Gains from Trade in a New Way: Elimination of a Negative Cross-Sector Effect

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I. Introduction

From real-world experience, it is not hard to imagine that sometimes industries affect each other negatively through channels other than crowding out of labor, land and equipment. The operation of a chemical factory may decrease the local output of agriculture even without altering the inputs there. With higher level of chemical production, this negative effect might be more significant. Although this phenomenon is often observed, few papers has considered it formally. In this paper, the existence of such a negative cross-sector effect will actually make a country worse off in autarky by reducing the quantity of goods produced. Then with trade, complete specialization, at least for small country, will make the country better off by eliminating this negative cross-sector effect. Thus, there is a new way that countries can possibly gain from trade, distinct from exploiting comparative advantage and other sources of gain from trade, by elimination of a negative cross-sector effect. This paper uses a simple Ricardian Model to illustrate the idea. But I think that this idea can be generalized to other trade models and be verified using well-constructed data.

I. Autarky Production and Consumption

Consider the most classic 2x2 Ricardian model with one factor labor (L). The two goods are X and Y. It is assumed that labor is perfectly mobile between industries and immobile between countries. The Home production functions are:

$$X_p = A_x L_x (1 - \delta_{xy}\, Y_p) \tag{1}$$

$$Y_p = A_y L_y \tag{2}$$

where X_p and Y_p are the quantities of X and Y produced in Home, A_x and A_y are the output per unit of labor of X and Y (productivity), L_x and L_y are the amounts of labor used to produce X and Y, δ_{xy} is the negative effect on X output per unit of Y production. It is assumed that $\delta_{xy} > 0$. Thus, the production of Y will reduce the output of X in a multiplicative manner. To make things more concrete, let us assume that δ_{xy} is small enough that even complete specialization in Y will not make $(1 - \delta_{xy} Y)$ negative.

For Foreign:

$$X_p^* = A_x^* L_x^* (1 - \delta_{xy}^*\, Y_p^*) \tag{3}$$

$$Y_p^* = A_y^* L_y^* \tag{4}$$

The interpretations for Foreign are the same as for Home. $\delta_{xy}^* > 0$ is also true for Foreign. I use Home to continue my analysis in Autarky; then by symmetry, every result in Autarky will follow in Foreign except for changing notation.

I assume perfectly competitive markets, with many homogeneous producers, all taking both prices and the aggregate output of Y as given. Free entry of these producers then drives profits to zero. Each producer produces either X or Y. This means, the producer only considers one sector to maximize its profit while taking the other sector's output and any negative effect as an externality. The maximization problem they want to solve is:

$$\max_{X_p} P_x X_p - w\, L_x, \quad \text{s.t. } X_p \geq 0 \tag{5}$$

$$\max_{Y_p} P_y Y_p - w\, L_y, \quad \text{s.t. } Y_p \geq 0 \tag{6}$$

where w is the wage in Home and P_x and P_y are prices for X and Y in Home in Autarky, all taken as given by the producer. What is more, for the firm producing X, it takes the other industry output Y_p in its production function as given.

Substitute L_x, L_y from equations (1-2) into the maximum problem in (5-6), after rearranging terms:

$$\max_{X_p}\left(P_x - \frac{w}{A_x(1-\delta_{xy}Y_p)}\right) X_p\,,\ \text{s.t. } X_p \geq 0 \tag{5'}$$

$$\max_{y_p}\left(P_y - \frac{w}{A_y}\right) Y_p,\ \text{s.t. } Y_p \geq 0 \tag{6'}$$

Zero profit gives:

$$P_x - \frac{w}{A_x(1-\delta_{xy}Y_p)} = 0 \quad \text{and} \quad P_y - \frac{w}{A_y} = 0 \tag{7}$$

From (7):

$$\frac{w}{P_x} = A_x\left(1 - \delta_{xy}Y_p\right), \qquad \frac{w}{P_y} = A_y \tag{8}$$

