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POLITICS, ECONOMICS, AND INVESTMENT:

Explaining Plant and Equipment Spending by U.S. Direct Investors in Argentina, Brazil, and Mexico

Guy V.G. Stevens

ABSTRACT

Few economists or laymen would deny that political events can have an important, sometimes even overwhelming, impact on economic decisions in general, and investment decisions in particular. The first goal of this paper was to integrate a number of political and non-traditional economic variables into the standard theory of investment based on the maximization of the expected value of the firm. The second goal was to test this generalized investment theory on a particularly fertile field for gauging the interaction of political and economic factors: the plant and equipment spending of foreign manufacturing affiliates of U.S. multinationals in Argentina, Brazil, and Mexico. The results of these tests show that the generalized theory is far superior to the traditional alternatives in explaining the real investment of the sample for the 1958-89 period.

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Guy V.G. Stevens[1]

I. Introduction

With the collapse of commercial bank lending to developing countries in the 1980s, much hope focused on direct investment capital as a possible substitute. The attractiveness of direct investment was increased by the prospect of its contributing a *bundle* of productive resources to the development process -- not only a flow of capital, but also flows of technology and management skills.

By now, however, it is well known that there seems to be no magic spigot that can be turned on to increase the flow of direct investment, let alone to assure a predetermined target.[2] In fact, in the past decade of special need, virtually all measures of the resource flows associated with direct investment fell, rather than rose. This fact is illustrated in Table 1 for the flows that are the subject of study in this paper: the *real* plant and equipment expenditure (P&E) of U.S. direct investors in manufacturing for three important developing countries: Argentina, Brazil, and Mexico. While a downturn was experienced in all three countries, the fall was most precipitous in Argentina, where at the end of the decade of the 80s the level was less than 20 percent of the 1980 high.[3]

This disappointing history, along with the continued interest in direct investment as a potential locomotive of development, raises inevitable questions concerning its predictability and the

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[1] The author is a Senior Economist in the Division of International Finance, Board of Governors of the Federal Reserve System. I am grateful for helpful discussions, comments and/or data series to Romita Biswas, Neil Ericsson, Russell Green, William Helkie, Steven Kamin, Andrew Levin, Robert E. Lipsey, Yves Maroni, Patrice Robitaille, Lois Stekler, Phillip Swagel, Charles Thomas, Peter Tinsley, and participants in seminars at the Federal Reserve Board and UCLA, and the meetings of the Western Economic Association. Naturally, the views expressed in this paper are the author's and should not be interpreted as reflecting those of the Board of Governors of the Federal Reserve System or other members of it staff.

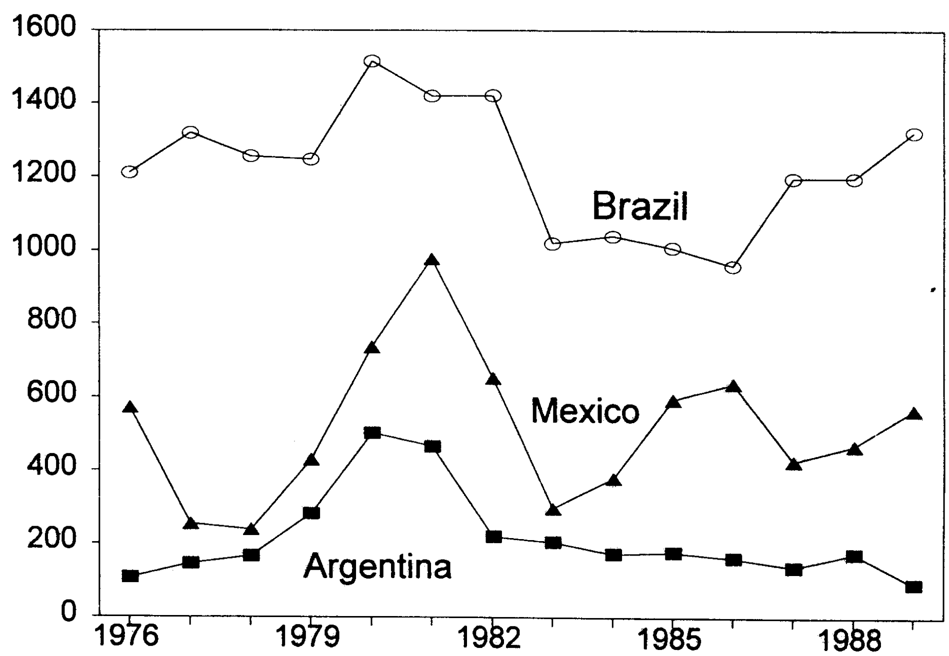
[2] For an outstanding survey of the evidence and issues, see *Investing in Development: New Roles for Private Capital?* [Moran (1986)]. Of particular relevance are the Overview by Moran and the chapter by David J. Goldsbrough, "Investment Trends and Prospects: The Link with Bank Lending."

[3] The changes displayed in Table 1 depend, of course, on the exchange rates and producer price indices that are used to deflate the nominal plant and equipment expenditure flows (the latter for the United States always expressed in U.S. dollars). The issues and alternatives are discussed in the Appendix, section II. As shown there, all reasonable alternatives lead to the same conclusions.

Table 1
Real P&E Spending by Country for U.S. Direct Investors in Manufacturing

Year	Argentina	Brazil	Mexico
1976	107	1211	571
1977	145	1320	253
1978	166	1256	237
1979	281	1247	429
1980	502	1516	736
1981	465	1420	978
1982	219	1421	652
1983	204	1020	297
1984	172	1040	380
1985	176	1007	594
1986	161	958	637
1987	137	1195	426
1988	173	1196	468
1989	91	1322	566

Notes: Figures are real P&E expenditures for direct investors in 1982 U.S. dollars



nature and controllability of its determinants. To what extent are any of the flows associated with direct investment activity -- particularly the real flow of plant and equipment spending -- explainable and predictable? And what factors, if any, can be manipulated in order to increase or regulate the flows? It will be seen below that an attempt to answer these questions inevitably leads to generalized versions of our standard investment functions, formulations that include political and non-traditional economic variables. The theoretical ideas developed in subsequent sections are tested on data for the P&E expenditures of manufacturing affiliates of U.S. multinationals in Argentina, Brazil and Mexico.

