4	2	4	1	3	2	2	2	2	3	3	2.60
France	4	5	3	7	9	3	6	4	6	7	7	6	6	5	8	5.73
Japan	21	8	15	8	7	5	3	5	1	4	3	3	3	1	2	5.93
UK	6	6	10	5	6	6	8	7	7	5	6	8	4	6	5	6.33
Italy	10	2	6	10	11	8	7	3	8	3	4	9	9	9	6	7.00
Netherlands	2	7	8	6	10	7	5	9	9	6	5	10	5	10	7	7.07
Korea	**24**	**3**	**22**	**11**	**18**	**11**	**2**	**10**	**4**	**9**	**10**	**4**	**15**	**4**	**10**	**10.47**
Spain	9	9	5	13	13	10	9	6	10	11	16	14	17	8	13	10.87
Australia	5	10	11	14	19	9	13	13	5	15	14	15	8	12	11	11.60
Sweden	17	18	9	4	22	14	10	14	11	8	11	7	12	7	14	11.87
Austria	14	16	7	9	23	17	15	8	15	10	13	12	14	11	12	13.07
Finland	28	12	4	3	29	16	11	12	13	12	9	5	13	14	17	13.20
Norway	15	13	16	12	14	12	14	16	14	14	15	13	11	13	15	13.80
Denmark	7	11	13	15	25	15	16	11	27	13	12	17	7	15	9	14.20
Ireland	11	27	23	16	32	4	17	22	37	17	8	11	10	21	4	17.33
Israel	23	14	18	18	36	13	12	15	25	16	17	16	16	24	16	18.60
Brazil	12	25	17	22	15	19	18	18	16	31	22	25	26	16	31	20.87
New Zealand	8	20	20	17	37	22	25	27	22	18	19	20	18	20	20	20.87
South Africa	16	22	25	20	12	18	22	24	12	25	20	28	27	17	26	20.93
Greece	18	17	29	19	41	24	21	23	20	20	23	22	22	29	21	23.27
China	25	21	21	27	8	25	28	19	21	26	31	23	29	28	22	23.60
Malaysia	19	23	19	24	17	34	19	28	31	28	21	18	24	31	19	23.67
Turkey	22	15	32	31	24	28	23	17	23	23	28	26	31	18	23	24.27
Iceland	20	24	33	32	34	20	26	33	26	21	18	21	19	25	18	24.67
Portugal	33	19	12	21	44	33	24	21	40	19	24	24	30	27	24	26.33
Mexico	34	29	36	29	26	23	31	29	33	27	27	27	23	23	28	28.33
Czech Republic	41	33	30	25	40	35	27	20	28	24	26	31	25	19	29	28.87
Hungary	38	30	31	30	33	32	29	30	39	29	25	19	21	22	27	29.00
Slovenia	49	26	24	23	51	29	20	25	32	22	29	32	20	30	25	29.13
Poland	31	31	26	26	35	30	30	26	29	30	30	30	28	26	30	29.20
Chile	13	35	14	28	38	21	32	36	17	33	35	38	34	35	32	29.40
Russia	40	44	27	34	1	26	41	38	18	38	36	39	37	32	45	33.07
India	35	28	38	37	28	31	33	31	30	34	37	36	38	34	36	33.73
Trinidad and Tobago	46	46	42	38	20	27	34	41	19	35	38	37	33	41	40	35.80
Indonesia	32	34	28	35	27	42	38	35	42	39	39	35	44	38	35	36.20
Slovakia	51	38	34	33	49	39	35	32	38	32	34	34	32	33	34	36.53
Colombia	26	36	43	36	21	38	37	34	36	43	41	41	42	44	38	37.07
Iran	36	37	50	45	5	37	42	37	41	41	40	40	41	37	37	37.73
Philippines	39	41	37	39	45	43	36	39	47	36	32	33	35	36	33	38.07
Uruguay	30	32	39	40	31	44	39	42	44	44	45	45	40	43	42	40.00
Costa Rica	29	43	40	41	50	45	40	43	48	37	33	29	36	45	41	40.00
Ecuador	27	47	35	42	16	48	43	44	45	40	43	47	45	42	43	40.47
Vietnam	37	40	41	44	39	50	44	40	50	42	47	43	49	39	39	42.93
Ukraine	44	48	45	47	30	41	47	48	24	47	44	46	46	40	48	43.00
Bulgaria	48	45	46	46	48	46	46	46	43	46	42	44	43	47	46	45.47
Mauritius	47	39	47	43	52	52	45	47	52	45	46	42	39	46	44	45.73
Peru	43	42	48	49	47	40	48	45	34	49	49	50	48	50	49	46.07
Kazakhstan	52	52	53	51	3	47	52	53	35	51	50	51	51	51	52	46.93
Jordan	53	49	51	48	42	36	50	50	46	48	48	48	47	48	47	47.40
Kenya	42	50	44	50	43	51	49	49	49	50	51	49	50	49	50	48.40
Tanzania	45	51	49	52	46	53	51	51	53	52	52	52	52	52	51	50.80
Ethiopia	50	53	52	53	53	49	53	52	51	53	53	53	53	53	53	52.27

