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INTERNATIONAL SAVING, INVESTMENT AND TRADE

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INTERNATIONAL SAVING, INVESTMENT AND TRADE

Peter Debaere Ufuk Demiroglu*

March 24, 1997

Abstract

Feldstein and Horioka (1980) observed that saving and investment move closely together in the major OECD countries. This finding is a puzzle if national economies are characterized by one sector production functions of the form $F(K,L)$. In that case, in a high saving country, the high rate of investment and capital accumulation would result in a decline of the marginal product of capital, leading to an incentive for exporting capital. In this paper, we show that this incentive disappears in a multi-sector world. National capital can be absorbed domestically without a decline in its marginal product through a shift in the sectoral composition of national production towards capital intensive sectors. This is nothing but the well-known Rybczynski effect. We present a modified version of the standard Heckscher-Ohlin (HO) Model to show that very small barriers to capital mobility are enough to force national savings to stay within the country of origin. We also argue that, while the assumptions of this model may appear special, they are not unrealistic for the developed countries in the Feldstein Horioka study.

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1. Introduction

In their seminal paper Feldstein and Horioka (1980) (**FH**) made the observation that domestic saving and investment are strongly correlated in the major OECD-countries for the period 1960-1974. Virtually all of what is saved in a country is also invested in that country. As shown by various studies, this is a robust relationship except for a deviation in the early 1980s. Saving and investment are correlated not only in terms of short-run year-to-year fluctuations in a given country, but also across countries in terms of long-term averages. The latter relationship is termed the "cross-sectional" saving-investment correlation.[1] These observations have not yet found a satisfactory explanation.

When the national economies are thought to be well characterized by one sector production functions of the form $F(K,L)$, the FH finding is a puzzle. A high rate of investment and capital accumulation would result in a decline in the marginal product of capital, and therefore, there would be an incentive to export capital in a country with a high saving rate. However, empirically, the high-saving countries do not experience declining interest rates.[2]

In this paper, we show that the Feldstein-Horioka puzzle disappears in a multi-sector world. A country with a high saving-rate can employ all of its national capital domestically without a decline in its marginal product through a shift in the composition of national production towards capital intensive sectors. This is nothing but the well-known Rybczynski effect. Instead of exporting capital directly, a country can produce more of capital intensive goods and export these products.

The shift in production can completely remove the incentive for capital movements. The well-known Factor Price Equalization (FPE) Theorem states that under certain conditions trade equalizes all the factor returns. As such, with equal returns, the incentive for capital to move abroad disappears, and the saving-investment correlation

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[1] The literature is reviewed in Tesar (1993), Mussa and Goldstein (1993) and Obstfeld (1986,1994), and Bayoumi (1996).

[2] This provides one reason for why barriers to capital mobility are not a satisfactory explanation alone. Another reason is that such barriers are not evident among the group of developed countries considered by FH.

becomes self-evident. The main requirements for FPE are similar country endowments, identical technologies, and free trade, so that goods prices are identical in all the countries. If these assumptions are satisfied, and if the changes in the capital stock do not violate the assumption of endowment similarity, the equality of the returns will stay intact and there will be no incentive for capital flows.

The Rybczynski and FPE Theorems give some indication of why it is possible to have no capital flows in an equilibrium. However, they do not exactly describe the economic mechanism that equalizes saving and investment in a country. In fact, if the returns to capital are equalized in all the countries, capital could either move abroad, or stay within the country of origin. This implies that the international allocation of capital would be indeterminate.

This indeterminacy, however, can be resolved by the following argument. If the returns to capital are identical in the home country and elsewhere, the preferred alternative should be to invest at home. There are certain risks and costs associated with foreign investment, such as the *exchange rate risks,* the information costs, and the *country risks* that arise from the possibility of appropriation by foreign authorities. In the model of section 2, we postulate that a flow of capital across country borders requires a *premium* (represented by Δ) to cover these risks. Unless the foreign return r^* exceeds the home country return r by the amount Δ (i.e., unless $r^* \geq r + \Delta$) , capital chooses to stay within the home country. The existence of such a required premium removes the multiplicity of equilibria. As shown in section 2, "no capital flows" emerges as the unique equilibrium outcome, as long as the country endowments are similar. This is true for any positive value of Δ. Thus, very small barriers to capital flows can be sufficient to prevent savings from flowing abroad.