By (8), the price ratio $\left(\frac{P_x}{P_y}\right)$ is:

$$\frac{P_x}{P_y} = \frac{A_y}{A_x(1-\delta_{xy}Y_p)} \tag{9}$$

In this expression, δ_{xy} is the change of unit converter. $\delta_{xy}Y_p$ can be seen as Y_p's impact on A_x after changing output through δ_{xy}. Or, $\delta_{xy}Y_p$ can also be seen as the projection coefficient of Y_p on the space of X_p. Using this way, then expression (9) is consistent with the classic result $\left(\frac{P_x}{P_y} = \frac{A_y}{A_x}\right)$ with productivity of the other industry properly projected.

For demand, there is a typical Cobb-Douglas function for utility, $U = X_c{}^{1-\alpha}Y_c{}^{\alpha}$ where X_c is X consumed, Y_c is Y consumed, and α is a constant. Then, use the usual implications of the Cobb-Douglas utility function:

$$X_c = (1-\alpha)\frac{wL}{P_x}, \quad Y_c = \alpha\frac{wL}{P_y} \tag{10}$$

L is the labor in Home.

II. Autarky Equilibrium

By Walras Law, if I have

$$X_c = X_p \quad \text{and} \quad Y_c = Y_p \tag{11}$$

then the labor market will automatically clear. Then use (10) and substitute (8) into it:

$$X_a = (1-\alpha)\left(1-\delta_{xy}\alpha A_y L\right)A_x L, \; Y_a = \alpha A_y L \tag{12}$$

where X_a and Y_a are autarky equilibrium quantities of X and Y.

From expression (12), it can be seen that the presence of δ_{xy} makes Home consume less of only X than in its absence, as this cross-sector effect causes the X industry to restrict its output. In the end, this makes consumers worse-off in Autarky because they consume less of X. There is a social cost in producing more Y.

Interestingly, compared to the classic result without the negative externality, the productivity of the other industry A_y also appears in $X_a = (1-\alpha)\left(1-\delta_{xy}\alpha A_y L\right)A_x L$. This is because, holding other things constant, if there is higher A_y, then the relative impact of Y on X should be bigger. This makes Home more concerned to restrict its consumption of Y in order to maintain the production level of X.

III. Free Trade of a Small Open Economy

For the small open economy, when open up to trade, it must specialize in either the X industry or the Y industry and take price from the world as given. This is because the economy is so small that changing output or demand will not change the world price at all.

Denote ${P_x}^w$ and ${P_y}^w$ as the world prices for X and Y respectively. The country will specialize in X if:

$$\frac{P_x}{P_y} < \frac{{P_x}^w}{{P_y}^w} \tag{13}$$

where P_x and P_y are autarky prices of X and Y. By the same argument, the country will specialize in Y if:

$$\frac{P_x}{P_y} > \frac{{P_x}^w}{{P_y}^w} \tag{14}$$

Since the probability of having these two prices equal is 0 for continuous prices, I only need to consider these two strict inequalities here. However, countries can also arbitrarily use a random mechanism, like toss a fair coin to decide in which product to specialize if they have these two price ratios equal. The mechanism is quite arbitrary and will not have influence on the analysis. If (13) is true, then the country has comparative advantage of producing X. After moving to specialization in X, the producer in the Y industry will die out. Substitute (9) and (12) into the inequality in (13):

$$\left(\frac{A_x}{A_y} - \delta_{xy} A_x \alpha L\right) {P_x}^w > {P_y}^w \tag{15}$$

For this inequality, it can be seen that if δ_{xy} equals to 0, it gives back the traditional inequality countries used to decide whether they specialize in X ($\frac{{P_x}^w}{{P_y}^w} > \frac{A_y}{A_x}$). Thus, equation (15)'s implication is consistent with what I had in the world where there was no negative effect.

