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INTERNATIONAL FINANCE DISCUSSION PAPERS

ON THE BALANCE-OF-PAYMENTS EFFECTS OF DIRECT INVESTMENT AND THE EFFICACY OF CONTROLS: COMMENTS ON AND EXTENSIONS OF AN ARTICLE BY PETER H. LINDERT

by

Guy V.G. Stevens

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Division of International Finance

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By demonstrating the superiority of the present-value to the recoupment-period criterion, Peter Lindert [4] has made a major contribution to the analysis of foreign investment controls. In fact, after reading Lindert's analysis, one wonders how the recoupment-period criterion got a foothold in the first place: the assessment of the net impact of a control program is clearly dependent on a comparison of capital inflows and outflows occurring at different points in time: and the accepted and <u>traditional</u> way to make such intertemporal comparisons is by a present value calculation. Moreover, as I attempt to show below, the present value formulation leads to useful insights into the analysis of the balance of payments effects of direct investment, independent of the existence of controls.

While heartily endorsing this methodological shift, one need not be satisfied with Lindert's use of his newly forged tool. It is my opinion that his policy conclusion is unproved: he has not established, as he claims, that it is impossible for temporary direct investment controls to help the U.S. balance of payments. This is the subject of section I.

Further, Lindert's analysis of the balance of payments effects of direct investment, while correct as far as it goes, is limited in coverage and, therefore, hides as much as it reveals--both about controls and the factors determining the payments effects of direct investment. As I show in section II, it is possible to deduce a much more comprehensive set of propositions than Lindert's, establishing:

(1) the general conditions (with respect to the parameters of the direct investment process) under which any temporary control program whatsoever will help or hurt the balance of payments.

(2) the conditions under which a temporary control program will hurt the balance of payments while, at the same time, permanent controls will help.

(3) the conditions under which any control program can turn the balance of payments effect of direct investment from a net drain into a net benefit, and vice versa.

The paper closes with the presentation of evidence on recent high rates of growth of the stock direct investment which, interpreted in the light of the preceding theoretical results, indicates that, at least for direct investment in manufacturing, the overall payments impact is probably negative and the situation is reversible only by a permanent control program. However, this result may be caused by Lindert's oversimplified definition of the balance-of-payments impact of direct investment (in equation (2)); a revised model which distinguishes between asset growth and foreign borrowing may modify this disturbing conclusion.

I. WHY WE MAY STILL DISAGREE AS TO THE IMPACT OF TEMPORARY DIRECT INVESTMENT CONTROLS

My reservation with Lindert's major conclusion that temporary direct investment controls have been counter-productive is based on the fact that Lindert forgets about two of the three alternative assumptions introduced by Hufbauer and Adler [2] regarding the impact of foreign subsidiary production on exports from the United States. To forget these distinctions seems to me to forget what all the shooting has been about. By assuming Hufbauer and Adler's reverse-classical case, and ignoring the others, Lindert overlooks the major reason why people may still reasonably disagree as to the effects of a temporary program of direct investment controls.

Lindert shows how conclusions on the desirability of a given direct investment control program depend on one's estimates of four parameters:[1/]

(1) r, the rate of return after host-country taxes per dollar of the stock of direct investment.

(2) x, the rate by which the stock of direct investment changes exports from the United States.

(3) v, the share of the flow of direct investment matched by exports of capital equipment from the United States.

(4) ρ, the social rate of discount used to find the present value of future balance-of-payments effects.

The first three of these parameters, along with the value of direct investment $[A(t)]$[2/] and its rate of change $[\dot{A}(t)]$, determine the impact of direct investment on the balance of payments $[B(t)]$:[2/]

(1) $$B(t) = (r+x)\ A(t) - (1-v)\dot{A}(t)$$

Following Lindert, all of the above variables plus the social rate of discount define the social present value (PV) of direct investment activities on the balance of payments:

(2) $$PV = \int_0^\infty B(t)e^{-\rho t}dt$$

Naturally, the success or failure of any program of controls is determined by its positive or negative impact on the present value in equation (2).