To summarize, saving and investment are equalized in a country (if the FPE assumptions are satisfied) in the following way. Take a country with a high saving rate. The supply of capital grows faster in that country than in the countries with lower saving rates, unless there is a capital outflow. However, capital does not flow abroad immediately, as there is the required premium Δ. The increase in the capital stock consequently puts downward pressure on the rental price of capital, and cheaper capital

creates an incentive for entry in the capital intensive sector. While more firms enter that sector, the excess of capital eventually gets fully employed, and the pressure on the rental rate of capital disappears. Hence, a new equilibrium is reached without any capital flows.[3]

The Heckscher-Ohlin (**HO**) Theory and FPE have been around for a very long time, and international trade is known to be a substitute for capital movements (Mundell 1957). Hence, our explanation should hardly sound novel to an international trade economist. It is remarkable, however, that the influence of trade on factor returns has never been seriously advanced to justify the saving-investment correlation.[4] One can only guess at the reason for this neglect.

One reason is the widespread use of the neoclassical one-sector models. While learning and teaching such models, we (economists) perhaps develop a tendency to mainly think in terms of a one-sector world. In section 4, an example with multiple sectors is presented where the high saving country turns out to be the more attractive direction for international capital flows. In other words, the implications of the one-sector and multi-sector models are very different when the issue is saving-investment correlations. Another reason for the neglect of FPE as an explanation for the FH result may be the growing separation, as noted by Krugman (1993), between the fields of international finance and international trade.

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[3] As we know from the Stolper-Samuelson Theorem, factor prices are determined by goods prices. If the country in the example is large, the shift in the country's production toward the capital intensive sectors may change the world relative prices of goods. Consequently, the factor prices may change worldwide as a result of the capital accumulation in that single country. However, the new goods prices will be identical *across* the world because of free trade, and as a result, the factor prices implied by these goods prices will be the same in all the countries also. If, for instance, there is a decline in the price of the capital intensive good, the rental rate of capital will decline everywhere in the world. The FPE Theorem assures that the returns to capital will still be identical across countries and there will be no incentive for capital flows as before.

[4] In a footnote Obstfeld (1986) refers to Kotlikoff (1984) who briefly mentions a conversation in which the possible relevance of the FPE result to the FH puzzle is brought up. The explanation is not pursued by either of the authors, possibly because it is thought of as an intellectual curiosity, rather than an issue that may have actual pertinence to reality.

Probably the most important factor is the distrust of the applicability of the HO Theory to real-life issues. The empirical failure of the various HO Theory predictions and the unrealistic and detailed assumptions (such as the 2x2x2 world, identical technologies, etc.) of the textbook HO model have made us more reluctant to think of the real world in HO terms. The anecdote in footnote 4 is likely to be an illustration of that. A major portion of this paper, sections 3 and 4, addresses these concerns. We argue that the HO assumptions are fairly realistic for the developed countries that are considered by Feldstein-Horioka.

In section 2, we illustrate our point in a modified version of the basic HO model that includes saving and investment explicitly. More specifically, we have a multi-period model in which each period is nothing but the standard 2x2x2 HO model. In section 3, we discuss the assumptions of the HO model and the FPE Theorem, and how the proposed explanation of the FH puzzle accords with general observations. In section 4, we show how returns to capital are equalized by trade even under more general conditions, allowing for different technologies in the countries and without requiring the equalization of *all* factor prices. Section 5 concludes.

2. Trade removes the need for capital movements

Consider a 2x2x2 standard Heckscher-Ohlin framework. Capital, K, and labor, L, are mobile across sectors within a country. Good 1 and 2 (G1 and G2) are produced with identical neoclassical constant returns to scale production functions. Their prices are p_1 (numeraire) and p_2. The country endowments are inside the diversification cone formed by the cost-minimizing capital-labor ratios of the two industries at prevailing world prices. Both countries produce both goods, and there are no factor intensity reversals.

We *modify* this setting and incorporate saving, investment and changes in the capital stock. We provide a setup in which each period accords with the standard HO model, so that the standard FPE and Rybczynski Theorems can be used separately for each period. Deviating from the standard HO model, we assume that capital is internationally mobile (whereas labor is not). The consumers save a fraction of their income and invest it in one of the two countries based on the return to capital in the next period. The

countries are assumed to be similar in terms of their endowments, and stay in the diversification cone in *every* period, although the location of the cone may itself change.

$$Y = Y_1 + p_2\, Y_2, \qquad Y^* = Y_1^* + p_2\, Y_2^*, \qquad \text{(note that } p_1=1\text{)}$$
$$S = sY, \qquad S^* = s^* Y^*,$$
$$S+S^* = I+I^*,$$
$$K_+ - K = I, \qquad K_+^* - K^* = I^*,$$

where Y_1 and Y_2 are the quantities of output in the two sectors, and Y is national income measured in good-1 prices. The national saving rate is denoted by s. S is national saving, I is investment, and K and K_+ are current and next period's real capital stock. Note that Y, S, I and K are all measured in units of the first good. Variables with asterisks (*) denote the foreign country variables, and the plus-subscripts ($_+$) denote the future quantities. Good 1 is the labor intensive good and is used only for consumption, while Good 2 is used also for investment. Consequently, the final demand for the second good will be $C_2 + I$ in the home country and $C_2^* + I^*$ abroad.[5] The households in both countries save different portions of their incomes[6].