II. The Insufficiency of Economic Determinants Alone

It becomes apparent at an early stage that traditional economic variables alone are frequently inadequate to explain the P&E spending of direct investors in these three countries.[4] Table 2 presents the best results that I can obtain using standard investment functions. The independent variables and functional form can be justified theoretically by appeal to simple stock adjustment models and, as well, to the more complicated equations discussed in the next section. The variation in the explanatory ability of the equations among the three countries is extreme. At one end, for Mexico, a traditional investment function involving lagged Mexican levels and changes in GDP (Q and ΔQ), along with the lagged level of the capital stock in manufacturing of U.S. direct investors in Mexico (measured by the terms K_{-1} and $(1-\delta)^t$), leads to quite good results: the R^2 reaches .89 in the best equation and the residuals show little sign of serial correlation. On the other hand, for Argentina, no normal variables are sufficient to provide a reasonable explanation; no equation can explain more than 19 percent of the variance of the dependent variable. In between these extremes is the Brazilian case, where traditional factors explain just under 80 percent of the variance of P&E expenditures, but with largely insignificant signs and extreme serial correlation. The results cannot be improved by adding cost or price variables that sometimes work in domestic U.S. equations: e.g. the cost of capital and wage rates.

The question then becomes whether non-traditional variables can lead to an improvement in

[4] For ease of exposition I will frequently use "P&E spending" for P&E spending for U.S. direct investors in manufacturing.

TABLE 2: BEST REGRESSION RESULTS USING TRADITIONAL ECONOMIC VARIABLES[1,2]

	GDP_{-2}	ΔGDP	ΔGDP_{-1}	ΔGDP_{-2}	K_{-1}	$(1-\delta)^t$	R^2	DW	SER	SAMPLE
ARGENTINA	-.18 (1.6)	-.05 (.34)	-.08 (.53)		-.14 (1.2)	-730 (1.8)	.19	.81	94	1958-89
BRAZIL	.012 (.77)	.019 (.84)	.041 (1.8)		.026 (.29)	-470 (1.2)	.79	.48	236	1958-89
MEXICO	1.1 (3.0)	.77 (2.9)	1.7 (7.0)	1.9 (4.8)	-.35 (2.1)	-305 (1.3)	.89	1.7	74	1958-89

1. The dependent variable for each equation is one of two alternative measures of real P&E expenditures by U.S. direct investors in manufacturing; it takes the nominal value, reported by the affiliates in U.S. dollars, and deflates by a U.S. index of plant and equipment prices. See the Appendix for alternative measures, giving very similar results, that translate the nominal dollar value into local currency units and deflate by domestic investment price indices.

2. The numbers in parentheses are *t*-ratios. Besides the multiple correlation coefficient (R^2), abbreviations in the table are: DW for the Durbin-Watson statistic, and SER for the standard error of the residual.

the results in Table 2, especially for Argentina and Brazil. There is some basis for optimism in pursuing research in this direction -- partly because of survey data and the results of a few econometric studies covering direct investment in developing countries, and partly because of a burgeoning body of findings linking economic growth to political factors. Concerning the latter, a number of recent studies have consistently shown a significant negative relationship between economic growth at the country level and measures of political instability [Londregan and Poole (1990), Barro (1991), Alesina et. al. (1992)]. With respect to direct investment specifically, the body of empirical results is surprisingly limited given the emphasis over the years by businessmen and commentators on the importance of political stability and other factors for a satisfactory "investment climate."[5] However, Weigel (1970), in a pathbreaking study, showed a significant negative impact of dividend restrictions on direct investment flows to Brazil. Nankani (1979) reports a negative relationship between aggregate foreign direct investment in manufacturing and general political instability and specific threats to foreign business. In an earlier study, Stevens (1969) found evidence for some Latin American countries that government changes and internal domestic violence had a negative impact on direct investment.

III. An Investment Model Incorporating Both Economic and Political Effects

The traditional, neoclassical theory of the firm postulates the maximization of the value of the firm as the ultimate objective, with investment, labor, and other factor inputs as the major decision variables. How the firm handles uncertainty is of fundamental importance; for this paper I shall adopt the standard, if somewhat cavalier assumption that the firm maximizes its *expected* present value. A typical expression for expected present value looks like the following:

$$V(t) = \sum_{i=0}^{\infty} D^i E_t\{p(Q_{t+i})\bullet Q(K_{t+i},L_{t+i}) - wL_{t+i} - qI_{t+i} - d/2I^2_{t+i}\}, \qquad (1)$$

$$\text{subject to: } I_{t+i} = K_{t+i} - K_{t+i-1} + \delta K_{t+i-1},$$

where: Q, I, and K are, as usual, output, investment, and capital; D is the discount factor, $1/(1+\rho)$,

[5] See Reuber et. al. (1973), p. 114; Frank (1980), pp. 111-112; O.E.C.D (1968).

δ the depreciation rate, w the wage rate, q the cost of investment goods, and d/2 is the coefficient of the nonlinear cost of adjusting the rate of investment.