My objection to Lindert's empirical conclusion concerns the values he entertains as plausible magnitudes for coefficient x, the effect of direct investment on U.S. net exports.[3/] In his Table 2, Lindert lists only the most favorable of Hufbauer and Adler's three sets of estimates for x--the set for the reverse-classical case, which assumes that the total levels of both U.S. and host-country investment and production are independent of the flow of U.S. direct investment. This means that direct investment does not affect U.S. domestic investment and for any decrease in direct investment brought about by controls, foreign firms in the host country step in to fill the gap--exactly. But Hufbauer and Adler have other figures for x based on different assumptions, the so-called classical and anti-classical cases. Three cases and three alternative sets of x's were distinguished because Hufbauer and Adler could not determine empirically what investors and governments in the U.S. and host countries would do, if anything, in the face of fluctuations in the flow of direct investment.

Depending on which reaction pattern one selects, the conclusion concerning the impact of temporary U.S. control programs varies radically. Table 1 below presents the results for the Hufbauer-Adler classical case: where the flow of U.S. direct investment causes a dollar-for-dollar reduction of U.S. domestic investment and a dollar-for-dollar increase in total host-country investment. As should be expected, the export coefficient, x, turn sharply negative. For now,

Table I

PARAMETER ESTIMATES FOR CLASSICAL CASE

Investments Covered	v	x	r	critical ρ, such that $\rho = (x+r)/(1-v)$
U.S. Manufacturing, 1962-65:				
in Canada	.121	-.845	.109	less than zero
in Europe	.009	-.068	.146	.079
in Latin America	.000	-.242	.113	less than zero
in Other Areas	.050	-.746	.197	less than zero

Sources: This table is identical to Lindert's Table 2 except for the estimate of x. The estimate for x is taken from Hufbauer and Adler's table for the classical case; the x values are the sum of columns (5), (7), (8) of Table 5.1-5.4, pp. 60-61.

using Hufbauer and Adler's admittedly rough calculations, not only does the flow of direct investment cause a reduction in U.S. exports because of increases in U.S. subsidiary sales abroad, but also it does not, as in the reverse-classical case, cause an increase in U.S. exports because of lower investment and sales by non-U.S. firms. For every area of the world save one, Lindert's conclusion is reversed; the internal rates of discount (making the present value of the balance-of-payments impact of a dollar's increase in direct investment equal to zero) is usually negative, and in any case so low as to make temporary direct investment controls worthwhile under any plausible assumption about the United States' social rate of discount.

Why does Lindert reject the classical case?--or the anti-classical case which leads to similar conclusions? The only argument he makes which is applicable to parameter x is the repetition of the Reddaway Report's [5] assumption that government stabilization policies will be used in both countries to offset any fluctuations caused by variations in the flow of U.S. direct investment.

Surely there are many reasons why we might resist the conclusion that this argument, without further verification, provides the final disposition of the case. First, it is hard to claim that all concerned governments succeed in running perfect stabilization programs. If they do not, the net effect of the flow of U.S. direct investment on U.S. exports will probably deviate considerably from that postulated by the reserve-classical case.

Second, even if governments managed to run perfect stabilization programs, if we assume that the value of parameter x may vary from industry to industry, for the reverse-classical case to hold it would be necessary for governments to set and reach targets for investment and production in all relevant industries; otherwise changes in the flow of direct investment to one industry might be offset by variations in host-country investment in another industry, with unpredictable effects on U.S. exports. Even if governments desired to fine-tune down to the industry level, the monopolistic characteristics[4/] of many of the products of foreign subsidiaries might make it impossible for host-country investment to completely supplant that part of U.S. direct investment which is restrained by U.S. controls.

Finally, stabilization policy operates on many more variables than the rate of investment;[5/] changes in government expenditures or consumption may be induced by the authorities in order to offset changes in the economy's rate of investment caused by variations in direct investment. Thus even perfect economic stabilization need not imply the reverse-classical case.

Going beyond the Reddaway argument, it is my opinion that little evidence of any kind--and no conclusive evidence--has been adduced to support either of the three Hufbauer-Adler alternatives. It is true that businessmen usually claim when interviewed that the reverse classical assumptions holds--that they only invest abroad when "forced to";[6/] but it seems unwarranted to me to claim that the reverse-classical case is established by such evidence, which is both subjective and self-serving.