Table 5 Total trade costs for Korean imports

Importer	Exporter	Food	Textile	Wood	Paper	Petroleum products	Chemicals	Rubber	Nonmetals	Metals	Metal products	Machinery, other	Machinery, e&c	Medical	Transport	Other
Korea	U.S.	149.5%	72.4%	176.8%	117.4%	358.0%	94.6%	54.6%	98.3%	80.7%	101.0%	56.6%	33.8%	28.9%	67.8%	51.9%
Korea	Japan	87.8%	42.9%	139.7%	78.2%	200.0%	53.3%	31.4%	54.4%	44.0%	72.0%	40.3%	23.0%	13.4%	89.6%	33.6%
Korea	China	109.6%	77.2%	185.4%	117.3%	175.4%	85.9%	56.8%	102.3%	53.2%	105.0%	53.9%	41.0%	31.1%	68.7%	58.3%
Korea	Germany	218.2%	88.9%	206.9%	130.8%	271.8%	96.9%	52.9%	118.8%	86.7%	95.2%	57.7%	50.2%	34.1%	63.6%	57.7%
Korea	Average*	188.3%	85.1%	217.6%	145.4%	215.8%	120.0%	85.3%	129.2%	91.0%	118.6%	71.5%	58.8%	50.2%	90.8%	71.8%

* Average of all 53 countries in the dataset

Table 6 Total trade costs for the U.S. imports

Importer	Exporter	Food	Textile	Wood	Paper	Petroleum products	Chemicals	Rubber	Nonmetals	Metals	Metal products	Machinery, other	Machinery, e&c	Medical	Transport	Other
U.S.	Korea	48.9%	57.3%	91.4%	76.6%	113.4%	47.8%	69.6%	75.1%	66.3%	66.4%	29.2%	33.0%	57.2%	54.1%	36.2%
U.S.	Japan	43.8%	57.9%	87.5%	67.5%	110.0%	37.0%	55.3%	68.7%	78.3%	61.1%	22.0%	25.5%	40.7%	48.4%	28.1%
U.S.	China	67.5%	58.6%	91.8%	59.2%	80.7%	54.3%	51.6%	77.0%	75.6%	61.3%	17.9%	25.7%	39.8%	50.7%	23.9%
U.S.	Average*	60.1%	39.9%	85.5%	63.5%	95.2%	40.1%	50.4%	49.7%	62.3%	59.4%	23.1%	30.7%	35.8%	39.6%	18.4%

* Average of all 53 countries in the dataset

Table 7 Existing tariffs between the U.S. and Korea

Importer	Exporter	Food	Textile	Wood	Paper	Petroleum products	Chemicals	Rubber	Nonmetals	Metals	Metal products	Machinery, other	Machinery, e&c	Medical	Transport	Other
Korea	U.S.	49.0%	10.0%	6.3%	1.4%	3.6%	6.6%	7.5%	7.8%	3.4%	7.0%	5.6%	5.9%	6.8%	6.0%	4.9%
U.S.	Korea	8.7%	8.2%	1.6%	0.1%	0.5%	4.1%	3.4%	3.8%	1.7%	2.5%	1.1%	2.1%	3.6%	1.6%	1.7%

