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CENTER DISCUSSION PAPER NO. 164

AN ALTERNATIVE THEORETICAL APPROACH TO THE IMPACT OF FOREIGN INVESTMENT ON THE HOST COUNTRY

Benjamin I. Cohen

November 1972

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AN ALTERNATIVE THEORETICAL APPROACH TO THE IMPACT OF FOREIGN INVESTMENT ON THE HOST COUNTRY

Benjamin I. Cohen*

October 1972

I.

Perhaps because of the impact of the Ricardian emphasis on the international immobility of capital and labor, economic theory has had relatively little to say about the impact of international investments by corporations. MacDougall's article is one of the few theoretical articles in this area. Caves and Johnson, in the late 1960's, wrote that "MacDougall's essay on foreign investment...points out the special characteristics of this form of international factor movements..."[1] Other readers of MacDougall's article may not easily discern these special characteristics, and at the end of his article MacDougall says that "no distinction is made between fixed interest and equity investment."[2] Assuming, among other things, perfect competition, MacDougall concludes that "the most important direct gains...from more rather than less private investment from abroad seem likely to come through higher tax revenue from foreign profits (at least if the higher investment is not induced by lower tax rates), through economies of scale and through external economies generally, especially where [local] firms acquire 'know-how' or are forced by foreign competition to adopt more efficient

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*I have benefitted from extensive discussions with Richard Brecher. Carlos Diaz Alejandro also made helpful comments on an earlier version of this paper. Ann Morgan helped with the computer analysis. Financial support for this research comes from NSF Grant No. GS33741X. I am solely responsible for the contents of this paper.

[1] Readings in International Economics, ed. Richard E. Caves and Harry G. Johnson (Homewood, Illinois: Richard D. Irwin, Inc., 1968), p. vii.

[2] G.D.A. MacDougall, "The Benefits and Costs of Private Investment from Abroad: A Theoretical Approach," Economic Record (March 1960), reprinted in Readings in International Economics, ed. Richard E. Caves and Harry G. Johnson (Homewood, Illinois: Richard D. Irwin, Inc., 1968), p. 193.

methods."[1] However, the host country may be worse off, according to MacDougall, if foreign firms are in such a monopolistic position that they exploit local buyers.[2]

This last "qualification" in MacDougall's analysis becomes the core of less formal analysis by other economists. As my colleague Carlos Diaz Alejandro put it, "much [direct foreign investment] in Latin America has occurred in areas and sectors where markets and competition are weak. [Pure competitive models] would miss most of what the argument is about."[3] Even among developed countries the assumption of perfect competition fails in that it cannot easily explain two-way foreign investment in the same industry.[4]

Within the framework of perfect competition, MacDougall's formal analysis pays only slight attention to the impact of the technology brought by foreign firms[5] and, by using a one sector model, ignores the consequences of having foreign investment in only one part of the economy. The transfer of technology and the operation in only certain sectors of the economy are two well documented tendencies of foreign investment by corporations.[6]

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[1] Ibid., p. 193.

[2] Ibid., p. 186.

[3] Carlos F. Diaz Alejandro, "Direct Foreign Investment in Latin America," The International Corporation, ed. Charles P. Kindleberger (Cambridge, Mass.: MIT Press, 1970), p. 319.

[4] The importance of monopolistic elements was developed by Stephen Hymer. For an exposition of his thesis, see Charles P. Kindleberger, American Business Abroad (New Haven: Yale University Press, 1969), pp. 11-25. For a discussion of the importance of oligopolistic market structure in predicting foreign investment, see Richard E. Caves, "International Corporations: The Industrial Economics of Foreign Investment," Economica, Vol. 38 (February 1971), pp. 1-27.

[5] MacDougall notes that the introduction of a heavily labor-saving technology could make the host country worse off. MacDougall, op. cit., p. 182.

[6] See, for example, Raymond Vernon, Sovereignty at Bay, The Multinational Spread of U.S. Enterprises (New York: Basic Books, 1971).

