International Trade and Imperfect Competition
Theory and Application to the Automobile Trade

Junichi Goto

The real world economy is much less competitive than an economics textbook assumes, especially for automobiles.
This paper develops a formal general equilibrium trade model for imperfect competition, a model easily applied to actual situations. Starting from the Krugman-Dixit-Stiglitz framework, the model incorporates labor market imperfection and variable elasticity of substitution between differentiated products.

The model shows that, in the long run, international trade brings about five gains:

- **Greater variety in consumption.** Consumers can enjoy a wider selection of goods through the introduction of foreign goods.

- **Efficiency in product markets.** Monopolistic power of domestic producers is weakened by foreign competition.

- **Technical efficiency.** The unit cost of production is reduced by foreign competition and by further use of increasing returns to scale technology.

- **Decline in structural unemployment.** Contrary to popular belief, foreign competition reduces unemployment in the long run by rectifying labor market imperfections.

- **Contribution to economic growth.** International division of labor encourages savings in fixed costs, and the saved capital resources can facilitate economic growth.

The model is also applied to the U.S. automobile industry in 1986 to estimate the magnitude of the five effects. The results suggest that the cost of trade restrictions is high because the restrictions further increase the imperfect competition in the American auto industry.

The model is general enough for the analysis of many industries in both developed and developing countries.

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1. Introduction

The purpose of this paper is to develop a formal general equilibrium trade model of under imperfect competition which can be readily used to analyze the effect of actual trade. Recently, the new theories, which are generally referred to as "the theory of international trade under imperfect competition," have been developed by prominent economists, including Krugman, Dixit and Norman, Lancaster, and Helpman. They have succeeded in explaining intra-industry trade among similar countries, based upon three assumptions: imperfect competition; increasing returns to scale; and product differentiation. Although their frameworks are path-breaking, a number of extensions and modifications are necessary before estimation using actual data. First of all, their models incorporate imperfect competition in the product market alone, and it is assumed that the labor market is perfectly competitive and that workers are always in full employment. While many arguments have been made about the impact of labor unions on international trade or the impact of international trade on unemployment, very few formal studies have analyzed these problems. Therefore, it is desirable to establish a formal model which consistently incorporates imperfect competition in both markets. Second, the elasticity of substitution among differentiated goods has been assumed to be constant in Krugman-Dixit-Stiglitz models. In other words, the degree of substitutability between differentiated goods where the choice available to consumers is between only two types of goods is exactly

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the same as where the choice is available among, say, hundreds of types of
goods. Actually, however, it seems plausible that goods become closer and
closer substitutes as the number of types of goods available to consumers
increases. In addition to the lack of intuitive appeal, the assumption of
invariant substitutability in their models encounters empirical
difficulties. As was reviewed by Jacquemin (1982), for example, many
empirical studies have found the three stylized facts about the effects of the
opening up of trade under imperfect competition: (i) an increase in variety of
goods available; (ii) a decrease in monopolistic power; and (iii) a decrease
in average cost. However, as will be discussed in detail below, (ii) and
(iii) cannot be explained under the assumption of invariant sub-
stitutability.

In the next section, a formal general equilibrium model of
international trade under imperfect competition is established which
incorporates labor market imperfections and a variable elasticity of
substitution. It will be rigorously shown that the opening up of trade brings
about the following five gains:

(i) a greater consumer satisfaction due to an increase in the
variety of goods;

(ii) a decrease in monopolistic power;

(iii) a technical efficiency due to a decrease in average cost;

(iv) a decrease in unemployment due to reduced imperfection in the
labor market;

(v) a contribution to economic growth through a release of capital
resources from the distorted sector.

At the end of the paper, the magnitude of these five gains from trade
will be estimated for the U.S. automobile trade in 1986.
2. A Model in the Closed Economy

In the following discussion a model is established for the closed economy first, and in the subsequent section effects of trade (and of its restrictions) will be analyzed using the model. The economy in the model consists of two sectors: the perfectly competitive sector and the distorted sector. The former sector produces homogeneous products under constant returns to scale, and both product and labor markets are perfectly competitive. The latter sector consists of many individual firms which are producing differentiated products in the framework of Chamberlinian monopolistic competition, and the technology is characterized by increasing returns to scale. In the latter sector, the labor market is also imperfect in that the labor union sets the wage rate higher than the competitive wage in the rest of the economy.

2.1. Specification of the Model

Consumers are characterized by the following individualistic social utility function.

\[ U = \left( \sum_{i=1}^{N} C_i^\theta \right)^{\theta} C_0^{1-\theta} \quad \text{for} \quad 0 < \theta < 1 \]

where \( \theta = \theta(N) \), \( 0 < \theta' < 1 \).

where \( C_i \) is the amount of consumption of the \( i \)-th differentiated good and \( C_0 \) is the amount of consumption of the goods produced by the rest of the economy (numeraire goods). \( N \) is the number of types of differentiated products, which consumers consider to be available to them. \( N \) will be the same as \( n \) (the number of types of goods actually available to consumers) in equilibrium. Namely, the behavioral assumption here is that consumers maximize utility, taking the prices and number of types of products as given, and the utility is a function of \( C_i \), \( C_0 \), and \( N \).
The utility function (1) is similar to that of Dixit and Norman (1980), where the utility was Cobb-Douglas in the quantity of the numeraire goods and a scalar measure of consumption of differentiated product, this scalar measure being a CES function in the quantity of each product type. However, the model used here has a crucial difference from their model: in Dixit and Norman, $\beta$ is given by a parameter, and therefore, the elasticity of substitution between differentiated goods ($= 1/(1-\beta)$) is invariant with regard to the number of product types, while in the model here, $\beta$ is assumed to be an increasing function of the number of types of goods available to consumers, i.e. differentiated goods become closer and closer substitutes as the variety of goods increases. Further, it seems reasonable to assume that the utility will increase as $N$ increases even if $\sum_{i=1}^{N} C_i$ (physical quantity of the differentiated goods) remains constant. Namely, the society is better off in the situation where, for example, 100 units of model A and 100 units of model B are available than in the situation where 200 units of model A alone are available, if both models enter the social utility function symmetrically. As long as $\beta$ satisfies these conditions, it can take any functional form.