Source: WITS

Figure 1 Evolution of total manufacturing trade costs between the U.S. and Korea

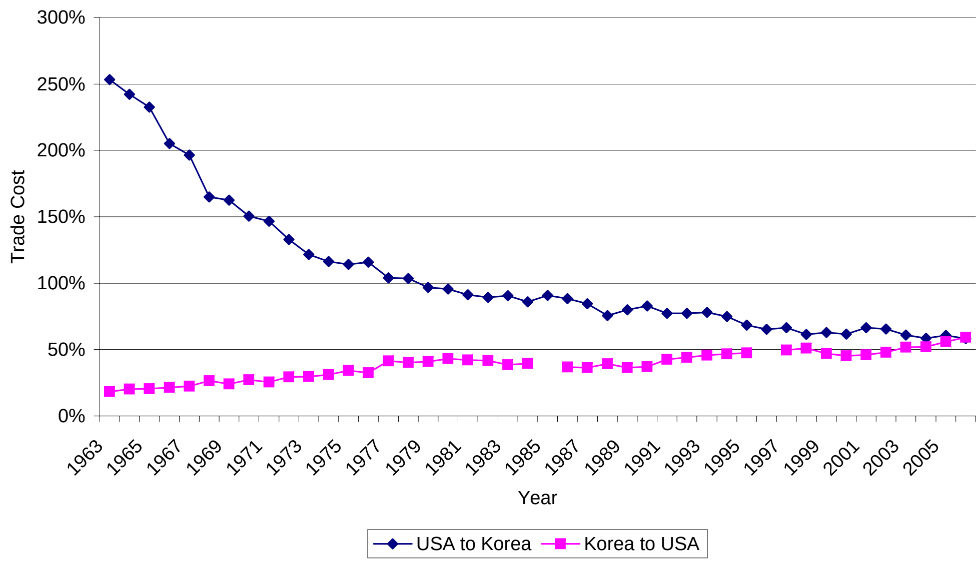

Table 8 Percent change in total Korean and U.S. manufacturing exports and imports, and world manufacturing trade

Total Korean manufacturing imports	5.18%
Total Korean manufacturing exports	4.34%
Total U.S. manufacturing imports	0.38%
Total U.S. manufacturing exports	2.14%
Total world trade	0.18%

Table 9 Percent change in the U.S.-Korea manufacturing trade

Importer	Exporter	Food	Textile	Wood	Paper	Petroleum products	Chemicals	Rubber	Nonmetals	Metals	Metal products	Machinery, other	Machinery, e&c	Medical	Transport	Other	All manuf.
Korea	U.S	422.3%	63.5%	21.1%	5.5%	7.2%	30.3%	48.0%	38.7%	17.0%	33.8%	31.9%	41.0%	45.0%	33.9%	28.5%	56.90%
U.S.	Korea	70.08%	56.34%	7.87%	1.36%	2.19%	28.24%	19.77%	20.46%	9.27%	14.21%	8.94%	15.53%	23.34%	9.91%	11.81%	18.88%