In fact, even in this relatively simple case, this problem becomes impossible to solve fully for the optimal paths of capital and labor.[6] For this reason, and because we have no data on labor input, we shall make simplifying assumptions sufficient to fit the model into the standard, one-variable form developed by Tinsley (1971) and elaborated by Sargent (1979). For the production function we will assume that the labor/capital ratio is constant -- either because of fixed factor prices or fixed coefficients in production. Thus, L = hK and, assuming constant returns to scale, Q = fK, where h and f are constants independent of time. Further, given the typically large size of U.S. manufacturing affiliates in these markets, it seems reasonable to reject perfect competition; the firm will be assumed to have a simple, linear, downward sloping demand curve: $P = a_{t+i} - bQ$. Here the intercepts for all future periods, a_{t+i}, are assumed to be unknown variables at the time *t* of decision (the importance and implications of this assumption are treated in section IV.A). As a result of these substitutions, equation (1) becomes the following:[7]

$$V(t) = \sum_{i=0}^{\infty} D^i E_t\{(a_{t+i} - bfK_{t+i})\bullet fK_{t+i} - w_{t+i}hK_{t+i} - q_{t+i}I_{t+i} - dI^2_{t+i}/2\}. \tag{2}$$

The firm maximizes (2) subject to the constraint in (1) with respect to the flow of investment for each period, t+i, in the future. At the optimum the firm is faced with solving an Euler equation of the following form:

$$\begin{aligned} 0 = {} & E_t\{fa_{t+i} - hw_{t+i} - q_{t+i} + q_{t+i+1}D(1-\delta)]\} + Dd(1-\delta)K_{t+i+1} \\ & -[2bf^2 + d + Dd(1-\delta)^2]K_{t+i} + d(1-\delta)K_{t+i-1}. \end{aligned} \tag{3}$$

Given the definition of D, the two terms in q are equivalent to a familiar formulation for the cost

[6] If perfect competition is assumed, the Euler equation for labor can be used to solve for labor in terms of capital, thus allowing labor to be easily substituted out. However, even in this case, the solution will not be tractable, because the equation substituting capital for labor contains the relative price term, w/p, which, if not constant, leads to an Euler equation with variable coefficients and no closed-form solution.

[7] A more elaborate version of (1) and (2) would incorporate exchange rates to translate returns in foreign currency into U.S. dollars; this is attempted in section III.D, below. It will be shown there that care is necessary to avoid incorporating variable exchange rate terms into the otherwise constant coefficients of the capital stock terms in equation (3).

of capital: $E_{t+i}\{-q_{t+i}/(1+\rho)[\rho+\delta q_{t+i+1}/q_{t+i}-\Delta q/q_{t+i}]\}$; hereafter this term will be abbreviated as cc_{t+i}.

Following Tinsley and Sargent, the solution to this second order difference equation with constant coefficients is an infinite series of the future expected net returns $E_t\{fa_{t+i}-hw_{t+i}-cc_{t+i}\}$, weighted by the two characteristic roots (λ_1, λ_2) of the homogenous part of equation (3):[8]

$$I_t = \lambda_1/[d(1-\delta)]\{\sum_{i=0}^{\infty}(1/\lambda_2)^i E_t[fa_{t+i}-hw_{t+i}-cc_{t+i}]\} - (1-\lambda_1-\delta)K_{t-1}. \qquad (4)$$

By reweighting the infinite series slightly, the investment function (4) can be expressed as a traditional partial adjustment equation, with the infinite weighted-average of future expectations representing the "target" capital stock, and 1 minus the smaller root, λ_1, representing the speed of adjustment.

III.A. Incorporating Political Effects

Anecdotal evidence, as well as the survey and empirical studies discussed above, suggest that many factors affect P&E by direct investors beyond the economic determinants incorporated into equation (4). Candidates include such factors as the possibility or actuality of exchange controls and other limitations on the repatriation of profits, the threat of expropriation, changes in government with their attendant changes in rhetoric and policy, and disruptions in production caused by strikes, domestic unrest and the like. Insofar as variables related to these factors affect the present and expected future profits of a given firm, they should be fitted into the value maximization framework developed above.

Nevertheless, a number of special problems hinder the incorporation of these non-tradition variables, particularly the ones that are usually described as *political* variables. On the theoretical level is the question of how a particular non-traditional factor, political or otherwise, is related to the expected future profits of the firm. On the empirical level are the questions of developing ade-

[8] Sargent (1979), pp. 195-200, provides a good exposition of the solution procedures for this kind of stochastic difference equation. As is well known, the product of the two roots must be positive and equal to $1/D = 1+\rho$ (the ratio of the coefficients of K_{t+i-1} and K_{t+i+1} in equation (3)); moreover, the (positive) sum of the two roots is equal to the absolute value of the ratio of the coefficients of K_{t+i} and K_{t+i+1}. Sargent shows (p.198) that the two roots appearing in equation (4) must be real and positive, and that: $\lambda_1 < D < 1 < \lambda_2$.

quate *measures* of the relevant factors, particularly the ones typically classified as political, and testing hypotheses about their effects on investment. The theoretical question is the subject of the following subsections. Questions of measurement and hypothesis testing will be addressed in sections IV through VI.

III.A.1. Classes of Political Factors In the widest sense a *political* factor might be defined as any variable that is affected directly -- or even indirectly -- by the political system. Such a broadly defined class contains many variables, well-known to economists, that frequently enter standard investment functions. A good example is the corporate income tax rate that enters the firm's cost of capital; less exclusively determined by the political system, but nevertheless almost always influenced by political forces, is the nominal interest rate. Such factors are rarely identified as political, partly because they are easily measured and are familiar variables in traditional investment functions. However, whether easily measured or not, in order to form expectations of *future* values of these and other political variables, it is necessary to enter into the forecasting of the political process. Thus, the expected values for future corporate tax rates that typically enter future costs of capital in equation (4), above, require some consideration of the political system.