There is no depreciation, and therefore I equals $K_+ - K$, the capital accumulation between two subsequent periods. We abstract from the complications that may arise due to population growth by fixing L and L^*. The equation $S + S^* = I + I^*$ states that world investment is financed by world saving. No restrictions have been imposed so far on how world saving is allocated between I and I^*. To completely identify the model, we

[5] Alternatively, good 1 could also be chosen as the investment good, and that would not make any difference in the model. We avoid to introduce a third sector for the investment good in order to be able to make use of the standard Rybczynski and Stolper-Samuelson results of the 2x2x2 model.

[6] The saving rate s is the country *average*. It is not important where s comes from; it can be given exogenously or may have resulted from an intertemporal maximization problem, it can be constant or varying over time, or, individuals may be heterogeneous or identical in their saving rates. The tools needed to obtain the saving-investment equality in our model are the FPE, Rybczynski, and Stolper-Samuelson Theorems. These theorems are valid and the saving-investment equality is obtained regardless of who saves how much or consumes which good and in what quantity. The crucial assumptions here are identical technologies, country endowment similarity, and same goods prices in both countries.

need to specify the investment behavior in each country. Let S^d denote the portion of the home country's savings S that does not leave the country and that is invested domestically, and let S^a be the part of S that flows abroad. Defining similar variables for the foreign country, we have:

$$S = S^d + S^a \qquad S^* = S^{d*} + S^{a*} \tag{1}$$

The amount of savings that moves abroad is determined by the difference in returns. The savers consider the *next* period return to capital when deciding where to invest, as the capital that results from current investment is used in the next period.[7] We assume that savings flow to the country with the higher return. More precisely, the foreign investment decision is made as follows. All of home savings (S) moves abroad if the future foreign rental rate of capital r_+^* is higher than $r_+ + \Delta$, where Δ is a premium required for foreign investment. That premium covers costs due to exchange rate volatility, transaction costs due to information barriers, and other possible risks. Δ is considered an arbitrarily small positive number, so that it constitutes no essential barrier for capital movements.[8] This leads to the following best response correspondences.

$$S^a = \begin{cases} 0 & if \quad r_+^* < r_+ + \Delta \\ [0,S] & if \quad r_+^* = r_+ + \Delta \\ S & if \quad r_+^* > r_+ + \Delta \end{cases} \quad and \quad S^{a*} = \begin{cases} 0 & if \quad r_+^* > r_+ - \Delta \\ [0,S^*] & if \quad r_+^* = r_+ - \Delta \\ S^* & if \quad r_+^* < r_+ - \Delta \end{cases} \tag{2}$$

Finally, foreign inflow S^{a*} and the part of domestic funds that stay in the home country S^d are available for and transformed into home country investments. The analogue of this is true in the foreign country.

$$I = S^d + S^{a*} \qquad I^* = S^{d*} + S^a \tag{3}$$

Now we solve for the equilibrium.

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[7] This may seem a short-sighted criterion for foreign investment as the capital gains or losses that may accrue due to the change in the price of the capital good should also play a role in the decision process. But, in this model, the capital good is good 1, and its price is the same in both countries due to free trade. Hence, capital gains or losses are the same in both countries.

[8] As mentioned in the introduction, Δ prevents indeterminacy. Without Δ, any allocation of world investment across countries is an equilibrium. With any positive Δ, no matter how small, $S = I$ and $S^* = I^*$ are the unique equilibrium outcome whenever FPE holds.

Solving the Model: Note that none of the necessary assumptions for the FPE result are altered in our setting. Consequently, the factor returns are equalized in the next period. With $r_+^* = r_+$, equation (2) implies that $S^a = 0$ and $S^{a*} = 0$. Using equation (1), we know that $S = S^d$ and $S^* = S^{d*}$. In other words, savings stay within its own country. Substituting these four equalities in (3), we obtain $I = S$ and $I^* = S^*$. Thus, in equilibrium, we find the equality of saving and investment, which is the basis of the FH puzzle. The equality of the returns (due to FPE) leaves no incentive for savings to move abroad.

In Figure 1, we depict the standard Lerner-Pearce diagrams with the familiar unit-value isoquants and unit isocost lines. Initially (solid lines), we have equal rates of return to capital at home and abroad, i.e. $r = r^*$, due to FPE. We do the following experiment. The foreign country (*) is the high saving and investing country, i.e. $s^* > s$. For simplicity in the diagrams, we set $s = 0$, so that the home country does not save, and as a result it does not invest or accumulate capital. We increase K^* while keeping K, L and L^* the same.

