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Factor Mobility and International Trade: The Case of Complementarity

By ANDREW SCHMITZ AND PETER HELMBERGER*

By far the largest single component of *U.S.* private long-term capital outflows is direct investment.¹ During the past 10 years, *U.S.* foreign direct investment more than tripled. The average direct investment for 1953–55 was \$17.7 billion which increased to an average of \$54.4 billion for 1965–67.² In attempting to explain this phenomenal growth, it is necessary to examine how a country's foreign direct investment is related to its international product trade.

The relationship between product trade and direct foreign investment was not established in the formal theories of international trade. This is because factors of production were assumed to be internationally immobile. The well-known theories, for example, of Ricardo and Heckscher-Ohlin were concerned with explaining how product trade could arise among countries given that international labor and capital mobility were absent. In the Ricardian theory, international trade in commodities occurs because countries have different production functions, while in the Heckscher-Ohlin theory trade occurs because of international differences in relative factor endowments.

There are, however, studies available

which have dealt with the question of how product trade affects international capital movements. It has been suggested that capital movements substitute for product trade; and thus, tariff barriers are largely responsible for international flows of capital. Herbert Marshall, Frank Southard, and Kenneth Taylor (p. 209), in studying *U.S.* construction of manufacturing plants in Canada, indicate that "... in the absence of tariffs the remaining barriers would be insufficient to explain the establishment of many—probably the majority—of plants now in existence." This view has been supported by Clarence Barber in a paper on "Canadian Tariff Policy." In both studies the reference is to secondary manufacturing and not to primary products and primary manufacturing. Also, their emphasis is on foreign ownership of production facilities in Canada. Thus, the international capital movements referred to are *U.S.* foreign direct investments.

In a more recent paper, Robert Mundell, within the framework of the Heckscher-Ohlin theory of trade, demonstrated that international trade in products and international capital movements are substitutes.³ His conclusion is that product trade and capital movements are perfect substitutes, trade impediments stimulating factor movements and, likewise, increased impediments to factor movements stimulating trade. An additional implication is that, in a world of free product trade, factors do not move among countries because factor and product prices are equalized.

* It should be pointed out that Mundell defined capital as a physical homogeneous factor which does not create balance-of-payments problems when it moves internationally. Also it is assumed that capitalists, as consuming units, do not move with their capital so national taste patterns are unaltered. This particular definition of capital raises certain questions which are discussed in a later section.

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¹ The distinction between direct and portfolio long-term investment (for example, foreign dollar bonds and foreign corporate stocks) is that legal control of the asset is involved in direct investment. Foreign direct investment, therefore, represents establishing a branch plant or subsidiary corporation abroad where the investor has voting control. Therefore, direct investment can be used as a measure of the *U.S.* control of corporations located in foreign countries. For a further discussion, refer to A. E. Safarian (pp. 1–2).

² Computed by the Department of Commerce.

However, a shortcoming of the Mundell analysis is that no distinction is made among the major classifications of product trade. As indicated, Marshall, Southard, and Taylor and Barber referred explicitly to trade in secondary manufacturing when claiming that product trade and foreign direct investment are substitutes. However, a large part of international trade and direct foreign investment associated with it are in primary commodities and primary manufacturing. For example, at the time of Mundell's paper, over 60 percent of *U.S.* foreign direct investment was in primary and not in secondary manufacturing industries.

The studies available on trade in primary products and primary manufacturing would lead one to question whether or not product trade and direct foreign investment are substitutes. To a large extent, primary exports of many countries are developed by foreign capital which suggests that product trade, at least in certain primary goods, and international capital movements are complements. A striking example of this is J. V. Levin's findings for Peru in which case, despite virtually free trade, large sums of foreign capital were invested in the 19th century in Peru to develop its then major export commodity, guano. This study suggests that, in the absence of foreign capital, the Peruvian exports of guano would not have been sizable. There are, however, a whole host of world export industries which are controlled by foreign interests. Examples are Chilean copper; Bolivian tin; Canadian iron ore, potash, pulp, and paper; Australian copper; and oil production and refining facilities in Venezuela and several Near-East states, including Iran. The industries cited are largely controlled by the United States. To illustrate, the seven largest oil companies in the United States account for approximately 90 percent of the world oil production outside of North America.

