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U.S. DIRECT MANUFACTURING INVESTMENT TO LATIN AMERICA: SOME ECONOMIC AND POLITICAL DETERMINANTS

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Two goals have guided this study. First there is a need to develop and test a theoretical framework within which it is possible to explain the important variables associated with the operations of U.S. foreign affiliates. Second, we want to do this in a context which is broad enough not only to predict, but also to permit the testing of signficiant hypotheses concerning foreign investment. Particularly we need to develop models within which it is possible to analyze the effects of variables that have been, or are likely to be, used as instruments of government policy.

Prior efforts to explain direct investment flows have been based on models which assume either profit maximization under conditions of certainty or, at best, the maximization of expected profits.[1] There are several characteristics of direct investment, particularly that in underdeveloped areas, that steer us toward a more unorthodox analysis. First is the fact of uncertainty. If the investor were clairvoyant,one would probably expect him to choose the investment that maximized his total profits. However, in the world of investment, and above all, foreign investment, the unpredictability of events implies that for any proposed venture there is a wide spectrum of possible future returns. A major question is whether this uncertainty of return affects the investor's behavior.

A second set of considerations that lead to an unorthodox analysis is the supposed importance of "investment climate", affected greatly by political factors, to the foreign investor. Probably the most imaginative step taken by the U.S. government to aid the flow of direct investment has been the creation of the Investment Guaranty Program. All of its provisions are

designed to protect against adverse political developments in the host country: expropriation, war and the imposition of exchange controls. Yet the underlying hypothesis that expectations and risks associated with political changes abroad are strong deterrents to direct investment has never really been tested. To test this hypothesis and the related ones concerning the effectiveness of our Guaranty Program, we must integrate political variables into the analysis and, to some extent at least, measure them.

In the following pages we shall develop alternative models of foreign investment and test them against a body of newly-collected economic and political data.[2] The variable we shall attempt to explain is the flow of U.S. "direct investment" in manufacturing to Latin America and to four countries therein: Brazil, Argentina, Mexico and Venezuela. The flow of direct investment is defined by the Department of Commerce as the value of the net capital outflow from the United States plus the value of foreign subsidiary retained earnings; as such, it is a good measure of the contribution of capital resources by direct investment to the host country.[3]

Two models will be tested. The first, to be sketched below, is a model incorporating elements of return and uncertainty. The alternative model will be a simple form of the stock adjustment models used widely to explain investment in the United States; direct investment is hypothesized to be a constant fraction of the difference between desired foreign capital and actual foreign capital; desired capital at time t will be simply a constant (the desired capital/output ratio) times sales at time t.

I. Behavior Under Uncertainty

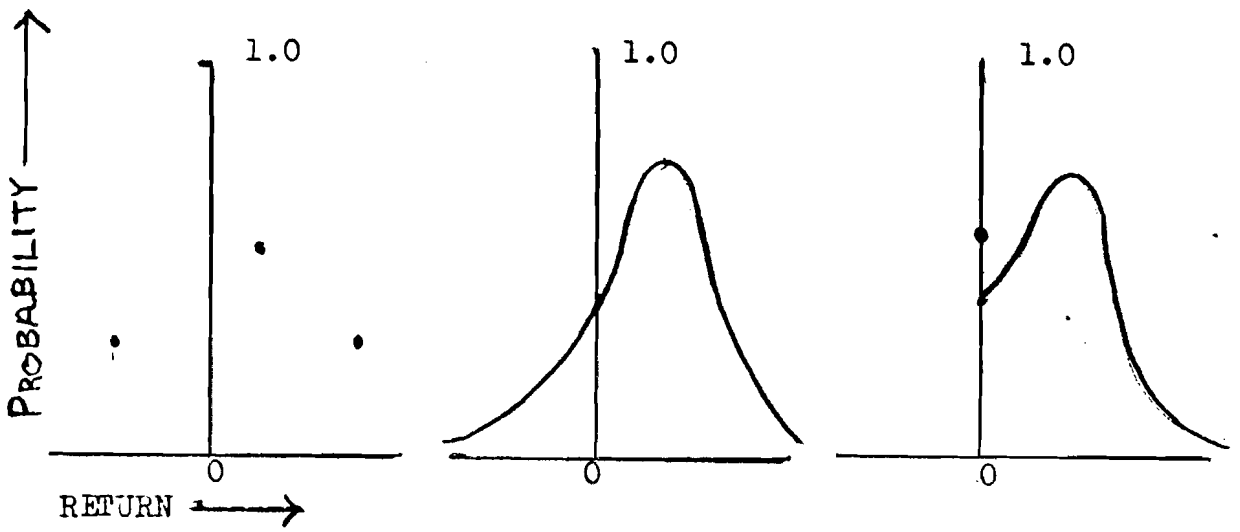
In a previous paper "Risk and Return and the Selection of Foreign Investments" I investigated in detail some theories of decision-making under risk and their applicability to foreign investment. In this section I shall outline the approach adopted in the prior and present paper and shall present the basic theoretical results on the determination of direct investment.

I.1. The Representation of Risk and Expected Return

The investor is operating under uncertainty when he admits that he cannot necessarily predict the future return on his investment. In this case it is quite likely that, explicitly or implicitly, the investor conceives of a set of possible returns to his investment -- depending on the occurrence of various economic and political events -- and attaches to each some sort of liklihood or probability. It is a small step from here to representing the investor's belief about the possible future by a probability distribution. The only constraint placed on the investor's beliefs by this representation is that the subjective probabilities attached to possible returns add up to 1.