But if the reverse-classical case is not established, Lindert's conclusion that temporary controls on U.S. direct investment hurt the balance of payments is, similarly, not established. I would be willing to bet that the "real" value of x lies somewhere between the values for the polar classical and reverse-classical cases. But as the comparison of my Table 1 and Lindert's Table 2 clearly shows, just where between the extremes the real value of x lies is of critical importance in assessing the impact of direct investment control programs.

II. TEMPORARY AND PERMANENT CONTROLS: THEIR NATURE AND LIMITATIONS

Even if Lindert's estimates of the relevant parameters turn out to be the true ones, we must be careful not to misjudge the rather narrow limits of his conclusions. First, he does not claim that <u>all</u> controls on direct investment will be counter-productive, but rather only a fairly broad selection of controls from the class that he defines as "temporary." By "temporary" Lindert means control programs that have an effect that is limited in time, in the sense that the value of direct investment eventually catches up to the path it would have followed had there been no controls. Second, Lindert's result does not imply that if temporary restraints on direct investment actually <u>hurt</u> the balance of payments, then uncontrolled direct investment must be <u>helping</u> it. As shown below, this proposition is not necessarily true: temporary controls by their very nature cannot cure balance-of-payments ills caused by a rapid growth in the value of direct investment. The analysis of this limitation of temporary controls leads naturally to a more general analysis, encompassing both temporary and permanent controls. In so doing, it will be possible to establish the mathematical conditions for the efficacy of various types of control programs, conditions which encompass Lindert's specific results as special cases.

Let us start the argument by recalling equation (1) above, Lindert's definitional equation for the balance-of-payments impact of direct investment activities for a given period of time:

$$(1) \qquad B(t) = (r+x)A(t) - (1-v)\dot{A}(t)$$

where, as defined in the previous section and Lindert's article, B(t) is the net balance-of-payments effect; A(t) and $\dot{A}(t)$ are the value of direct investment and its rate of change (the flow), respectively; r and x are the rate of profit and the rate of U.S. export stimulation per dollar of the value of direct investment, and v is the rate of stimulation of U.S. exports of capital equipment per dollar of the flow (change) of direct investment.

Further, following Lindert, the social present value of all balance-of-payments effects of the direct investment process was defined as:

$$(2) \qquad PV = \int_0^\infty B(t)e^{-\rho t}dt ,$$

where ρ is the social rate of discount, assumed by Lindert to be equal to the "rate of interest paid on liquid instruments used to finance deficits."[7/]

Suppose that direct investment were growing so fast that B(t) was negative for all t. (If $\dot{A}/A$ is constant at rate g, then any $g > \frac{r + x}{1 - v}$ will do.) With such a growth rate and all $B(t) < 0$, clearly the social present value of direct investment for the balance-of-payments would be negative. Just as clearly, if we could devise a program to stop future flows of direct investment entirely, the present value of such a program would be positive (providing of course that $r + x > 0$). Paradoxically, however, as long as Lindert's criterion holds $[(r + x)/(1 - v) > \rho]$ --a condition independent of the rate of growth g -- any <u>temporary</u> program can only <u>harm</u> the balance of payments. The first example -- a "permanent" program -- shows, however, that the fact that temporary programs are counter-productive implies neither (1) that direct investment as a whole is of net benefit to the balance of payments nor (2) that beneficial control programs are mathematically impossible to design.

One can explain this paradox as follows. From equations (1) and (2), the present social value of direct investment equals:

$$(3) \qquad PV = \int_0^{\infty} B(t)e^{-\rho t}dt = \int_0^{\infty}(r+x)A(t)^{-\rho t}dt - \int_0^{\infty}(1-v)\dot{A}(t)e^{-\rho t}dt$$

Using intergration by parts,[8/] the last integral equals:

$$(1-v)\int_0^\infty \rho A(t)e^{-\rho t}dt \;+ \underset{t\to\infty}{\text{Limit}}\ (1-v)A(t)e^{-\rho t} - (1-v)A(0)$$