One distinction among political variables is whether a change in a given political variable can be represented by the change of a single variable, like a tax rate, within a single expression for the firm's profits, or whether the change signals a *shift* from one profit function to a completely different one. A good example of the latter is a government's announcement of an expropriation; in the pure case, where no compensation is given, the firm's expected net revenues shift to zero for the present period and all future periods.

The above distinction is independent of measurability. Difficulty with measurement is, however, another typical problem with political variables. Here one can distinguish two aspects of the general problem: difficulties in getting data to measure a particular political concept and difficulties in linking this concept to variables that affect directly the profits of the firm. The various problems of measurement encountered in this study are discussed at more length in section IV.

III.B. The Case of a One-Period Shutdown

To illustrate the incorporation of a shift from one return function to another, consider the generic case of a one-period shutdown of production operations -- caused by anything from a long strike to a war. By definition, the return in this state is characterized by the fact that there is no production; for simplicity we shall also assume that this implies no revenues (i.e. no sales out of inventories). The fact of no revenues does not typically imply zero profits for the period; rather, it is likely that fixed costs related, at least, to the depreciation and financing of the firm's capital will still be incurred. To keep the example simple, we shall assume that the shutdown does not affect any future exogenous variables. Assuming the continuation of the firm's fixed and investment-related costs during the shutdown, the firm's profits *given* a shutdown in some period t+i -- Π/S_{t+i} -- would be:

$$\Pi/S_{t+i} = -qI_{t+i} - d/2I^2_{t+i} \,. \qquad (5)$$

Ex ante, of course, the firm rarely knows with certainty if an "event" will occur that triggers a shutdown in a particular period; if normal times occur, the firm's profits will be determined by the normal profit function embedded in equations (2) through (4); however, if a shutdown occurs, the firm's (negative) profits will be determined by the entirely different function (5).

So far, no measurement of the "event" that triggers this shift has been necessary. However, in order to assess the *expected* return or profit in any future period t+i, one must know, not only the return in each possible state, but also the *probability,* P( ), of the occurrence of each state. These probabilities should be functions of exogenous variables; particularly for the probabilities of "non-normal" states -- such as a shutdown brought on by a war -- the difficulties of measurement noted above are exacerbated by the general difficulty of measuring subjective expectations of any kind.

Without trying to solve these measurement problems at this point in the paper, one can at least write out the overall expected profits of a foreign affiliate facing a non-zero probability of a one-period shutdown. Given two possible states, normal operations (N) or a shutdown (S), overall expected profits for the period t+i are:[9]

$$E_t(\Pi_{t+i}) = P(S_{t+i})E_t(\Pi/S_{t+i}) + P(N_{t+i})E_t(\Pi/N_{t+i}) = P(S_{t+i})E_t(\Pi/S_{t+i}) + [1-P(S_{t+i})]E_t(\Pi/N_{t+i}). \qquad (6)$$

To make the solution tractable, we will assume that the probabilities, however determined, are functions of variables or factors that are exogenous to the firm's actions. As well, for simplicity, we assume that the probability of a shutdown in the future -- on the basis of information available at time t -- is constant for all periods in the future; this probability can change as new information becomes available, but for this paper we will ignore the situation where information available at time t suggests that the probability of a shutdown is, say, small for the short run but large in some future period.[10]

Before moving to these measurement issues, let us consider how the original Euler equation (3), and derived investment function (4), are affected by the modified return function (6). Since both states of the world contain identical terms for investment-related costs, (5) above, the valuation function that incorporates the possibility of periodic shutdowns takes the following form:

$$V(t) = \sum_{i=0}^{\infty} D^i E_t\{[1-P(S)][(a_{t+i}-bfK_{t+i})\bullet fK_{t+i} - w_{t+i}hK_{t+i}] - q_{t+i}I_{t+i} - dI^2_{t+i}/2\}. \qquad (7)$$

The modified Euler equation appears only slightly changed from (3), above:

$$0 = E_t\{[1-P(S)][fa_{t+i}-hw_{t+i}] - cc_{t+i}\} + Dd(1-\delta)K_{t+i+1}$$
$$-\{[1-P(S)]\cdot 2bf^2 + d + Dd(1-\delta)\}K_{t+i} + d(1-\delta)^2K_{t+i-1}. \qquad (8)$$

As long as the probability of a complete shutdown in any future period (based on information at the time of decision) is not a function of time, the homogenous part of the Euler equation is still a solvable second order difference equation with constant coefficients.

Although the possibility of a shutdown changes the Euler equation only a little, this change

[9] Here, as everywhere else in this paper, we assume that the expectation of the profit level at time t+i is taken at time t on the basis of the information existing at that time t.

[10] The derivation of a closed-form investment function for this problem, as discussed below, is impossible for this more complicated problem.

does lead to fundamental changes in the associated investment function. The probability of a shutdown affects two sets of terms in (8). First, two of the three terms in the forcing function are now multiplied by the probability of normal operations [1-P(S)]. Just as significant econometrically, the coefficient of K_{t+i} is modified (lowered in absolute value) by this same probability; such a change affects both of the characteristic roots of the associated homogenous equation. Since the characteristic roots appear in every term in the investment function (cf. equation (4)), this implies that, if the variables change that affect the firm's perception of the probability of a shutdown, then *all the coefficients of the investment function change*. In the empirical section VI below, we will see, however, that the coefficients often change proportionally to each other, so that there is efficiency to be gained by pooling data from different political periods or regimes. [11]

Despite the oversimplification involved in the description of the above shutdown example, many other types of political effects can be modeled using this general form. The expected return in a given period is a weighted average of revenues during normal times and revenues given a shutdown or whatever other event occurs (investment costs in the case of a shutdown, but possibly something else in the case of, e.g., exchange restrictions or special taxes); moreover, the cost-of-capital term and costs of investment are typically not affected in the value function or Euler equation, because these are usually incurred whatever state occurs.