Consumers maximize the utility function (1) subject to the budget constraint (3),

\[ \sum_{i=1}^{N} \pi_i C_i = Y \]

where price of the numeraire goods is set to 1, and $\pi_i$ and $Y$ are the price of the $i$-th differentiated product and income, respectively. From this maximization problem, we get the following two demand functions.

\[ C_0 = (1 - \alpha) Y \]

\[ \pi_i = \alpha \pi_i^{\beta-1} Y / Z \]
Elasticity of demand of the $i$-th differentiated good ($\epsilon_i$) is obtained by taking the derivative of (5).

\[
\frac{1}{\epsilon_i} = - \frac{\partial P_i}{\partial C_i} \cdot \frac{C_i}{P_i} = (1 - \theta) + \frac{\beta C_i^\theta}{Z} 
\]

Therefore, the elasticity is given by (8). 2/

\[
\epsilon_i = \frac{1}{(1-\theta) + \beta C_i^\theta / Z} 
\]

Further, because of the symmetry of the problem, (8) will reduce to (8')

\[
\epsilon_i = \frac{1}{1 - \theta \cdot (1 - 1/N)} 
\]

Production of the numeraire goods is characterized by the following Cobb-Douglas cost function.

\[
TC_o = r^a W_o^{1-a} x_o, \quad 0 < a < 1 
\]

where $r$ is rental rate of capital and $W_o$ is competitive wage rate, both of which are expressed in terms of the price of numeraire goods, and $x_o$ is the output of the numeraire good, and $TC_o$ is total cost. Note that the production technology exhibits constant returns to scale, and there is no profit in equilibrium. So, unit production cost is the same as price, which is set to unity here, and (10) holds in equilibrium.

\[
r^a W_o^{1-a} = 1 
\]

2/ Note that, different from Krugman etc., we are not neglecting the second term, and therefore, we do not have to assume large $N$. 

Demand for capital input in the numeraire good sector can be obtained by taking the derivative of the cost function (9) with respect to the rental rate (i.e., by using Shepard's lemma).

\[(11) \quad K_o = \frac{\partial (TC_o)}{\partial r} = a r^{-1} w_0 l^{-a} x,\]

where \(K_o\) is the amount of capital input in the numeraire goods sector.

Similarly, labor input \((L_o)\) is given by,

\[(12) \quad L_o = \frac{\partial (TC_o)}{\partial w_o} = (1-a) r a w_o^{-a} x.\]

On the other hand, production of the \(i\)-th differentiated good is characterized by the following cost function.

\[(13) \quad TC_i = r F + r a w_i^{-1-a} x_i,\]

where \(TC_i, W_i,\) and \(x_i\) are total cost, wage rate, output level of the \(i\)-th firm, respectively. Namely, each firm has to commit \(F\) units of capital as a fixed cost first if it is to produce any positive amount. In addition to the fixed cost \(r F,\) constant marginal cost \(r a W_i^{-1-a}\) is necessary thereafter. Note that the production of each differentiated good exhibits increasing returns to scale because of the fixed cost. Costless differentiation is assumed in the model, and therefore, no two firms ever produce the same types of differentiated products in equilibrium because the firm is always better off by differentiating its product type from the existing types to a new type.

Equilibrium is given by monopolistic competition: each firm maximizes its profit, and equilibrium profit is forced to be zero due to free entry and exit. The optimization problem of the representative firm \(i\) is given by,

\[(14) \quad \text{Max } \pi_i = p_i(x_i) x_i - (r F + r a w_i^{-1-a} x_i),\]

where \(\pi_i\) is the profit of the \(i\)-th firm. Since each firm has monopoly power for its particular type of differentiated goods, the optimization problem is
essentially the same as regular profit maximization of the monopolist. So, from (8) and (14), and noting that $N$ (the number of product types which consumers consider to be available to them) is the same as $n$ (the actual number of available product types) in equilibrium, we get the following profit maximizing price:

$$p_i = \frac{r^*_{W_i}^{a-m}l^{1-a}}{\beta(1-C_{i1}^{Z}/Z)}$$

Further, due to the symmetry of the problem, (15) reduces to (15').

$$p_i = \frac{r^*_{W_i}^{a-m}}{\beta(1-1/n)}$$

In addition, free entry and exit are assumed in the model. So, whenever there is a positive profit entry occurs, and therefore, profit is forced to be zero, or price must be the same as average cost in equilibrium.

$$P_i = (rP+r^*_{W_i}^{a-m}x_{i1})/x_{i1}$$

By invoking Shepard's lemma, as in (11) and (12), we get factor demand functions of the $i$-th firm as follows:

$$k_i = \delta(TC_{i1})/\delta r$$
$$= P + \alpha r^*_{W_i}^{a-m}x_{i1}$$

$$l_i = \delta(TC_{i1})/\delta W_i$$
$$= (1-a)r^*_{W_i}^{a-m}x_{i1}$$

where $k_i$ and $l_i$ are the demand for capital and the demand for labor of the firm $i$, respectively.

The elasticity of derived demand for labor is obtained from the inverse demand function (5) and conditional labor demand function (18). It
can be shown by simple algebra that the elasticity of derived demand for labor
\( n_i \) is reduced to (19).

\[
(19) \quad n_i = a + (1 - a) \epsilon_i
\]

Note that equation (19) shows the essence of the Hicks-Marshall Laws of
Derived Demand. As is widely known, the main point of the Hicks-Marshall Laws
is that, other things being equal, the own wage elasticity for a category of
labor is high when:

(i) the price elasticity of demand for the product being produced is high;

(ii) the cost of employing the category of labor is a large share of the
total cost of production;

(iii) other factors of production can be easily substituted for the
category of labor.