Making this substitution, equation (3) becomes:

$$(4) \qquad PV = \int_0^\infty B(t)e^{-\rho t}dt = \int_0^\infty [r+x - (1-v)\rho]A(t)e^{-\rho t}dt$$

$$- (1-v)\ \underset{t\to\infty}{\text{Limit}}\ A(t)e^{-\rho t} + (1-v)A(0)$$

Note that if Lindert's condition holds, every term in the first integral on the right hand side of (4) is positive; it will be shown below that temporary control programs affect only this integral. We have seen above that, at the same time Lindert's condition holds, the overall present value of direct investment (PV) may be negative; if so, this must show up by having the negative term in the $\underset{t\to\infty}{\text{limit}}\ A(t)e^{-\rho t}$ outweigh the other, positive, terms. This can arise mathematically and, from the evidence presented below, would seem to be empirically possible as well.[9/] In such a world, temporary control programs cannot get at the essential factor causing direct investment to hurt the balance-of-payments: a rate of growth that is too high. By definition, only permanent control programs can lower the limit term in equation

(4), the place where the overly-rapid growth rate manifests itself.

A General Theorem on the Sign of the Effect of a Temporary Control Program.

The fact that a program of controls is temporary implies, it should be recalled, that the actual value of direct investment eventually catches up to the path it would have followed had controls never been instituted. Let $A^*(t)$ be the value direct investment would have attained at time t had it been left uncontrolled; let $A(t)$ be the actual or observed value of direct investment at t. Lindert's definition of a temporary program implies, then, that:

$$\lim_{t\to\infty} A(t) = \lim_{t\to\infty} A^*(t)$$

Combining this condition with equation (4) we see immediately that any changes in the payments effect of direct investment caused by a temporary program must be reflected in changes in the integral $\int_0^\infty [r+x-(1-v)\rho]\, A(t)e^{-\rho t}dt$.

Following Lindert[10] define the net effect of a control program as:

$$\int_0^\infty \Delta B e^{-\rho t} = \int_0^\infty B(t)e^{-\rho t}dt - \int_0^\infty B^*(t)e^{-\rho t}dt$$

$$= \int_0^\infty (x+r)[A(t) - A^*(t)] - (1-v)[\dot{A}(t) - \dot{A}^*(t)]\, e^{-\rho t}dt$$

$$= \int_0^\infty [r+x) - (1-v)\,\rho]\,[A(t) - A^*(t)]e^{-\rho t}dt$$

$$-(1-v)\lim_{t\to\infty}[A(t) - A^*(t)]e^{-\rho t} + (1-v)[A(0) - A^*(0)]$$

For all programs, by convention we choose time 0 such that $A(0) = A^*(0)$: i.e., before controls affect capital flows, the controlled and uncontrolled levels of direct investment are identical; hence the last term equals zero. Further, as noted above, for a temporary program of any kind, the definition of a temporary program implies that the $\lim_{t \to \infty} [A(t) - A^*(t)]\, e^{-\rho t} = 0$. Therefore, for any temporary program, the sign of the effect of the program depends exclusively on its effect on the first integral.

Given the constancy of r, x, v, and ρ, a general result for all temporary control programs follows: If $\frac{r + x}{1 - v} > \rho$, then any program whatsoever of temporary direct investment controls will adversely affect the balance of payments; if $\frac{r + x}{1 - v} < \rho$, any such program will help the balance of payments.

The above conditions are the ones derived by Lindert; but we have proved here a much more general and robust result; as long as $A(t) \leq A^*(t)$--i.e. as long as the program actually restricts direct investment--Lindert's condition holds no matter what the nature of the control program or what the path of adjustment from A to A* after the controls are lifted. Thus, all of Lindert's examples are special cases of this general result.

On the Magnitude of the Impact of Temporary Controls

The preceding analysis showed that any temporary program of direct investment controls can help the balance of payments only under certain conditions, i.e., if $(r + x) < (1 - v)\rho$. By "help" we mean only that the present value of the balance-of-payments contribution of direct investment is greater, *ceteris paribus*, than previously; nothing has been asserted as to whether this present value would be positive or negative after the application of controls. This consideration suggests another, stronger, question: Under what conditions can a control program turn a bad process into a good one? That is to say, if uncontrolled direct investment has an overall negative impact on the balance of payments, can a temporary program turn the overall impact into a positive one? And can a misguided program do the opposite?

