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# INTERNATIONAL TRADE AND FACTOR MOBILITY

By ROBERT A. MUNDELL\*

Commodity movements are at least to some extent a substitute for factor movements. The absence of trade impediments implies *commodity*-price equalization and, even when factors are immobile, a tendency toward *factor*-price equalization. It is equally true that perfect mobility of factors results in *factor*-price equalization and, even when commodity movements cannot take place, in a tendency toward *commodity*-price equalization.

There are two extreme cases between which are to be found the conditions in the real world: there may be perfect factor mobility but no trade, or factor immobility with unrestricted trade. The classical economists generally chose the special case where factors of production were internationally immobile.

This paper will describe some of the effects of relaxing the latter assumption, allowing not only commodity movements but also some degree of factor mobility. Specifically it will show that an increase in trade impediments stimulates factor movements and that an increase in restrictions to factor movements stimulates trade.<sup>1</sup> It will also make more specific an old argument for protection.

## I. *Trade Impediments Stimulate Factor Movements*

Under certain rigorous assumptions the substitution of commodity for factor movements will be complete. In a two-country two-commodity two-factor model, commodity-price equalization is sufficient to ensure factor-price equalization and factor-price equalization is sufficient to ensure commodity-price equalization if: (a) production functions are homogeneous of the first degree (*i.e.*, if marginal productivities, relatively and absolutely, depend only on the proportions in which factors are combined) and are identical in both countries; (b) one

\* The author, a postdoctoral fellow in political economy at the University of Chicago, has benefited considerably from the suggestions and criticisms of M. Corden, M. Friedman, A. Harberger, H. G. Johnson, R. Lipsey, J. E. Meade, S. A. Ozga and T. Rybczynski. Any mistakes that remain are his responsibility.

<sup>1</sup> This proposition is implied in Bertil Ohlin, *Interregional and International Trade* (Cambridge, 1935), Ch. 9; Carl Iversen, *Aspects of the Theory of International Capital Movements* (London, 1935), Ch. 2; and J. E. Meade, *Trade and Welfare* (London, 1955), Ch. 21, 22.

commodity requires a greater proportion of one factor than the other commodity at any factor prices at all points on any production function; and (c) factor endowments are such as to exclude specialization.<sup>2</sup>

These assumptions are not always satisfied in the real world, so a model employing them is somewhat limited. But they do isolate some important influences determining the pattern of international trade and for present purposes will be adhered to. It will become clear later that relaxing them does not seriously affect the conclusions of the paper.

First we shall show that an increase in trade impediments encourages factor movements, and to do this we shall make some rather drastic assumptions regarding mobility. Assume two countries, A and B, two commodities, cotton and steel, and two factors, labor and capital.<sup>3</sup> Country A is well endowed with labor but poorly endowed with capital relative to country B; cotton is labor-intensive relative to steel. For expositional convenience we shall use commodity indifference curves.

For the moment we shall assume that country B is the rest of the world and that country A is so small in relation to B that its production conditions and factor endowments can have no effect on prices in B.<sup>4</sup>

Let us begin with a situation where factors are immobile between A and B but where impediments to trade are absent. This results in commodity- and factor-price equalization. Country A exports its labor-intensive product, cotton, in exchange for steel. Equilibrium is represented in Figure 1:  $TT$  is A's transformation function (production-possibility curve), production is at  $P$  and consumption is at  $S$ . Country A is exporting  $PR$  of cotton and importing  $RS$  of steel. Her income in terms of steel or cotton is  $OY$ .

Suppose now that some exogenous factor removes all impediments to the movement of capital. Clearly since the marginal product of capital is the same in both A and B no capital movement will take place and equilibrium will remain where it is. But now assume that A imposes a tariff on steel and for simplicity make it prohibitive.<sup>5</sup> Initially the price of steel will rise relative to the price of cotton in A and both production and consumption will move to  $Q$ , the autarky (economic self-

<sup>2</sup> For the necessity of these assumptions and a fairly complete list of references to the literature on factor-price equalization see P. A. Samuelson, "Prices of Factors and Goods in General Equilibrium," *Rev. Econ. Stud.*, 1953-54, XXI (1), 1-21.

<sup>3</sup> Capital is here considered a physical, homogeneous factor which does not create any balance-of-payments problems when it moves internationally. It is further assumed that capitalists qua consuming units do not move with their capital, so national taste patterns are unaltered.

