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THE GAINS FROM INTERNATIONAL FACTOR
MOVEMENTS

by

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THE GAINS FROM INTERNATIONAL FACTOR MOVEMENTS

A B S T R A C T

In this paper I study the welfare gains from free international movement of factors in the presence of free and restricted trade in goods. In moving from an equilibrium with free trade in goods and no factor movements to one with free trade in both goods and factors, a sufficient condition for welfare improvement is that the Paasche index of terms of trade does not decline. Some movement of factors is not necessarily better than none, in the sense that a prohibitive tax on factor trade may be second-best optimal when a government is constrained to follow a free-trade-in-goods policy.

When goods trade is restricted, the introduction of free factor movements is welfare improving if the sum of the terms-of-trade effect and the volume-of-trade effect is non-negative. The maintenance of optimal tariffs and export subsidies on goods in the cum-factor-movements equilibrium is not sufficient to ensure gains from factor trade.

I. INTRODUCTION

Ever since the pioneering articles by Samuelson (1939, 1962) and Kemp (1962), the theorems on the gains from trade have served as a cornerstone of international trade theory. It is by now well known that under competitive conditions, the free trade equilibrium can be no worse for each and every country than autarchy.¹ Furthermore, Ohyama (1972) and others have made precise the statement that "some trade is better than no trade," by deriving conditions sufficient to guarantee the welfare superiority of restricted trade relative to autarchy. By comparison, relatively little has been written on the welfare effects of free or restricted movements of the primary factors of production across international boundaries.²

In one sense, such an extension is trivial. Since "factors" or inputs, appropriately defined, are isomorphic in microeconomic theory to "goods" or outputs, a mere reinterpretation of the standard theorems is all that is needed to conclude that "some" or free trade in goods and factors must be superior to complete autarchy. In this paper, I shall be concerned with a slightly different type of question, namely: are there additional gains from the introduction of free or restricted trade in factors, once free or restricted trade in goods alone is already established? It will be shown that such gains cannot necessarily be guaranteed, for reasons familiar from the theory of the second best. The introduction of factor movements may cause the terms of trade in the international goods markets to turn against a country to an extent that more than offsets (from its point of view) the direct efficiency gain from the relocation of the factors. Surprisingly, and in contrast to some results in the literature on immiserizing growth, the

potential for welfare-worsening factor movements cannot be eliminated by the maintenance of optimal tariffs on goods trade in the cum-factor-movement equilibrium.

The paper is organized as follows. In the next section, I derive and interpret a condition that is sufficient to ensure gains from the opening of factor trade, starting from an initial equilibrium with free trade in goods. In Section III, I investigate whether or not some factor trade in conjunction with free goods trade, is better than none. The analysis of Section II is repeated in Section IV for the case where trade in goods is initially and ultimately restricted by trade taxes and subsidies. Here I consider as well the possibility that these restrictions are set optimally. Finally, in Section V, I offer some concluding remarks.

II. THE GAINS FROM FACTOR MOVEMENTS WITH FREE TRADE IN GOODS

I consider, for simplicity, an economy with one consumer and fixed factor supplies.³ The economy produces a vector of goods $Y = \{Y_1, \dots, Y_n\}$ with the primary factors $V = \{V_1, \dots, V_m\}$ subject to a production technology that is convex. The consumption vector, $C = \{C_1, \dots, C_n\}$ is chosen to maximize a strictly quasi-concave utility function. All markets are assumed to be perfectly competitive.

In the free-trade, no-factor movement equilibrium, denoted by a superscript "0", a vector M^0 of goods is imported (negative elements indicate exports) by the home country at prices P^0 which clear the

international markets. The superscript "1" denotes variables in the free-trade, free-factor-movement equilibrium. In this equilibrium, in addition to goods imports of M^1 , the home country imports a vector of primary factors $F^1 = \{F_1^1, \dots, F_k^1\}$ (where negative elements again indicate exports), at factor prices $W = \{W_1^1, \dots, W_k^1\}$. Note that the set of tradeable factors may or may not include all the primary factors used in production.