When the country specializes in X:

$$X_p = LA_x \text{ , } Y_p = 0 \tag{16}$$

Then, use the usual implications of the Cobb-Douglas utility function:

$$\mathrm{X_c}{=}(1-\alpha)\,\frac{wL}{P_x{}^w}\ ,\quad \mathrm{Y_c} = \alpha\,\frac{wL}{P_y{}^w} \tag{17}$$

All incomes are paid to labor by the competitive market structure:

$$wL = P_x{}^w \mathrm{L} A_x \tag{18}$$

Substitute (18) into (17):

$$\mathrm{X_c} = (1-\alpha)\mathrm{L}A_x\ ,\ \ \mathrm{Y_c} = \alpha\,\frac{P_x{}^w}{P_y{}^w}\,\mathrm{L}A_x \tag{19}$$

Next let us analyze the case when the opposite of (15) is true:

$$\left(\frac{A_x}{A_y} - \ \delta_{\mathrm{xy}} A_x \alpha L\right) P_x{}^w < P_y{}^w \tag{20}$$

The country will specialize in Y in this case:

$$\mathrm{X_p}' = 0, \mathrm{Y_p}' = \mathrm{L}A_y \tag{21}$$

The same method as (17 - 18) applies:

$$\mathrm{X_c}' = (1-\alpha)\,\frac{P_y{}^w}{P_x{}^w}\,\mathrm{L}A_y\ ,\ \ \mathrm{Y_c}' = \alpha \mathrm{L}A_y \tag{22}$$

The complete specialization production and consumption are exactly the same as the case where this negative effect does not exist. This is expected as the gains from trade in my settings are more like avoiding cost from Autarky.

The last thing before the welfare gains from opening up to trade is try to check whether the price signal indicated in (15) and (20), from which firms decide which good to produce under free trade, will give the correct instruction for specialization, i.e. maximize total utility for consumers.

If the country has the signal (15), $\left(\frac{A_x}{A_y} - \ \delta_{\mathrm{xy}} \alpha L\right) P_x{}^w > P_y{}^w$, then the country will specialize in X. The utility of specializing in X is (substitute (19) into the Cobb-Douglas utility):

$$U_x{}^{FT} = ((1-\alpha)\mathrm{L}A_x)^{(1-\alpha)} \left(\alpha \frac{P_x{}^w}{P_y{}^w} \mathrm{L}A_x\right)^{\alpha} \tag{23}$$

The utility of specializing in Y is, using (22):

$$U_y{}^{FT} = \left((1-\alpha) \frac{P_y{}^w}{P_x{}^w} \mathrm{L}A_y \right)^{(1-\alpha)} \left(\alpha \mathrm{L}A_y\right)^{\alpha} \tag{24}$$

The ratio of utilities from specializing in X and specializing in Y, using (23 - 24), is the equality (25):

$$\frac{U_x{}^{FT}}{U_y{}^{FT}} = \frac{((1-\alpha)\mathrm{L}A_x)^{(1-\alpha)} \left(\alpha \frac{P_x{}^w}{P_y{}^w} \mathrm{L}A_x\right)^{\alpha}}{\left((1-\alpha) \frac{P_y{}^w}{P_x{}^w} \mathrm{L}A_y \right)^{(1-\alpha)} \left(\alpha \mathrm{L}A_y\right)^{\alpha}}$$

$$= \left(\frac{A_x}{\frac{P_y{}^w}{P_x{}^w} A_y} \right)^{1-\alpha} \left(\frac{\frac{P_x{}^w}{P_y{}^w} A_x}{A_y} \right)^{\alpha}$$

$$= \frac{P_x{}^w}{P_y{}^w} \frac{A_x}{A_y} \tag{25}$$

Then, by (15)

$$\frac{U_x{}^{FT}}{U_y{}^{FT}} > \frac{1}{\frac{A_x}{A_y} - \delta_{\mathrm{xy}} A_x \alpha L} \frac{A_x}{A_y}$$

$$= \frac{1}{1 - A_y \delta_{\mathrm{xy}} \alpha L} > 1$$

If the consumer welfare is used as the criterion, then specializing in X whenever signal (15) true is the optimal strategy for the economy.