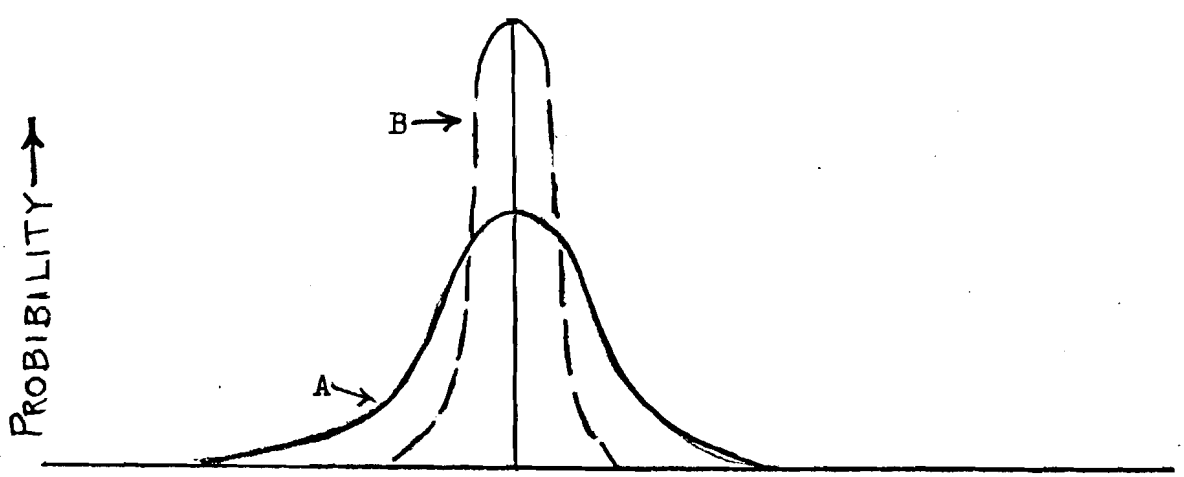
Three possible probability distributions are presented in Figure 1. The first is a discrete distribution, where only three possible outcomes are envisaged. The second allows for a continuous range of returns. The third is, in a sense, a combination of the first two types, since part of the previous distribution has been collapsed to a single point, 0.

Figure 1: Possible Distributions of Returns From A Foreign Investment



How can we represent the degree of uncertainty or risk that the investor faces? Intuitively we say that we become more uncertain when the set of likely returns becomes larger and larger. That is, a proper indicator of risk must measure how the investor's probability distribution is dispersed or stretched out. Of the distributions in Figure 2, there is no problem determining that distribution A is more dispersed than B and thus more uncertain or risky than B.

Figure 2: Alternative Distributions with Same Expected Return and Differing Degrees of Risk



A traditional statistical measure of dispersion is the variance -- the weighted sum of squared deviations of possible returns from the average return. This is the measure of uncertainty that we shall adopt -- because of wide use as a measure of risk and the ease with which it is manipulated. In the case of the normal distributions depicted in Figure 2, it can be shown that virtually all measures of risk can be expressed in terms of the variance.

I.2. Decision-Making Under Risk

A most important empirical question is whether the investor is affected by the risk associated with a contemplated investment. In terms of Figure 2, given alternative investments with the same expected return such as A and B, does the investor prefer one to the other because of the differing risks? Most previous theories of investment have assumed that the investor is neutral -- that he decides on the basis of expected return or some other return indicator alone; thus he would be indifferent between investment A and B. The simple stock adjustment theory of investment that we shall use as an alternative hypothesis can be interpreted as assuming profit maximization under risk neutrality. If, all other things equal, the investor prefers less uncertainty to more, we shall call him a "risk-averter". Phenomena common to the world of foreign investment such as the buying of insurance and the borrowing funds at high interest rates in order to hedge exchange risks usually imply risk-aversion.[5] That is a basic postulate of one model developed and tested below.

The risk-averter desires profits (expected return) and wishes to avoid risk. His problem is to choose that combination of investments that leads to the most desirable feasible combination of return and risk. The raw

materials of this choice are his preference or utility function and a set of feasible alternative combinations of investments often called portfolios; he is limited in his choice of alternatives by the availability of attractive investments and by financial limits imposed by his net worth and borrowing opportunities.

The risk-averter attempts to find the most desirable situation in terms of the overall return and risk.[6] In most cases it can be shown that the most desirable portfolio will be comprised of a number of investments, the proportionate holdings of which are determined by the expected returns and risks of the individual investments and the correlations among the returns of these assets. In terms of the choice of the foreign investor or international firm, the optimal distribution of the investor's assets involves investments in a number of countries, even though some investments bring a lower return than others.

I.3. Theorems on the Distribution of the Risk-Averter's Assets and the Determinants of Overall Return and Risk

In this section we shall face the problem of presenting explicit relationships for both the optimal composition of assets in the foreign investor's portfolio and the measurement of the expected return and risk in terms of the underlying economic and political considerations. No proofs will be presented in this section; the interested reader will find them in the indicated sections of the author's earlier theoretical paper, Stevens (3).