<sup>4</sup> It will become evident in Section II that the terms of trade and factor prices do not change even if A is fairly large.

<sup>5</sup> Actually, under the assumed conditions any tariff is prohibitive, as will eventually become clear.

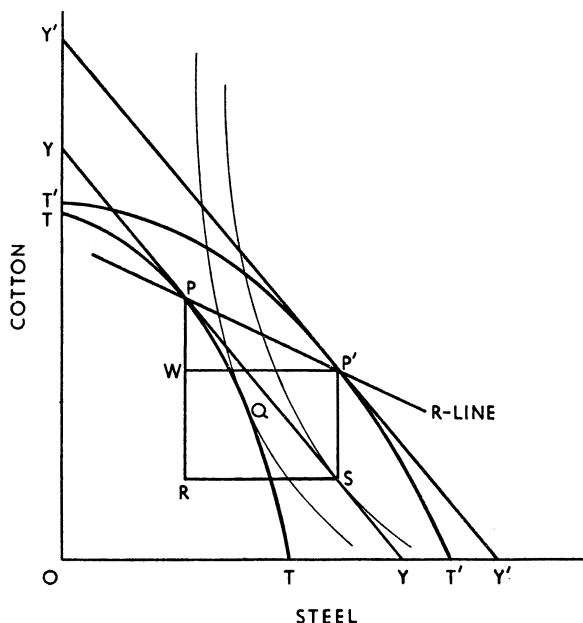


FIGURE 1

sufficiency) point. Factors will move out of the cotton into the steel industry; but since cotton is labor-intensive and steel is capital-intensive, at constant factor prices the production shift creates an excess supply of labor and an excess demand for capital. Consequently the marginal product of labor must fall and the marginal product of capital must rise. This is the familiar Stolper-Samuelson tariff argument.<sup>6</sup>

But since capital is mobile, its higher marginal product in A induces a capital movement into A from B, changing factor endowments so as to make A more capital-abundant. With more capital A's transformation curve expands until a new equilibrium is reached.

Some help in determining where this new equilibrium will be is provided by the box diagram in Figure 2. Country A initially has  $OC$  of capital and  $OL$  of labor;  $OO'$  is the efficiency locus along which marginal products of labor and capital are equalized in steel and cotton. Equilibrium is initially at  $P$  which corresponds to  $P$  on the production block in Figure 1. Factor proportions in steel and cotton are given by the slopes of  $OP$  and  $O'P$  respectively.

After the tariff is imposed production moves along the efficiency locus to  $Q$ , corresponding to the autarky point  $Q$  in Figure 1. The

<sup>6</sup> Cf. W. F. Stolper and P. A. Samuelson, "Protection and Real Wages," *Rev. Econ. Stud.*, Nov. 1941, IX, 58-73.



ratio; that this is so has been recently proved by Rybczynski.<sup>7</sup>

Since the same price ratio as at  $P$  will prevail, the locus of all tangents to larger and larger production blocks based on larger and larger endowments of capital must have a negative slope. Such a line, which I shall call the  $R$ -line, is drawn in Figure 1.

Capital will flow in until its marginal product is equalized in A and B, which will be at the point where A can produce enough steel and cotton for consumption equilibrium at  $S$  without trade, and at the same time make the required interest payment abroad. This point is clearly reached at  $P'$  directly above  $S$ . At any point along the  $R$ -line to the northwest of  $P'$ , country A would have to import steel in order to consume at  $S$ —i.e., demand conditions in A cannot be satisfied to the northwest of  $P'$ . At  $P'$  demand conditions in A are satisfied and the interest payment can be made abroad at the same price ratio as before the tariff was levied. Thus the capital movement need not continue past this point, although any point to the southeast of  $P'$  would be consistent with equilibrium.

Production takes place in A at  $P'$ , consumption is at  $S$  and the transfer of interest payments is the excess of production over consumption in A,  $SP'$  of cotton.<sup>8</sup> The value of A's production has increased from  $OY$  to  $OY'$  in terms of steel, but  $YY'$  (which equals in value  $SP'$  of cotton) must be transferred abroad, so income is unchanged.