Now, let us consider the case when firms face signal (20) and then specialize in Y. The utility ratio (25) is here again:

$$\frac{U_x{}^{FT}}{U_y{}^{FT}} = \frac{P_x{}^w}{P_y{}^w} \frac{A_x}{A_y} \tag{26}$$

$$< \frac{1}{\frac{A_x}{A_y} - \delta_{\mathrm{xy}} A_x \alpha L} \frac{A_x}{A_y} \text{ (by (20))}$$

$$= \frac{1}{1 - A_y \delta_{xy} \alpha L}$$

Since $\frac{1}{1 - A_y \delta_{xy} \alpha L} > 1$, there is no guarantee, in this case, that the ratio is smaller than 1. What that means is that it is possible that, if the country sees signal (20) and specializes in Y, the signal is misleading, i.e. the country can gain more if it specializes in X.

I propose that there is a better signal for the country to take as a reference if A_x and A_y are measurable. Then, if the country can estimate them precisely, the new signal will be:

$$P_x{}^w A_x > P_y{}^w A_y, \text{ then specialize in X} \tag{27}$$

$$P_x{}^w A_x < P_y{}^w A_y, \text{ then specialize in Y} \tag{28}$$

These signals are really accurate in determining how the country should specialize if A_x and A_y can be measured precisely. The only difficulty here is to estimate A_x, which is the productivity of X without having the negative effect from Y, unlike A_y which can be directly observed in Autarky $\left(\frac{w}{P_y} = A_y\right)$. However, if δ_{xy} can be estimated using regression analysis, then using $\frac{w}{P_x} = A_x\left(1 - \delta_{xy} Y_p\right)$ in Autarky after plugging in things, the country can also get a rough estimate of A_x. Then it is suggested that the firms respond to signal (27-28) instead of (15) and (20) in this case to decide what should they specialize in. This signal is more accurate.

However, if signals (15) and (20) are followed by firms, then even in free trade, there is inefficiency induced in some cases where the country specializes in Y. This inefficiency is in the sense that the country would have earned higher welfare if it had specialized in X but it specializes in Y based on the wrong signal. This inefficiency can be eliminated if an omniscient social planner directs economic activity instead of markets.

IV. Gains from Trade through Elimination of the Cross-Sector Effect

In this section I want to prove there are gains from trade when the country moves from Autarky to Free Trade, separating into two cases when (27) or (28) is true. I separate these two cases here is because there are no longer symmetric production functions. Let us first take the real wage perspective. After observing signal (27), the country specializes in X, from (18):

$$\frac{w}{{P_x}^w} = A_x \tag{29}$$

Compared with (8) where $\frac{w}{P_x} = A_x(1-\delta_{xy}Y_p)$, since $1-\delta_{xy}Y_p < 1$, there is clear gain from trade in the real wage of people in the X industry when the country specializes in X.

This is something new here in my model. When open up to trade, people in Home will gain from trade in terms of X, that is, in terms of their export good. When $\delta_{xy} = 0$, we are in the classic Ricardian model, where free trade is not strictly preferred in terms of the export good. When there is bigger δ_{xy}, the country gains more by opening up to trade because it is worse off in Autarky.

For people in the Y industry, in FT where the country is specializing in X, the real wage in terms of Y is, by (29):

$$\frac{w}{{P_y}^w} = A_x \frac{{P_x}^w}{{P_y}^w} \tag{30}$$

By (8) and (27):

$$\left(\frac{w}{{p_y}^w}\right)^{FT} \Big/ \left(\frac{w}{p_y}\right)^{Autarky} = \left(A_x \frac{{P_x}^w}{{P_y}^w}\right) \Big/ A_y$$

$$= \frac{{P_x}^w}{{P_y}^w}\frac{A_x}{A_y} \quad > \ 1 \tag{31}$$

This gain from trade is expected because opening up to trade will let Home buy more Y at a lower price.