Table 10 Percent change in industry employment

	Food	Textile	Wood	Paper	Petroleum products	Chemicals	Rubber	Nonmetals	Metals	Metal products	Machinery, other	Machinery, e&c	Medical	Transport	Other	All manuf.
Australia	-0.440%	-0.072%	-0.046%	-0.090%	-0.018%	-0.114%	-0.118%	-0.029%	-0.068%	-0.060%	-0.116%	-0.159%	-0.167%	-0.056%	-0.065%	-0.150%
Austria	-0.031%	-0.065%	-0.029%	-0.026%	-0.010%	-0.054%	-0.061%	-0.025%	-0.069%	-0.048%	-0.100%	-0.162%	-0.169%	-0.066%	-0.052%	-0.070%
Brazil	-0.047%	-0.155%	-0.010%	-0.021%	-0.009%	-0.051%	-0.057%	-0.017%	-0.043%	-0.036%	-0.057%	-0.154%	-0.125%	-0.052%	-0.028%	-0.060%
Bulgaria	-0.070%	-0.104%	-0.020%	-0.030%	-0.013%	-0.057%	-0.058%	-0.017%	-0.060%	-0.040%	-0.057%	-0.146%	-0.271%	-0.067%	-0.040%	-0.070%
Chile	-0.157%	-0.082%	-0.027%	-0.035%	-0.019%	-0.092%	-0.128%	-0.022%	-0.032%	-0.040%	-0.071%	-0.144%	-0.095%	-0.105%	-0.048%	-0.070%
China	-0.319%	-0.306%	-0.076%	-0.110%	-0.055%	-0.215%	-0.216%	-0.070%	-0.115%	-0.108%	-0.140%	-0.316%	-0.452%	-0.062%	-0.106%	-0.200%
Colombia	-0.036%	-0.349%	-0.015%	-0.020%	0.007%	-0.069%	-0.104%	-0.009%	-0.029%	-0.031%	-0.060%	-0.142%	-0.083%	-0.094%	-0.040%	-0.080%
Costa Rica	0.037%	-0.708%	-0.039%	-0.053%	-0.027%	-0.113%	-0.139%	-0.062%	-0.146%	-0.115%	-0.074%	-0.290%	-0.068%	-0.142%	-0.086%	-0.170%
Czech Republic	-0.004%	-0.074%	-0.029%	-0.028%	-0.014%	-0.053%	-0.061%	-0.031%	-0.068%	-0.053%	-0.077%	-0.171%	-0.113%	-0.054%	-0.045%	-0.070%
Denmark	-0.091%	-0.049%	-0.032%	-0.031%	-0.013%	-0.047%	-0.059%	-0.021%	-0.071%	-0.049%	-0.100%	-0.194%	-0.168%	-0.056%	-0.064%	-0.080%
Ecuador	0.024%	-0.123%	-0.017%	-0.002%	0.013%	-0.021%	-0.099%	-0.002%	-0.028%	-0.019%	-0.067%	-0.179%	-0.157%	-0.105%	-0.060%	-0.010%
Ethiopia	-0.051%	-0.122%	-0.012%	-0.020%	0.000%	-0.049%	-0.037%	-0.014%	-0.038%	-0.018%	-0.041%	-0.143%	-0.046%	-0.052%	-0.026%	-0.050%
Finland	-0.017%	-0.059%	-0.036%	-0.026%	-0.016%	-0.061%	-0.071%	-0.029%	-0.073%	-0.060%	-0.085%	-0.162%	-0.158%	-0.070%	-0.071%	-0.080%
France	-0.025%	-0.070%	-0.020%	-0.021%	-0.009%	-0.052%	-0.051%	-0.017%	-0.058%	-0.036%	-0.077%	-0.155%	-0.106%	-0.047%	-0.068%	-0.060%
Germany	-0.010%	-0.067%	-0.030%	-0.027%	-0.014%	-0.066%	-0.075%	-0.028%	-0.072%	-0.058%	-0.099%	-0.196%	-0.222%	-0.078%	-0.074%	-0.080%
Greece	-0.038%	-0.055%	-0.007%	-0.010%	-0.004%	-0.039%	-0.037%	-0.006%	-0.044%	-0.015%	-0.025%	-0.095%	-0.047%	-0.132%	-0.024%	-0.040%
Hungary	-0.060%	-0.062%	-0.032%	-0.036%	-0.017%	-0.053%	-0.066%	-0.034%	-0.079%	-0.063%	-0.079%	-0.156%	-0.109%	-0.056%	-0.052%	-0.090%