We initially assumed a prohibitive tariff; in fact even the smallest tariff is prohibitive in this model. A small tariff would not prohibit trade immediately: because of the price change some capital would move in and some trade would take place. But as long as trade continues there must be a difference in prices in A and B equal to the ad valorem rate of tariff—hence a difference in marginal products—so capital imports must continue. Marginal products and prices can only be equalized in A and B when A's imports cease.

The tariff is now no longer necessary! Since marginal products and prices are again equalized the tariff can be removed without reversing the capital movement. The tariff has eliminated trade, but after the capital movement there is no longer any need for trade.

<sup>7</sup>T. M. Rybczynski, "Factor Endowment and Relative Commodity Prices," *Economica*, Nov. 1955, XXII, 336-41. The proof can be easily demonstrated in Figure 2. At unchanged prices equilibrium must lie along  $OP$ -extended. With the larger endowment of capital,  $O'P'$  must be shorter than  $OP$ . Since these lines have the same slope and constant returns to scale apply, output of cotton at  $P'$  must be less than at  $P$ . A paper by R. Jones written at the Massachusetts Institute of Technology in the spring of 1955 contained a similar proof.

<sup>8</sup> $SP'$  must equal in value the marginal product of the capital inflow at constant prices. In Figure 1,  $PP'$  is the change in output associated with the increase in capital; steel output increases by  $RS$  but cotton output decreases by  $PW$ . The marginal product of the capital inflow is the value of  $RS$  minus the value of  $PW$  which, in terms of cotton, is  $P'S$ .

This is not really such a surprising result when we refer back to the assumptions. Before the tariff was imposed we assumed both unimpeded trade and perfect capital mobility. We have then two assumptions each of which is sufficient for the equalization of commodity and factor prices. The effect of the tariff is simply to eliminate one of these assumptions—unimpeded trade; the other is still operative.

However, one qualification must be made. If impediments to trade exist in both countries (tariffs in both countries or transport costs on both goods) and it is assumed that capital-owners do not move with their capital, the interest payments on foreign-owned capital will be subject to these impediments; this will prevent complete equalization of factor and commodity prices. (This question could have been avoided had we allowed the capitalist to consume his returns in the country where his capital was invested.) The proposition that capital mobility is a perfect substitute for trade still stands, however, if one is willing to accept the qualification as an imperfection to capital mobility.

## II. *Effect of Relative Sizes of the Two Countries*

The previous section assumed that country A was very small in relation to country B. It turns out however, that the relative sizes of the two countries make no difference in the model, provided that complete specialization does not result.

Suppose as before that country A is exporting cotton in exchange for steel. There are no impediments to trade and capital is mobile. But we no longer assume that A is small relative to B. Now A imposes a tariff on steel raising the internal price of steel in relation to cotton, shifting resources out of cotton into steel, raising the marginal product of capital and lowering the marginal product of labor. A's demand for imports and her supply of exports fall. This decline in demand for B's steel exports and supply of B's cotton imports raises the price of cotton relative to steel in B; labor and capital in B shift out of steel into cotton raising the marginal product of labor and lowering the marginal product of capital in B. Relative factor returns in A and B move in opposite directions, so the price changes in A which stimulate a capital movement are reinforced by the price changes in B. The marginal product of capital rises in A and falls in B; capital moves from B to A, contracting B's and expanding A's production block.

The assumption that capital is perfectly mobile means that factor and commodity prices must be equalized after the tariff. It is necessary now to show that they also will be unchanged. The price of cotton relative to steel is determined by world demand and supply curves. To



prove that prices remain unchanged it is sufficient to show that these demand and supply curves are unchanged—or, that at the pretariff price ratio demand equals supply after the capital movement has taken place. But we know that at the old price ratio marginal products, hence incomes, are unchanged—thus demand is unchanged. All that remains then is to show that at constant prices production changes in one country cancel out production changes in the other country.