I also want to consider the welfare (utility) gains from trade. When in Autarky, substitute equation (12) into the Cobb-Douglas utility function:

$$U^{Autarky} = \left((1-\alpha)\left(1-\delta_{xy}\alpha A_y L\right)A_x L\right)^{1-\alpha}\left(\alpha A_y L\right)^{\alpha} \tag{32}$$

By (23), which gives the utility when the country specializes in X, by (27):

$$\frac{U^{Autarky}}{U_x{}^{FT}} = \frac{\left((1-\alpha)\left(1-\delta_{xy}\alpha A_y L\right)A_x L\right)^{1-\alpha}\left(\alpha A_y L\right)^{\alpha}}{\left((1-\alpha)LA_x\right)^{(1-\alpha)}\left(\alpha \frac{P_x{}^w}{P_y{}^w}LA_x\right)^{\alpha}}$$

$$= \frac{\left(1-\delta_{xy}\alpha A_y L\right)^{1-\alpha}\left(A_y\right)^{\alpha}}{\left(\frac{P_x{}^w}{P_y{}^w}A_x\right)^{\alpha}} \tag{33}$$

$$< \left(1-\delta_{xy}\alpha A_y L\right)^{1-\alpha} < 1$$

This proves that there is gain from trade in utility terms for the country specializing in X when open to trade. What is more, when δ_{xy} gets bigger, the upper bound in (33) will approach 0. This means the gain from trade in utility will be larger if there are larger negative effects.

What is more, if firms observe the signal (15), the imperfect one, instead of (27), they will specialize in X without the misleading signal issue, which is proved in (25) and discussed after (25). The imperfect signal can actually be interpreted as a weaker signal. However, the weaker signal is still sufficient for specializing in X, which is more beneficial compared with specializing in Y. I know that the signal will give me $\frac{P_y{}^w}{P_x{}^w} < \left(\frac{A_x}{A_y} - \delta_{xy}A_x\alpha L\right)$.

By (33):

$$\frac{U^{Autarky}}{U_x{}^{FT}} = \frac{\left(1-\delta_{xy}\alpha A_y L\right)^{1-\alpha}\left(A_y\right)^{\alpha}}{\left(\frac{P_x{}^w}{P_y{}^w}A_x\right)^{\alpha}}$$

$$= \left(1 - \delta_{xy}\alpha A_y L\right)^{1-\alpha} \left(\frac{A_y}{A_x}\frac{{P_y}^w}{{P_x}^w}\right)^{\alpha}$$

$$< \left(1 - \delta_{xy}\alpha A_y L\right)^{1-\alpha} \left(\left(\frac{A_x}{A_y} - \delta_{xy} A_x \alpha L\right)\frac{A_y}{A_x}\right)^{\alpha}$$

$$= \left(1 - \delta_{xy}\alpha A_y L\right)^{1-\alpha} \left(1 - \delta_{xy}\alpha A_y L\right)^{\alpha}$$

$$= 1$$

This indicates that even the imperfect signal (15) will lead to the gains from trade when moving from Autarky to Free Trade.

However, in other cases when the country receives signal (28) and specializes in Y, I also want to make sure the country can gain from trade in this scenario. When the country completely specializes in Y when (28) is true, by the same argument as (18), since all incomes are paid to labor by the competitive market structure:

$$wL = {P_y}^w L A_y \tag{34}$$

Then the real wage in terms of Y is:

$$\frac{w}{{P_y}^w} = A_y \tag{35}$$

This makes the real wage in terms of Y the same as in Autarky, by equation (8). This is also true because the Y industry is not affected by the production of the X industry. In this competitive environment, firms operating in the Y industry will not care about output of X. Thus, opening up to trade will not induce any gain for the real wage in Y if the country specializes in Y. This result is accordant to what I have in classic Ricardian model.