Iceland	-0.070%	-0.111%	-0.040%	-0.038%	-0.029%	-0.061%	-0.068%	-0.036%	-0.081%	-0.060%	-0.060%	-0.097%	-0.066%	-0.155%	-0.082%	-0.080%
India	-0.019%	-0.260%	-0.025%	-0.038%	-0.016%	-0.094%	-0.088%	-0.018%	-0.064%	-0.045%	-0.067%	-0.158%	-0.090%	-0.039%	-0.047%	-0.100%
Indonesia	-0.077%	-0.368%	-0.067%	-0.097%	-0.025%	-0.209%	-0.136%	-0.045%	-0.166%	-0.088%	-0.148%	-0.225%	-0.215%	-0.035%	-0.113%	-0.170%
Iran	-0.046%	-0.081%	-0.010%	-0.041%	-0.018%	-0.082%	-0.181%	-0.010%	-0.054%	-0.024%	-0.048%	-0.087%	-0.083%	-0.030%	-0.018%	-0.050%
Ireland	-0.034%	-0.123%	-0.037%	-0.027%	-0.017%	-0.020%	-0.055%	-0.025%	-0.076%	-0.053%	-0.085%	-0.296%	-0.152%	-0.055%	-0.070%	-0.050%
Israel	-0.012%	-0.464%	-0.026%	-0.032%	-0.017%	-0.052%	-0.101%	-0.006%	-0.088%	-0.062%	-0.095%	-0.313%	-0.360%	-0.131%	-0.077%	-0.100%
Italy	-0.015%	-0.121%	-0.023%	-0.022%	-0.011%	-0.056%	-0.054%	-0.018%	-0.065%	-0.039%	-0.066%	-0.138%	-0.106%	-0.049%	-0.049%	-0.060%
Japan	-0.046%	-0.072%	-0.064%	-0.060%	-0.026%	-0.153%	-0.147%	-0.058%	-0.122%	-0.099%	-0.153%	-0.273%	-0.844%	-0.086%	-0.165%	-0.150%
Jordan	-0.048%	-0.921%	-0.078%	-0.147%	-0.046%	-0.157%	-0.167%	-0.051%	-0.084%	-0.114%	-0.126%	-0.133%	-0.079%	-0.038%	-0.091%	-0.470%
Kazakhstan	-0.012%	-0.043%	-0.011%	-0.013%	-0.018%	-0.070%	-0.052%	-0.009%	-0.052%	-0.037%	-0.049%	-0.096%	-0.044%	-0.049%	-0.067%	-0.030%
Kenya	-0.008%	-0.781%	-0.016%	-0.038%	-0.016%	-0.106%	-0.097%	-0.011%	-0.068%	-0.031%	-0.052%	-0.066%	-0.060%	-0.047%	-0.034%	-0.170%
Korea	**-12.864%**	**8.250%**	**0.074%**	**-0.403%**	**0.221%**	**0.204%**	**1.280%**	**0.391%**	**1.559%**	**0.926%**	**0.839%**	**2.703%**	**1.031%**	**1.742%**	**0.666%**	**0.970%**
Malaysia	-0.268%	-0.363%	-0.147%	-0.242%	-0.105%	-0.306%	-0.297%	-0.237%	-0.278%	-0.254%	-0.114%	-0.342%	-0.338%	-0.186%	-0.157%	-0.290%
Mauritius	-0.011%	-0.286%	-0.028%	-0.044%	-0.017%	-0.113%	-0.069%	-0.014%	-0.056%	-0.039%	-0.092%	-0.125%	-0.070%	-0.038%	-0.026%	-0.160%
Mexico	0.011%	-0.495%	-0.025%	-0.022%	0.007%	-0.089%	-0.132%	-0.032%	-0.078%	-0.051%	-0.083%	-0.282%	-0.084%	-0.204%	-0.061%	-0.140%
Netherlands	-0.044%	-0.068%	-0.037%	-0.040%	-0.018%	-0.060%	-0.068%	-0.043%	-0.064%	-0.065%	-0.068%	-0.173%	-0.798%	-0.051%	-0.059%	-0.110%
New Zealand	-0.447%	-0.102%	-0.050%	-0.124%	-0.024%	-0.100%	-0.154%	-0.040%	-0.078%	-0.075%	-0.075%	-0.125%	-0.055%	-0.060%	-0.048%	-0.200%
Norway	-0.031%	-0.043%	-0.014%	-0.016%	-0.007%	-0.044%	-0.064%	-0.013%	-0.066%	-0.038%	-0.153%	-0.166%	-0.261%	-0.037%	-0.048%	-0.050%