I.3.1. Theorems on the Optimal Investment in a Given Location

Equations for optimal levels of capital in each country or market are derived from the solution of the mathematical problem of maximizing the investor's utility function of overall risk and return subject to his net worth

and borrowing constraints. Of the many cases that are considered in Stevens (3), we shall focus on one here: the case where outside borrowing is neglected and where there is no expectation of a correlation of returns among investments in different countries.

Under these conditions the general equation for the level of investment in any country (or location) X_i is:[7]

$$(1) \qquad X_i = \frac{r_i - r_j}{2v_i}\left(\frac{-U_E}{U_V}\right) + \frac{v_j X_j}{v_i}$$

where r_i and r_j refer to the expected rate of return in location i and some other location j, respectively; v_i is the variance in location i; $-U_E/U_V$ is the absolute value of the ratio of the partial derivatives of the investor's utility function with respect to overall expected return ($+U_E$) and risk (U_V) at the point of equilibrium. This term is the investor's trade-off between risk and return at the optimum (dV/dE).

Clearly any asset j can be used in this equation. Thus the equation says that there is a relationship between the value of capital X_i and X_j in any two countries, which depends on their individual expected returns, variances and the overall trade-off between risk and return. This overall trade-off probably varies over time, since it depends on the investor's net worth and the available supply of investments; thus equation (1) will not generally provide the basis for an estimating direct investment over time. However, since dV/dE is constant at a given moment of time, we might test the theory by using the equation as the basis of a cross-section regression.

In general, this is as far as we can go without assuming a specific kind of utility function and solving for each X_i in terms of the underlying parameters of the utility function. However, if we are willing to assume the existence of one asset that is riskless (i.e., its return is certain --

like currency whose return is zero except for inflation), then a remarkable theorem first proved by James Tobin[8] allows us to go further. Given this additional assumption we can show that the ratio of the levels of any two risky assets in the optimal portfolio is independent of the investor's utility function and determined only by the expected returns and variances of the two assets:

$$(2) \qquad \frac{X_i}{X_j} = \frac{(r_i - r^*)v_j}{(r_j - r^*)v_i},$$

where r^* is rate of return on the riskless asset. As might be expected, the amount invested in country i increases relative to that in country j as the expected return in country i increases, and as the risk (v_i) decreases. And vice-versa for the return and risk in country j.

1.3.2. Expected Return and Risk in a Given Country

Given the existence of a relationship like (2) determining the ratios, X_i/X_j, one could not predict this ratio without knowledge of the expected returns r_i and r_j, the variances V_i and V_j and the riskless rate of interest, r^*.

In some cases a past average of observed returns will be the best possible empirical estimate of the future expected return. If the probability distribution underlying observed returns is unchanging or stationary, then statistical theory tells us that an average of a fairly large number of observations will be a good indicator of the underlying expected return. In such a case we can dispense with a knowledge of the various factors that cause the observed returns -- market conditions, political conditions and the like. Similar remarks apply to the empirical measure of risk.

A simple weighted average of past returns may be a poor indicator of expected return in the case of a foreign investment, however. First the underlying determinants of expected return may be changing so rapidly that the past will be a poor guide to the future. Second, and perhaps more important, for some variables which have non-zero values infrequently -- e.g. expropriations -- even if there were a stable underlying process, it would take a very long average to get a good estimate of the true expected return.

In those cases where past averages will not do, the only alternative seems to be to develop a causal model of the determinants of expected return.

In Stevens (3) the distribution of returns from a foreign investment and the mean and risk of that distribution were related to a number of theoretical factors: profitability during normal times, the probability of expropriation and the losses to the firm if expropriation occurred, the probability of and losses due to revolution or internal warfare, and shut-downs due to strikes. Primarily, three types of losses were identified in addition to the normal profits from undisturbed operations: losses due to being shut-down, losses due to the destruction of plant and equipment, losses due to compensation less than the fair market value of the investment. A theorem was developed which expressed the over-all expected return and risk in terms of the factors that might cause these losses.[10]

For illustrative purposes, consider the fairly simple case where there are two possible states of the world: normal operations where the firm maximizes profits without any fundamental change in the political environment, and a second state where it gets expropriated. For each given state there is a probability, expected return and risk of return -- all of which are,

of course, determined by exogenous factors. For this example the overall expected return and risk which appear in equation (2) are the following composites of the probabilities of expropriation and normal operations P_{Exp} and P_N, the expected returns (r_{Exp}, r_N), and variances (v_{Exp}, v_N) for the two alternative states:

(3) $$r = P_{Exp}r_{Exp} + P_N r_N$$

$$v = P_{Exp}(v_{Exp} + r_{Exp}^2) + P_N(v_N + r_N^2) - r^2$$

The above or more complicated expressions relate the expected returns and variances in equation (2) to more basic causal factors. We must now relate these constructs to empirical data.

II. Measurement of Factors Determining the Expected Return and Risk From Foreign Investment

II.1. The Expected Return and Risk during Normal Times

Normality for the foreign corporation is defined by the absence of losses from expropriation, revolution or other extraordinary events. Thus the probability of normal times is 1 minus the sum of the probabilities of the various extra-ordinary events. We argued above that a good measure of the expected returns, given normality, might be an average of past returns. This need not be true if normal times are not more-or-less unchanging times. However, this is the measure used in the tests below: we hypothesize that the expected rate of return in time t is the average rate of return over the past five years. A five year period was chosen because it was felt to correspond somewhat to the probable time period over which the new investor tries to predict: once a manufacturing investment is made, it is quite immovable for a period that is likely as long as five years.