Figure 1 about here

The arrow in Figure 1 represents capital accumulation. (The home country endowment point, $E=(L,K)$, stays the same, while the foreign endowment increases from $E^* =(L^*,K^*)$ to $E_+^* =(L^*,K_+^*)$ --only K^* changes.) The foreign country observes a shift in production from the labor intensive towards the capital intensive sector as it accumulates capital (Rybczynski Theorem). The change in the world endowment can, however, cause a change in all goods and factor prices to change. (If the capital accumulation does *not* change the equilibrium world prices p_1 and p_2, the factor prices remain the same.) Figure 1 is drawn assuming a fall in p_2. The dashed lines represent the new situation after the price change. Although the factor prices change, their

equality is preserved, as long as the endowment points (E_+ and E_+^*) are still inside the diversification cone. Again, no incentive is left for international capital movements.

3. Empirical Relevance of the Assumptions of the HO Model and the FPE Theorem

As with most models in economics, some of the assumptions in the HO Theory are not realistic. Furthermore, the HO predictions have not been borne out empirically. We discuss in this section whether these unrealistic assumptions and empirical failures provide sufficient grounds to dismiss neoclassical trade theory as a way to understand saving-investment correlations.

The FPE, Rybczynski and Stolper-Samuelson Theorems are not restricted to the 2x2x2 case. In the 2x2x2 world, the FPE Theorem requires that the country endowments lie in the cone of diversification, which is a similarity requirement for the country endowments. Deardorff (1994) generalizes this condition to the case of an arbitrary number of goods and countries. He introduces a higher dimensional counterpart of "lying in the diversification cone", called the "Lens Condition" that can be applied to a multi-sector and multi-country world. This condition tells us how dissimilar the endowments of a group of countries can be for a given set of capital-labor ratios used in the production of the different goods. The Rybczynski and Stolper-Samuelson Theorems have "correlation" versions in higher dimensions. (Ethier (1984) for the Rybczynski and Deardorff and Stern (1995) for the Stolper-Samuelson Theorem.)

As pointed out by Leamer and Levinsohn (1994), the literature has neglected to explicitly check the appropriate similarity condition before judging the empirical relevance of FPE. The observed wage differences between a developed and a developing country do not give any information about the validity of the FPE Theorem. With apparent dissimilarity of endowment structure and likely differences in technology between the developed and developing world, the FPE Theorem would not predict equalization of factor prices in the first place.

FPE need not necessarily involve the whole world. It can hold among a subset of countries as long as they have identical technologies and similar factor proportions, as shown by Debaere and Demiroglu (1996). Using the lens condition of Deardorff (1994), we also investigate empirically whether the factor similarity conditions is satisfied or not for different sets of countries. We find that the endowments of the developed OECD countries considered by FH are indeed very similar. Thus, FPE within this group of countries is possible. On the other hand, in the case of a larger group of 34 countries that includes both developed and less developed countries, the lens condition is, not surprisingly, violated. Consequently, FPE is not expected for this larger group and there may be incentives for capital movements.

Note also that there were substantial capital flows in the nineteenth century from the UK to overseas (Obstfeld (1994)). Given the dissimilarity of the endowments of the UK and the economies of the new world at that time, the returns to capital are not expected to have been equalized by trade. Hence, the observed net capital flows are not surprising. Another situation where the saving-investment correlation is not as strong is the case of developing countries (Montiel (1994) and Dooley, Frankel and Mathieson (1987)), in spite of the fact that these countries have much stronger restrictions on capital movements.[9]

Another condition for FPE, the equality of international goods prices, is less of a concern for the same group of OECD countries. Tariff rates are low and have been decreasing. Although purchasing-power-parity does not hold at every moment in time, major price differences are leveled out over longer periods. Note that, FH (1980) take a fairly long time horizon for the averages of saving and investment in their regressions.

As mentioned earlier, a factor that may have made economists reluctant to consider the relevance of the HO Framework is its poor empirical performance, especially the

[9] These existing capital flows may reflect aid or funds from the IMF and the World Bank rather than private capital looking for higher gains. Nevertheless, they are consistent with the analysis of the endowments mentioned above. Another point one can raise is that the existence of net capital inflows to LDCs implies that there should be corresponding net capital outflows from developed countries. However, the size of LDC economies is small compared to output of developed economies. Thus, capital flows that are significant for the LDC economies are relatively insignificant for the developed countries.

failure of the prediction of the Heckscher-Ohlin-Vanek (HOV) Theorem. That Theorem states that the relative factor abundance of countries should be reflected in the net factor content of trade. The net factor content of trade prediction hinges critically upon the assumption of identical homothetic preferences, whereas the FPE, Rybczynski or Stolper-Samuelson Theorems do not. These three theorems depend only on the production side of the economy, and are valid irrespective of the consumption patterns. As a matter of fact, the HOV prediction may not be satisfied in our very model, as we do not impose any restrictions on the consumption side[10]. We need the HO Model in this paper only because it provides us with an already established, familiar framework to analyze the *multi-sector* world.