Peru	-0.067%	-0.483%	-0.026%	-0.040%	-0.014%	-0.106%	-0.124%	-0.015%	-0.056%	-0.040%	-0.067%	-0.115%	-0.092%	-0.079%	-0.041%	-0.130%
Philippines	-0.629%	-0.598%	-0.098%	-0.231%	-0.067%	-0.317%	-0.330%	-0.159%	-0.255%	-0.234%	-0.137%	-0.395%	-0.490%	-0.088%	-0.129%	-0.330%
Poland	-0.019%	-0.058%	-0.022%	-0.020%	-0.008%	-0.042%	-0.045%	-0.016%	-0.061%	-0.037%	-0.058%	-0.133%	-0.078%	-0.035%	-0.038%	-0.050%
Portugal	-0.010%	-0.114%	-0.015%	-0.015%	-0.008%	-0.048%	-0.044%	-0.014%	-0.050%	-0.031%	-0.077%	-0.160%	-0.064%	-0.051%	-0.026%	-0.060%
Russia	-0.130%	-0.038%	-0.015%	-0.030%	-0.023%	-0.062%	-0.102%	-0.017%	-0.047%	-0.039%	-0.045%	-0.119%	-0.050%	-0.057%	-0.028%	-0.060%
Slovakia	-0.003%	-0.065%	-0.025%	-0.022%	-0.010%	-0.059%	-0.061%	-0.024%	-0.065%	-0.050%	-0.059%	-0.114%	-0.170%	-0.068%	-0.035%	-0.070%
Slovenia	-0.014%	-0.079%	-0.027%	-0.025%	-0.013%	-0.051%	-0.056%	-0.021%	-0.065%	-0.045%	-0.057%	-0.178%	-0.088%	-0.045%	-0.041%	-0.060%
South Africa	-0.049%	-0.075%	-0.031%	-0.022%	-0.011%	-0.053%	-0.054%	-0.017%	-0.053%	-0.031%	-0.057%	-0.123%	-0.071%	-0.044%	-0.027%	-0.050%
Spain	-0.039%	-0.065%	-0.016%	-0.016%	-0.007%	-0.047%	-0.047%	-0.014%	-0.051%	-0.029%	-0.051%	-0.112%	-0.137%	-0.045%	-0.028%	-0.050%
Sweden	-0.011%	-0.070%	-0.027%	-0.029%	-0.012%	-0.049%	-0.075%	-0.025%	-0.066%	-0.055%	-0.095%	-0.200%	-0.301%	-0.076%	-0.051%	-0.080%
Tanzania	-0.016%	-0.104%	-0.015%	-0.008%	-0.014%	-0.037%	-0.108%	-0.014%	-0.196%	-0.012%	-0.046%	-0.063%	-0.057%	-0.017%	-0.016%	-0.040%
Trinidad and Tobago	0.013%	-0.087%	-0.010%	0.001%	0.007%	0.032%	-0.048%	-0.007%	-0.132%	-0.046%	-0.060%	-0.111%	-0.064%	-0.057%	-0.052%	-0.010%
Turkey	-0.026%	-0.129%	-0.017%	-0.023%	-0.009%	-0.060%	-0.061%	-0.013%	-0.047%	-0.033%	-0.059%	-0.120%	-0.093%	-0.052%	-0.031%	-0.070%
UK	-0.046%	-0.069%	-0.019%	-0.020%	-0.007%	-0.047%	-0.054%	-0.018%	-0.059%	-0.039%	-0.084%	-0.192%	-0.156%	-0.061%	-0.063%	-0.060%
Ukraine	-0.053%	-0.087%	-0.019%	-0.026%	-0.014%	-0.072%	-0.087%	-0.019%	-0.061%	-0.041%	-0.054%	-0.108%	-0.051%	-0.069%	-0.032%	-0.060%
Uruguay	-0.114%	-0.194%	-0.025%	-0.044%	-0.010%	-0.068%	-0.140%	-0.016%	-0.041%	-0.031%	-0.050%	-0.160%	-0.068%	-0.020%	-0.021%	-0.090%
USA	**0.989%**	**-0.532%**	**0.115%**	**0.152%**	**0.036%**	**0.282%**	**0.096%**	**0.080%**	**0.073%**	**0.092%**	**0.282%**	**0.367%**	**0.622%**	**-0.075%**	**0.285%**	**0.260%**
Vietnam	-0.527%	-0.387%	-0.098%	-0.214%	-0.027%	-0.301%	-0.294%	-0.072%	-0.181%	-0.136%	-0.148%	-0.240%	-0.271%	-0.098%	-0.117%	-0.300%