First of all, it is obvious that equation (19) shows that the elasticity of
derived demand for labor is an increasing function of the elasticity of
product demand (Law (i)). Further, from cost function (13) it is obvious that
the share of the labor cost in the total variable cost is \((1-a)\). Therefore,
equation (19) also shows that the derived demand for labor is more elastic,
the larger the share of the labor cost (Law (ii)). 3/ Law (iii) is not
applicable as long as we use a Cobb-Douglas function, where the elasticity of
substitution between the two factors is always unity.

The labor market in the differentiated goods sector is assumed to be
imperfect while that in the rest of economy is perfectly competitive. The

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3/ In order that this holds, \( \epsilon_i \) has to be larger than one. But, since we
are \( 0 < \theta < 1 \), assuming it is obvious that \( \epsilon_i \) is always greater than
one. (See equation (8')).
labor market in the distorted industry is assumed to be controlled by a single labor union. Although everyone would agree that the labor market is imperfect in many industries and that the union is an important player, there is no consensus on the objective function of the union. In spite of the variety of arguments made on the objective function of the union, it seems that the majority would agree that the union's utility is a (quasi-concave) increasing function of wage and employment, as Oswald (1982) suggested. In the model here I will use the objective function (20), which is simple and of the same functional form as that of Calvo (1978). The behavioral assumptions in the model here are: the union decides the wage rate in order to maximize its objective function (20), firms decide the employment level, taking the wage rate set by the union as given.

\[ \text{(20) } \max V = \sum_{i=1}^{n} W_i - W_0 \]

Namely, the union is seeking to maximize the difference between its (employed) members' income and what they would get without a union (i.e. the competitive wage rate in the rest of the economy).

By rearranging the first order conditions of the maximization problem (20) we get the following.

\[ \frac{W_i - W_0}{W_i} = \frac{1}{\eta_i} \text{ for every } i \]

Equation (21) shows that the rate of wage markup in each firm is equal to the inverse of the elasticity of derived demand for labor of the firm, which seems to have a resemblance to the so-called Ramsey pricing rule.
Note that because of the symmetry of the problem, $C_i$, $P_i$, $x_i$, $\varepsilon_i$, $W_i$, and $\eta_i$ are the same for all $i$. So, let us adopt the short-hand notations without subscript in the following discussion. Further, note that the elasticity of demand for labor by the differentiated goods sector as a whole is the same as the elasticity of demand for labor by the individual firm, because each of many firms in the industry is assumed here to make its input decision under monopolistic competition without taking the interactions between firms into account.

Workers allocate themselves to one of the two sectors by comparing the competitive wage in the rest of the economy with the expected wage in the distorted industry. The framework here is an application of the Harris-Todaro model, which was used to analyze migration. The probability of getting a job after allocating themselves to the distorted sector is as follows:

\begin{equation}
Pr = \frac{L_a}{N_a}
\end{equation}

where, $Pr$, $L_a$, and $N_a$ are the probability of getting a job, the amount of employment, and the supply of workers in the distorted sector, respectively. Workers are assumed to be risk neutral for simplicity here. Through the movement of workers between the two sectors the expected wage of the distorted sector will be equated with the competitive wage in the rest of the economy in equilibrium. Therefore, in equilibrium, equation (23) holds.

\begin{equation}
W_0 = W_0(L_a/N_a)
\end{equation}

where $W$ is the wage rate in the distorted sector. Note that we are denoting

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4/ It is easy to incorporate the risk aversion of workers. All we have to do for that purpose is to put some measure of degree of risk aversion in equilibrium condition (23).
it without subscript because the wage rate in each firm turns out to be the same in equilibrium, as discussed above. Equation (23) can be rearranged as follows.

\[
\frac{W - W_o}{W} = \frac{N_a - L_a}{N_a} = \alpha
\]

The right-hand side of equation (24) is the unemployment rate in the distorted industry while the left-hand side can be interpreted as the rate of wage markup in the industry, which bears a strong analogy to the Lerner Index. Equation (24) shows that the unemployment rate in the imperfectly competitive sector becomes higher, the higher the wage markup. The intuition behind this would be as follows: when there is a big wage difference between the two sectors, some workers tend to remain unemployed because they do not pick up the lower wage job in the competitive sector, hoping that they would be able to find a job in the high wage sector. Such behavior would be especially relevant for the workers who were laid off from the high wage industry. Even if there are sufficient job openings in the low wage sector, they may wait until they are employed again by the high wage sector. Such prolonged unemployment tends to be higher, the larger the wage difference between the two sectors. From (21) and (24), we know that the (long-run) unemployment rate in the imperfectly competitive sector is a decreasing function of the elasticity of derived demand for labor.