The answer depends on what happens to the $\text{Limit}_{t\to\infty} A(t)e^{-pt}$. Three relevant alternatives can be distinguished: $\text{Limit}_{t\to\infty} A(t)e^{-pt}$ equals 0 (case I); infinity (case II); or some constant, $C > 0$ (case III).

The first conclusion is that where the limit is greater than zero (case II or case III), no temporary program can change the sign of the overall impact of the direct investment process.[11/] This conclusion becomes intuitively clear when one shown that (1) the present value of the direct investment process is infinite in these two cases and (2) the net effect of any temporary program is finite. These two propositions are proved in the Appendix. There remains only the question of Case I. Here the present value of the balance of payments effect of the uncontrolled process is finite, so it is possible that the finite effect of temporary controls could reverse the sign of the present value. In fact we can show that in this case a temporary control program can sometimes turn a "bad" overall process into a "good" one, but can never turn a good one into a bad one.

Recall that the present value of the balance of payments impact of the uncontrolled process is, for Case I, given by:

$$\int_0^\infty B(t)e^{-\rho t} = \int_0^\infty [r+x - (1-v)\rho]A^*(t)e^{-\rho t} + (1-v)A^*(0)$$

For both controlled and uncontrolled direct investment, $A(t) > 0$ and $A(0) > 0$. Hence where $r + x - (1-v)\rho > 0$, the overall effect of the process will be positive both before and after controls are applied; in this case, it will be remembered, a temporary program hurts the balance of payments, but not so much as to turn the overall effect from positive to negative.

However, where $r + x - (1 - v)\rho$ is less than zero, the analysis can go the other way--because now the overall effect is the sum of two terms with different signs. If the integral term is outweighed by $(1-v)A^*(0)$, the overall direct investment process affects the balance of payments positively, and since all the temporary programs now have a positive effect, controlled direct investment still has a positive effect. On the other hand if the negative integral outweighs the last term, then the finite, positive effect of a control program may, in this case, turn the negative impact of uncontrolled direct investment into an overall positive impact.

Permanent Programs

Temporary programs show limitations both as to the situations they can help at all and the magnitude of the balance of payments improvement they can provide. In particular, because the effect of a temporary program on the present value of the balance of payments is necessarily finite, it will have an insignificant impact in those cases where the rate of growth of direct investment is greater or equal to the social rate of discount--Cases II and III above.[12/]

But where temporary programs fail, permanent programs can succeed. For example, we saw above in the case where the growth rate of direct investment was so great such the $g > \rho$ and $(r + x) - (1 - v)g < 0$, that the simple but admittedly Draconian program forbidding further flows of direct investment would do what no temporary program could: turn a drain on the balance-of-payments into a benefit. This regime falls outside of the class of temporary programs in that the controlled level of direct investment does not at any time approach the uncontrolled level. All permanent controls must affect the long-run level and rate of growth of direct investment assets; by doing so, they ofter have an infinite effect on the present value of the balance of payments.

Is it conceivable that direct investment, as we know it, is growing and will be growing so fast as to imply that a permanent control program might be required? A look at the evidence at least suggests the answer yes, particularly for direct investment in manufacturing. The evidence strongly implies that, as in Table 1 above, the value of the U.S. export parameter, x, is crucial for determining the sign of the overall effect on the balance of payments.

Table 2 shows the growth rates of U.S. direct investment for two periods directly prior to the institution of the direct investmennt controls in 1965.[13/] The first, 1962-65, corresponds to Lindert's sample period; the second is for the eight year period prior to the program, starting with the last pre-control census year of 1957.

For manufacturing direct investment to Europe, Latin America, and "other areas," the rate of growth of the value of direct investment is so high that, for almost any reasonable social rate of discount, we would expect the present value of the payments effects to be plus or minus infinity (Case II). For aggregate direct investment (all industries and areas) and for Canadian manufacturing, the growth rates are high enough to necessitate a knowledge of the social rate of discount before one can tell into which class the process falls.