The risk associated with the normal return at time t., is hypothesized to be related to the variance of return in the past five years:

$$V_t = \frac{1}{5} \sum_{i=t-4}^{i=t} (r_i - \bar{r})^2$$

where $\bar{r}$ is the five year average return. Similarly, the riskless rate of interest, r*, against which this risky alternative is compared is the rate of interest on five year U.S. government bonds.

II.2. Expropriation: Probability, Expected Return and Risk

The probability of and losses from expropriation envisaged by the foreign investor depend on his beliefs about the motivations of and constraints upon present and future governments of the host country.

We shall assume here that the foreign government acts with a degree of rationality: that its acts toward the foreign investor are a result of the government's attempts to maximize a utility function which may depend upon a number of economic and political values. We shall also assume that the foreign investor has a fairly clear perception of this process -- so that his belief about the probability of expropriation and the possible losses therefrom is a function of the same factors that determine the actual decisions of the government.

The host government may take over a foreign investment or all foreign investments within its jurisdiction because it will be economically profitable to do so: if by confiscating all or a portion of the investment it can gain capital investment at a price less than the fair market value of the investment. However, more than economic values can enter the utility function of the host government:

(1) It may expropriate in order to satisfy nationalistic demands for

sovereignty; by doing so it may be solidifying its hold on political power.

(2) Unrelated to the desire to hold on to power, the leaders of the country may be hostile to foreign investment generally because of their belief that foreign investors mulcted the country.

On the other hand there may be numerous factors constraining the government in its desire to expropriate or to pay inadequate compensation:

(1) Dependence on American aid, which might be cut off if the host government deviates too greatly from U.S. policy toward compensation.

(2) The negative effects of expropriation and inadequate compensation on new foreign investment.

(3) Treaties and/or internal legal standards which, if violated, might raise domestic opposition and threaten the power of the government.

Hypotheses may be more easily stated than measurement and testing done. In framing measures of the above factors affecting the probability and return from expropriation, one should like to distinguish between measures that are directly related to particular causal variables and measures that may reflect one or more causal factors indirectly. In particular, an indirect measure that has been collected and used in this study is reported statements and threats by government leaders against foreign investment. If it is true that all intentions are verbalized or that verbal statements pro or con foreign investment pour forth roughly in proportion to the degree to which it is loved or despised, then an index of pro and con statements toward foreign investment would prove to be related to the probability and expected return from expropriation. However, this measure might not allow us to identify the basic causal elements that caused the existing attitude of the host government.

Alternatively one can attempt to measure directly the elements mentioned above. Treaties and the host country's legal standards with respect to compensation are matters of public record. Past aid and investment levels are measurable. If we have a theory as to how aid and future investment will act in reaction to expropriations, then we can build models of the host country's overall return to expropriation.

The potential usefulness of anti-foreign investment activities in holding political power depends on the predispositions of the population of the host country; such predispositions can only be measured by counting anti-foreign investment statements and actions or by getting expert opinions. The same holds for the personal utility function of the rulers.

II.3. Other Factors Affecting the Return and Variance From a Foreign Investment

Changes in the government, especially revolutionary changes may affect the various elements in the probability distribution of returns envisaged by a foreign investor. A change of any kind may lead to uncertainty about the intentions of the new government and an increase in risk; of course, if the intentions of the new government are made clear by verbal threats or promises, then no increase of uncertainty need occur. In many cases, however, one would expect the intentions of a new government to be unclear to the public for a period of time. If the intentions of a new government are known, then a change in government can encourage or discourage foreign investment, depending on how these intentions compare to those of its predecessor.

Revolution, riots and other violence raise the possibility of losses dues to physical destruction of capital. Besides measuring the occurrences of such incidents, below we also attempt to measure the intensity of riots

and revolutions by the number of reported deaths due to such violence.

The probability of loss from riots and internal violence might be measured by past frequencies of serious incidents; and the expected losses by some measure of the intensity of the violence associated with these outbreaks.

II.4. The Role of Guarantee Insurance

The U.S. Investment Guarantee Program permits the investor in some host countries to insure against losses due to damage from internal revolution and war and confiscation. How this might affect the expected return and risk of an investor was investigated at length in an earlier paper, Stevens (3). Briefly, the holding of an expropriation guarantee will reduce or eliminate losses should the investor be expropriated. Thus the larger the percentage of the total investment in a given country that is covered by Guarantees, the smaller should be the effect of any factor that raises the probability or expected loss from expropriation. As well, the mere fact of the negotiation of a Guarantee treaty may, in the minds of the foreign investor, constrain the host government to treat all foreign investors with more deference.

III. Tests

Empirical tests of the ability of models and variables discussed in previous sections to explain the flow of U.S. direct investment in manufacturing are the subject of this section. Although certain variables are shown below to be significantly related to the flow of direct investment and others are shown to have no explanatory ability at all, it will be emphasized here and in following pages that these results should not be considered conclusive; as will be seen, the assumptions underlying these tests are the most stringent

that can be made -- appropriate, I think, upon entering a new field of research -- and, therefore, further verification of these findings is necessary under relaxed and more realistic assumptions before anyone should conclude that a given hypothesis is accepted or rejected -- or before anyone should recommend a policy based upon these results.