The next section of this paper is a theoretical critique of the introduction of a foreign technology within the MacDougall framework of a one sector economy. The following section considers the impact of introducing profit maximizing firms and a new technology into one portion of a two sector economy when some local producers do not maximize profits. These are important because, as my colleague Richard Brecher pointed out, in a two-sector economy foreign capital has no effect on the domestic income of a "small" country unless it either brings a new technology or changes behavior. This conclusion follows from the "Rybczynski effect":[1] with world prices fixed, perfect competition, universal profit maximization, and a given linear homogeneous production function in each sector, the arrival of foreign capital has no impact on the domestic wage or interest rate and hence no impact on domestic income.

The purpose of these two sections is to show that under "plausible" assumptions foreign investment can make the host country worse off if it brings an inappropriate technology. The paper ignores such dynamic considerations as the impact of foreigners on domestic savings rates and on domestic entrepreneurs and is in the comparative statics tradition.

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[1] T. M. Rybczynski, "Factor Endowment and Relative Commodity Prices," Economica, Vol. 22 (November 1955), reprinted in Caves and Johnson, op. cit.

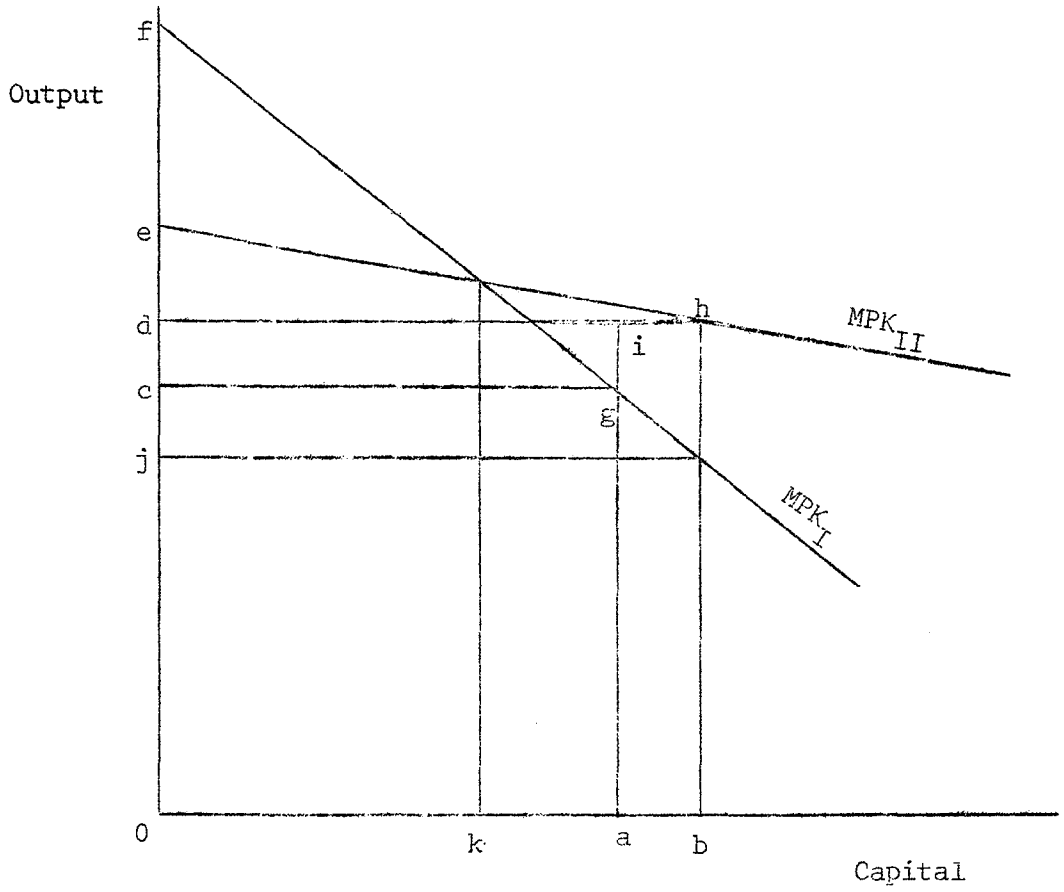
II.