Labor supply is assumed to be given, i.e. there is no wage-leisure tradeoff. Therefore, the sum of labor supply in both sectors is the same as the labor endowment of the economy (L).

\[
N_a + L_c = L
\]
Further, due to the symmetry of the problem, the amount of labor demanded by the firm is the same for all firms in the differentiated goods sector. So, the amount of labor demanded by the sector as a whole \((L_a)\) is as follows.

\[(26) \quad L_a = nl\]

In contrast to the labor market, the capital market is assumed to be perfectly competitive. Therefore, the sum of the capital demanded in both sectors is equal to the capital endowment of the economy \((K)\).

\[(27) \quad K_0 + \sum_i k_i = K\]

Because of the symmetry of the problem, \((27)\) reduces to \((28)\).

\[(28) \quad K_0 + K_a = K\]

\[(29) \quad \text{where} \quad K_a = nk\]

Since there are no profit in equilibrium, the national income is equal to factor payments.

\[(30) \quad rK + W_0 L_0 + WL_a = Y\]

2.2. Equilibrium Conditions

The equilibrium values of the 18 endogenous variables \((x_0, x, P, n, r, W_0, W, K_0, K_a, k, L_0, L_a, l, N_a, Y, \beta, \epsilon, n)\) are obtained by solving the system of the following 18 independent equations.

\[(2') \quad \beta = \beta(n), \quad \beta' > 0, \quad 0 < \beta < 1\]

\[(4') \quad x_0 = (1 - \alpha) Y\]

\[(8') \quad \epsilon = 1 / (1 - \beta(1 - 1/n))\]

\[(10') \quad r^a W_0^{1-a} = 1\]

\[(11') \quad K_0 = a r^{a-1} W_0^{1-a} x_0\]

\[(12') \quad L_0 = (1 - a) r^a W_0^{1-a} x_0\]
(15') \( P = r^{a_1} W^{1-a_{1m}} / \beta(1 - 1/n) \)

(16') \( P = (rF + r^{a_1} W^{1-a_{1mx}})/r \)

(17') \( k = F + ar^{a_1-1} W^{1-a_{1mx}} \)

(18') \( l = (1 - a_{1}) r^{a_1-a_{1mx}} \)

(19') \( \eta = a + (1 - a) \varepsilon \)

(21) \( (W - W_o)/W = 1/\eta \)

(23) \( W_o = W_s(L_a/N_a) \)

(25) \( N_a + L_o = L \)

(26) \( L_a = nl \)

(28) \( K_o + K_a = K \)

(29) \( K_a = nk \)

(30) \( W_o L_o + W L_a + rK = Y \)

In the following section, gains from trade (or losses from trade restrictions) will be analyzed by using the above system of equations.

3. Quintuple Gains from International Trade

In addition to the orthodox gains from trade based on the (Baldwin) availability locus there are various other sources of gains from trade in the real world. As discussed in the beginning of the paper many econometric studies have found at least threefold empirical regularities (i.e. stylized facts) on gains from trade: (i) an increase in the variety of goods; (ii) a decrease in monopolistic power; (iii) a decrease in average cost. The model developed here gives theoretical grounds to these three stylized facts.
Further, the model also explains the gains from trade which result from the decrease in factor market imperfections.

In what follows, gains from international trade under imperfect competition will be rigorously analyzed by using the formal model developed in the last section. I examine the effects of trade between two countries which are identical in tastes, technology, and relative factor endowment. Based upon these assumptions, I will compare the two extreme situations: autarky and free trade. Since the two countries are assumed to be identical, the opening up of trade is essentially equivalent to the increase in the size of the economy (i.e. the increase in the amount of factor endowments).

It would be convenient to solve the model before examining the effects of trade and its restrictions. After some simple but tedious algebra we get the following reduced forms.

\begin{align*}
(32) \quad x_o &= (1 - \alpha)(G^{a-1} + G^a)K^{a-1 - a} \\
(33) \quad x &= F(a-1)(K/L)^{a-1}/(D^{1-a_m}) \\
(34) \quad P &= \frac{D^{1-a_m}}{s(1-1/n)} \\
(35) \quad n &= \frac{1 - a(1-a)(1+G)}{F*(1+a(\varepsilon-1))} \cdot K \\
(36) \quad r &= (GK/L)^{a-1} \\
(37) \quad W_o &= (GK/L)^a \\
(38) \quad W &= D*(GK/L)^a \\
(39) \quad K_0 &= K - nF(1+a(\varepsilon-1)) \\
(40) \quad K_a &= nF(1+a(\varepsilon-1)) \\
(41) \quad k &= F(1+a(\varepsilon-1))
\end{align*}
3.1. Greater Variety of Goods

First of all, international trade gives consumers greater satisfaction through a wider selection of goods than in autarky. This gain corresponds to stylized fact (i) above. The effect of trade on the variety of goods is rigorously shown by using equation (35) above. By differentiating equation (35) we can show $\frac{\partial n}{\partial K} > 0$ and $\frac{\partial^2 n}{\partial K^2} < 0$. Namely, the number of types of differentiated goods ($n$) will increase as capital endowment of the economy ($K$) increases, although the rate of increase in $n$ is less than proportional to the increase in $K$. As explained above, the opening up of trade between the two countries is essentially equivalent to increase in the amount of factor endowments which can be used in an integrated way. So, the
opening up of trade means the increase in K available to the integrated economy. The increase in K, in turn, increases the number of types, which is the same as the number of firms (or plants) due to the assumption of costless differentiation, as explained in the previous section. Further, since we are assuming that the increase in the number of types of goods will increase utility even if the physical quantity of differentiated goods remains constant, trade liberalization will increase consumer satisfaction through the greater variety of goods, which is brought about by the increase in the size of the integrated economy. This first gain has been pointed out by Krugman and Dixit etc. But, as shown below, trade will bring about other important gains.

3.2. Market Efficiency -- Decrease in Monopolistic Power

As is pointed out as stylized fact (ii) above, trade liberalization would decrease the market power of domestic producers. Many empirical studies have been made on the relationship between the degree of foreign competition and the degree of market power of domestic producers. Most studies seem to agree that import competition reduces market power. But new trade theories based upon the Krugman-Dixit framework have been unable to explain this stylized fact. For example, in the monopolistic competition model of Dixit and Norman (1980), elasticity of demand for each differentiated good is constant without regard to the degree of foreign competition. But such an assumption is not very realistic, and if we adopt the assumption of variable substitutability, as is assumed in the model here, the effect of trade on market power is well explained.