4. With Differences in Technologies

The assumption of identical technologies is fairly reasonable when we consider a limited group of high-income countries such as the major OECD countries. Yet, as shown in this section, one can go beyond FPE. The mechanism that forms the basis of the Rybczynski Theorem, i.e., the response of the sectoral output mix to changes in factor endowments can still bring the returns to capital together even when technologies across countries are different.[11] The analysis in this section is by no means a general treatment of technological differences. It presents two special examples that help gain insight into what happens when the technologies are not identical. The message is that trade may remove the need for capital flows even when there are technological differences among countries.

The setup of section 2 is retained except for the identical technology assumption. The home country is assumed to be more productive in a Hicks-neutral fashion. In other words, if the production function of sector j is $A_j^* F(K,L)$ in the foreign country, it is

[10] Even if we assumed identical-homothetic preferences, the HOV prediction would not likely be true in the model of section 2. Our high saving country has a higher investment rate and thus absorbs more of the capital intensive good. As such, the capital abundant country may well be a net importer of capital.

[11] The identical technology assumption is only needed for FPE and not for the Rybczynski and Stolper-Samuelson Theorems. The latter two theorems are still operational in this section.

$A_jF(K,L)$ in the home country with $A_j > A_j^*$. As there is a separate cone for each country in this case, the assumption regarding the diversification cone is replaced by the requirement that "both countries are diversified", so that each country produces both goods. The effect of an increase in the capital stock in the foreign country is analyzed graphically in Figure 2a. We start from an initial situation where $r = r^*$. This initial equality of r and r^* can be justified on the basis of past capital movements.[12] In Figure 2a, this makes the vertical intercept of the unit factor cost lines for both countries the same point, (0,1/r). Again, note that the horizontal intercept for the unit factor price line equals 1/w, and therefore in Figure 2a the foreign wages are lower.[13] (As before, the solid lines depict the initial situation in both countries and the dashed ones represent the new equilibrium.)

Figure 2 about here

We compare the initial capital returns, r and r^*, with the returns in the new equilibrium, r_+, and r_+^*. If the foreign country is small, the effect of changes in that country on world prices is negligible and factor prices stay the same in the world. Consequently, as predicted by the Rybczynski Theorem, the foreign country that accumulates capital produces more of the capital intensive and less of the labor intensive good. As the equality of the returns is left intact, no incentive arises for capital to move.

Even with a large foreign country, the saving-investment equality may not be a surprise. Figure 2b depicts that case. As before, when the foreign country accumulates capital, more of the capital intensive and less of the labor intensive good is produced in that country. This changes the pattern of world production, and that, in turn, may influence the world prices p_1 and p_2 as in the previous section. In Figure 2b we consider

[12] In our model, capital is mobile with no essential barriers to its movements (the required premium Δ is assumed to be arbitrarily small). Thus, $r = r^*$ is a reasonable starting point, as previous capital movements would have eliminated the return differentials if they existed. In this section we try to obtain the equality in the *future* period ($r_+ = r_+^*$) without resorting to any further capital movements.

[13] The rental price of capital and the goods prices the producers face are the same in both countries, but foreign firms have inferior technology. This disadvantage for the foreign firms is offset by lower wages.

a fall in the price of the capital intensive good p_2, while p_1 is kept the same (as good 1 is the numeraire). In response to that price change, the Stolper-Samuelson Theorem tells us that the return to capital in each country falls, as shown in Figure 2b by the steeper factor price lines. These lines may, though need not, have the same vertical intercept. In the appendix, we show that in the case of Cobb-Douglas production functions and Hicks-neutral technological differences, the changes in the rental rate are the same in both countries, and hence, $r_+ = r_+^*$. In other words, the equality is preserved in the new equilibrium even though there are no capital flows.

In general, the sizes of the changes in r and r^* may be different. Yet the directions of the changes are always the same in this setup; as stated by the Stolper-Samuelson Theorem, a decrease in the relative price of the capital intensive good reduces the rental price of capital. This is true as long as the same good is capital intensive in the two countries.