It is extremely doubtful that trade in oil, copper, iron ore, etc., would have been fostered by placing impediments on the international flow of capital. To develop these industries requires substantial amounts of capital and the associated know-how,

which in many countries, is simply not available from domestic sources.⁴ Therefore, it appears that international capital movements and trade in primary products and primary manufacturing are not substitutes but are instead complements.⁵ To support these findings, this paper demonstrates that it is theoretically possible to construct models in which long-term international investment and product trade are complements, not substitutes, in that impediments to the movement of one also impede the movement of the other.

I

In attempting to demonstrate that product trade and international capital movements can be complements rather than substitutes, as previous authors have argued, it appears necessary to relax at least one of the assumptions underlying the Heckscher-Ohlin theory apart from the assumption of international factor immobility. That is the assumption of identical international production functions. As mentioned, Mundell's demonstration that international capital movements and product trade are substitutes is based on the Heckscher-Ohlin framework which assumes, among other things, identical production functions and similar tastes; for, if production conditions are identical, it is not immediately obvious why capital would be invested abroad to develop primary industries unless perhaps because of lower input costs. In addition, although not as crucial as the production function assumption, it will become apparent that different demand conditions should be assumed to exist among regions.

⁴ For an excellent discussion, see Robert Baldwin (1963) and Anne Krueger.

⁵ Whether or not *U.S.* foreign direct investment and product trade in secondary manufacturing are substitutes is even debatable. See, for example, the empirical studies by Anthony Scaperlanda and Ralph d'Arge. Also, in this connection, it should be pointed out that foreign direct investment, in certain cases, is not a function of the degree of tariff protection. That is, foreign direct investment can occur even in a world of free trade in secondary manufacturing which, as Mundell demonstrated, is ruled out when using the Heckscher-Ohlin framework of analysis. Some individual studies which suggest this to be true are those by Aharoni, John Dunning, and Dudley Phelps.

The reason for assuming different production functions among countries when dealing with primary commodities should be apparent.⁶ For primary products, such as copper, oil, timber, and potash, production conditions are not identical among regions of the world. In certain countries some of these natural resources do not exist. Among regions where they do exist, the relative costs of developing these resources differ widely. One cause is the poor ore quality and the depth of mining required in some areas relative to those with large natural supplies.⁷

Like production, different total demand conditions also exist among countries. For most primary products, the demand, after population and income differences are taken into account, is larger for the country supplying capital than for the recipient country. For example, as pointed out earlier, the United States has a large market for oil as compared to either Canada, Iran, or Venezuela. Likewise, there are virtually no local markets for potash mined in Canada. Therefore, any sale of Canadian potash must be to foreign markets.⁸

⁶ Studies which have refuted the notion of identical international production functions include those by Kenneth Arrow, Hollis Chenery, Bagicha Minhas, and Robert Solow. Also, see the study by Kreinin.

⁷ It is our contention that the larger the differences in production conditions among countries in primary products the greater will be the flow of international capital.