5/ See Jacquemin et al. (1980), for example.
A commonly used measure of market power is the Lerner Index (L.I.), which is defined as follows:

\[ \text{L.I.} = (P - MC) \div P \]

where \( MC \) is marginal cost. From equation (13) we know that the marginal cost of each firm in the distorted sector is \( r^a w^{1-a} \). Substituting \( MC = r^a w^{1-a} \) and equation (34) into equation (53), we get (54):

\[ \text{L.I.} = 1 - B \cdot (1 - 1/n) \]

\( B \) is an increasing function of \( n \) as is shown in equation (2), and we know from the discussion above that trade liberalization increases \( n \) through the increase in the integrated capital endowment. Hence, equation (54) shows that trade liberalization will reduce the market power of the firm, which is expressed here as the Lerner Index (or the rate of price markup).

The intuition behind it is as follows. Trade liberalization increases the number of types of differentiated goods through the increase in the market size of the integrated economy, as explained in the previous subsection. Due to the increased variety of goods available to consumers, they have a wider selection than before. Since the range of selection is widened, goods become closer and closer substitutes than before, and each firm faces more elastic demand for its products. Therefore, the price markup by the monopolistic firm would be lessened.

3.3. Technical Efficiency

International trade often becomes a catalyst to more efficient production. First of all, import competition forces domestic firms to reorganize their production lines in a more efficient way. Many empirical studies have found a negative relationship between protection and technical efficiency. \(^6\) Second, the expansion of market size by trade liberalization

\(^6\) See Block (1974) for example.
will contribute to technical efficiency through exploitation of the benefits of increasing returns to scale technology.

Such impact of trade restrictions on technical efficiency can be rigorously shown as follows. The production level of each firm \((x)\) is given by equation (33) above. By differentiating (33) we can show \(\frac{\partial x}{\partial n} > 0\). And we already know that trade liberalization will increase \(n\), as discussed above. Hence, after trade liberalization the production level of each firm increases. Since technology of the differentiated goods sector is characterized by increasing returns to scale (IRS), average cost of production will be decreased by trade liberalization. \(^7\) Thus the positive relationship between trade liberalization and technical efficiency is proved.

Further, trade liberalization would also contribute to the decrease in average cost through another channel. Due to free entry and exit, pure profit is forced to be zero in the long run, or average cost (AC) must be equal to unit price (P). So, from equation (34) we get (55).

\[
(55) \quad AC = P = D^{1-a} m/n D(1-1/n)
\]

Note that the right hand side of (55) is an increasing function of D. Dividing equation (38) by equation (37) we get (56).

\[
(56) \quad D = \frac{W}{W_0}
\]

Namely, \(D\) turns out to be the degree of wage markup in the differentiated goods sector where the labor market is imperfect. By differentiating \(D\), we can show \(\frac{\partial D}{\partial n} < 0\). This means that the average cost will decrease through the decline in wage markup after trade liberalization. \(^8\)

\(^7\) Note that we can show that \(r\) and \(W\) also decrease when \(n\) increases.

\(^8\) Note that in spite of the decrease in \(W\) the total wage of workers in the distorted sector \((WL_a)\) increases after the liberalization of trade. (We can show \(\frac{\partial^2 (WL_a)}{\partial K a K} > 0\) by using (38) and (44)).
Hence, from (55), trade liberalization brings about a decline in average cost (i.e., technical efficiency) through two major channels: further exploitation of IRS technology and the decline in wage markup.

3.4. Efficiency in Factor Utilization -- Decrease in Unemployment

In the above discussions, theoretical explanations have been given to the three stylized facts on gains from trade liberalization, all of which concern the product market. In addition to the triple gains in the product market, trade liberalization would bring about another important effect through a change in the degree of labor market distortion.

As shown in equation (24) above, unemployment can exist even in the long run equilibrium if union power creates a sectoral wage differential, and the degree of wage markup in the imperfect sector is high when the elasticity of labor demand is low, as shown in (21). In fact, when workers are risk-neutral, the following equilibrium condition is obtained from (21) and (24).

\[
\frac{W - W_0}{W} = \frac{N_a - L_a}{N_a} = \frac{1}{n}
\]

Note that \((N_a - L_a)/N_a\) is the unemployment rate in the distorted industry, as explained in the previous section. And from (2), (48) and (49), it can be

\[9/\text{Note that the unemployment considered here must be distinguished from unemployment in the usual sense which results from short-run macroeconomic disturbances. The unemployment considered here results from the workers' free choice. In this sense, it could be argued that the unemployment is "voluntary". However, to the society, such "voluntary (or structural)" unemployment resulting from the imperfect labor market structure is clearly a loss because it means the underutilization of the factor.}

\[10/\text{Note that it is very easy to incorporate risk averseness of workers in the model, as explained in the footnote above. Risk neutrality is assumed here for the sole purpose of mathematical simplification.} \]
shown that the elasticity of demand for labor \((n)\) is an increasing function of \(n\).

\[(58) \quad \frac{\partial n}{\partial n} > 0\]

Hence, from (57) and (58), trade liberalization, which increases \(n\) in the integrated economy, will decrease unemployment at least in the long run.

The above finding may be a little surprising because proponents for trade restrictions often argue that such restrictions are necessary in order to reduce unemployment. Actually, however, trade liberalization decreases unemployment through correcting distortions in the labor market. The intuition behind such an effect would be as follows. As shown above, trade liberalization increases the elasticity of demand for a product. When demand for a product becomes more elastic, derived demand for labor in each firm also becomes more elastic (Hicks-Marshall Laws of Derived Demand). Such an increase in the elasticity of derived demand for labor in each firm, in turn, will decrease wage markup by the union. \[11/\] Faced with lower wage markup, producers of differentiated goods will hire more workers in order to substitute labor for capital because labor becomes cheaper than before. In addition, the demand for products is increased by the decrease in price, as examined in the above subsections. Employment in the differentiated goods sector will, therefore, be increased for two reasons: higher demand for products due to lower price markup; and the factor substitution to lower wage

\[11/\] Note that the union is assumed here to negotiate with each firm separately. So, wage markup happens to be the same for every firm because of the symmetry of the problem.
markup. Finally, increase in employment, along with the decrease in wage markup, will reduce unemployment. 12/

3.5. Contribution to Economic Growth

International trade would bring about an additional gain which is especially relevant to developing countries where capital is a relatively scarce resource. As shown below, under trade restrictions the differentiated goods sector tends to take more capital from the rest of the economy than under free trade, although capital is important for economic growth.