Below, we show that the possible difference of r_+ and r_+^* has an interesting implication (although it is difficult to derive an intuition from it): the country that accumulates more capital may well end up with a higher rental rate. This means that the country that accumulates more capital emerges as the more attractive direction for capital flows, contrary to what we would expect in a one-sector neoclassical model. Consider the following setup that uses Leontief technologies, $F_1(K,L) = A_1\min\{2K,L\}$ and $F_2(K,L) = A_2\min\{K,2L\}$. The equilibrium interest rate in this case is $r = (4/3)(p_2A_2\text{-}p_1A_1/2)$, and that gives a partial derivative of r with respect to p_2 of $(4/3)A_2$, and, similarly, in the foreign country $\partial r^*/\partial p_2 = (4/3)A_2^*$. If the foreign country is the country that accumulates capital, and if $A_2 > A_2^*$, the fall in p_2 causes a drop in r^* in the foreign country. One should note, however, that r^* falls by *less* than r in the home country. The final outcome is $r_+ < r_+^*$.[14]

[14] One might argue that capital movements will yield the initial equality of returns to capital in the 2x2x2 case with technological differences, yet that they are also likely to lead to specialization in the production of one good in one of the countries. This specialization would make the comovements of the returns to capital impossible. On the other hand, with many goods, complete specialization is less likely. That is why we consider the case of diversification in our 2x2x2 analysis. (As for the comovements of factor

5. Concluding Remarks

The long-standing FH observation is less of a puzzle once trade theory is taken into account. This paper presents a modified HO model to make this point explicitly. Among a group of countries that have similar endowments, FPE equalizes returns, and that leaves no incentive for capital to move from one country to another.

The FH observation arises when the economies of individual countries are characterized by one-sector neoclassical production functions. In a multi-sector world, countries with high investment rates can still employ the additional capital without a decline in returns as they shift production and exports toward more capital intensive goods. The example with different Leontief technologies shows how the intuition based on the neoclassical view of investment can be misleading in a multi-sector context with international trade. Capital may actually flow from the low to the high saving/investing country. There is no *a priori* reason to expect that capital should be channeled from the high to the low saving rate countries.

We emphasize that the insights from the theoretical HO model and the FPE result should not be discarded on the grounds that the maintained assumptions are not realistic. We argue that these assumptions are fairly accurate in the case of major OECD-countries. We also point out that trade can cause the returns to capital in different countries to move together even with different technologies and different wage rates. In particular, with Cobb-Douglas technology and Hicks neutral technological differences, the returns to capital across countries stay equal due to trade and there is no incentive for capital flows.

One caveat is that we address the long term cross-sectional correlation rather than the year-to-year comovements in saving and investment. The type of economic adjustments proposed in this paper are not likely to take place in the short run.[15] The equalization of

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returns, the correlation version of the Stolper-Samuelson Theorem (Deardorff-Stern (1995)) is applicable to the case of multiple goods.)

[15] As pointed out by Bayoumi (1996), the short-run comovements of saving and investment may be related to the business cycles. For example, an economic downturn is typically associated with a low level of investment. On the other hand, a fall in output results in a decline in the tax revenues, and that, in turn, reduces national saving through a lower (T-G).

goods prices (i.e., PPP) requires many years, and shifts in the composition of national production also take long periods of time. In addition, while the explanation in this paper involves only the real side of the economy, there may be short-run capital movements due to monetary reasons. A very tight monetary policy (as in the U.S. in the early 1980s) can raise the interest rate significantly and trigger financial flows. The sectoral shifts proposed in this paper cannot take place immediately in response to abrupt changes in the interest rates. The main message of this paper is that countries can accumulate different amounts of capital over long periods of time, yet this does not necessarily lead to differences in the rates of return to capital.

A dimension that is left unexplained is the following. The returns to assets in different countries do not appear to be completely correlated. Therefore, there seems to be an incentive to pool risks to lifetime consumption profiles through acquisition of foreign assets. While the incentives to pool the consumption risks may not be as strong as some authors contemplate, our paper does not deal with this issue.

This paper does not provide an empirical test of whether the proposed shifts in the composition of national production and exports have taken place. However, our explanation accords well with historical facts. High saving/investing countries should experience a shift toward the capital intensive sectors. In line with this is the observation that Japan, the highest saving country in the FH sample, has developed an increasing presence during the post W.W.II period in the auto and steel industries, two major capital intensive sectors. A similar case could be made for Germany.

There are two other observations that support our explanation. These are the capital movements in the 19th century between the UK and the new world and the weakness of the saving-investment correlation in the case of the developing countries. Both are instances of dissimilar factor endowments, and, therefore, unlikely cases where international trade enables countries to employ their factors efficiently through shifts in the sectoral mix of production. In the terminology of the HO Theory, the endowments are not likely to be in the cone of diversification and FPE is not expected to hold for these two cases.

Appendix

The following proposition states that, starting from a situation with identical returns to capital in the two countries, the change in r is the same in response to a change in prices in the case of Cobb-Douglas production functions with multiplicative technological differences.

PROPOSITION: Suppose that $r = r^*$, and the production functions in each sector of the home and foreign country are, respectively,

$$F_i(K_i, L_i) = A_i K_i^{\alpha_i} L_i^{1-\alpha_i} \quad \text{and} \quad F_i^*(K_i, L_i) = A_i^* K_i^{\alpha_i} L_i^{1-\alpha_i} \tag{1}$$

where $i = 1, 2$ is the index for the sectors. Then $\partial r/\partial p_2 = \partial r^*/\partial p_2$.