Table 11 Percent change in specialization and welfare

	Food	Textile	Wood	Paper	Petroleum products	Chemicals	Rubber	Nonmetals	Metals	Metal products	Machinery, other	Machinery, e&c	Medical	Transport	Other	Welfare
Australia	-0.285%	0.084%	0.109%	0.065%	0.137%	0.041%	0.037%	0.126%	0.087%	0.096%	0.039%	-0.004%	-0.012%	0.099%	0.090%	0.002%
Austria	0.038%	0.004%	0.039%	0.043%	0.058%	0.015%	0.008%	0.043%	0.000%	0.020%	-0.032%	-0.094%	-0.101%	0.002%	0.017%	0.001%
Brazil	0.015%	-0.093%	0.051%	0.040%	0.053%	0.010%	0.005%	0.045%	0.019%	0.025%	0.004%	-0.093%	-0.064%	0.010%	0.033%	0.002%
Bulgaria	0.003%	-0.031%	0.054%	0.044%	0.061%	0.017%	0.016%	0.057%	0.014%	0.034%	0.017%	-0.073%	-0.197%	0.007%	0.033%	0.001%
Chile	-0.084%	-0.009%	0.047%	0.038%	0.055%	-0.018%	-0.055%	0.051%	0.042%	0.033%	0.003%	-0.071%	-0.022%	-0.032%	0.026%	0.003%
China	-0.119%	-0.106%	0.124%	0.091%	0.145%	-0.015%	-0.016%	0.131%	0.086%	0.093%	0.060%	-0.116%	-0.252%	0.139%	0.094%	0.004%
Colombia	0.047%	-0.266%	0.068%	0.063%	0.090%	0.014%	-0.021%	0.074%	0.054%	0.052%	0.023%	-0.059%	0.000%	-0.010%	0.043%	0.003%
Costa Rica	0.206%	-0.540%	0.131%	0.116%	0.142%	0.056%	0.030%	0.107%	0.023%	0.054%	0.096%	-0.121%	0.101%	0.027%	0.083%	0.004%
Czech Republic	0.065%	-0.004%	0.041%	0.041%	0.055%	0.016%	0.008%	0.039%	0.001%	0.016%	-0.008%	-0.102%	-0.044%	0.016%	0.024%	0.001%
Denmark	-0.013%	0.030%	0.047%	0.047%	0.066%	0.032%	0.020%	0.058%	0.008%	0.029%	-0.022%	-0.115%	-0.089%	0.022%	0.015%	0.001%
Ecuador	0.037%	-0.110%	-0.003%	0.011%	0.027%	-0.008%	-0.085%	0.011%	-0.015%	-0.005%	-0.054%	-0.165%	-0.143%	-0.092%	-0.047%	0.004%
Ethiopia	0.001%	-0.070%	0.040%	0.032%	0.000%	0.003%	0.015%	0.038%	0.014%	0.034%	0.011%	-0.091%	0.006%	0.000%	0.026%	0.002%
Finland	0.063%	0.022%	0.045%	0.055%	0.065%	0.020%	0.010%	0.052%	0.008%	0.020%	-0.004%	-0.082%	-0.077%	0.011%	0.010%	0.001%
France	0.031%	-0.013%	0.037%	0.036%	0.048%	0.004%	0.005%	0.040%	-0.001%	0.021%	-0.021%	-0.098%	-0.050%	0.010%	-0.011%	0.001%
Germany	0.072%	0.015%	0.052%	0.055%	0.068%	0.016%	0.008%	0.054%	0.010%	0.024%	-0.017%	-0.114%	-0.140%	0.004%	0.008%	0.002%
Greece	-0.002%	-0.018%	0.029%	0.026%	0.033%	-0.003%	0.000%	0.030%	-0.007%	0.021%	0.011%	-0.059%	-0.011%	-0.096%	0.012%	0.002%
Hungary	0.027%	0.026%	0.055%	0.051%	0.071%	0.035%	0.021%	0.053%	0.008%	0.025%	0.008%	-0.069%	-0.021%	0.031%	0.036%	0.001%
Iceland	0.005%	-0.035%	0.035%	0.038%	0.047%	0.015%	0.008%	0.039%	-0.006%	0.015%	0.016%	-0.022%	0.010%	-0.080%	-0.007%	0.001%
India	0.076%	-0.165%	0.071%	0.058%	0.079%	0.001%	0.007%	0.077%	0.031%	0.051%	0.028%	-0.062%	0.005%	0.056%	0.048%	0.002%
Indonesia	0.094%	-0.197%	0.104%	0.074%	0.146%	-0.039%	0.034%	0.126%	0.004%	0.083%	0.023%	-0.054%	-0.044%	0.136%	0.058%	0.002%
Iran	0.004%	-0.032%	0.039%	0.008%	0.031%	-0.032%	-0.132%	0.039%	-0.005%	0.025%	0.001%	-0.038%	-0.033%	0.019%	0.031%	0.003%
Ireland	0.018%	-0.071%	0.014%	0.025%	0.034%	0.031%	-0.003%	0.026%	-0.025%	-0.002%	-0.034%	-0.245%	-0.101%	-0.004%	-0.019%	0.002%
Israel	0.087%	-0.365%	0.074%	0.067%	0.083%	0.047%	-0.002%	0.094%	0.012%	0.038%	0.004%	-0.213%	-0.260%	-0.031%	0.023%	0.003%
Italy	0.047%	-0.058%	0.039%	0.040%	0.052%	0.007%	0.009%	0.045%	-0.002%	0.024%	-0.003%	-0.076%	-0.044%	0.013%	0.013%	0.001%
Japan	0.102%	0.076%	0.084%	0.087%	0.122%	-0.005%	0.001%	0.090%	0.026%	0.049%	-0.006%	-0.125%	-0.698%	0.062%	-0.017%	0.002%
Jordan	0.419%	-0.458%	0.390%	0.320%	0.421%	0.309%	0.300%	0.416%	0.384%	0.353%	0.341%	0.334%	0.388%	0.429%	0.376%	0.004%