For the real wage in terms of X, by (35), (28), and (8):

$$\frac{w}{{P_x}^w} = A_y \frac{{P_y}^w}{{P_x}^w}$$

$$> A_x$$

$$> A_x\left(1-\delta_{xy}Y_p\right)$$

$$= \left(\frac{w}{P_x}\right)^{Autarky} \tag{36}$$

So, there are gains from trade in the real wage in terms of X when open up to trade. This gain is larger when there is bigger δ_{xy}. The gain is positive even if the negative effect $\delta_{xy} = 0$, which is just the typical Ricardian gain. It can be concluded that this real wage gain from trade comes from two channels. The first channel is to enjoy a low price of X when the country opens up to trade and only produces Y, as it generally has in the classic Ricardian Model. The second channel is to eliminate the negative effect when specializing in Y and producing no X.

Finally, let us take a look at the welfare change when the country opens up to trade and the country is specializing in Y. Using (24) and (28):

$$\frac{U^{Autarky}}{{U_y}^{FT}} = \frac{\left((1-\alpha)\left(1-\delta_{xy}\alpha A_y L\right)A_x L\right)^{1-\alpha}\left(\alpha A_y L\right)^{\alpha}}{\left((1-\alpha)\frac{{P_y}^w}{{P_x}^w}LA_y\right)^{(1-\alpha)}\left(\alpha L A_y\right)^{\alpha}}$$

$$= \left(\frac{\left(1-\delta_{xy}\alpha A_y L\right)A_x}{\frac{{P_y}^w}{{P_x}^w}A_y}\right)^{1-\alpha}$$

$$= \left(\frac{{P_x}^w}{{P_y}^w}\frac{A_x}{A_y}\right)^{1-\alpha}\left(1-\delta_{xy}\alpha A_y L\right)^{1-\alpha} < 1 \tag{37}$$

since $\frac{{P_x}^w}{{P_y}^w}\frac{A_x}{A_y} < 1$ by (28) and $\left(1-\delta_{xy}\alpha A_y L\right) < 1$. This proves that there is gain from trade in utility terms for a country specializing in Y when open to trade. As usual, if δ_{xy}, the negative effect, gets larger, then $\frac{U^{Autarky}}{{U_x}^{FT}}$ will converge to 0, which means the gain from trade will be bigger. This is consistent with my findings throughout the paper.

Note that, even under the misleading signal, signal (20), $\frac{P_x{}^w}{P_y{}^w} < \frac{1}{\frac{A_x}{A_y} - \delta_{xy} A_x \alpha L}$, there is still gain from trade. The signal is misleading in the sense that under some conditions, when open to trade, specializing in X will be a better option compared with specializing in Y, even though the signal (20) indicates the country should specialize in Y. Using the "weaker signal" terminology, it means in this case that the weaker signal for Y is not sufficient for specializing in Y. But I still need to see whether specializing in Y is better compared with Autarky under signal (20). By (37) and (20):

$$\frac{U^{Autarky}}{U_y{}^{FT}} = \left(\frac{P_x{}^w}{P_y{}^w}\frac{A_x}{A_y}\right)^{1-\alpha} \left(1 - \delta_{xy}\alpha A_y L\right)^{1-\alpha}$$

$$< \left(\frac{1}{\frac{A_x}{A_y} - \delta_{xy} A_x \alpha L} \frac{A_x}{A_y} \left(1 - \delta_{xy}\alpha A_y L\right)\right)^{1-\alpha}$$

$$= \left(\frac{\frac{A_x}{A_y}\left(1 - \delta_{xy}\alpha A_y L\right)}{\frac{A_x}{A_y} - \delta_{xy} A_x \alpha L}\right)^{1-\alpha}$$

$$= \left(\frac{1-\delta_{xy}\alpha L\ A_y}{1-\delta_{xy}\alpha L\ \ A_y}\right)^{1-\alpha} = 1$$

So even if firms see the weaker signal (20) and specialize in the wrong good Y, the country still has gain from trade when it opens up. That establishes the robustness of gain even if firms follow the distorted market signal.