This proposition can be proved in the following way: If commodity and factor prices are to be unchanged after the capital movement has taken place then factor proportions in each industry must be the same as before; then the increment to the capital stock used in A will, at constant prices, increase the output of steel and decrease the output of cotton in A, and the decrement to the capital stock in B will decrease the output of steel and increase the output of cotton in B. But the increase in A's capital is equal to the decrease in B's capital, and since production expands at constant prices and with the same factor proportions in each country, the increase in resources used in producing steel in A must be exactly equal to the decrease in resources devoted to the production of steel in B. Similarly, the decrease in resources used in producing cotton in A is the same as the increase in resources devoted to cotton production in B. Then, since production functions are linear and homogeneous, the equal changes in resources applied to each industry (in opposite directions) imply equal changes in output. Therefore, the increase in steel output in A is equal to the decrease in steel output in B, and the decrease in cotton output in A is equal to the increase in cotton output in B—*i.e.*, world production is not changed, at constant prices, by a movement of capital from one country to another. In the world we are considering it makes no difference in which country a commodity is produced if commodity prices are equalized.

This proposition can perhaps be made clearer by a geometrical proof. In Figure 3a,  $T_aT_a$  is A's transformation curve before the tariff, and  $T_a'T_a'$  is the transformation curve after the tariff has been imposed and the capital movement has taken place. At constant prices equilibrium moves along A's  $R$ -line from  $P_a$  to  $P_a'$  increasing the output of steel by  $RP_a'$  and decreasing the output of cotton by  $RP_a$ . Similarly, in Figure 3b,  $T_bT_b$  is country B's transformation curve before the capital movement and  $T_b'T_b'$  is the transformation curve after capital has left B. At constant prices production in B moves along B's  $R$ -line to  $P_b'$ , steel production decreasing by  $SP_b$  and cotton production increasing by  $SP_b'$ .

To demonstrate the proposition that world supply curves are unchanged it is necessary to prove that  $RP_a'$  equals  $SP_b$  and that  $RP_a$



equals  $SP_b'$ . The proof is given in Figure 4.  $OL_a$  and  $OC_a$  are, respectively, A's initial endowments of labor and capital;  $OL_b$  and  $OC_b$  are the endowments of B.  $OO_a$  and  $OO_b$  are the efficiency loci of A and B with production taking place along these loci at  $P_a$  and  $P_b$ , corresponding to the same letters in Figures 3a and 3b.

Now when A imposes a tariff on steel suppose that  $C_bC_b'$  of capital leaves B, shifting B's cotton origin from  $O_b$  to  $O_b'$ . At constant prices labor-capital ratios in each industry must be the same as before so equilibrium must move to  $P_b'$ , corresponding to  $P_b'$  in Figure 3b. Since

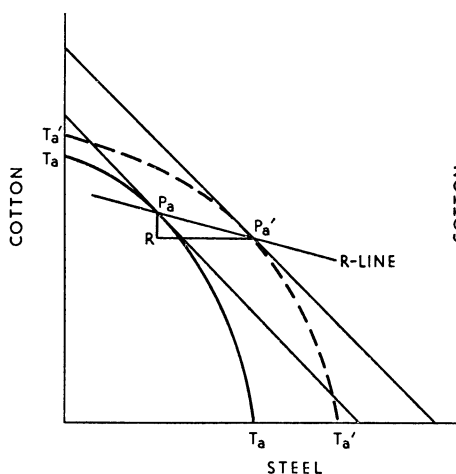


FIGURE 3a. Country A

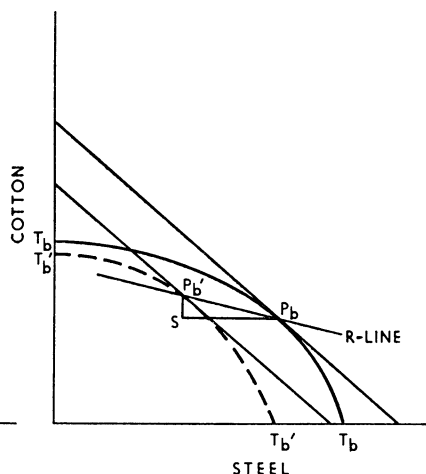


FIGURE 3b. Country B

the capital outflow from B must equal the capital inflow to A, A's cotton origin must move to the right by just the same amount as B's cotton origin moves to the left—*i.e.*, from  $O_a$  to  $O_a'$ ; and A's production equilibrium at constant prices must move from  $P_a$  to  $P_a'$ . The proof that world supply is unchanged at constant prices is now obvious since  $JP_aP_a'$  and  $KP_b'P_b$  are identical triangles.  $P_aP_a'$ , representing the increase in steel output in A, equals  $P_bP_b'$ , the decrease in steel output in B, and the decrease in cotton output in A,  $JP_a$ , equals the increase in cotton output in B,  $KP_b'$ .<sup>9</sup>