Kazakhstan	0.016%	-0.015%	0.017%	0.015%	0.010%	-0.042%	-0.024%	0.019%	-0.024%	-0.009%	-0.021%	-0.068%	-0.016%	-0.021%	-0.039%	0.002%
Kenya	0.158%	-0.616%	0.150%	0.128%	0.149%	0.060%	0.068%	0.154%	0.097%	0.135%	0.113%	0.100%	0.105%	0.118%	0.131%	0.002%
Korea	**-13.704%**	**7.207%**	**-0.891%**	**-1.363%**	**-0.745%**	**-0.761%**	**0.304%**	**-0.576%**	**0.581%**	**-0.046%**	**-0.133%**	**1.713%**	**0.058%**	**0.761%**	**-0.304%**	**0.269%**
Malaysia	0.021%	-0.075%	0.142%	0.046%	0.184%	-0.018%	-0.009%	0.051%	0.010%	0.034%	0.175%	-0.054%	-0.050%	0.103%	0.132%	0.004%
Mauritius	0.153%	-0.123%	0.136%	0.120%	0.147%	0.051%	0.094%	0.150%	0.107%	0.125%	0.072%	0.039%	0.093%	0.126%	0.137%	0.002%
Mexico	0.151%	-0.355%	0.115%	0.118%	0.148%	0.051%	0.008%	0.108%	0.062%	0.090%	0.057%	-0.142%	0.056%	-0.064%	0.080%	0.003%
Netherlands	0.061%	0.037%	0.069%	0.066%	0.088%	0.045%	0.038%	0.062%	0.042%	0.041%	0.038%	-0.067%	-0.693%	0.055%	0.047%	0.002%
New Zealand	-0.247%	0.098%	0.150%	0.076%	0.177%	0.100%	0.046%	0.160%	0.122%	0.126%	0.126%	0.075%	0.146%	0.140%	0.152%	0.002%
Norway	0.022%	0.010%	0.039%	0.037%	0.046%	0.009%	-0.011%	0.040%	-0.013%	0.015%	-0.100%	-0.113%	-0.208%	0.016%	0.005%	0.001%
Peru	0.068%	-0.348%	0.108%	0.095%	0.121%	0.028%	0.010%	0.120%	0.079%	0.094%	0.068%	0.019%	0.043%	0.056%	0.094%	0.003%
Philippines	-0.297%	-0.266%	0.235%	0.102%	0.267%	0.016%	0.003%	0.174%	0.078%	0.099%	0.196%	-0.063%	-0.158%	0.246%	0.205%	0.003%
Poland	0.027%	-0.011%	0.025%	0.026%	0.039%	0.004%	0.002%	0.031%	-0.015%	0.009%	-0.012%	-0.086%	-0.031%	0.011%	0.008%	0.002%
Portugal	0.052%	-0.052%	0.047%	0.047%	0.054%	0.014%	0.018%	0.048%	0.012%	0.031%	-0.016%	-0.098%	-0.002%	0.011%	0.036%	0.001%
Russia	-0.075%	0.017%	0.040%	0.025%	0.032%	-0.007%	-0.047%	0.038%	0.008%	0.016%	0.010%	-0.064%	0.005%	-0.002%	0.027%	0.002%
Slovakia	0.062%	0.001%	0.041%	0.044%	0.056%	0.007%	0.005%	0.042%	0.001%	0.015%	0.007%	-0.048%	-0.104%	-0.002%	0.031%	0.003%
Slovenia	0.048%	-0.017%	0.035%	0.037%	0.049%	0.011%	0.006%	0.040%	-0.003%	0.017%	0.004%	-0.117%	-0.026%	0.017%	0.020%	0.001%
South Africa	0.000%	-0.027%	0.017%	0.026%	0.038%	-0.005%	-0.006%	0.031%	-0.005%	0.017%	-0.009%	-0.075%	-0.023%	0.004%	0.021%	0.002%
Spain	0.007%	-0.019%	0.029%	0.029%	0.039%	-0.001%	-0.001%	0.032%	-0.005%	0.017%	-0.006%	-0.066%	-0.091%	0.001%	0.018%	0.001%
Sweden	0.070%	0.011%	0.054%	0.052%	0.070%	0.032%	0.006%	0.056%	0.015%	0.026%	-0.014%	-0.119%	-0.220%	0.005%	0.031%	0.001%
Tanzania	0.021%	-0.067%	0.023%	0.029%	0.023%	0.000%	-0.071%	0.023%	-0.159%	0.025%	-0.008%	-0.026%	-0.019%	0.020%	0.021%	0.002%
Trinidad and Tobago	0.022%	-0.078%	-0.001%	0.010%	0.016%	0.040%	-0.039%	0.002%	-0.124%	-0.037%	-0.051%	-0.103%	-0.055%	-0.048%	-0.043%	0.003%
Turkey	0.042%	-0.062%	0.051%	0.044%	0.058%	0.007%	0.007%	0.054%	0.021%	0.034%	0.009%	-0.052%	-0.025%	0.016%	0.036%	0.002%
UK	0.015%	-0.007%	0.043%	0.042%	0.055%	0.015%	0.007%	0.044%	0.003%	0.022%	-0.022%	-0.130%	-0.095%	0.001%	-0.001%	0.002%
Ukraine	0.005%	-0.028%	0.039%	0.033%	0.044%	-0.014%	-0.028%	0.039%	-0.002%	0.018%	0.005%	-0.050%	0.008%	-0.011%	0.027%	0.002%
Uruguay	-0.019%	-0.099%	0.070%	0.051%	0.085%	0.027%	-0.045%	0.079%	0.054%	0.064%	0.045%	-0.065%	0.027%	0.076%	0.074%	0.003%
USA	**0.727%**	**-0.790%**	**-0.144%**	**-0.108%**	**-0.223%**	**0.022%**	**-0.163%**	**-0.180%**	**-0.186%**	**-0.168%**	**0.023%**	**0.107%**	**0.361%**	**-0.334%**	**0.025%**	**0.013%**
Vietnam	-0.225%	-0.084%	0.205%	0.089%	0.277%	0.002%	0.009%	0.232%	0.123%	0.168%	0.155%	0.064%	0.033%	0.206%	0.187%	0.004%