⁸ How the size of a domestic market relative to foreign markets affects investment decisions remains an empirical question. One would expect, however, that the smaller the domestic market relative to foreign markets the more reluctant are domestic investors to develop a given product, especially one which requires large initial sums of capital. In addition, even though a country has a large natural supply of such commodities as oil, tin, copper, and potash, if the potential domestic demand for these is small, then potential demand in foreign markets may go unnoticed by domestic investors. These—both the high cost of information and the unavailability of information—appear to be among the major reasons why the United States, France, and West Germany invested large sums of capital in Canada to mine its potash. Raymond Vernon (p. 202), in discussing product specialization for less-developed countries, states:

In projecting the patterns of exports from less-developed areas, however, we cannot afford to disregard the fact that information comes at a cost,

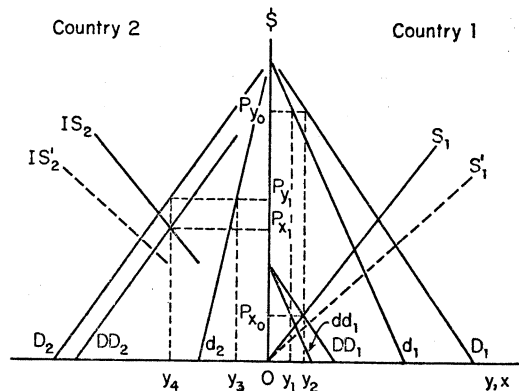


FIGURE 1. A SPATIAL MODEL OF TRADE EXCLUDING AND INCLUDING FACTOR MOBILITY.

To illustrate that product trade and international capital movements can be complements, a spatial equilibrium framework is used. The analysis is shown graphically in Figure 1. It is assumed that, in the absence of international factor movements, capital, which is denoted by x , is available only in country 1.⁹ The supply curve of capital in country 1 is OS_1 while the domestic demand for product y is d_1 . In country 2, d_2 represents the domestic demand for y . To be consistent with the previous discussion, d_1 , which corresponds to the country supplying the capital x , is substantially larger than d_2 . In the model, transportation costs are excluded.

Assuming that factors of production are internationally immobile, production will only occur in country 1 since x is not available in the other country. Therefore, country 1 produces product y for both markets; thus, the relevant product demand curve is the aggregate of d_1 and d_2 which is represented by D_1 . Equilibrium production is oy_2 , which is the amount determined by the intersection of the supply curve of x (not shown) and DD_1 which is the aggregate derived demand for

and that entrepreneurs are not readily disposed to pay the price of investigating overseas markets of unknown dimensions and unknown promise. Neither are they eager to venture into situations which they know will demand a constant flow of reliable marketing information from remote sources.

⁹ The question as to the meaning of capital is raised in the last section.

α .¹⁰ The latter corresponds to D_1 and the equilibrium product price P_y . In the model, both countries pay P_y for product y , and factor α receives a payment P_α . Country 1 exports y_1y_2 of product y to country 2.

The next step is to demonstrate the case in which not only products can be traded but also factors can move between countries. To be consistent with our earlier discussion, production functions are assumed to be different between regions, and α is much more productive in country 2 than in country 1. As noted earlier, α is unavailable to country 2 from domestic sources. This being the case, it is necessary to plot the excess supply curve of α in the second quadrant in Figure 1. This is represented by IS_2 . Given the aggregate demand curve of d_1 and d_2 represented as D_2 , if all of y is produced in country 2, it is possible to determine equilibrium trade flows of factor α and product y and equilibrium prices for both. The equilibrium is represented by the intersection of IS_2 and DD_2 which is the aggregate derived demand curve for α .¹¹ The corresponding equilibrium product price is P_{y1} ; for α , it is $P_{\alpha1}$. In this situation, αy_4 of product y is produced of which y_3y_4 is exported to country 1. Therefore, by comparing this analysis with that earlier, which allows for only trade in the product, trade increases when factors are allowed to move internationally. Therefore, using free trade in both the factor and product as a norm, factor and product movements are not substitutes—they are complements.

¹⁰ Actually, when deriving the demand for α corresponding to the equilibrium value for y and P_y , one merely determines one quantity for α . P_α is obtained from knowing the supply curve of α . But for completeness and ease of illustration, rather than merely representing a point on the supply curve of α corresponding to an equilibrium situation, the derived demand curve is drawn although it need not be drawn parallel to D_1 . In addition, DD_1 is drawn to correspond with the equilibrium product price P_y and is, therefore, not the derived demand curve for alternative product prices corresponding to the entire D_1 curve.