Suppose the ρ is low enough relative to g to imply that all five of the above processes will fall into Case II. A further important question is: Will the present values equal plus or minus infinity? If these growth rates persist for all time, the answer will depend on the sign of $r + x - (1 - v)g$.[14/] As we found in section I in the criticism of Lindert's policy conclusion, the results are crucially dependent on the value chosen for x, the U.S. export effect. Again we find that the results for the classical and reverse-classical cases are, except for Europe, contrary to each other. Table 3 presents the present values for the two cases along with the critical level of x below which $r + x - (1 - v)g$ is negative. Once again we find that the true value of x is invaluable social information.

TABLE 2

GROWTH RATES OF DIRECT INVESTMENT

Industry and Area	1962-65	1957-64
Aggregate of all Industries and All Areas	.096	.087
Manufacturing		
Canada	.079	.072
Europe	.153	.162
Latin America	.142	.126
Other Areas	.184	.148

Notes: The data are taken from various issues of the Survey of Curreny Business. In calculating the growth rates for the longer period, the value of Cuban investments was excluded.

TABLE 3

PRESENT VALUES OF CONSTANT GROWTH CASES

(Growth rates for 1962-65)

Sign of $r+x - (1-v)g$

Industry and Area	Reverse-Classical	Classical	Critical x
Manufacturing			
Canada	> 0	< 0	-.0392
Europe	> 0	< 0	+.0056
Latin America	> 0	< 0	+.029
Other Areas	< 0	< 0	+.0222

III. SUMMARY AND CONCLUDING REMARKS

This paper has used and recommends for universal adoption in the analysis of direct-investment control programs the present value method pioneered by Peter Lindert. While accepting his method, I have questioned both Lindert's explicit policy conclusions and some implicit inferences that the unwary reader would be likely to make. Lindert's conclusion that temporary direct investment restraint programs, such as the recent American ones, can only have hurt the (present values of) balance of payments is unwarranted because it is dependent on an unproved and highly controversial assumption about the interaction between direct investment and U.S. exports. Alternative and equally realistic assumptions lead to the opposite conclusion.

The unwary reader on looking at Lindert's analysis is likely to conclude, as I once did, that if temporary restraints of direct investment actually hurt the balance of payments, then uncontrolled direct investment must be helping the balance of payments. As shown in section II above, this proposition is not necessarily true. Temporary controls by their very nature cannot cure balance-of-payments ills caused by a rapid growth in the value of direct investment. If the long-run growth rate of the value of direct investment is sufficiently high, the consequent capital outflows can wipe out any balance-of-payments benefits attributable to remitted earnings, royalties and exports. To remedy this situation, permanent, not temporary, programs are required.

In order to focus attention on Lindert's model and conclusions, this paper has neglected a number of points that might be of interest to those who formulate and evaluate direct investment control programs. First, Lindert's framework regrettably does not distinguish between the assets owned by U.S. foreign affiliates and the value of direct investment, which is essentially the equity interest of the U.S. owners. It is misleading and dangerous to associate, as Lindert and others do, a constant rate of earnings to each dollar of the value of direct investment. If a constant rate of earnings should be associated with anything, it should be with the affiliate's asset level. To assume that the level of direct investment generates the earnings is dangerous, as well, because control programs will often change the ratio of assets to direct investment--by encouraging foreign borrowing--and thus act directly on the rate of earnings per unit of direct investment.

A superior model would relate foreign affiliate earnings, export displacement and the capital equipment effect to foreign affiliate assets (AS) or sales; it would naturally retain the capital outflow effect associated with the flow of direct investment ($\dot{D}$); it might or might not directly incorporate the level of liabilities (L) raised from non - U.S. sources. Instead of Lindert's equation (1) for the (definition) of the balance-of-payments effect of direct investment activities one might start with the following:

$$B(t) = (r+x)AS(t) - iL(t) + v\dot{AS}(t) - \dot{D}(t)$$

where all the variables are as defined previously except i, the rate of interest payable to non-U.S. creditors.