Define the expenditure function $E(P, U)$ as the minimum expenditure at prices P required to achieve utility level U . Then

$$E(P^1, U^1) = P^1 \cdot C^1 \quad (1)$$

$$= P^1 \cdot Y^1 - W^1 \cdot F^1 \quad (2)$$

$$\geq P^1 \cdot Y^0 \quad (3)$$

$$= (P^1 - P^0) \cdot Y^0 + P^0 \cdot Y^0 \quad (4)$$

$$= (P^1 - P^0) \cdot Y^0 + P^0 \cdot C^0 \quad (5)$$

$$= (P^0 - P^1) \cdot M^0 + P^1 \cdot C^0 \quad (6)$$

$$\geq E(P^1, U^0) + (P^0 - P^1) \cdot M^0 \quad (7)$$

The key steps are (3) and (7). The former follows from the fact that the competitive maximizes national product (the value of domestic output less net factor payments abroad) at domestic prices. Thus, at prices P^1 , the outputs Y^1 and factor imports F^1 must yield higher national product than any alternative, such as, for example, Y^0 and $F^0 (\equiv 0)$. The inequality in (7) uses the definition of the expenditure function. Equations (2) and (5) are the income-expenditure equalities in situations "1" and "0" respectively, and the other steps are simple manipulations.

Rewrite (7) as

$$E(P^1, U^1) - E(P^1, U^0) \geq (P^0 - P^1) \cdot M^0 \quad (8)$$

Now, since expenditure is increasing in utility, the following proposition is proved.

Proposition 1: If the condition $(P^0 - P^1) \cdot M^0 \geq 0$ is satisfied, then

free trade in goods and factors is no worse than free trade in goods and no factor trade.

In other words, for there to be gains from factor movements relative to a free-trade-in-goods equilibrium, it is sufficient that the terms of trade (defined in the Paasche sense) not deteriorate after the factor trade is introduced.

Two corollaries are immediate. First, for a small, price-taking country, $P^0 = P^1$, so that

Corollary: A price-taking country cannot be harmed by the introduction of free factor movements, from an initial situation of free trade in goods.

Second, since in a two-country world, one country's imports are the other's exports, the terms of trade must improve for one of the two countries. Hence,

Corollary: In a two-country world in which each initially follows a free-trade-in-goods policy, at most one country can be harmed by the introduction of free factor trade.

How is it that the introduction of free factor mobility can be harmful to a country, given that it improves the efficiency of world production? An example will illustrate the point. Consider a specific-factors model in which the home country has an abundance of the factor specific to the production of good 1, and therefore exports that good in the free-trade equilibrium. It is nonetheless possible for the return to this specific factor to be higher in the home country than abroad, if, for example, the home country has a technological advantage in the production of good 1. When free movement of this factor is introduced, it will flow into the home country and generate a surplus there equal to the area under the marginal product curve between the equilibrium rates of return. This surplus is an addition to home welfare. However, world output of good 1 is likely to increase, and if world demand for this good is inelastic, its price might fall precipitously. Then the home country's earnings on its initial quantity of exports would decline, and the net effect on home country welfare would be ambiguous.

III. IS SOME FACTOR MOVEMENT BETTER THAN NONE?

In the preceding section, I compared free factor mobility with no factor mobility, each in the presence of free trade in goods. One might ask, instead, whether there is necessarily some level of factor trade which is better than none. Put differently, if factor movements can be restricted or encouraged by taxes and subsidies, is it possible that a second-best optimum (i.e., in the absence of taxes or subsidies on goods trade) would require prohibitive taxes? I will use the special case of a model with two goods and one potentially mobile factor to show that the answer is affirmative.⁴

Let $E(p,U)$ be the home country's expenditure function defined over the two goods, with good 1 as numeraire, and p the (relative) price of good 2. Define the home country's revenue or domestic product function $R(p,V,F)$, which is the maximal gross value of all goods produced in the home country, given the level of net factor imports F . The analogous functions that apply to the foreign country are $E^*(p,U^*)$ and $R^*(p,V^*,F^*)$, where $F^* \equiv -F$. Assume that $R_F > R_{F^*}^*$ at $F = F^* = 0$. Consider first the welfare effect of a potential inflow of the mobile factor into the home country. Let $t \geq 0$ be the rate of specific taxation on imports of this factor. Our strategy will be to show that, for certain parameter values, a small reduction of t from the particular rate which is just prohibitive leaves domestic utility unchanged,

and that further reductions cause home welfare to decline. It will then be necessary to show that, under these same parameter values, a subsidy to encourage exports of this factor is welfare worsening as well.