The "inappropriate technology" argument may be graphically illustrated by slightly modifying MacDougall's approach. Assume perfect competition in the host country, full employment, and no taxes on profits earned by foreign investors. Suppose initially all capital is owned locally and the amount of capital in the host country is oa. Then in Diagram I total output (and domestic income) is the area under the marginal productivity of capital curve MPK_1 and the rate of profit is oc. Now suppose ab of foreign capital enters the country. With no change in technology, the marginal product of capital falls in the host country to oj. Domestic income increases; the income of local workers increases, and the income of local capitalists falls. This is the essence of MacDougall's analysis.

But suppose the foreign capital brings along a new technology which tilts the marginal productivity curve of capital curve to MPK_{11}. The equilibrium rate of profit rises to od, and total output is the area under the new marginal productivity of capital curve (oehb), which may well be larger than the old total product (ofga). But now foreigners receive some of this larger output: the profit rates times the amount of foreign capital (or the rectangle abhi). So domestic income with foreign capital may be smaller than without foreign capital; it is an empirical matter of comparing ofga with oehb minus abhi. Even if the host country taxes some of the profits earned by the foreign investors, domestic income with the foreign investment may be less than it was without the foreign investment.

As drawn in Diagram I, the "foreign" technology is more profitable than the "domestic" technology at the initial level of capital, is not used by local capitalists prior to the arrival of the foreign investors, and then

Diagram I



is used by all local capitalists after the foreigners arrive. How might one rationalize this assumed sequence? First, one notes that with small amounts of capital--any amount less than ok in Diagram I--the "domestic" technology is more profitable. Having chosen the "domestic" technology at low levels of capital, domestic firms, I assume, retain it as the country's capital stock grows even when, with a larger stock of capital, the "domestic" technology is less profitable. In the absence of foreign investments, local managers could be said to "forget" about the "foreign" technology. Thus, one views the "knowledge" contained in a production function in an innovative sense rather than as Samuelson defined truth (quoting Ramsey's quote of Blake): "Truth can never be told so as to be understood and not be believed."[1] The success of Schumpeter's entrepreneur, on the other hand, "...depends upon intuition, the capacity of seeing things in a way which afterwards proves to be true, even though it cannot be established at the moment..."[2] After demonstrating that the "foreign" technology is more profitable (with a large capital stock) by actually using it to increase profits, the foreign firm, by assumption, will be quickly imitated by the local firms. As Schumpeter put it, "in industries in which there is still competition and a large number of independent people we see first of all the single appearance of an innovation... and then we see how the existing businesses grasp it with varying rapidity and completeness, first a few, then continually more."[3]

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[1]Paul A. Samuelson, "Economists and the History of Ideas," American Economic Review, Vol. 52 (March 1962), p. 18.

[2]Joseph A. Schumpeter, The Theory of Economic Development (Oxford University Press paperback, 1961), p. 85.

[3]Ibid., p. 229.

My analysis, like MacDougall's, is comparative statics and does not specify how (or whether) the economy moves from one position to another. In particular, why do all the existing firms change over from the "domestic" technology to the "foreign" technology? As my colleague Richard Nelson pointed out to me, a private monopolist (or central planner) who wished to maximize the income of all capitalists would have some of the plants continue using the "domestic" technology. My argument simply demonstrates that if all firms--local and foreign--behave in the same way, then foreign investment may reduce host country income.