Other types of political events, however, are not so easily modeled. In these cases, the occurrence of the event in a given period, say t+i, not only affects the return in that period, but also the return and, possibly, the probability of various states in subsequent periods. A good example is the analysis of the possibility of expropriation.

III.C. An Event With Multiperiod Effects: Expropriation

As in the previous case of a shutdown, when expropriation occurs there is an immediate cessation of production. However, in the classic expropriation, all *future* production is also eliminated, as the firm's assets are taken over by the state. For expositional simplicity, let us also assume that the firm's assets are actually confiscated, with no compensation paid.

The analysis of the expropriation case differs from the previous one in that the probability of

[11] Note that since a positive probability of a shutdown changes (reduces) only the coefficient of the K_{t+i} term in equation (8), only the sum of the two characteristic roots change (are reduced in absolute value), and not their product. Implications of this and other changes in the characteristic roots are examined in section VI.

normal operations in the *future* is obviously dependent on the occurrence of an expropriation in the past. In fact, the dependence is particularly simple: once an expropriation occurs, the probability of normal operations in all future periods drops to zero. Given this fact, one can calculate, the probability at time t of normal operations in any future period t+i, $P(N_{t+i})$. Normal operation in period t+i thus requires the occurrence of two independent events -- no expropriation in any period previous to t+i and no expropriation during period t+i. Assuming a constant probability of expropriation in any future period, $P(E)_{t+i} = P(E)$, the probability of the former event -- not being expropriated from time t through period t+i-1 -- becomes $[1-P(E)]^{i-1}$. Since the probability of not being expropriated in period t+i is also 1-P(E), the composite probability, taken at time t, of normal operations in t+i is $[1-P(E)]^{i}$.

One can combine the expropriation case with that of the previous example by assuming that, besides the probability of expropriation in period t+i, there is the separate probability, analyzed above, of a one-period shutdown due to other causes. In this case, the probability (taken at t) of operating normally in period t+i, is : $[1-P(E)]^{i-1}[1-P(E)-P(S)]$.

We now have the pieces to formulate the expected return for the future period t+i given the possibility of these two types of political event. There are three possible returns at t+i accompanied by their respective probabilities: normal returns; being shutdown temporarily with the return expressed above in equation (5); and being expropriated, either in t+i or before, with return then and thereafter equal to 0. The associated valuation equation is as follows:

$$V(t) = \sum_{i=0}^{\infty} D^{i} E_{t}\{[1-P(E)]^{i-1}[1-P(E)-P(S)][(a_{t+i}-bfK_{t+i})\bullet fK_{t+i} - w_{t+i}hK_{t+i}] \tag{9}$$

$$+[1-P(E)]^{i}[-cc_{t+i}K_{t+i} - q_{t+i}I_{t+i} - dI^{2}_{t+i}/2]\}.$$

By factoring out $[1-P(E)]^{i}$, one can see that the probability of expropriation functions like an added discount factor. After factoring and cancellation, the basic form of the associated Euler equation is fairly similar to equation (8):

$$0 = E_t\{[1\text{-}P(E)\text{-}P(S)]/(1\text{-}P(E))[fa_{t+i}\text{-}hw_{t+i}] \text{-}cc_{t+i}\} + dD(1\text{-}P(E)(1\text{-}\delta)K_{t+i+1} \quad (10)$$

$$-\{[1\text{-}P(E)\text{-}P(S)]/(1\text{-}P(E)] \bullet 2bf^2 + d + dD(1\text{-}P(E)(1\text{-}\delta)^2\}K_{t+i} + d(1\text{-}\delta)K_{t+i\text{-}1}.$$

The bottom line for this model is very similar to the one for the previous model. A positive probability of expropriation affects, in predictable ways, both the weights on the terms from the forcing function and the roots of the associated second-order difference equation. However, as discussed in more detail below, the probabilities now affect two terms of the homogenous part of the difference equation -- with somewhat different implications for the coefficients of the derived investment function.

III.D. Exchange Market and Repatriation Restrictions

In the previous two sections, the return after the occurrence of the relevant political event was assumed by the foreign investor to be particularly simple -- zero. This is handy, but not required analytically, and obviously incorrect for some important practical cases.

An important real-world case, shown below to be very significant empirically, is the governmental imposition of exchange or repatriation restrictions. Although sometimes complicated and difficult to understand, all such restrictions somehow reduce, but do not wipe out, the dollar value of the profit stream that is generated by the firm's operations. Here we will focus on one type of restriction that has been quite important in the past: forcing dividends to be repatriated at a non-preferential or penalty exchange rate. The Bonex system in Argentina, to be investigated in the next section, is a case in point.[12]

To properly analyze this case, one must introduce exchange rates into our objective function. In the preceding examples we have, for simplicity, ignored the fact that multinational firms typically produce earnings in a foreign currency and remit these earnings in the currency of the home country. Under normal conditions, without exchange controls, this can be modelled by multiplying the net returns of the firm for a given period by the market exchange rate, x_{t+i}. Thus, the firm's original objective function (2) would be transformed to:

[12] It is often argued that another typical type of restriction has, in one way or another, discouraged the repatriation of dividends in excess of a stipulated percentage of the value of the firm's capital; typically, dividends above the magic percentage would lead to penalty taxes from 15% to 25% of the "excess" dividends. Such restrictions were prevalent in Argentina and Brazil, but so far I have not been able to find any significant impact of these restrictions.

$$V(t) = \sum_{i=0}^{\infty} D^i E_t\{ x_{t+i}[(a_{t+i}-bfK_{t+i})\bullet fK_{t+i} -w_{t+i}hK_{t+i} -q_{t+i}I_{t+i}-dI^2_{t+i}/2]\} \tag{11}$$