Proof: For a given price p_i and factor prices w and r, the revenue function is $p_i A_i K_i^{\alpha_i} L_i^{1-\alpha_i}$ and the profit function in sector i can be written as $\pi_i(K_i, L_i) = p_i A_i K_i^{\alpha_i} L_i^{1-\alpha_i} - wL_i - rK_i$. Maximization of $\pi_i(K_i, L_i)$ with respect to K_i and L_i yields

$$K_i = \frac{\alpha_i}{1-\alpha_i} \frac{w}{r} L_i. \tag{2}$$

With perfect competition and constant returns to scale production functions, profits will be zero in the equilibrium, i.e., $\pi_i(K_i, L_i) = 0$. Substituting equation (2) in $\pi_i(K_i, L_i) = 0$ and solving for w, we obtain

$$w = (1-\alpha_i)\alpha_i^{\frac{\alpha_i}{1-\alpha_i}} (p_i A_i)^{\frac{1}{1-\alpha_i}} r^{-\frac{\alpha_i}{1-\alpha_i}}. \tag{3}$$

Equation (3) will hold for both of the sectors, $i = 1, 2$, with the same w and r:

$$w = (1-\alpha_1)\alpha_1^{\frac{\alpha_1}{1-\alpha_1}} (p_1 A_1)^{\frac{1}{1-\alpha_1}} r^{-\frac{\alpha_1}{1-\alpha_1}}, \qquad w = (1-\alpha_2)\alpha_2^{\frac{\alpha_2}{1-\alpha_2}} (p_2 A_2)^{\frac{1}{1-\alpha_2}} r^{-\frac{\alpha_2}{1-\alpha_2}}. \tag{3'}$$

Using the pair of equations (3′), one can solve for r as

$$r = c(p_2 A_2)^{\beta_2} / (p_1 A_1)^{\beta_1}, \tag{4}$$

where (letting $\gamma = (\frac{\alpha_2}{1-\alpha_2} - \frac{\alpha_1}{1-\alpha_1})$) $\beta_i = [\gamma(1-\alpha_i)]^{-1}$, $i = 1, 2$, and $c = \frac{\alpha_2^{\alpha_2\beta_2}}{\alpha_1^{\alpha_1\beta_1}} (\frac{1-\alpha_2}{1-\alpha_1})^{\frac{1}{\gamma}}$. Without loss of generality, consider a change in p_2. From equation (4), the partial response of r is

$$\frac{\partial r}{\partial p_2} = c \frac{\beta_2 p_2^{\beta_2 - 1} A_2^{\beta_2}}{p_1^{\beta_1} A_1^{\beta_1}}. \tag{5}$$

Similarly, for the foreign country, we have

$$r^* = c(p_2 A_2^*)^{\beta_2} / (p_1 A_1^*)^{\beta_1}, \tag{6}$$

and

$$\frac{\partial r^*}{\partial p_2} = c \frac{\beta_2 p_2^{\beta_2 - 1} A_2^{*\beta_2}}{p_1^{\beta_1} A_1^{*\beta_1}}. \tag{7}$$

Since $r = r^*$ initially, we equate the right hand sides of (4) and (6). That yields

$$\frac{A_2^{\beta_2}}{A_1^{\beta_1}} = \frac{A_2^{*\beta_2}}{A_1^{*\beta_1}}. \tag{8}$$

Finally, equations (5), (7) and (8) imply that $\partial r/\partial p_2 = \partial r^*/\partial p_2$.□