III.1. Results for the Flow of U.S. Direct Investment in Manufacturing to Latin America as a Whole

Initial tests of the basic Tobin model (equation 2, p. 8).were run for the flow of direct investment to Latin America as a whole. The longest possible time period for which data are available was used, 1954-1966.

Since the data were for Latin America as a whole, no political variables (specific only to particular countries) were included. The basic form of the equation tested, as developed in section II, was:

$$(2) \qquad \frac{X_i}{X_j} = \frac{(r_i - r^*)v_j}{(r_j - r^*)v_i}$$

where r_i, r_j and r^* are, respectively, the five-year average rate of return for the past five years on the value of foreign investment in Latin America and Canada; and r^* is the rate of return on U.S. government bonds of a five to ten year maturity, v_i and v_j are the variances of return over the past five years for Latin America and Canada, and X_i and X_j are the levels of the stock of total capital invested in these two areas.

In principle any alternative area j should be usable in these equations, not only Canada. Investment in the United States would be a natural choice; however, in the case of the United States, figures for investment and return are inevitably biased because of the unknown percentage of foreign assets

and profits that are consolidated with all aggregate U.S. data.

By taking the logarithms of all the variables we can transform equation (2) into one that is linear in the logarithms of all the independent variables. The following are the results obtained for Latin America for 1954-66 ("t" ratios are in parenthesis below the estimated coefficients and * or ** indicates significance at the 5% and 1% levels respectively):

$$(4) \qquad \ell n(X_{L.A.}/X_{CAN}) = -1.41 + \underset{(4.46)}{0.26^{**}}\,\ell n(r_{L.A.} - r^*) - \underset{(3.87)}{0.46^{**}}\,\ell n(r_{CAN} - r^*)$$

$$- \underset{(2.09)}{0.24^{*}}\,\ell nv_{LA} + \underset{(0.017)}{0.0017}\,\ell nv_{CAN}$$

$$R^2 = .94 \qquad D.W. = 2.36$$

$$(5) \qquad \ell nX_{L.A.} = -2.38 + \underset{(3.29)}{0.20^{**}}\,\ell n(r_{L.A.} - r^*) - \underset{(1.30)}{0.23}\,\ell n(r_{CAN} - r^*)$$

$$\underset{(2.43)}{-0.025^{*}}\,\ell nv_{L.A.} + \underset{(0.010)}{0.00087}\,\ell nv_{CAN} + \underset{(0.010)}{1.17^{**}}\,\ell nX_{CAN}$$

$$R^2 = .99 \qquad D.W. = 2.09$$

The estimated equation for the ratio of Latin American to Canadian capital and for the absolute level of U.S. capital in Latin America both lend fairly strong support to the underlying theory. All coefficients are of the hypothesized sign and all coefficients are signficiantly different from zero at the 5% level, except for the variance of Canadian return. The results indicate strongly that our measure of expected return in Latin America affects investment in Latin America and that expected return in alternative areas, in this case, Canada, affects Latin American investment in the

expected negative direction. The results also indicate that risk affects direct investment flows -- at least the risk in Latin America. The only variable that was not significantly related to the level of capital in Latin America was our measure of the expected risk of return for investment in Canada.

Despite the positive nature of the above results, there are some drawbacks. According to the theoretical equation, if we fit the log forms (4) and (5), the estimated coefficients all should be insignificantly different from either 1.0 or -1.0. Clearly they are not, being considerably lower than expected (in absolute value), except for the coefficient of X_{CAN}.

One possible cause of this downward bias in the estimated coefficients is the unrealistic implicit assumption in the above model of instantaneous adjustment of the actual stock of direct investments to optimal levels. Thus the ratios in equation (2) are optimal levels of total capital investment in equilibrium. There are a number of reasons why actual observed levels may deviate from the ideal. Most important probably are the necessary lags in building new plant and equipment and getting rid of the same when dis-investment is indicated. These considerations suggest that some sort of lagged adjustment mechanism should be tried, e.g.,

$$(6) \qquad \Delta X_{L.A.} = X(t)_{L.A.} - X(t-1)_{L.A.} = a(X^*(t) - X(t-1)_{L.A.}),$$

where X* indicates the optimal level of capital determined in equation (2). A number of different types of lagged adjustment mechanism were tried. All indicated that lagged adjustment was probably present and that some, but not all, of the explanation of the smallness of the estimated coefficients is due to this phenomenon. This point will be taken up at greater length in the next section.

III.2. Results for the Flow of U.S. Direct Investment in Manufacturing to Argentina, Brazil, Mexico and Venezuela

We shall now apply the model tested above and more complicated alternatives to the explanation of the flow of direct investment in manufacturing to four specific Latin American countries: Argentina, Brazil, Mexico and Venezuela. Only by getting down to the country level can we test for the impact of political factors and U.S. policies toward individual countries.