This relationship holds at all combinations of commodity and factor prices provided some of each good is produced in both countries. It means that world supply functions are independent of the distribution of factor endowments. More simply it means that it makes no difference

<sup>9</sup> The *R*-lines in Figures 3a and 3b must be parallel when output expands at the same price ratio in each country, and they must be straight since production changes are compensating.

to world supply where goods are produced if commodity and factor prices are equalized. Since world supply and demand functions are not changed by the capital movements, so that the new equilibrium must be established at the same prices as before, our earlier assumption that A is very small in relation to B is an unnecessary one.<sup>10</sup>

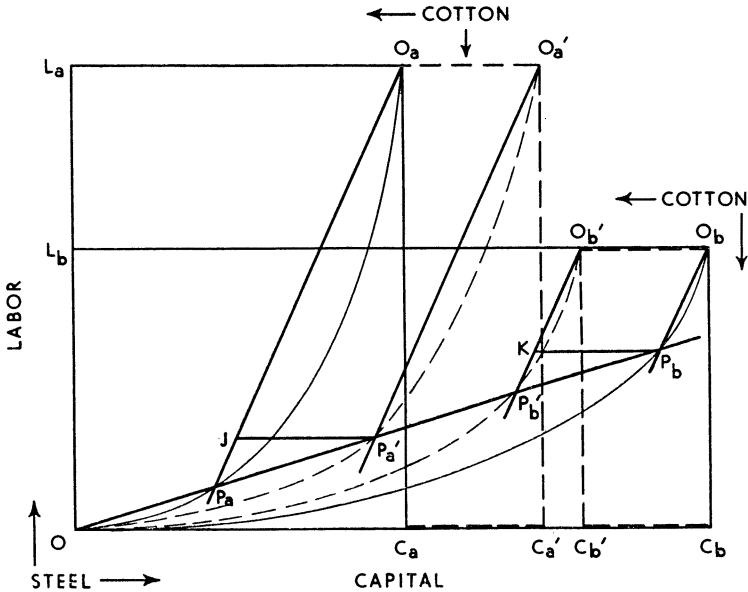


FIGURE 4

The general conclusion of Sections I and II is that tariffs will stimulate factor movements. Which factor moves depends, of course, on which factor is more mobile. The assumption used here, that capital is perfectly mobile and that labor is completely immobile is an extreme

<sup>10</sup> One qualification to the argument must be noted which is not necessary when the other country is very large. A condition for the marginal product of capital in A to rise as a result of the tariff is that the price of steel rise relative to the price of cotton. It is possible, if the foreign offer curve is very inelastic, that the improvement in A's terms of trade in raising the relative price of exports (cotton) will more than offset the effect of the tariff in raising the relative price of imports (steel). The condition that the "normal" case is satisfied requires that the sum of the foreign elasticity of demand and the domestic marginal propensity to import be greater than unity (the marginal propensity to import is relevant because the improvement in the terms of trade increases income). This is Metzler's qualification to the Stolper-Samuelson tariff argument. See Lloyd Metzler "Tariffs, the Terms of Trade and the Distribution of the National Income," *Jour. Pol. Econ.*, Feb. 1949, LVII, 1-29. If this criterion is less than unity a tariff imposed by a labor-abundant country would stimulate foreign investment rather than attract capital—a result, it should be noted, based on the static assumptions of this model; if dynamic elements were involved the direction of the capital movement would depend on whether the effects of the tariff on production preceded or followed the effects on the terms of trade.

one which would have to be relaxed before the argument could be made useful. But a great deal can be learned qualitatively from extreme cases and the rest of the paper will retain this assumption. When only capital is mobile, a labor-abundant country can attract capital by tariffs and a capital-abundant country can encourage foreign investment by tariffs. The same is true for an export tax, since in this model the effect of an export tax is the same as that of a tariff.

The analysis is not restricted to tariffs; it applies as well to changes in transport costs. An increase of transport costs (of commodities) will raise the real return of and thus attract the scarce factor, and lower the real return and thus encourage the export of the abundant factor. The effect of any trade impediment is to increase the scarcity of the scarce factor and hence make more profitable an international redistribution of factors. Later we shall consider, under somewhat more realistic assumptions than those used above, the applicability of this proposition as an argument for protection.