By differentiating equation (40) we can show the following.

\[(59) \frac{\partial^2 K_a}{\partial K_a K} < 0\]

where \(K_a\) is the input of capital in the differentiated good sector and \(K\) is the capital endowment of the economy. Namely, (59) shows that input of capital in the distorted industry in each country will decrease after trade liberalization. And from (33) and (35) we can show the following.

\[(60) \frac{\partial^2 (nx)}{\partial K_a K} > 0\]

where \(n\) is the number of firms in the distorted industry which is the same as the number of types of differentiated goods due to the assumption of costless differentiation. (60) shows that the amount of differentiated goods

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12/ However, one caveat seems to be necessary here. The above finding is based upon comparative statics in the symmetric case, and therefore, it is true only in the long run equilibrium when the two trading partners are symmetric. The above analysis does not necessarily preclude possible gains from trade restrictions in the adjustment period and/or in the asymmetry case. For the discussion of the short-run asymmetry case, see Goto (1986).
production in each country after trade liberalization is larger than that in autarky. Hence, from (59) and (60), after the trade liberalization, the differentiated good sector in each country requires less capital, although production of differentiated goods in each country increases.

Intuition behind the above effect is as follows. As examined in the previous subsections, the integration of the two economies will increase the number of types of differentiated products but less proportionally. Therefore, fixed cost of the distorted industry in each country declines. The decrease in fixed cost, in turn, decreases the capital requirement in the industry, and thereby makes it possible to release capital resources to the rest of the economy. Where capital is scarce but very important to economic development (this situation probably holds for many developing countries), such release of capital to the rest of the economy could be counted as an additional gain from trade liberalization.

4. Cost of Trade Barrier - A Simulation

While the qualitative analysis has been made in the previous section, this section undertakes a quantitative analysis of the five gains from trade, using the U.S. automotive trade in 1986 as an example.

4.1 Method

The basic method of estimation is as follows: Parameter values in the model are identified first, and the model is solved to get predicted values of endogenous variables in the current actual situation (partially-
opened trade). The model is then solved for hypothetical situations (autarky and no trade barriers). Finally, the values of the endogenous variables in the actual case will be compared with those under autarky and with those under no trade barriers in order to evaluate the magnitude of gains from trade (and losses from trade barriers).

Note that, in the following estimation for the no trade barrier case, we are comparing the actual case in 1986 with the situation where the existing auto producing countries are totally integrated without artificial and natural barriers to automotive trade. Therefore, it should be pointed out first that there are problems of both overestimation and underestimation in the figures of Table 3 below. On the one hand, the figure is an overestimation of the real losses from various trade restrictions because we are comparing here the current partially-opened situation with the situation where no barriers to automotive trade exist. Obviously, even after total integration of the world economy, there exist some natural barriers, such as transportation costs. On the other hand, the figure in Table 3 is an underestimation of losses in the long run because we are considering here only the current size of auto production in each country. In the near future, some developing countries will start producing automobiles while others expand their production. If we take potential auto production into account the size of the integrated economy (and the gains from economic integration) would become greater than the figure in Table 3.

As is clear from the specifications of the model, the model can be solved if the values of parameters are identified. Unfortunately, however, because most parameters are unobservable, their values are calculated indirectly.
First, a specific functional form should be given to $B$ in equation (2). Since $B$ has to satisfy various conditions for reasonable properties of utility function (1), the possible functional form is fairly limited. One possibility is as follows:

$$(2') B = 1 - \gamma / (\log N + \gamma), \quad 0 < \gamma$$

In the following estimation the functional form of (2') is given to $B$.

Second, $a$ in the utility function (1) must be identified.

$$U = \left( \sum_{i=1}^{N} C_i B \right)^a B C_0^{1-a}, \quad 0 < a < 1$$

Since the utility function is of the Cobb-Douglas functional form, $a$ turns out to be the same as the share of the differentiated products (in this case, automobiles) in total expenditure. Table 1 shows the trend of the share of expenditures on new passenger cars. Since automobiles are durable goods, the expenditure share fluctuates substantially according to economic conditions. Therefore, it is reasonable to use the average value and set $a$ equal to 0.034.

Third, since the cost function (9) is also Cobb-Douglas, a similar argument can be made, i.e. $(1-a)$ is equal to the labor share of total output.$^{13/}$

$$T_C = r^{a}W_0^{1-a} x_0, \quad 0 < a < 1$$

It is widely known that the percentage of labor share is very stable over a long period of time (see Douglas (1976) for example). This stability is also

$^{13/}$ Exactly speaking, this statement is not correct because only the rest of the economy, which does not include the auto industry, exhibits constant returns to scale (CRS). However, since the share of automobiles is only 3.4%, CRS in the whole economy may well be assumed for the purpose of estimation here.
Table 1: THE SHARE OF NEW AUTOS IN TOTAL CONSUMPTION EXPENDITURES