III.2.1. Econometric Complications

In section I.3 above, models were developed whereby political and other factors could be integrated into the basic risk-return model. Thus, assuming that of countries i and j there is a possibility of expropriation in country i (but none in country j), by substituting the expressions (3) for r_i and v_i in the basic equation (2) we get an equation for the optimal level of capital in country i, (X_i^*), expressed as a function of both economic and political factors:

$$(7) \qquad X_i^* = X_j^* \frac{(P_{Exp}r_{Exp} + P_N r_N - r^*)(v_j)}{(r_j - r^*)[P_{Exp}(v_{Exp} + r_{Exp}^2) + P_N(v_N + r_N^2) - (P_{Exp}r_{Exp} + P_N r_N)^2}$$

where, as stated previously, P_{Exp} and $P_N = 1 - P_{Exp}$ are the probability of expropriation and normality in country i; r_{Exp} and r_N are the expected returns from the direct investment given, respectively, an expropriation or normal times. Similarly, v_{Exp} and v_N are the risks (variances of return) under the conditions of expropriation or normality. Since we assume that there is no possibility of expropriation or other politically caused losses in the country j (here chosen as Canada), the expected return and risk in country j are interpreted as returns during normal times.

Although we may be able to relate the above probabilities and expected values to empirically observable factors to test the model with equation (7), we have run into a number of econometric difficulties. First, equation (7) differs from equation (2) in being highly non-linear, even in the logarithms. Therefore, it is necessary either to use a non-linear estimation procedure or to approximate equation (7) with a linear function. For this paper we do the latter, approximating equation (7) by the linear terms in a Taylor series expansion in the independent variables:

$$(8) \qquad X_i = X^*_j \left[\sum_{i=1}^{n} a_i Y_i \right]$$

where the variables Y_i are the independent variables that determine the probabilities, expected returns and risks in equation (7). The coefficients a_i are the partial derivitives of X_i with respect to the Y_i taken at some point.

A second econometric problem is encountered with the use of X^*_j in equation (8) along with a hypothesis of lagged adjustment, such as that in equation (6) above. If we assume lagged adjustment, as it will be shown we should, then for any area, including X_j, the observed value of capital invested in the area will no longer be equal to the optimal value, X^*_j. In the following tests we substitute the observed value, X_j, for the optimal value, knowing that some bias is introduced. Since Canada is again used as country j, this substitution is equivalent to the assumption that, in Canada, firms adjust instantaneously to the optimal level of capital -- certainly not the case in fact, given the pronounced cycles in recent Canadian economic history. Again, a much more complicated estimation procedure will be required in order to relax this unrealistic assumption. For the above reasons, the results presented below cannot be taken as final.

III.2.2. Economic Factors Only: Results for the Basic Risk Model and the Alternative Model, by Country

The first tests run on the country data were the same as those for Latin America as a whole, presented in the last section. Only economic variables were used and the optimal level of capital in a given country was expressed as in equation (2):

$$X_i^* = X_j^* \frac{(r_i - r^*)v_j}{(r_j - r^*)v_i}$$

It became clear from this and later tests that a lagged adjustment framework should be used, so the basic question tested was:

$$(9) \qquad X_i(t) = aX_j(t) \cdot \frac{(r_i - r^*)v_j}{(r_j - r^*)v_i} - bX_i(t-1)$$

The expected returns and risks could not be broken apart as earlier because of the non-linear nature of the equation. Results for three countries for 1954-65 are presented in Table 1. The risk and return term is strongly significant in explaining direct investment to Brazil, but uniformly insignificant in the other cases for this period.

Table 1: Direct Investment to Three Latin American Countries, 1954-65, Explanatory Ability of Basic Risk-Return Model.

	Intercept	$X(t)\frac{(r_i-r^*)V_{CAN}}{CAN(r_{CAN}-r^*)v_i}$	$X_i(t-1)$	R^2	D.W.	S.E.
Argentina	-0.77 (0.24)	-0.035 (0.88)	0.16 (2.16)	.44	1.78	26.0
Brazil	91.96** (4.17)	+0.023* (2.45)	-0.090* (2.50)	.45	2.87	14.7
Mexico	-34.8 (1.09)	-0.00083 (0.307)	+0.22 (2.89)	.48	0.97	27.6

In contrast to these rather poor results are those for the alternative stock adjustment model, for the years 1957-65, the only years for which sales ($S_{i(t)}$ for foreign manufacturing affiliates are available:

$$X_i(t) = aS_i(t) - bX_i(t-1) \qquad (10)$$

The results are compared to those for the risk-return model for the 1957-65 period in Table 2. The results show that, in terms of R^2 and the signs and significance of the estimated coefficients, the alternative stock adjustment model outperformed the risk-return model in three of the four countries; the only exception was Mexico, and in that case the superior performance of the risk-return model was due mainly to a relationship between direct investment and the lagged stock of investments which was positive and, therefore, contrary to that hypothesized. In fact, in the Mexican case, the insignificance of the estimated coefficients can be attributed to multicollinearity; the

simple correlation of the sales term alone with the dependent variable is .92; hence the R^2 is higher for both equations in this case than for any other country. In all countries but Mexico the preliminary results based on economic factors alone show that about 1/3 or the discrepancy between the desired and the actual stocks of direct investments was removed each year. In summary, the alternative stock adjustment model does a consistently good job in explaining a significant portion of the variation in flows of U.S. direct investment to Argentina, Brazil, Mexico and Venezuela. However, as the level of the R^2's show, there is still much of the variation in these flows to be explained by other factors.

Table 2: Direct Investment to Four Latin American Countries, 1957-65. Explanatory Ability of Stock Adjustment and Risk-Return Models.