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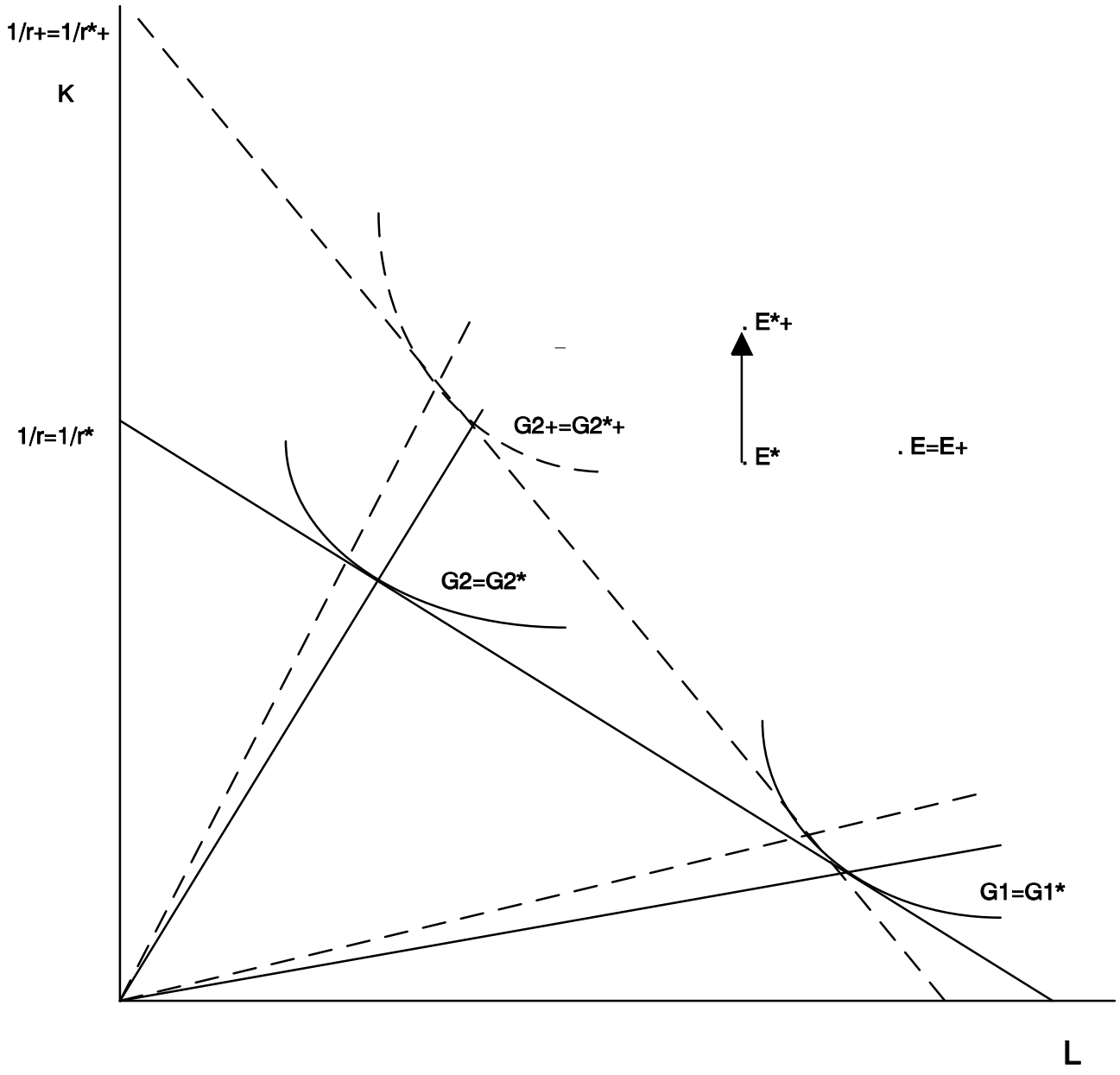


FIGURE 1

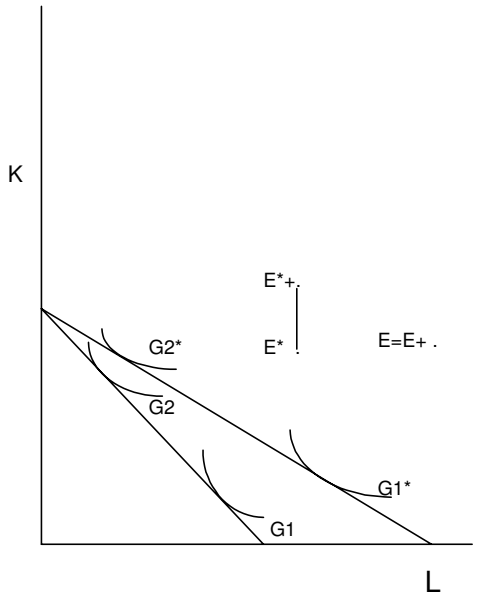


FIGURE 2a

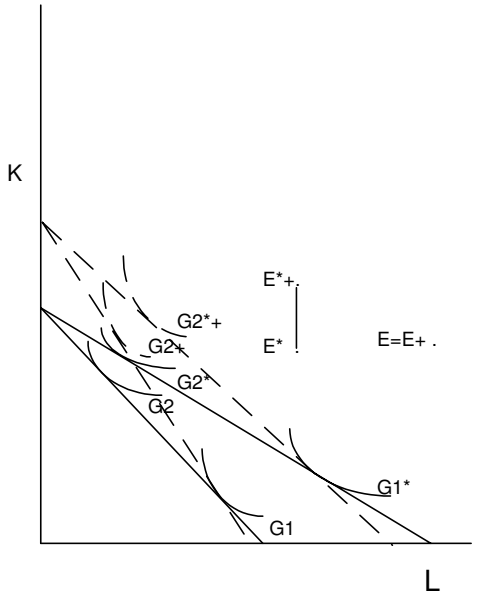


FIGURE 2b