It may be useful to illustrate this argument with a numerical example. Suppose the "domestic" production function is

$$(II\text{-}1) \qquad 0 = 1.16\, L^{1/2} K^{1/2}$$

where 0 = output, L = stock of labor, and K = stock of capital. Suppose the "foreign" production function is

$$(II\text{-}2) \qquad 0 = L^{1/4} K^{3/4}$$

Thus both production functions are assumed to belong to the Cobb-Douglas family. Assume full employment, the profit rate (π) equal to the marginal productivity of capital (MPK), and the wage rate (W) equal to the marginal productivity of labor (MPL). Suppose that initially there are 100 units of labor and 64 units of local domestic capital. As shown in Column (1) of Table I, output with the domestic technology is 92.80, the profit rate is .725, and local capitalists receive 46.4. Suppose that 36 units of foreign capital are added to the domestic capital. Using domestic technology, output rises--in Column (2)--to 116 and the rate of profit falls to .58. As foreign

Table 1

Alternative Production Functions

	"Domestic"			"Foreign"		
Output	$1.16\ L^{1/2}\ K^{1/2}$			$L^{1/4}\ K^{3/4}$		
	(1)	(2)	(3)	(4)	(5)	(6)
Labor Stock	100	100	100	100	100	100
Capital Stock	64	100	25	64	100	25
Output	92.80	116	58	71.6	100	35.36
Profit Rate	.725	.58	1.16	.839	.75	1.061
Wage Rate	.464	.58	.29	.179	.25	.088
Capital's Income	46.4	58	29	53.7	75	26.52
Labor's Income	46.4	58	29	17.9	25	8.84
Foreign Capital's Income	0	20.88	0	0	27	0
Local Capital's Income	46.40	37.12	29	53.7	48	26.52
Domestic Income	92.80	95.12	58	71.6	73	35.36

capitalists earn 20.88 (.58 times 36 = 20.88), domestic income is 95.12 (116 - 20.88 = 95.12). If all firms shift to the foreign" technology, then output--as shown in Column (5)--is 100--more than in the absence of foreign capital but less than using foreign capital and "domestic" technology; the profit rate using the "foreign" technology is .75, higher than with the "domestic" technology. Domestic income is 73 (100 minus .75 times 36 = 73), which is less than if the foreign capital were combined with "domestic" technology and also less than in the complete absence of foreign capital.[1]

In a one sector model, therefore, one need not explain a coalition between local capitalists and foreign capitalists solely on "political" grounds.[2] Even if foreigners behave as perfect competitors, it is theoretically possible for foreign capitalists to reduce the total income accruing to the natives, to increase the income accruing to local capitalists, and to reduce the income accruing to local workers.

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[1] Note that at a low level of domestic capital--say 25 units--the "domestic" technology is both more profitable (1.16 versus 1.061) and more productive (58 versus 35.36), as shown by comparing Columns (3) and (6).

[2] Baran, for example, says "afraid that hostility toward foreign interests might deprive them of foreign support in a case of a revolutionary emergency, the native capitalists deserted their previous anti-imperialist, nationalist platforms." Paul A. Baran, "On the Political Economy of Backwardness," The Manchester School (January 1972), reprinted in The Economics of Underdevelopment, ed. A. N. Agarwala and S. P. Sirgh, (Oxford University Press paperback, 1958), p. 80.

III.

I now consider a two sector economy--agriculture and manufacturing--using two factors of production--labor and capital. Each commodity is assumed to be produced by a Cobb-Doublas production function, and the quantities produced are valued at world prices.[1] Symbolically, let Q_i be the quantity of the i'th good produced, and let L_i and K_i be the amounts of labor and capital used in the production of the i'th good:

$$Q_A = L_A^{\gamma} K_A^{1-\gamma} \qquad \text{where } 0 < \gamma < 1 \tag{III-1}$$

$$Q_M = L_M^{B} K_M^{1-B} \qquad \text{where } 0 < B < 1 \text{ and } \gamma > B \tag{III-2}$$