Since the three variables are connected by the balance sheet identity--AS = L + D--one of the variables can be eliminated, say L:

$$B(t) = (r+x)AS(t) - i[AS(t) - D(t)] + v\dot{AS}(t) - \dot{D}(t).$$

This revised expression for the payments impact of direct investment clearly shows that there are two independent variables any control program can work on, not just direct investment alone.

The introduction of more than one instrumental variable leads to a final point. Both this paper and Lindert's have neglected to study <u>optimal</u> control programs. In fact, in the simple model introduced by Lindert there was no need to; with constant parameters r, x, and v, if a control helped the balance-of-payments, it would pay to increase the pressure until all the flow of direct investment was eliminated. However, when we have more than one independent variable to work with and when some of the parameters such as r and i may be affected by AS(t) or L(t), it begins to pay to investigate what sort of control program will <u>maximize</u> the balance-of-payments effect or, possibly, some more complicated objective.

APPENDIX

The Infinite Effect of Some Direct Investment Processes on the Balance of Payments and the Finite Impact of All Temporary Programs

Consider the first proposition. For Case III, $\lim_{t\to\infty} A(t)e^{-\rho t}$ equals C. Hence for any number E, no matter how small, we can find some time T, such that for all $t > T$, $A(t)e^{-\rho t}$ is arbitrarily close to C, i.e., $| A(t)e^{-\rho t} - C| < E$. This inequality allows us to show that the first integral in equation (4), the balance-of-payments effect of direct investment, is infinite. Recall that the integral equals. $\int_0^{\infty}[r+x-(1-v)\rho]A(t)e^{-\rho t}dt$. Assume first, that $r+x-(1-v)\rho > 0$. Since $A(t)e^{-\rho t}$ is arbitrarily close to $C > 0$, for $t > T$, it follows that the above integral is greater than or equal to:

$$\int_0^{T}[r+x - (1-v)\rho]A(t)e^{-\rho t}dt + \int_T^{\infty}[(r+x) - (1-v)\rho](C-E)dt$$

The first of these is positive and finite. But the last integral increases without limit, equalling $(r + x - (1-v)\rho)(C-E)t\,]_T^{\infty}$. Hence the original integral also must be infinite. Similarly, if $r + x - (1-v)\rho < 0$, we can show that the original integral equals minus infinity. Since the other terms in the present value are finite for Case III, the overall present value is equal to plus or minus infinity.

A similar argument shows that the first integral is infinite for Case II. If $r + x - (1-v)\rho < 0$, then the present value equals the sum of two terms which approach minus infinity; if $r + x - (1-v)\rho > 0$, usually, but not always, one or the other infinite, but opposite signed terms, will dominate the other. In particular, for the important case of exponential growth $\dot{A}$, gA, the present value of the effects will be infinite unless $(r+x)/(1-v) = g$.

Now to show that the effect of any temporary program on the present value is finite. It was shown in the previous section that this effect is measured by:

$$\int_0^\infty [r+x - (1-v)\rho]\ [A(t)-A^*(t)]e^{-\rho t}dt.$$

Can we prove that this integral is finite? The answer is yes. We can divide the above integral into two parts, as above:

$$\int_0^T [(r+x) - (1-v)\rho]\ [A(t) - A^*(t)]e^{-\rho t}dt + \int_T^\infty [r+x - (1-v)\rho][A(t)-A^*(t)]e^{-\rho t}dt$$

Sinve $A(t)$, $A^*(t)$ and e^{-pt} are finite, for all finite t, the first integral is finite. By the definition of a temporary program we know that $A(t)$ approaches $A^*(t)$ as $t\to\infty$. This means that for some appropriately chosen T, $A(t) - A^*(t)$ can be made arbitrarily small, for all $t > T$. Thus by an appropriate choice of T we can show that the last integral is finite: i.e.:

$$\int_T^\infty [(r+x)-(1-v)\rho][A(t)-A^*(t)]e^{-\rho t}dt\Big| < \Big|\int_T^\infty [r+x-(1-v)\rho]Ee^{-\rho t}\Big| < \infty$$

Hence the net payments effect of a temporary program is the sum of two finite parts and, therefore, finite.