### III. *Increased Impediments to Factor Movements Stimulate Trade*

To show that an increase in impediments to factor movements stimulates trade we shall assume that some capital is foreign-owned and illustrate the effects on trade of taxing this capital. Strictly speaking this is not an impediment to a capital *movement*; but if it were assumed that a steady capital flow was taking place the tax on foreign-owned capital would operate as an impediment.

We shall use Figures 1 and 2. Begin with equilibrium initially at  $P'$  in Figure 1. No impediments to trade exist but since factor and commodity prices are already equalized no trade takes place. We assume that  $O'O''$  of capital in Figure 2 is foreign-owned so a transfer equal in value to  $YY'$  in Figure 1 is made. Consumption equilibrium in A is at  $S$ .

If a tax is now levied on all foreign capital its net return will be decreased, and since factor prices must be equalized in A and B, all of it ( $O'O''$ ) must leave A. As capital leaves A, her production block contracts. At constant prices more cotton and less steel is produced. The price of steel relative to cotton tends to rise but, since there are no impediments to trade, is prevented from doing so by steel imports and cotton exports.

Since all foreign capital leaves A the final size of A's transformation function is  $TT$ , that consistent with domestically owned capital. Production equilibrium moves from  $P'$  to  $P$ , but consumption equilibrium remains at  $S$  because interest payments are no longer made abroad.  $PR$  is now exported in exchange for steel imports of  $RS$ . The effect of the tax has been to repatriate foreign capital and increase trade. By

similar reasoning it could be shown that a subsidy will attract capital and decrease trade, although in the latter case the capital movement will only stop when factor prices change—*i.e.*, specialization takes place.

In order to achieve efficiency in world production it is unnecessary that both commodities and factors move freely. As long as the production conditions are satisfied it is sufficient that *either* commodities *or* factors move freely. But if some restrictions, however small, exist to both commodity and factor movements, factor- and commodity-price equalization cannot take place (except in the trivial case where trade is unnecessary because prices are already equal). This principle applies only to those restrictions which are operative—obviously it does not apply to import tariffs on goods which are exported, transport costs for factors which are immobile anyway or quotas larger than those required for equalization to take place.

If it were not for the problem of transporting interest payments, referred to earlier, one mobile factor would be sufficient to ensure price equalization. When the labor-abundant country imposes the tariff, equalization will take place as long as the other country continues a free-trade policy and there are no transport costs involved. But if the capital-abundant country imposes a tariff, inducing the export of capital, prices cannot be equalized even if the labor-abundant country maintains free trade unless the transfer of goods constituting interest payments is also tariff-free.<sup>11</sup>

#### IV. *An Argument for Protection*

The proposition that an increase in trade impediments stimulates factor movements and an increase in impediments to factor movements stimulates trade has implications as an argument for protection. In order to examine these implications we shall relax some of the assumptions previously made—first, by introducing trade impediments, then decreasing the degree of factor mobility, and finally relaxing the assumption that constant returns to scale apply by taking account of external economies. We shall begin with a model similar with that of Section II except that we shall assume country A to be considerably smaller than country B.<sup>12</sup>

<sup>11</sup> If trade were a perfect substitute for factor movements in the absence of trade impediments, a rough idea of the cost of trade impediments could be acquired by calculating the increase in world income which could take place if capital were redistributed from capital-rich to capital-poor countries until its marginal product throughout the world was equalized. Alternatively this could be considered the most of capital immobility. This statement would have to be qualified in the many-factor case.

<sup>12</sup> I make this assumption so that the change in the terms of trade resulting from A's tariff is small. In passing, however, it should be noted that the more mobile is capital, the

Take as a starting point the absence of trade impediments; trade is sufficient to ensure commodity- and factor-price equalization. Now suppose that, overnight, transport costs come into existence; this raises the price of importables relative to exportables, shifts resources into importables, raises the marginal product of the scarce factor and lowers that of the abundant factor in each country. Incomes of A-capitalists and B-workers increase while incomes of A-workers and B-capitalists decrease. These changes in factor returns create the incentive for a capital movement from B to A, a labor movement from A to B, or a combination of both movements. Where the final equilibrium will be depends on the degree of factor mobility. I shall assume that labor is immobile between countries but that capital is at least partially mobile.