The total supply of labor ($\bar{L}$) and of capital ($\bar{K}$) are fixed and there is no "open unemployment," so that

$$L_A + L_M = \bar{L} \tag{III-3}$$

$$K_A + K_M = \bar{K} \tag{III-4}$$

Initially managers are assumed to lack a "capitalist" mentality: rather than maximize profits, they hire labor until the wage rate (w_i) equals a fraction (f_i) of the <u>average</u> product of labor in the sector. Capitalists also receive a rate of return (r_i) on the capital used in each sector. My model is thus closely related to Arthur Lewis's "subsistence" economy,[2]

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[1] For a justification of the use of world prices and a model whose mathematical structure is similar to this one, see Thomas Birnberg and Benjamin I. Cohen, "A Theoretical Analysis of Partial Economic Reform," Economic Growth Center Discussion Paper No. 135 (December 1971).

[2] W. Arthur Lewis, "Economic Development with Unlimited Supplies of Labor," <u>The Manchester School</u> (May 1954). See also John C. H. Fei and Gustav Ranis, <u>Development of the Labor Surplus Economy: Theory and Policy</u> (Richard D. Irwin, Inc., 1964) and Richard A. Brecher, "Disguised Versus Open Unemployment: A Trade-Off" (mimeo, October 1971).

though in my model labor does not receive the entire agricultural product and the agricultural wage level is not set exogenously.[1] While labor is paid a fraction of its average product, I do not assume labor's marginal product is zero.[2]

$$(III\text{-}5) \qquad w_A = f_A \left(\frac{K_A}{L_A} \right)^{1-\gamma} \qquad \text{where } 0 < f_A < 1$$

$$(III\text{-}6) \qquad r_A = (1-f_A) \left(\frac{K_A}{L_A} \right)^{-\gamma}$$

$$(III\text{-}7) \qquad w_M = f_M \left(\frac{K_M}{L_M} \right)^{1-B} \qquad \text{where } 0 < f_M < 1$$

$$(III\text{-}8) \qquad r_M = (1-f_M) \left(\frac{K_M}{L_M} \right)^{-B}$$

I assume capitalists and laborers move capital and labor around until wage rates and interest rates are equal in both sectors:

$$(III\text{-}9) \qquad w_M = w_A$$

$$(III\text{-}10) \qquad r_M = r_A$$

I also assume the country is so small that its output does not affect the

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[1] I also assume that both labor and capital are used in agriculture and that the capital-labor ratio is higher in manufacturing. For example, Ho presents data that indicate that in Taiwan in 1951 the capital-labor ratio of agriculture was about one-sixth that of non-agriculture. Ho says the wage in agriculture in Taiwan is set by the average product of labor in agriculture. Yhi-Min Ho, "Development with Surplus Population--The Case of Taiwan: A Critique of the Classical Two-Sector Model, à la Lewis," Economic Development and Cultural Change, Vol. 20 (January 1972), pp. 212, 213, 224.

[2] Little, Scitovsky and Scott conclude, "there is now a wide consensus of opinion that this marginal product (of labor in agriculture) is significantly greater than zero even in the most overpopulated countries such as India and Pakistan." Ian Little, Tibor Scitovsky, and Maurice Scott, Industry and Trade in Some Developing Countries, A Comparative Study (Oxford University Press paperback, 1970), p. 146.

world prices of the two goods (P_A and P_M). For simplicity, I let $P_A = P_M = 1$. When there are no foreigners in the country, output (Y) equals domestic income (DI).

$$(III\text{-}11) \qquad Y = P_A Q_A + P_M Q_M = Q_A + Q_M$$

$$(III\text{-}12) \qquad Y = DI$$

Once we stipulate the total amount of capital, the total amount of labor, and the fraction of the average product which workers receive as a wage rate in each sector, we can solve this system of 12 equations describing a "pre-capitalist" economy.