FOOTNOTES

1/ Lindert [4], p. 1086. Although they need not be so, for convenience these coefficients were assumed in Lindert's paper to be constant over time.

2/ Ibid., p. 1086. Where it is important to avoid confusion, I shall refer to the stock (A) as the value of direct investment and its rate of change ($\dot{A}$) as the flow of direct investment. Although it is not important for Lindert's analysis it should be made clear that the value of direct investment bears no necessary relation to the value of the assets controlled by the foreign branches and subsidiaries of U.S. firms. Some implications of this latter point are discussed in the last section of this paper.

3/ Alan Severn [6] has dissented from Lindert's conclusions on the grounds that Lindert's values for ρ are too low.

4/ See e.g., Hymer [3] or Caves [1].

5/ I am indebted to my colleague, Ray Lubitz, for this point.

6/ See e.g., Stobaugh [7].

7/ Lindert [4], p. 1084. Lindert sees the value of ρ as equal to a weighted average of "the rates on U.S. Treasury bills, bank deposits, foreign gold purchases, etc...." (p. 1086).

8/ See, e.g., Thomas [8], pp. 359-363. This substitution is often used in the theory of corporate investment and admits of a clear economic interpretation. If the limit term equals zero, as is usually assumed, then the substitution says that the present cost to the firm of internally financing all its investment expenditures

is just equal to the present cost of borrowing the finance (or renting the capital goods) at rate ρ per period. (Note that the first and last terms combine to: $(1-v)\int_0^\infty \rho[A(t) - A(0)]e^{-\rho t}dt$).
However, if the limit term does not coverge, the present cost of the self-financing alternative is greater -- perhaps infinitely greater -- then the borrowing alternative.

9/ Naturally, if the limit term outweighs the positive integral, it cannot be equal to zero; the limiting rate of growth of direct investment must be equal to or greater than ρ. Table 3, below, indicates that the growth rate of direct investment has been greater than Lindert's ρ for most, if no all, areas during the decade immediately preceding the U.S. control program. Such evidence does not establish the point that the limiting rate of growth, g, as t approaches infinity, will be greater than ρ; however, given the small base from which our direct investment started, such high growth rates seem maintainable for many years to come.

This paper is not the place to explore the question whether a limiting g greater than ρ is compatible with long-run general equilibrium.

10/ Lindert [4] , p. 1086.

11/ The one exception to this rule is a special situation falling under case II; if $(r+x) - (1-v)\rho > 0$, it may be that the integral term and the limit term offset each such that their sum is a finite constant. This would seem unlikely empirically.

12/ In this section, for convenience the discussion will be limited to processes where direct investment is growing at a constant exponential rate, i.e., $A(t) = A(0)e^{gt}$.

13/ The estimates of g presented in Table 2 are the unweighted averages of annual growth rates: $\frac{V_t - V_{t-1}}{V_{t-1}}$. As such, this estimates are identical to the least squares regression coefficient of g in the following equation: $\frac{\Delta V}{V} = g + u$.

14/ If $\dot{A}(t) = gA(t)$ at each point in time, then we can substitute for $\dot{A}$ in equation (4) for the present value of the balance-of-payments effects of direct investment:

$$\int_0^\infty B(t)e^{-\rho t}dt = \int_0^\infty \left\{(r+x)A(t) - (1-v)\dot{A}(t)\right\}e^{-\rho t}dt = \int_0^\infty [r+x-(1-v)g]A(t)e^{-\rho t}dt .$$

Since $A(t) \geq 0$, the sign of the present value will depend on the sign of $r + x - (1-v)g$.

The world as a whole is excluded from Table 3 because Hufbauer and Adler limit their calculations of x and v to manufacturing direct investment.

References

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[3] Hymer, S., The International Operation of National Firms: A Study in Direct Foreign Investment, Unpublished doctoral thesis, M.I.T., 1960.

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[5] Reddaway, W.B., in collaboration with S.J. Potter and C.T. Taylor, Effects of U.K. Direct Investment Overseas: Final Report, Cambridge, England: Cambridge University Press, 1968.

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