International equilibrium is characterized by four equations, two that equate income with expenditure in each country, one that specifies the clearing of the market for good 2, and one that equates the two countries' after-tax rates of return to the mobile factor. Thus

$$E(p, U) = R(p, V, F) - [R_F(p, V, F) - t]F \quad (9)$$

$$E^*(p, U^*) = R^*(p, V^*, F^*) + [R_F(p, V, F) - t]F \quad (10)$$

$$E_p(p, U) + E_p^*(p, U^*) = R_p(p, V, F) + R_p^*(p, V^*, F^*) \quad (11)$$

$$R_F(p, V, F) - t = R_{F^*}^*(p, V^*, F^*) \quad (12)$$

After total differentiation of (9) through (12), and some tedious algebra, relegated to the appendix, the following expression for the derivative of domestic utility with respect to the factor-import tax rate is obtained:

$$\frac{dU}{dt} = \frac{t}{D(R_{FF} + R_{F*F*}^*)} \left\{ S + m \left[\frac{E_{pU*}^*}{E_{U*}^*} - \frac{R_{pF} - R_{pF*}^*}{t} \right] + \right. \quad (13)$$

$$\left. F \left[\frac{SR_{FF}}{t} + \frac{E_{pU*}^* R_{pF*}^*}{E_{U*}^*} + \frac{R_{pF*}^* - R_{pF}}{t} R_{pF*}^* \right] \right\}$$

Here, $D < 0$ is necessary for stability. (D is defined in the appendix),
 $S \equiv E_{pp} + E_{pp}^* - R_{pp} - R_{pp}^* < 0$ is the world substitution matrix,
 and m is the home country's import of good 2.

Suppose now that

$$S + m \left[\frac{E_{pU*}^*}{E_{U*}^*} - \frac{R_{pF} - R_{pF*}^*}{t} \right] = 0$$

Then $dU/dt = 0$ at the point where t is just prohibitive; i.e.,
 $t = R_F(p, V, 0) - R_{F*}^*(p, V^*, 0)$. If, in addition, the term in the second
 square bracket is positive,⁵ then (13) is positive for $F > 0$, which
 implies that non-infinitesimal reductions in t reduce home welfare.

Consider the alternative possibility open to the home country of
 subsidizing exports of the mobile factor. For $F \leq 0$, the equilibrium
 conditions (9), (10) and (12) are replaced by:

$$E(p, U) = R(p, V, F) + R_{F*}^*(p, V^*, F^*)F^* \quad (9')$$

$$E^*(p, U^*) = R^*(p, V^*, F^*) - R_{F*}^*(p, v^*, F^*)F^* \quad (10')$$

$$R_F(p, V, F) = R_{F*}^*(p, V^*, F^*) + \sigma \quad (12')$$

where σ is the specific rate of subsidy to exports of the mobile factor.
Again we can compute

$$\begin{aligned} \frac{dU}{d\sigma} = & \frac{\sigma}{D'(R_{FF} + R_{F*F*}^*)} \left\{ S + m \left[\frac{E_{pU*}^*}{E_{U*}^*} - \frac{R_{pF} - R_{pF*}^*}{\sigma} \right] + \right. \\ & \left. + F^* \left[\frac{SR_{F*F*}^*}{\sigma} + \frac{E_{pU*}^* R_{pF*}^*}{E_{U*}^*} + \frac{(R_{pF*}^* - R_{pF}) R_{pF*}^*}{\sigma} \right] \right\} \quad (14) \end{aligned}$$

This expression is zero at $F = 0$ for the same parameter values that make $dU/dt = 0$ at $F = 0$, and is negative when the term in the second square bracket is positive. It is possible, therefore, that starting from a policy of prohibitive taxation on factor import and insufficient subsidy to encourage export, any change in the tax or subsidy rate that causes factor trade to occur will lower welfare. We conclude that the prohibition of factor movements may be a second-best optimal policy in the presence of free trade in goods.

IV. THE GAINS FROM FACTOR MOVEMENTS WITH RESTRICTED GOODS TRADE

The fact that the introduction of factor trade can be welfare worsening if the terms of trade deteriorate sufficiently is reminiscent of the potential for immiserizing growth under these same conditions, as first identified by Bhagwati (1958). Bhagwati (1971) later argued that so long as optimal tariffs are in force after an episode of growth, then the growth cannot be immiserizing. Might it be the case, then, that the availability of unrestricted policy tools to regulate goods trade optimally would preclude the possibility of harmful factor trade? Before turning to this question, let us derive a condition that is sufficient to ensure gains from the introduction of free factor mobility in the presence of restricted trade in goods.