If we assume that capital is perfectly mobile, but that capitalists do not move with their capital, the latter will move from B to A until the return from capital invested in A is the same as from that invested in B; but this implies that marginal physical products cannot be equalized since transport costs must be paid on the goods constituting interest payments.<sup>13</sup> The introduction of transport costs would, then, reduce world income even if capital were perfectly mobile unless capitalists are willing to consume their income in the country in which their capital is invested.

But we shall not assume that capital is perfectly mobile. Instead suppose that B-capitalists insist on receiving a higher return on any capital they invest in A than on that which they invest in B, perhaps because of political instability, patriotism, risk or economic uncertainty. Let us assume that B-capitalists require a 10 per cent higher return on capital invested in A than on that invested in B, but that if this interest differential rises above 10 per cent, capital is perfectly

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smaller is the change in the terms of trade resulting from a tariff; this means that the optimum tariff will be smaller with, than without, capital mobility; and in the limiting case where capital is perfectly mobile, discussed in Sections I and II, the optimum tariff is zero.

Also, in what follows I neglect to discuss the tariff proceeds which are implicitly assumed to be redistributed in such a way as to leave A's indifference map unchanged. Alternatively, to abstract both from changes in the terms of trade and the tariff proceeds, it could be assumed that the tariff is prohibitive.

<sup>13</sup> However, interest rates must be the same! Since capital goods—call them machines—can move costlessly from one country to the other, the price of machines in money terms will be the same in both countries; and since machines will move to A until marginal products in money terms are equal, interest rates (the return to a machine as a proportion of the price of a machine) must be the same in both countries. The interest rate, of course, is not commensurable with the marginal product of capital unless the latter is defined as a proportion of the price of machines; in the new equilibrium the two are equal when the marginal product of capital is so defined.

mobile. Suppose further that the return to capital in both countries before introducing transport costs was 12 per cent; and that the effect of introducing transport costs is to lower the marginal product of capital in B to 11 per cent and to raise it in A to 17 per cent. Since the interest differential is less than 10 per cent no capital movement will take place.

It is at this point that we shall consider the argument for a tariff in A. Let A impose a tariff, further increasing her relative scarcity of capital and B's relative scarcity of labor. Rates of return on capital change to, let us say, 25 per cent in A and 9 per cent in B, creating an interest differential of 16 per cent. Capital will now move from B to A until this differential is reduced to 10 per cent. Obviously the rates of return cannot return to the pretariff rates of 17 per cent for A and 11 per cent for B: first, because part of the tariff will be "used up" in bringing the marginal products of capital in A and B to the point where B has an incentive to export capital; and second, because transport costs must be paid on the interest returns.

If capital moves until the return in A falls to 20 per cent and in B rises to 10 per cent, what can be said about the economic effects of the tariff as far as country A is concerned?

First, A-capitalists are better off; the tariff increases and the capital inflow decreases capital scarcity, but the net effect is a higher return than before the tariff. Second, A-workers are worse off in spite of the fact that the total ratio of capital to labor in A has increased. Marginal products are determined not by the total ratio of capital to labor in a country, but by the ratio of capital to labor in each industry. The capital from B is largely absorbed by increasing the output of capital-intensive importables in A; it can never succeed in raising the capital-labor ratio in each industry to its pretariff level. Real wages must be lower than before the tariff.

Third, real national income in A is less than before the tariff; the tariff makes A's scarce factor relatively more scarce, and her abundant factor relatively more abundant, reducing her potential gains from international trade. Even under the most favorable assumptions, with capital perfectly mobile and capitalists moving with their capital, A's income would remain the same; it could not improve.

So far no valid tariff argument has been produced.<sup>14</sup> Capital can be

<sup>14</sup> It is true that B's national income has increased since the effect of A's tariff is to raise B-wages and stimulate capital investment in A, where B-capitalists receive a higher rate of return than at home; but it cannot be said that B-capitalists are better off since, *ex hypothesi*, they are indifferent between investment at home and an investment in A in which the rate of return is 10 per cent higher. In any case the purpose of policy makers in A is to raise A's not B's income.



attracted to a capital-scarce country by a tariff, but the capital movement can only alleviate some of the unfavorable effects of the tariff; it can not eliminate them.