It will also be helpful, at this point, to be somewhat more explicit with respect to the price variables appearing in the rest of the objective function. Let us emphasize the role of *relative* prices in the firm's demand curve by rewriting it as: $P/p_c= a_{t+i} -bQ$, adding a competitive price, p_c, to the previous representation of the demand curve (p_c could also be a general price level); this addition, more in accord with theory, implies that, *ceteris paribus*, changes in the competitive price or the general price level will result in an equal percentage change in the firm's price. We will also make the role of price explicit in the (nominal) adjustment cost term, $-dq_{t+i} I^2_{t+i}$. The modified objective function becomes equation
(12), below, along with the associated Euler equation (13):

$$V(t) = \sum_{i=0}^{\infty} D^i E_t\{ x_{t+i}[p_{c,t+i}(a_{t+i}-bfK_{t+i})\bullet fK_{t+i} -w_{t+i}hK_{t+i}-q_{t+i}I_{t+i}-dq_{t+i} I^2_{t+i}/2]\} \tag{12}$$

$$\begin{aligned} 0 = {} & E_t\{x_{t+i}[fp_{c,t+i}a_{t+i} -hw_{t+i} -q_{t+i}]+D(1-\delta)x_{t+i+1}q_{t+i+1}\} \\ & + Dd(1-\delta)E_t\{x_{t+i+1}q_{t+i+1}\}K_{t+i+1} + d(1-\delta)E_t\{x_{t+i}q_{t+i}\}K_{t+i-1} \\ & -E_t\{x_{t+i}[2bf^2 p_{c,t+i} + dq_{t+i}]+ Dd(1- \delta)^2 x_{t+i+1}q_{t+i+1}\}K_{t+i}. \end{aligned} \tag{13}$$

In each term of (13), a future, unobserved exchange rate multiplies one or more random variables; thus, in order for the decision-maker to form the necessary expected values, he must make some assumption about the *covariances* among these variables.[13] Further, to be able to solve (13) for the associated investment function, we must assume that the expected values, taken at time t, in the homogenous part of the equation are constants or powers of some initial value.[14] Thus, one might assume: $E_t\{x_{t+i}q_{t+i}\} = x_tq_t(1+g)^i$, where t is the time of decision and g is the relevant

[13] It might be argued that the objective function (12) should be expressed in *real* rather than nominal U.S. dollars; in this case, the terms in equation (12) should be divided by some U.S. price index. Note that this step then makes the terms in (12) -- and, subsequently, (13) -- into price relatives: the dollar value of foreign prices and wages divided by U.S. prices.
[14] This was the case in the previous section for the probability that the firm would be expropriated by a given period.

growth rate (which could be zero or negative, and different for different variables).[15]

The new investment function -- before accounting for the exchange market controls -- would be quite similar in form to the original investment function (4):

$$I_t = \lambda_1 /[d(1-\delta)]\{\sum_{i=0}^{\infty} (1/\lambda_2)^i E_t\{x_{t+i}[p_{c,t+i}fa_{t+i}-hw_{t+i}-cc_{t+i}]\} - (1-\lambda_1-\delta)K_{t-1}. \tag{14}$$

However, the assumptions about the growth rate, g, and any non-zero covariances between price variables would affect the sizes of the eigenvalues, λ_1 and λ_2.

<u>III.D.1. *Adding a Bonex System*</u> In the Argentine system of dividend restrictions, firms were forbidden access to the official exchange market for converting foreign profits into dollars; to some extent (perhaps varying depending on the regime), U.S. affiliates were forced to exchange their pesos for Argentine government bonds (BONEX), denominated in dollars, that could be sold for dollars on the open market. The exchange rate realized for these bonds could be expected to be much less favorable than the official rate, both because of the latter's typical overvaluation and because of default risk on the Bonex.[16]

How should one represent this system in our equations (12) and (13)? The return, given the Bonex state of the world, would seem to differ from the net profit expressed in (12) only by having a different, lower exchange rate substituted for the "normal" rate x_{t+i}. One could also represent the Bonex rate by a time-varying discount on the normal, official rate, say $1-B_{t+i}$.

Following the rule, (6), for calculating the overall expected value of profits as a weighted average of the expected profits in the individual states, the expected return for period t+i to appear in equation (12) should now read:

$$\begin{aligned} &P(BONEX)\bullet E_t\{(1-B_{t+i})x_{t+i}[p_{c,t+i}(a_{t+i}-bfK_{t+i})\cdot fK - w_{t+i}hK_{t+i}\} \\ &+[1-P(BONEX)]\bullet E_t\{x_{t+i}[p_{c,t+i}(a_{t+i}-bfK_{t+i})\cdot fK - w_{t+i}hK_{t+i}\} \\ &-E_t\{x_{t+i}[q_{t+i}I_{t+i}-dq_{t+i}I^2_{t+i}/2]\}. \end{aligned} \tag{15}$$

[15] If one went further and took the sensible step of assuming that the firm maximized the real value of this stream of nominal dollars, one would divide the value of profits at a given t+i by the appropriate U.S. price index for that period. For this objective function, the Euler equation would end up with the expected value of price relatives -- i.e. real exchange rates.