Let T^j be a vector of specific trade taxes or subsidies in situation j , where again $j = 0$ refers to the no-factor-trade equilibrium, and $j = 1$ denotes the equilibrium with free factor trade. Then, $T^j = p^{jd} - p^{jf}$, i.e., the difference between domestic and foreign prices. By reasoning familiar from Section II above, we have:

$$E(p^{1d}, U^1) = p^{1d} \cdot C^1 \quad (15)$$

$$= p^{1d} \cdot Y^1 - W^1 \cdot F^1 + T^1 \cdot M^1 \quad (16)$$

$$\geq p^{1d} \cdot Y^0 + T^1 \cdot M^1 \quad (17)$$

$$= p^{od} \cdot \gamma^0 + (p^{1d} - p^{od}) \cdot \gamma^0 + T^1 \cdot M^1 \quad (18)$$

$$= p^{od} \cdot C^0 - T^0 \cdot M^0 + (p^{1d} - p^{od}) \cdot \gamma^0 + T^1 \cdot M^1 \quad (19)$$

$$= p^{1d} \cdot C^0 + (p^{od} - p^{1d}) \cdot M^0 + T^1 \cdot M^1 - T^0 \cdot M^0 \quad (20)$$

$$\geq E(p^{1d}, U^0) + (p^{od} - p^{1d}) \cdot M^0 + T^1 \cdot M^1 - T^0 \cdot M^0 \quad (21)$$

Rearranging terms and substituting the condition for trade balance in the situation "0" (i.e., $p^{of} \cdot M^0 = 0$), yields

$$E(p^{1d}, U^1) - E(p^{1d}, U^0) \geq (p^{of} - p^{1f}) \cdot M^0 + (p^{1d} - p^{1f}) \cdot (M^1 - M^0) \quad (22)$$

This proves

Proposition 2: If the condition $(p^{of} - p^{1f}) \cdot M^0 + (p^{1d} - p^{1f}) \cdot (M^1 - M^0) \geq 0$ is satisfied, then free trade in factors plus restricted trade in goods is no worse than restricted goods trade and no factor trade.

The condition in Proposition 2 is quite similar in form to the expression derived by Markusen and Melvin (1979), in their study of the welfare effects of a small inflow of capital, starting from an equilibrium without factor trade. By analogy to the phraseology of those authors and Jones (1967), we may refer to the term $(p^{1d} - p^{1f}) \cdot (M^1 - M^0)$ as the "volume of trade effect." It measures the

extent to which the production and consumption distortions associated with the deviation from free trade are exacerbated by the factor movements. Note that a small country with restricted goods trade can be harmed by the introduction of unrestricted factor mobility, if the factor trade on net causes its trade in those goods subject to taxes (subsidies) to fall (rise).⁶

Suppose now that a (large) country can optimally set tariffs and export subsidies on all traded goods. Can it always manipulate these policies to ensure that the condition of Proposition 2 is satisfied? Evidently not, as a simple counterexample will serve to prove.⁷

Consider the standard Heckscher-Ohlin model with two factors, two goods and identical technologies across countries. In the absence of factor trade let the home country implement its optimal tariff, or indeed any tariff which raises welfare above the free trade level. Now allow one or both factors to be traded. As Mundell (1957) has argued, so long as both countries remain incompletely specialized after factor mobility is introduced, any tariff will be prohibitive in the cum-factor-movement equilibrium. Furthermore, free factor mobility in the Heckscher-Ohlin model is a perfect substitute for free goods trade, in the sense that they yield the identical levels of utility and patterns of consumption in each country. Thus, the introduction of free factor movement in the Heckscher-Ohlin model in situations where it does not lead to complete specialization precludes the exercise of monopoly power in goods trade, and must, therefore, cause the level of welfare to be lower than is achieved in an equilibrium with no factor trade and an optimal or

utility-raising tariff on imports. Although the potential for welfare-worsening free factor movements is associated with the deterioration of the terms of trade in the goods markets, the unconstrained availability of trade taxes and subsidies on goods in the cum-factor-movement equilibrium is not sufficient to preclude such immiserization.

V. CONCLUDING REMARKS.

This paper has been concerned with the welfare effects of the introduction of factor mobility in situations where final goods are traded both ex ante and ex post. Emphasis has been placed on comparing the equilibria that occur with and without factor mobility, rather than on evaluating the consequences of an incremental increase in factor trade. The main conclusion is that there is an important asymmetry between the move to free or restricted trade in goods from a situation of autarchy, and that to free or restricted trade in factors, once goods trade is already taking place.

Nothing in the preceding analysis hinges on the fact that factors are inputs rather than outputs. Indeed, this distinction is inconsequential. All of the results of the paper apply as well to situations where new, formerly nontradeable goods are allowed to enter the trading set. Thus, one remarkable implication of the analysis is that, if we imagine a stepwise progression to complete free trade consisting of the addition of new commodities one-by-one to a list of freely-traded goods, then a welfare gain is assured only for the first entry to the list.