¹¹ Again, there is no specific reason that DD_2 has to be drawn parallel. Also, as in the earlier example of allowing only trade in the product, DD_2 is drawn only with reference to a given price of y which in equilibrium is given by P_{y1} . DD_2 does not represent the derived demand for α for all product prices corresponding to D_2 .

This is because in the model country 2 is much more productive than country 1 in the production of the product. Consequently, by allowing factor mobility, the product has become so much cheaper that total use has expanded—and, with it, the volume of trade.

In Figure 1, the aggregate derived demand curve DD_2 was arbitrarily drawn such that in equilibrium none of y is produced in country 1. How the derived demand curve for α is drawn depends on the production function specified for each region.¹² The analysis demonstrates that the greater the differences in international production functions the greater will be the flow of international capital from the capital-intensive country. This is clearly indicated since, if the production function in country 2 becomes similar to that in country 1, due, for example, to a change in technology, DD_2 would shift to the right. This would decrease product trade, increase product prices, decrease capital flows, and decrease factor prices. In addition, the volume of factor movements depends on the responsiveness of the factor to changing factor prices. Consider a new supply equation for α represented by S'_1 and the corresponding excess supply IS'_2 . It can be demonstrated, with reference to the derived demand equation for α , that the new equilibrium price is below P_{y1} ; thus, the volume of product trade increases as does the transfer of α between regions. This is so since the shift of DD_2 to the right is not of sufficient magnitude to intersect IS'_2 directly below IS_2 and DD_2 . Therefore, with reference to the relationship between capital movements and trade in primary products and primary manufacturing, the model suggests that volume of international capital movements depends on the response of capital to changes in interest payments and the extent to which there exist international differences in production functions.

II

To this point considerable emphasis has been placed on distinguishing among types

¹² In Figure 1, different production functions are represented by a small vertical distance between D_2 and DD_2 relative to that between DD_1 and D_1 .

of products which are traded internationally. For empirical purposes, however, it is also necessary to delineate the types of international capital movements which are affected by imposing restrictions on the flow of products among countries.

Carl Iverson and George Borts, for example, in their writings on long-run international movements, conceive a capital movement to be a transfer of goods and services between countries offset by an opposite movement of private titles to ownership of private-debt instruments. Thus, a country which is importing capital has a surplus in its balance on capital account and a deficit in its balance on current account; that is, the level of investment in the country exceeds the level of savings. As pointed out at the outset, if one considers only the largest component of long-term private *U.S.* capital movements—direct investment—only those assets abroad have to be considered which are legally controlled by *U.S.* firms. This represents establishing a branch plant or subsidiary corporation abroad where the investor has voting control.

Recently, Baldwin and H. Oniki and Hirofumi Uzawa have demonstrated models of international trade which explicitly incorporate trade in capital goods. These, however, are capital goods exports, such as machinery and equipment, which are paid for with goods produced in the country importing the physical capital. Therefore, this type of analysis is consistent with the Heckscher-Ohlin framework, and it does not imply that factors of production are internationally mobile. The above models therefore incorporate trade in capital goods along with the assumption that capital is internationally immobile.¹³ This is because of the distinction made between capital goods trade, which is the analysis by Baldwin and Oniki and Uzawa, and international long-term capital movements. In the latter case, a capital export is defined in equilibrium to be the posi-

tive excess of savings over investment, equal in magnitude to the current account balance of payments. Therefore, capital goods exports do not imply an export or import of capital.