Now suppose a group of foreigners arrive, bringing additional capital (FK), a "capitalist" mentality, and a new technology. Their sole objective is to maximize profits.[1] It has been commonly observed that foreign capitalists invest in only part of the economy. Assume that foreigners invest in manufacturing and that all capitalists in the manufacturing sector thereupon become profit maximizers; they therefore all hire labor until its marginal product equals the wage rate. In the agriculture sector labor is still hired until its wage equals a fraction of its average product. A "mixed economy" now exists.

As foreigners only invest in manufacturing, the new technology is confined to manufacturing, and so equation (III-2) becomes

$$(III\text{-}2') \qquad Q_M = L_M^{B'} K_M^{1-B'} \qquad 0 < B' < 1$$

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[1] As Little, Scitovsky, and Scott put it, foreign capitalists "...manifest [a] greater reliance on careful calculations of costs and profitability than is customary in developing countries." Ian Little, Tibor Scitovsky, and Maurice Scott, op. cit., p. 57.

What will happen to domestic income, i.e., to total output less profits earned by the foreigners on their capital? A quick answer might be that since at least some firms are behaving "rationally" (i.e., maximizing profits) and since the capital stock is larger, domestic income will rise in a fashion analogous to MacDougall's analysis of a one sector economy. But there is a new technology and also the possibility of a "Second-Best"[1] situation, since only the manufacturing sector maximizes profits. Thus, in this new "mixed economy" equations (III-7) and (III-8) are replaced by:

$$(III\text{-}7') \qquad w_M = B' \left(\frac{K_M}{L_M} \right)^{1-B'}$$

$$(III\text{-}8') \qquad r_M = (1-B') \left(\frac{K_M}{L_M} \right)^{-B'}$$

As the capital stock is larger, equation (III-4) is replaced by

$$(III\text{-}4') \qquad K_A + K_M = \bar{K} + FK$$

Domestic income is less than output because of the income of foreign capitalists, and so equation (III-12) is replaced by

$$(III\text{-}12') \qquad DI = Y - r_M FK$$

While I do not have a general solution of this new system of equations which I can compare with a general solution of the old system, I will now

[1] R.G. Lipsey and Kelvin Lancaster, "The General Theory of Second Best," Review of Economic Studies, Vol. 24 (1956-57).

pick a set of values for the parameters which gives the result that domestic income is lower in the "mixed economy" than in the "pre-capitalist" economy. For both the "pre-capitalist" and "mixed" economies I let $\gamma = .8$ and $P_A = P_M = 1$; B is .2 in the "pre-capitalist" society and .4 in the "mixed" society. Thus the foreigners bring a technology to manufacturing that is more labor-intensive than the native manufacturing firms were using. Initially the capital stock is 100, the labor stock is 100, $f_A = .90$, and $f_M = .30$.[1]

With these parameter values, output and domestic income in the "pre-capitalist" economy is 117.09. Now suppose the foreigners bring up 10 units of capital (FK = 10); suppose B becomes .4, and suppose all manufacturing firms maximize profits. Then output in the "mixed economy" falls to 111.20 and domestic income is 106.71. The rate of return on capital falls from .59 to .45, and the wage rates rises from .58 to .62.[2] These results are summarized in Columns (1) and (4) of Table 2.

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[1] A partial equilibrium approach might suggest that the wage rate is higher in the "pre-capitalist" economy than it would be if all firms maximized profits. In agriculture, for example, the average product of labor is $\left(\frac{K_A}{L_A}\right)^{.2}$, and so the agricultural wage is $.9\left(\frac{K_A}{L_A}\right)^{.2}$. If labor were paid its marginal product, the agricultural wage would be $.8\left(\frac{K_A}{L_A}\right)^{.2}$. However, the general equilibrium solution indicates that the wage rate in the "pre-capitalist" economy is .58, which is less than the equilibrium wage rate of .61 when all firms maximize profits.

[2] While this paper does not deal with domestic savings, the distribution of income is obviously important for future total income if the marginal propensity to save of workers differs from that of capitalists.