F O O T N O T E S

1. For a recent treatment, see Dixit and Norman (1980, pp.71-80). They show that free trade (weakly) Pareto dominates autarchy in a one-consumer economy with perfect competition and variable factor supplies, as well as in a many-consumer economy where lump-sum transfers or commodity taxes are available for redistribution.
2. Most of the existing literature on the welfare effects of factor trade considers only "small" movements of one or more factors, generally from an initial position of no trade in factors. See, for example, Markusen and Melvin (1979), Dixit and Norman (1982, pp.142-149), Brecher and Choudri (1982) and Helpman and Razin (1982). An exception is the recent, interesting paper by Svensson (1982), who studies the equilibrium level of factor trade for two economies that differ in endowments by a "small" amount. To my knowledge, there has been no systematic comparison of the equilibria that result in general with and without factor movements.
3. The extensions to cases of many consumers and variable factor supplies are straightforward, and are accomplished in a manner analogous to the treatment in Dixit and Norman (1980, pp.75-80).
4. Kemp (1966) and Jones (1967) have investigated the sign of the second-best optimal tax on factor trade when goods are traded freely, but neither of these authors asked whether the optimal policy could be prohibitive.
5. For this to be the case, it is sufficient, but not necessary, that m and R_{pF}^* have the same sign.

6. Brecher and Diaz Alejandro (1977) have shown that in a Heckscher-Ohlin world, a small inflow of capital is necessarily welfare worsening for a small, labor abundant country with a positive tariff. However, in the example they study, free movement of capital is necessarily welfare improving for reasons related to Mundell (1957) as will be discussed further below.
7. There is no contradiction here with the propositions of Bhagwati (1971). An application of Bhagwati (1971) would suggest that the introduction of factor trade cannot be immiserizing if optimal policies are followed ex post. But a complete set of optimal policies would include not only taxes on goods trade, but also taxes on factor trade. Of course, the statement that optimally restricted trade in goods and factors is superior to optimally restricted trade in goods alone is vacuous, because a prohibitive tax on factor movements is always an option open to the government in the cum-factor-trade situation.

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APPENDIX : THE DERIVATION OF EQUATION (13)

Differentiating (9) through (12) totally, we obtain:

$$(m + FR_{pF})dp + (FR_{FF} - t)dF + E_U dU = Fdt \quad (A1)$$

$$(-m - FR_{pF})dp - FR_{FF}dF + E_{U^*}^* dU^* = -Fdt \quad (A2)$$

$$S dp + E_{pU} dU + E_{pU^*}^* dU^* = (R_{pF} - R_{pF^*}^*)dF \quad (A3)$$

$$(R_{pF} - R_{pF^*}^*)dp + (R_{FF} + R_{F^*F^*}^*)dF = dt \quad (A4)$$

where $S = E_{pp} + E_{pp}^* - R_{pp} - R_{pp}^*$. Summing (A1) and (A2) gives

$$E_U dU + E_{U^*}^* dU^* = tdF \quad (A5)$$

Solving (A4) and (A5) for dF and dU^* , respectively, and substituting the resulting expressions into (A1) and (A2) yields the following matrix equation:

$$\begin{aligned}
 & \left[\begin{array}{c} S + \frac{t E_{pU}^* (R_{pF}^* - R_{pF})}{E_{U}^* (R_{FF} - R_{F^*F^*}^*)} + \frac{(R_{pF} - R_{pF}^*)^2}{R_{FF} + R_{F^*F^*}^*} \\ m + FR_{pF} + \frac{(FR_{FF} - t)(R_{pF}^* - R_{pF})}{R_{FF} + R_{F^*F^*}^*} \end{array} \right] \begin{array}{c} \frac{E_{pU} - E_{pU}^* E_U}{E_{U}^*} \\ E_U \end{array} \begin{array}{c} dp \\ dU \end{array} = \\
 & \left[\begin{array}{c} \frac{R_{pF} - R_{pF}^*}{R_{FF} + R_{F^*F^*}^*} - \frac{t E_{pU}^*}{E_{U}^* (R_{FF} + R_{F^*F^*}^*)} \\ \frac{FR_{F^*F^*}^* + t}{R_{FF} + R_{F^*F^*}^*} \end{array} \right] dt \quad (A6)
 \end{aligned}$$

Let the determinant of the Jacobian matrix be denoted by D . Then $D < 0$ is necessary for the stability of equilibrium. Now, straightforward application of Cramer's rule to (A6) yields equation (13) in the text.

Equation (14) is derived from equation (9'), (10'), (11) and (12') similarly.