<table>
<thead>
<tr>
<th>YEAR</th>
<th>SHARE (%)</th>
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<tbody>
<tr>
<td>1971</td>
<td>4.2</td>
</tr>
<tr>
<td>1972</td>
<td>4.3</td>
</tr>
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<td>1973</td>
<td>4.2</td>
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<td>3.1</td>
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<td>1975</td>
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<tr>
<td>1976</td>
<td>3.5</td>
</tr>
<tr>
<td>1977</td>
<td>3.7</td>
</tr>
<tr>
<td>1978</td>
<td>3.6</td>
</tr>
<tr>
<td>1979</td>
<td>3.3</td>
</tr>
<tr>
<td>1980</td>
<td>2.8</td>
</tr>
<tr>
<td>1981</td>
<td>2.7</td>
</tr>
<tr>
<td>1982</td>
<td>2.7</td>
</tr>
<tr>
<td>1983</td>
<td>3.0</td>
</tr>
<tr>
<td>1984</td>
<td>3.2</td>
</tr>
<tr>
<td>1985</td>
<td>3.3</td>
</tr>
<tr>
<td>1986</td>
<td>3.6</td>
</tr>
</tbody>
</table>

Source: Bureau of Economic Analysis, U.S. Department of Commerce

verified by the recent data in Table 2. Therefore, it is reasonable to use the average of data from 1970 to 1986 and set \(1-a\) equal to 0.745 (or \(a = 0.255\)).

Fourth, \(\gamma\) in equation (2') above must be identified. Since it is extremely difficult to directly estimate \(\gamma\), a different approach is taken. Namely, \(\gamma\) is calculated by using the actual values of the endogenous variables \(\beta\) and \(n\). Once we identify the value of \(\epsilon\), \(\beta\) can be calculated by using equation (8). Therefore, the estimate of \(\gamma\) can be derived from the actual values of \(n\) (number of the available models of automobiles) and
### Table 2: The Share of Compensation to Workers in the National Income

<table>
<thead>
<tr>
<th>Year</th>
<th>Share (%)</th>
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<tbody>
<tr>
<td>1970</td>
<td>75.5</td>
</tr>
<tr>
<td>1975</td>
<td>75.1</td>
</tr>
<tr>
<td>1977</td>
<td>74.3</td>
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<tr>
<td>1978</td>
<td>73.9</td>
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<tr>
<td>1979</td>
<td>74.1</td>
</tr>
<tr>
<td>1980</td>
<td>75.6</td>
</tr>
<tr>
<td>1981</td>
<td>74.7</td>
</tr>
<tr>
<td>1982</td>
<td>76.2</td>
</tr>
<tr>
<td>1983</td>
<td>74.3</td>
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<tr>
<td>1984</td>
<td>73.1</td>
</tr>
<tr>
<td>1985</td>
<td>73.4</td>
</tr>
<tr>
<td>1986</td>
<td>73.2</td>
</tr>
</tbody>
</table>

Source: Survey of Current Business

\( \epsilon \) (elasticity of demand for each model).\(^{14/15/}\) Substituting the values of \( n \) and \( \beta \) into (2') and (8'), we get \( \gamma = 0.6857 \).

Fifth, coefficients \( m \) and \( F \) in the cost function (13) must be identified.

\[
TC = rP + r^{aW_{1-a}}mx, \text{ if } x > 0
\]

\( F = 229.157 \) million and \( m = 8753 \) were estimated using a technique similar to that used in estimating \( \gamma \) -- the actual value of the price of each car \( (P) \) and the average number of the production of automobiles in each firm \( (x) \) were

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\(^{14/}\) (n=91) was calculated by using the actual data in 1983 (Automotive News) after adjusting for the effective availability of imports. We neglected the models which had a very small volume of sales (i.e., less than 10% of the average sales of each model).

\(^{15/}\) (\( \epsilon = 7.06 \)) used in this section is an estimation of Cowling and Cubbin (1971). Several attempts to estimate elasticity of demand for each model have been made, including Hunker (1983) and Toder (1978). Hunker's estimate is a short-run elasticity and Toder's estimates vary widely according to the regression equation specifications. See Goto (1986) for results obtained using Hunker and Toder elasticities.
substituted into equation (15') and (16') above. The rental rate \( r \) and the (competitive) wage rate in the rest of the economy \( W_0 \) in 1986 are, without loss of generality, set to unity by the choice of units of endowments of capital \( K \) and labor \( L \). Note that costs considered here include normal profit of the firms, which is to be distributed to the owner of capital. Finally, the values of \( K \) and \( L \) are calculated so that factor prices in the current situation become unity.

4.2 Result of Estimation

With values for all parameters, the model can be solved for the eighteen endogenous variables. The second column of Table 3 shows the predicted values of the selected endogenous variables in the actual situation of the United States in 1986. The third column shows the predicted values of the same variables under the hypothetical situation where all barriers to automobile trade were removed, while the first column is the autarky situation (no automotive trade). As explained above, trade liberalization is essentially the same as an increase in factor endowments in the integrated economy. Therefore, the size of the integrated economy is calculated to evaluate gains from automotive trade (and losses from trade barriers). In order to get values under no trade barriers, \( K \) and \( L \) are multiplied by the inverse of the share of the passenger cars produced in the United States in the total car output of the world, and the figure is adjusted to take into account the degree of openness of the current U.S. market.

\[16/\] P and x are calculated by using data in Automotive News and Survey of Current Business.
By inspecting Table 3, the real-world case can be compared to the hypothetical cases in order to examine the magnitude of the five previously analyzed gains from trade under imperfect competition.

(i) Gain 1: Greater Variety of Goods

First of all, if all trade barriers were removed, the number of models available to the U.S. consumers would increase from the current 91 to 213, and social welfare would increase because consumers prefer greater variety. Conversely, consumers are now obliged to be content with less variety of automobile choice due to various barriers. Note that the number of models available to consumers after trade liberalization (=213) is fewer than the sum of available models in each country before trade. As explained above, although the number of domestic models in each country is decreased by foreign competition after the trade liberalization, consumers are able to enjoy greater variety by economic integration. On the other hand, if all the current imports are banned, the choice of American consumers would be reduced to 69 models.