[16] See the IMF's annual *Exchange Arrangements and Exchange Restrictions.*

The reason the investment terms are not multiplied by an obvious probability is that funds for investment goods always must come through the official market (a less favorable rate for purchasing investment goods).[17] Since the expected returns in the different states differ only by the factor $(1-B_{t+i})$, after making the required assumption about the covariance between B_{t+i} and the other random variables, one can simplify the overall expected return. Assuming for convenience that the Bonex discount at t+i is independent of the other random variables,
the firm's modified objective function becomes:

$$V(t) = \sum_{i=0}^{\infty} D^{i}\{[1-E_t(B_{t+i})\bullet P(BONEX)]\}\bullet E_t\{ x_{t+i}[p_{c,t+i}(a_{t+i}-bfK_{t+i})\cdot fK - w_{t+i}hK_{t+i}\}$$

$$+ E_t\{ x_{t+i}[-q_{t+i}I_{t+i}-dq_{t+i} I^{2}_{t+i}/2]\}\}. \qquad (16)$$

Even though there is a positive return in both possible states of the world, the *form* of the modified objective function is identical to that for the case of a one-period shutdown; the only substantive difference is that more than the probability of the Bonex state multiplies the expected return in normal times -- it is the probability times the percentage difference in the two exchange rates. When times are normal and the probability of the institution of a Bonex system is small, the discount factor $1-E_t(B_{t+i})\bullet P(BONEX)$ is likely to be close to one; and the possibility of the institution of such dividend restrictions should not affect the firm's investment very much. However, if we are actually in a Bonex state, then the probability of future Bonex states should be much higher, perhaps even 1, and the effect on investment could be devastating. In fact, the Euler equation (13), above, is changed exactly the way the Euler equation (3) is changed to (8) for the case of a one-period shutdown. The corresponding investment functions are changed similarly.

In this section, we have gone over most of the permutations in the firm's valuation and investment functions that can be caused by political factors, broadly defined. Cases have been examined where a political event has a one-period effect, and others where the event can last for many periods or even end the life of the firm. Before an investment function can actually be estimated, however, we must specify variables that will affect, if not completely determine, the

[17] Of course, insofar as a firm's gross profits in the foreign currency are enough to cover investment expenditures, it might be hard for the country to enforce this rate differential.

probabilities and returns that are embedded therein.

IV. Variables Defined and Sources of Data

For the empirical sections, investment functions will be estimated that are specified according to the various Euler equations defined in the last section. This means that measures and sources of data will have to be found for: real P&E expenditures (I), the capital stock (K), the terms in the forcing function such as the intercept of the firm's demand curve (a), the wage rate (w) and the cost of capital (cc); moreover, political and other non-traditional variables must be found that are related to the probabilities of a shutdown (S), an expropriation (E), the imposition of repatriation restrictions (Bonex), and, possibly, other events that cause a shift in the firm's return function. This section will concentrate on specific measures and measurement problems; a more detailed discussion and listing of specific sources for the measures chosen can be found in the Appendix.

IV.A. Traditional Economic Variables

The nominal value for the P&E expenditures abroad by U.S. foreign affiliates is collected by the Bureau of Economic Analysis (BEA) on an annual basis; data are available from 1957 to the present. The major question with these data is choosing a deflator and, possibly, an exchange rate to go from the nominal data, which is originally expressed in U.S. dollars, to *real* P&E expenditures; a number of options have been tried which, fortunately, lead to the same qualitative results. For the results presented in sections V and VI, a U.S. investment cost index is used. The empirical results using this measure are superior econometrically, possibly because of the extraordinary inflation and exchange rate instability in Argentina and Brazil. Insofar as new or used investment goods are exported from the United States to the foreign subsidiary, the U.S. deflator is the appropriate one. In the Appendix, results are presented using an alternative real P&E series, which relies on the exchange rate and domestic price data collected using the Summers-Heston (1991) approach.

Once the real investment series is constructed, the capital stock series was calculated using the perpetual inventory method (assuming a constant depreciation rate of 13 percent).[13] One often-ignored drawback of this method is that a long series for investment is required, going back far beyond the starting point of the estimation period. Without it, as discussed in the Appendix and at length in Stevens (1994) and Stevens and Lipsey (1992), all the estimated coefficients in the investment function can be seriously biased. Since the BEA data start only in 1957, this is potentially a serious problem; however, in Stevens (1994) it is shown that incorporating the additional variable $(1-\delta)^t$ into the regression can eliminate this source of bias. For the most part, the addition of this variable improved the empirical results.

Because the capital stock variables often performed quite poorly in the linear regressions reported in Tables 2 and 3, regressions were also fitted using a transformed version of the investment function based on the work of Coen (1971). As discussed at more length in the Appendix, this involves substituting the lagged value of investment or an instrument for it in place of the lagged capital stock. In Table 3, equations using both alternatives are frequently compared.

Various traditional measures for country wage rates and the firm's cost of capital have been tried; none showed any statistical significance. For this reason, no wage or cost-of-capital terms appear in the results presented below.

The one remaining economic variable needed to estimate investment functions like (4) or (14) is the intercept of the firm's demand curve, $E_t(a_{t+i})$ -- or in the case of (14), the product $E_t(x_{t+i}p_{c,t+i}a_{t+i})$. For the latter, more complicated case, we will make the plausible assumption that the first two terms in the product, $x_{t+i}p_{c,t+i}$, are statistically independent of a_{t+i}. As discussed above, in taking the expectation at time t for the product $x_{t+i}p_{c,t+i}$, the assumption will be that the decision-maker projects forward the current level multiplied by a subjectively determined growth rate: i.e., $E_t(x_{t+i}p_{c,t+i}) = x_{t-1}p_{c,t-1}(1+g)^{i+1}$, where the observations at t-1 are the most recent observations on these variables.

As argued below and earlier in Stevens and Lipsey (1992), lagged output terms will be used to approximate the variables a_{t+i}. I consider the approach of linking lagged output terms to the expectations for a_{t+i} preferable to the traditional one of inserting output or sales into the investment

[13] For details on the method and the justification for 0.13 as the value for the depreciation rate, see Stevens (1994).

function in a completely *ad hoc* manner. Since the proxies for a_{t+i} are the only traditional variables that remain in the forcing function part of the investment function, I will discuss the alternative derivations at some length.

A variable, but unobservable intercept, a_{t+i} or a_t, is of no empirical use until it can be related to observable variables. A firm in a situation of smooth, steady growth can represent a_t adequately by an arithmetic or exponential time trend, i.e., $E_t(a_t) = (1+g)a_{t-1}$. Our sample period was, however, far from one of steady growth for the countries in our sample.