The argument can be rescued if we assume the appropriate nonlinearities of scale.<sup>15</sup> If external economies of scale<sup>16</sup> exist in the production of A-importables, the tariff will encourage more capital to enter than would otherwise be attracted since the marginal product of capital entering A will not fall as rapidly as it would fall in the absence of economies of scale. The new equilibrium will be established with a higher marginal product of labor, factor returns now being dependent not only on the proportions in which factors are combined, but also on the total output of importables. Real wages will be higher in A with than without economies of scale, though it is not certain that they will be higher than before the tariff; to demonstrate the latter it would have to be established that the economies of scale are sufficient to make up for the transport costs which must be paid on the interest returns. If they are sufficient, the tariff would be unequivocally beneficial.<sup>17</sup>

It is easy to see that economies of scale in importables or diseconomies of scale in exportables increase the likelihood that the net effect of the tariff in a labor-abundant country is favorable, and vice versa. To justify an argument for protection on the above grounds it would have to be established that capital-intensive industries are subject to external economies of scale and/or that labor-intensive industries are

<sup>15</sup> It may be possible to rescue the argument in other ways by assuming irrational, though possibly not implausible, behavior. For example, after B-capitalists have begun investing in A, they may acquire more confidence, and be willing to accept a smaller interest differential. In this case after the capital movement the marginal product of labor may be higher, and the marginal product of capital lower, than before the tariff, thereby increasing A's national income. Or, while some (relatively) capital-scarce countries may fear "exploitation" from foreign investment, others may view the increase in productive capacity resulting from it as desirable in itself (perhaps with the intent of future expropriation!)—in which case this factor would have to be balanced against the reduction in national income.

<sup>16</sup> It is sometimes overlooked that internal economies of scale do not constitute an argument for a tariff. An industry must not only be able to compete some years after the tariff; it must also earn a sufficient return to repay the economy for the loss of income resulting from the tariff in the period of the industry's infancy. The investment will then only be worthwhile if future output is sufficient to earn for the firm the current rate of interest on the capital involved. But when economies to scale are internal the investment will be profitable for private enterprise. Only when divergences between private and social costs due to *external* economies of scale are present is the case for government intervention valid.

<sup>17</sup> But if the same nonlinearities of scale exist in B the argument is weakened; economies of scale in A-importables will cause the marginal product of capital to fall at a slower rate than in their absence, but in this case the marginal product of capital in B will rise at a much faster rate as capital is exported. Similar economies of scale in B, then, may cancel out the effect of economies in A in inducing a larger capital movement, although this effect could be neglected if B were the rest of the world and A a small country.



subject to external economies of scale; and these nonlinearities are of the required size.<sup>18</sup>

### *V. Concluding Remarks*

Like all theory, the above analysis is remote from reality. The problems of many factors, goods and countries, monopolistic competition and differences in production functions have not been considered. In addition the model is nonmonetary and static. Still, these limitations do not interfere with the central theme, although any policy considerations would have to take them into account.

A number of questions present themselves. Did the growth of protection in the late nineteenth century in North America stimulate the large labor and capital inflows of that period (assuming land to have been the abundant factor)? Did the increased protection in Britain in this century stimulate capital export? Did the breakdown in international factor movements in the interwar period stimulate trade? And to what extent have the high tariff barriers between Canada and the United States contributed to the stimulus of American investment in Canada? It would be interesting to see what help this model offers in finding answers to these questions.

<sup>18</sup> A possible extension of the model to allow for many goods could be made as follows: All goods could be ordered in terms of their capital intensities—*i.e.*, the ratios of capital to labor at any given price ratio. B would export those goods that are most capital-intensive and A those goods which are most labor-intensive. In the absence of trade impediments one of the intermediate commodities would be produced in common, establishing the ratio of factor returns in much the same way as goods produced in common establish the ratio of international values in a Graham model. Now the effect of a tariff in A (as of any impediment) is to increase the relative price of capital-intensive goods in A and to lower them in B thus raising in A and lowering in B the marginal product of capital. Now not one commodity but a whole series of commodities would be produced in common, A's exports comprising only the most labor-intensive and B's exports only the most capital-intensive goods. In A new capital-intensive industries, and in B new labor-intensive industries, would be created. If some capital were not allowed to move to A, the margin of comparative advantage would be extended to capital-intensive industries in A, thus increasing the number of goods produced in common in both countries.