At the outset, it was pointed out that the studies by Marshall, Southard, and Taylor and Barber used the concept of private *U.S.* direct investment and how it was affected by restricting product trade. However, this does not appear to be the concept of capital used in Mundell's demonstration (p. 322) that product trade and international capital movements are substitutes since capital is defined as a physical, homogeneous factor which does not create any balance-of-payments problems when it moves internationally. This implies a concept of capital similar to capital goods trade rather than capital exports of a long-run nature.¹⁴

It is our contention, however, that the relationship between product trade and capital goods trade is not the same as between product trade and long-term international capital movements. Thus, it is necessary to distinguish among different forms of capital movements. Restrictions placed on international trade in products may have a substantial impact on *U.S.* foreign direct investment with little or no effect on *U.S.* capital goods trade. Consider, for example, the recent large increase in *U.S.* direct investment in Europe which many argue has resulted from the common external tariff established by the European Economic Community. Part of this increase in investment has been a result of mergers between *U.S.* and European firms.¹⁵ These mergers

¹⁴ Since, in the Heckscher-Ohlin theory, the assumption of international capital immobility does not refer to capital goods, it could be argued that Mundell never really relaxed the assumption of international capital immobility.

¹⁵ Although data are scanty, they suggest that there has been a phenomenal increase in international merger activity between United States and European firms. In 1968, for example, Monadnock Paper Mills, Inc., of Bennington, New Hampshire merged and now has control of the leading paper manufacturer in Austria—Lenzinger Zellulose and Papierfabrik, A.G. Likewise, Scott Paper Company merged with Bouton Brocard of France and has voting control in the so-called international firm. One last example is Litton Industries which

¹³ As Baldwin (p. 841) points out: "It is perhaps not out of place to remind ourselves that the traditional assumption of trade theory concerning the immobility of capital refers to abstract capital and not capital goods."

generally involve international transfers of technical entrepreneurial skills accompanied by little or no flows of physical capital. However, even in cases where mergers are not involved, *U.S.* industrial complexes in Europe can purchase, from internal sources, most of the physical capital needed, thus eliminating the need for capital goods exports from the United States. In addition, it should be pointed out that *U.S.* direct foreign investment does not necessarily even involve large transfers of liquid capital from the United States. J. Servan-Schreiber (p. 14) points out that although in 1965 the United States invested \$4 billion in Europe only 10 percent of this was a direct dollar transfer from the United States. This is due to: 1) American investors obtaining loans from the European capital market to finance investments abroad; 2) direct credits from European countries and government subsidies; and 3) internal financing from local earnings. Therefore, the major component of the recent phenomenal growth in *U.S.* foreign direct investment appears to be international movements of human capital and not capital goods exports or direct dollar transfers from the United States.¹⁶

III.

In this paper we have demonstrated that it is possible to construct models in which factor and product flows can be substitutes or complements depending on the framework of analysis and assumptions used. We have demonstrated that in at least one rather common economic situation—that is, when capital inputs are exported because natural resources and primary manufactured prod-

ucts can be imported—factor and product flows are complements.

The extent to which product trade and international capital movements are substitutes or complements is an empirical question and is not dealt with here. We merely emphasize the points raised earlier. It was demonstrated that, in order to carry out quantitative analysis to determine how product trade affects international capital movements, both the type of commodity traded and the form of international capital transactions must be specified. It appears that the relationship between international capital movements and exports of primary products and primary manufacturing is not the same as between capital movements and exports of secondary manufacturing. Also, the relationship between product trade and capital goods exports appears to be different from that between product trade and long-term international capital movements. Hopefully, future empirical studies will determine how restrictions on different types of product trade affect different forms of international capital flows.

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acquired control of Grundig Organization of Triumph and Adler factories at Frankfurt and Nuremberg, Germany.

¹⁶ In our demonstration in the previous section, the capital input was not defined. If defined as physical capital, as in the Mundell analysis, the analysis would demonstrate the complementarity relationship between product trade and capital goods exports. However, to demonstrate complementarity between product trade and foreign direct investment—a specific type of long-run international capital movements—the definition of capital must include technical and entrepreneurial know-how which, as pointed out, is a crucial component of *U.S.* foreign direct investment.

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