V. Gains from Trade for a Social Planner Treating Negative Effects as Endogenous

Now, let us consider the case, instead of having firms taking the negative effect as an externality, there is a social planner that controls both industries and its objective is to maximize total utility. The result in Free Trade will be the same: the social planner will determine which industry the country should specialize in based on which of the signals it observes in (27) and (28). The only difference is in Autarky. The social planner's objective function that it wants to maximize is:

$$\max_{X,Y} X^{1-\alpha} Y^{\alpha}, \quad \text{s.t. } X, Y \geq 0 \tag{38}$$

The production function is still (1) and (2).

Since the equilibrium result in (12) is always achievable if the social planner is willing to and the social planner is maximizing utility, thus, the utility in social planner case will always be better than the case where firms can only operate in one industry and treat negative effects as externality. Also, the full specialization case for a small country in Free Trade will achieve full efficiency because full specialization will make the negative effect no longer influence the outcome. Then, for the small open economy, the relationship below holds:

$$U_{ex}{}^{Autarky} < U_{sp}{}^{Autarky} < U_{ex}{}^{FT} \leq U_{sp}{}^{FT} \tag{39}$$

Here "ex" represents the case when firms producing X treat the negative effect as an externality and "sp" represents social planner. The inequalities rephrase and give a good summary of the welfare analysis. The utility of treating Y as an externality in Autarky is the lowest because firms produce too much Y, as the Y output in (12) will not shrink due to the existence of this negative effect. The utility of the social planner in Autarky is the second lowest because, although the social planner tries its best to achieve maximal utility, the social inefficiency cost of producing Y will still make utility not as good as can be achieved under free trade and specialization. The utility of ex and sp are basically the same when the country uses the accurate signal (27 - 28). But if the country directly uses (15) (20) and specializes in Y, it is possible that the it has the misleading signal condition which the social planner can avoid. The Free Trade utilities are the highest because it avoids the inefficiency it had in Autarky by opening up to trade and fully specializing.

If I interpret the case where entities need to consider both industries as government planning and interpret the case of competitive firms as a complete market economy, no countries are really completely fall into one category instead of the other. Every country in the world now has government interventions and no country's economy is completely planned for all industries by the government. If I denote $\beta \in [0, 1]$ as the coefficient that describes the degree of the market economy, then each country can be represented by an expression, $\beta \cdot$ market economy + $(1-\beta) \cdot$ government planning. Because it is proved that there are gains from trade in both government planning and competitive firm cases, I can conclude that there are gains from trade, for almost every country regardless of market structure, existing whenever there is one industry having negative effects on the other in the country. I can even further conclude that, with higher degree of competitive market structure, this gain from opening up to trade becomes even more significant since I proved that gain from trade in the competitive case is larger.

VI. Conclusion

It can be seen from the above discussion that in general, there are gains from trade from elimination of a negative cross-sectoral effect whatever the market structure. Although the derivation is not extremely complicated, it adds a new channel of gain from trade to our classic notions. Intuitively, it is true as always that Home country is better off if it can stop producing the good that it is comparatively not good at producing. This will also stop imposing a negative effect on the good Home is good at, and thus, this allows Home to produce more of this good. What is more, when Home let the other country produce less of the good at which they are relatively less productive by selling them ours, this will enhance their efficiency for producing the good Home needs. This will further reduce the world price of our imported good. This will also benefit Home. From a welfare perspective, the social costs of these negative effects are no longer there if countries move to complete specialization with Free Trade. The theoretical derivation and intuition seem clear. However, the empirical evidence of this source of gain from trade still needs justification. Does the gain really exist in data? What is the size of this gain? These are all questions that call for our attention.