	Intercept	$S_i(t)$	$X(t)_{CAN} \frac{(r_i-r^*)v_{CAN}}{r_{CAN}-r^*)v_i}$	$X_i(t-1)$	R^2	D.W.	S.E.
Argentina	22.7 (0.74)	0.16* (2.39)		-0.27 (1.48)	.62	2.12	20.5
	34.1 (0.73)		-0.063 (1.057)	+0.10 (1.00)	.34	2.06	27.1
Brazil	117.3* (2.87)	0.22* (2.00)		-0.31* (2.41)	.56	1.93	13.9
	97.6* (2.0)		+0.015 (1.29)	-0.089 (1.66)	.42	2.99	16.0
Mexico	-84.3 (1.61)	0.069 (0.092)		+0.16 (0.498)	.84	1.23	15.9
	-172.2** (5.63)		0.0045* (2.80)	+0.45** (8.2)	.93	2.70	10.4
Venezuela	27.9* (2.66)	0.11* (2.68)		-0.36** (3.07)	.65	2.28	5.3
	23.6 (0.84)		+0.0029 (0.33)	-0.063 (0.45)	.18	1.51	8.1

III.2.3. Political Factors Affecting the Flow of Direct Investment to Argentina, Brazil, Mexico and Venezuela.

Since the stock-adjustment model produced the best results in explaining flows of direct investment to the four countries -- with and without the inclusion of political factors -- the only results reported below are those using this basic framework. Various political and other measures were added linearly to the sales and lagged capital term in the stock adjustment model. This can be justified, as in section III.2.1 above, as the simplest linear approximation to more complicated non-linear equations.

Expropriations and Threats of Expropriations. The rationale for including political events in the explanation of foreign investment is to attempt to measure the investor's perception of the probability, expected value and risk of losses due to non-economic events: expropriation, destruction of physical capital by war or internal violence, and enforced idleness of physical capital.

It was hypothesized that the investor might pay attention to government threats and promises related to expropriation or, possibly, to other things such as relations with the United States. Consequently, a time series of official and unofficial statements pro and con actual threatened expropriations etc. was collected for each of a number of countries, including the four studied here. The conclusion that emerged from testing many types of indices constructed from these statements and acts was that government statements, pro or con, or considered together had no significant impact on the flows of direct investment to any of the four countries.

It was also hypothesized that expectations about future expropriations might be related to expropriations in the recent past. Expropriations occurred during this period in both Argentina and Brazil. However, in neither case did contemporaneous or lagged expropriations affect the flow of direct in-

vestment for manufacturing. This surprising result may be due to the fact that the expropriations observed were all in the utility sector and were isolated events. The governments apparently tried to make it clear that the expropriations did not indicate a generally hostile attitude to foreign investment, and it seems that this approach succeeded in allaying fears.

Revolutions and Changes in the Government. Revolutions and changes in government can be related to one or all of the non-economic losses identified above. A revolution can bring violence and destruction. It can also increase the risk of expropriation -- if a favorably disposed regime is replaced by its opposite; conversely, where the incumbents are hostile to foreign investors a revolution could decrease the probability of expropriation. The same can be said of peaceful changes in government.

Revolutions and central government changes were with one exception negatively related to flows of foreign investment; as Table 3 shows, the effect of all government changes in Argentina was first positive and then negative, the lagged effect slightly outweighing the contemporaneous effect. The effects of central government changes were fairly strongly negative in Venezuela and Brazil. Mexico had no government changes during the period, in the sense that the same party ruled throughout the period.

The effects of illegal changes, i.e., revolutions, were in the same direction but slightly less significant than all changes in government. Attempts to distinguish between changes in government that would be desired or opposed by foreign investors so far have not led to improvements in the results.

Riots and Deaths due to Domestic Violence. An attempt to measure the fear of losses due to domestic failures of order was made by entering two additional variables into the regressions: the number of large riots occurring in the country and the annual total of people killed in riots and revolutions.

Table 3: Effects of Government Changes (GC) added to the Stock Adjustment Model, 1957-65.

	Intercept	$S_i(t)$	$X_i(t-1)$	GC(t)	GC(t-1)	R^2	DW	SE
Argentina	4.92 (0.50)	0.16** (5.98)	-0.22* (2.53)	41.1** (6.29)	-43.1** (5.01)	.99	3.32	3.4
Brazil	102.6* (2.33)	0.14 (0.82)	-0.20 (1.04)	-9.61 (1.28)	-2.25 (0.29)	.72	1.42	11.1
Venezuela	24.0* (2.69)	0.16* (3.76)	-0.45* (4.14)	-12.9 (1.73)	-5.2 (1.61)	.85	1.60	3.4

As can be seen from Table 4 below, the former variable was very significantly related to foreign investment in Mexico and less so in Venezuela; for Argentina and Brazil there was no observed significant relationship. A negative sign was in most cases observed in regressing the number killed in domestic violence on the flow of direct investment but it was much less significantly related to the flow than the riot variable.

Table 4: Effects of Riots (R) added to the Stock Adjustment Model, 1957-65.