Table 2

	"Pre-capitalist"	"Mixed"		
	(1)	(2)	(3)	(4)
Labor ($\bar{L}$)	100	100	100	100
Capital ($\bar{K}$)	100	100	100	100
Foreign Capital ($\bar{F}K$)	0	0	10	10
Labor Share in Agriculture (f_A)	.9	.9	.9	.9
Labor Share in Manufacturing (f_M)	.3	-	-	-
Agricultural Output (Q_A)	37.51	47.73	45.97	34.71
Manufacturing Output (Q_M)	79.58	70.95	78.86	76.49
Total Output (Y)	117.09	118.68	124.83	111.20
Domestic Income (DI)	117.09	118.68	118.68	106.71
Interest Rate (r)	.59	.62	.62	.45
Wage Rate (w)	.58	.57	.57	.62
Exponent on Labor in Cobb-Douglas:				
(a) in Agriculture	.8	.8	.8	.8
(b) in Manufacturing	.2	.2	.2	.4

What is the economic "story" behind these results? The impact of the foreigners can be divided into three parts: a change in the allocation of labor and local capital because of a change in the behavior of manufacturing firms, the impact of the increase in the stock of capital, and a change in the allocation of labor and capital because of the new technology in manufacturing.

Changing the mentality of all manufacturers leads them to change the capital-labor ratio; with my parameters the capital-labor ratio in manufacturing rises from 2.26 in the "pre-capitalist" economy to 3.71 in the "mixed" economy and falls slightly in agriculture, from .108 to .103. The wage rate is lower, and the interest rate is higher. Money costs are higher in manufacturing, and output of manufacturing contracts. As both labor and capital shift into agriculture, the value of the extra agricultural output is more than the value of the lost manufacturing output, and so the value of total output rises by about one percent, from 117.09 to 118.68. This result can be seen by comparing Columns (1) and (2) in Table 2.

The effect of increasing the stock of capital from 100 to 110--given the change in behavior--is to reduce the output of agriculture and to increase the output of manufactures, but the increase in total output--from 118.68 to 124.83--is absorbed by the foreign capitalists, and so domestic income remains at 118.68; this result can be seen by comparing Columns (2) and (3) in Table 2.

The effect of introducing the more labor-intensive technology in the entire manufacturing sector[1]--given the change in behavior and the increase in

[1]For evidence that foreign and local firms in manufacturing have about the same capital-labor ratios, see Benjamin I. Cohen, "Comparative Behavior of Foreign and Domestic Export Firms in a Developing Economy," Review of Economics and Statistics (forthcoming).

capital--is to lower the capital-labor ratio in manufacturing to 2.07 and to raise it to .15 in agriculture. The wage rate increases and the interest rate falls; output falls in both sectors. Total output falls from 124.83 to 111.20, and domestic income falls by 10 percent, from 118.68 to 106.71. These results can be seen by comparing Columns (3) and (4) in Table 2.

IV.

In conclusion, some argue that the multinational firm brings a more capital intensive technology than local firms were using because it pays less for capital and is more familiar with the advanced technology of the rich countries, which, it is argued, is capital-intensive in response to expensive labor and cheap capital. Others argue that the foreign firm brings a more labor intensive technology than the local firms because it can better scan the earth's entire "shelf" of available technologies and is less influenced by "irrational" considerations (such as the prestige of a capital-intensive factory). Vernon, in assessing the available published evidence, says "the actual facts are, as usual, obscure. There are no comprehensive data on the degree to which multinational enterprises adapt their production processes to the conditions of less-developed countries, and scarcely any data at all on the comparative adaptive actions of local competitors."[1] This paper is a formal statement illustrating the importance of technology--in either a one sector model or a two sector model--in assessing the impact of foreign investors in terms of both the total size of domestic income and its distribution between labor and domestic capital.

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[1] Raymond Vernon, Sovereignty at Bay, The Multinational Spread of U.S. Enterprises (New York: Basic Books, 1971), p. 181.