(ii) Gain 2: Market Efficiency

When trade barriers exist, market distortion is greater than otherwise. As shown in Table 3, Lerner Index (i.e. the degree of price markup) would be decreased from 0.14 to 0.12 by the removal of trade barriers. Monopolistic power of domestic firms would be decreased by increased foreign competition after the removal of trade barriers. Thus, international trade may be considered to be an antitrust policy.

(iii) Gain 3: Technical Efficiency

Probably, the most interesting point of the estimates in this section is the effect on the prices of automobiles. The average price of an automobile would decrease from the current 11,837 dollars to 11,213 dollars.
### Table 3: GAINS FROM AUTOMOTIVE TRADE

**Country:** the United States  
**Year:** 1986

<table>
<thead>
<tr>
<th></th>
<th>Autarky</th>
<th>Current Situation</th>
<th>No Trade Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Available models:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foreign and domestic (n)</td>
<td>69</td>
<td>91</td>
<td>213</td>
</tr>
<tr>
<td>Domestic models (n)</td>
<td>69</td>
<td>65</td>
<td>54</td>
</tr>
<tr>
<td><strong>Production in each plant (x)</strong>*</td>
<td>91.1</td>
<td>100.0</td>
<td>126.7</td>
</tr>
<tr>
<td><strong>Total domestic production (n₁x)</strong>*</td>
<td>96.3</td>
<td>100.0</td>
<td>105.1</td>
</tr>
<tr>
<td><strong>Price (P)</strong>**</td>
<td>12,117</td>
<td>11,837</td>
<td>11,213</td>
</tr>
<tr>
<td>Relative wage (W/W₀)</td>
<td>1.240</td>
<td>1.221</td>
<td>1.180</td>
</tr>
<tr>
<td>Auto employment (Lₐ)***</td>
<td>97.3</td>
<td>100.0</td>
<td>106.4</td>
</tr>
<tr>
<td>Supply of auto workers (nₐ)***</td>
<td>98.8</td>
<td>100.0</td>
<td>102.7</td>
</tr>
<tr>
<td>Unemployed (Nₐ-Lₐ)***</td>
<td>105.7</td>
<td>100.0</td>
<td>86.0</td>
</tr>
<tr>
<td>Capital in auto industry (a)***</td>
<td>102.0</td>
<td>100.0</td>
<td>95.3</td>
</tr>
<tr>
<td>Lerner index ((P-MC)/P)</td>
<td>0.16</td>
<td>0.14</td>
<td>0.12</td>
</tr>
</tbody>
</table>

* Index (current situation = 100.0)  
** Current dollars (1986)

**Source:** Author's estimate. For method of estimation, see the main text.
(or become 624 dollars cheaper), if various trade barriers were removed. Note that this price reduction is a net gain (not a mere transfer of income from producers to consumers) to the U.S. society, because, as explained above, the price is equal to the average cost of production in the long run due to entry and exit. In other words, due to various barriers to automotive trade, the U.S. society is losing about 7 billion dollars every year.

(iv) Gain 4: Less Structural Unemployment

The effect on structural unemployment is also substantial. Note that long-run equilibria are compared here, and that the unemployment considered here must be distinguished from cyclical unemployment resulting from short-run macroeconomic disturbances. As explained above, such structural unemployment exists even in the long-run equilibrium due to the wage markup in the imperfectly competitive labor market. It is often pointed out that structural unemployment in the U.S. economy has increased since the early 1970s, which corresponds to the increase in the gap between the average wage in the whole economy and the wage of certain industries, such as automobiles and steel. Using the model, it is estimated that the predicted value of the current relative wage of auto worker is 1.221. Namely, auto workers are paid 22.1% higher than average workers due to labor market imperfections. 17/ This wage markup would decrease to 18.0% if foreign competition were increased by the removal of trade barriers. Due to the decrease in wage markup and the increased demand for automobiles, the amount of structural unemployment would decrease by 14.0%. Thus, various trade barriers present obstacles to such a

17/ Note that the relative wage of auto workers in 1986 was 1.535. Part of the wage difference is due to the difference in their skill level etc. The figure 22.1% is to be considered as a pure wage markup.
reduction in structural unemployment, and society suffers another inefficiency due to insufficient factor utilization.

(v) **Gain 5: Possible Facilitation of Economic Growth**

Finally, due to the decrease in the necessary fixed cost in the automotive industry after the removal of trade barriers (note that the number of the domestic models decreases from the current 65 to 54, some capital resources (4.7% of total capital in the auto industry) are released from the auto industry, although the total domestic production of automobiles is increased by 5.1%. The released capital resources could be used for additional investment in the rest of the economy. Although economic growth and development may be less important to the United States, such a release of capital would be very important to many developing countries.

As summarized above, the magnitude of the quintuple gains from automotive trade, which were rigorously derived in previous sections, is substantial. While the United States is losing 7 billion dollars every year due to the various barriers to the automotive trade, it can be seen that under the general equilibrium framework based on the three realistic assumptions, other losses from barriers are also substantial. In particular, it is an unexpected finding that the removal of trade barriers could decrease the amount of structural unemployment by as much as fourteen percent in the long run. 18/

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18/ As pointed out earlier, the estimate here is based on the long-run symmetric equilibrium. For estimates based on the short-run asymmetric equilibrium, see the estimate on the effect of the Japanese voluntary export restraints (VER) by Goto (1986).
SELECTED BIBLIOGRAPHY


Block, H., "Prices, Costs, and Profits in Canadian Manufacturing", Canadian Journal of Economics, 1974


Krugman, P. R., "Intra-industry Specialization and the Gains from Trade," *Journal of Political Economy*, 1981


<table>
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