	Intercept	$S_i(t)$	$X_i(t-1)$	R(t)	R(t-1)	R^2	DW	SE
Argentina	22.0 (0.56)	0.16 (1.87)	-0.26 (1.13)	-1.09 (0.20)	0.88 (0.16)	.63	2.13	20.2
Brazil	113.2 (2.32)	0.22 (1.65)	-0.32 (2.01)	2.35 (0.26)	0.58 (0.74)	.63	2.22	12.8
Mexico	30.8* (2.10)	0.15** (5.36)	-0.075 (0.83)	-6.8* (3.95)	-8.9* (3.77)	.99	1.94	2.98
Venezuela	37.5* (3.93)	0.088* (2.30)	-0.31* (2.87)	-1.85 (1.14)	-0.96 (1.37)	.87	2.60	3.27

Guaranty Insurance. The holding of an investment guaranty will presumably reduce the expected loss should an expropriation or loss due to domestic violence occur. At this time only the roughest type of test has been run to measure the effects of Guaranty Insurance. Dummy variables were included to indicate when the various Guaranty Programs were in effect in the four countries. This is a very rough test because nothing was included to measure the proportion of the stock of foreign investments covered by Guaranties in a given year. It should be reported however, that in no case did the existence of any of the Guaranty Programs significantly affect the flow of direct investment. However, since this test is a rather poor one, the result should only be interpreted as no proof and not a rejection of the hypothesis that the Guaranty Program encouraged direct investment.

Other Variables. No other significant effects were discovered. In particular, the flow of foreign aid -- economic, military, loans or grants -- did not seem to be related to the flow of foreign investment. Foreign investors did not seem to conclude that a degree of dependence on the United States for foreign aid protected the investor in any way.

IV. Conclusions

We have shown in the preceding pages that the flow of U.S. direct investment in manufacturing is explainable -- both by economic and political factors. Among the economic factors, we had difficulties assessing the relative significance of risk and return factors as opposed to factors related to capacity adjustment; aggregate regressions for all of Latin America gave fairly strong support to the risk-return model; but results for

Argentina, Brazil, Mexico and Venezuela were strongly in favor of a simple stock adjustment model of investment.

There was a significant effect of government changes, both legal and illegal, and large riots and disturbances on the flow of direct investment.

The magnitude of the effect of government changes was, counting the immediate and lagged effects, negative for all countries experiencing changes in government during the period. The overall effect was least in Argentina, where it amounted to less than 4% of the average flow of investment during the period. On the other hand for Brazil and Venezuela the estimated effects were very large: 24% and over 100% of the average flow.

Riots seemed to affect the flow of investment significantly only in Mexico and Venezuela. In both cases the effect was large: 28% and 19% of the average flow of direct investment over the period.

So far -- and it has been emphasized that the results cannot be considered final -- there has been no evidence that any U.S. programs -- Aid or Investment Guaranty -- have had a significant effect on the flow of direct investment in manufacturing.

APPENDIX

A Note on the Data Used in This Study

A rather time consuming effort was made,and is continuing, in order to collect a time-series of economic and political data with which to test alternative hypotheses about the determinants of the flow of direct foreign investment. The aggregate economic data used in this study was obtained easily from the statistics gathered by the Office of Business Economics. However, there seemed to be no adequate existing collection of political data for the countries involved. To be sure, a number of political scientists have recently gathered extensive data on, among other things, government changes, revolutions, and violence. However, all these data were gathered for only one or a few years; this limits testing to cross-section regressions -- which are deficient for many reasons and purposes -- particularly if one's eventual goal is forecasting.

Consequently, in the summer of 1968 Mr. David Doc , then at A. I. D. and Miss Anne Williams of Brookings undertook to collect a considerable body of economic and political data for 19 countries for the years 1954-65. These data were used in this study and a short description follows. The major sources for the political data were The New York Times Index and the Brittanica Book of the Year; specialized publications were consulted for specific variables.

A major part of the effort was spent, so far with little result as the above regression indicates, in collecting acts and statements of foreign governments for and against foreign investors. This information was classified into acts and statements, type of act, motivation, whether the object was a

specific firm or industry or all foreign investors. Similar data were collected with respect to statements and acts whose object was the United States or its citizens.

Data were also collected concerning government changes -- when they occurred, whether they were peaceful and/or legal, etc.

Other data were collected concerning domestic conflict and violence: peaceful demonstrations, general strikes, wars, revolutions, riots and where possible, the numbers participating and killed.

Finally, the data tapes have recently been expanded to include information on foreign aid, treaties and constitutional provisions relating to compensation and expropriation, tax laws and a number of other variables.

FOOTNOTES

1. For a discussion of past efforts see Stevens (2), p.7.

2. See the Appendix to this paper for a discussion of the data collected.

3. For a detailed consideration of the construction and significance of this and related variables see Stevens (2), pp.2-9.

4. This paper was largely written while I was a member of the A.I.D. summer research program, 1968.

5. It is possible that the above actions actually raise the investor's expected return -- in which case such behavior need not imply risk aversion. For most kinds of insurance and hedging, however, it is usually conceded that the buyer is sacrificing expected return in order to reduce risk.

6. There are well known statistical theorems for finding the overall expected return and risk of a collection of assets as a function of the expected returns and risks of the individual component assets. Thus if the expected returns and variances and amount invested in an asset i are r_i, v_i and X_i, then (if returns are not correlated) the overall expected return (R) and variance (V) are:

$$R = \sum_{i=1}^{n} X_i r_i$$

$$V = \sum_{i=1}^{n} X_i^2 v_i$$

7. Stevens (3), pp. 9-11.

8. Tobin (4).

9. See, e.g., H. Cramer, (1), p.197.

10. Stevens (3), p. 25-32.