The key to approximating a_t in a more general setting is to use the observable elements in the firm's demand curve: $P_t/p_{c,t} = a_t - bQ_t + v_t$, where v_t is a a white-noise error, and P/p_c equals the firm's product price divided by a price index of competitive prices. No matter how a_t or v_t bounce around, in every period the unobservable intercept is equal to the observable quantity (p/p_c+bQ) plus the random error v. For the firm making decisions at time t, the above relation holding at time t is of no help, because both P_t and Q_t are endogenous variables. However, if the intercept a_t is serially correlated, then previous realizations are useful information. Thus, if, for example, a_t is assumed to be a weighted average of past realizations, say $a_t = \sum_{i=1}^{N} w_i a_{t-i}$, then:

$$E_t(a_t) = \sum_{i=1}^{N} \{w_i[P_{t-i}/p_{c,t-i} + bQ_{t-i}]\}. \qquad (17)$$

Thus, the approximation of the expected value of a_t can justify the incorporation of lagged relative prices and outputs into the firm's investment function. Values of E(a) farther into the future, $E_t(a_{t+i})$, can be related to the observed values on the right hand side of (17) by recursive substitution. At time t, therefore, the whole stream of expected future values $E_t(a_{t+i})$ found in investment functions (4) or (14) will be proxied by a weighted average of past output and/or price terms as shown in (17).

Because no data exist on the actual prices charged by U.S. foreign affiliates in Argentina, Brazil, or Mexico and only partial series exist for affiliate sales, it was necessary to use aggregate national variables as proxies, basically measures of real GDP and GDP deflators. See the

Appendix for more details. For all the results reported below, the prices or price relatives have added nothing to the explanatory ability of the estimated investment equations; thus, $E_t(a_t)$ has ended up being approximated only by a distributed lag of output levels and changes.[19]

IV.B. Non-Traditional Variables

Once a particular state of the world has materialized, it is fairly safe to assume that the probability of this state continuing into the future is increased significantly. In some cases, the states can be observed; into this class fall the materialization of exchange controls, dividend restrictions, and devaluations. In other cases, where we could not observe disruptions of production, expropriation, or the imposition of new regulations, we have postulated that the probability of these states would be positively related to such factors as: the orientation of the government vis a vis foreign investment or the United States, the passage of laws important for foreign investment, the occurrence of wars and domestic violence (that might cause disruptions in production), and the frequency of changes in government. It has also been argued that the period of time from 1982-1989, which corresponded to an international debt crisis in all three countries, could have been an independent factor reducing direct investment; this argument will also be examined below. The sources for each of these variables are listed and discussed in the Appendix.

V. The Impact of Political Factors: Linear Estimates

One reason Argentina, Brazil and Mexico were chosen for study was because of the ostensibly wide variations in the political fortunes of foreign direct investors within these countries. Regimes came and went, some pro foreign investment, some mildly or strongly against. Numerous laws were passed that either restricted foreign investment or removed restrictions from it. In Argentina and Brazil, particularly, there were military takeovers of the government and large numbers killed in domestic violence; Argentina even entered into a war with the United Kingdom in 1982. Some of these factors appear to have affected the P&E of U.S. subsidiaries in

[19] An alternative approach would be to use the expression for a_t, but to make the rational expectations assumption that the firm's expectation differs from the observed a_t by only a random error. In this case, since a_t continues to unobservable, we have $E(a_t) = P_t/p_{c,t} + bQ_t$. Even if we had direct measures of the realized values of the right hand side variables for the relevant U.S. foreign affiliates, McCallum (1976) has shown that an instrumental variable approach is necessary to avoid biased and inconsistent estimators. If we used contemporaneous and lagged values of *aggregate* country variables as the instruments, we would end up with the same estimators as we propose above.

manufacturing significantly, but many did not. This section will be devoted primarily to presenting results for the political variables that *did* seem to have a statistically significant impact on real P&E expenditure by U.S. direct investors in one country or another, for the sample period 1958 to 89.

Our first cut at incorporating the effects of political factors into investment functions uses what might be called the standard linear approach: events assumed to increase the probability of "abnormal" or non-standard returns, such as a change in government or passage of a law regulating direct investment, are measured directly or, more usually, by a dummy or binary variable; the effect of the induced change, by default, is assumed to enter additively, unaffected by the levels of other independent variables. In some cases, the political variable may have a natural measure, so that a dummy variable can be avoided -- e.g. the number killed in domestic violence. This linear approach is not ideal in the sense of not using some of the key findings of the last section. Thus, for example, the cases of a shutdown and expropriation analyzed in section III show that such events change *all* the coefficients in an investment function -- that there is a nonlinear interaction between the political variable and the other variables in the investment function. The linear results will provide a baseline against which to measure the potentially superior nonlinear results presented in section VI.

Table 3 shows primarily the best of the linear results obtained by adding political and non-traditional economic variables to the standard investment functions developed above. As for Table 2, the dependent variable is real P&E spending by U.S. direct investors in manufacturing for the sample period 1958 to 89. The fitted equations are all variants of the general form:

$$P\&E_t = a_0 + b_0 GDP_{t-k} + \sum_{i=0}^{M} b_{i+1} \Delta GDP_{t-i} + \sum_{j=0}^{N} \sum_{i=0}^{K} c_i NT_{j,t-i} + d_0 K_{t-1} + u_t , \qquad (18)$$

where: besides P&E and a distributed lag of country GDP (as a proxy for the a_{t+i} terms), NT_j is the jth non-traditional variable, which may appear with one or more lags; K_{t-1} is a general indicator for the measure of the lagged capital stock and a power of $(1-\delta)$ or, as discussed above, for a substitute in terms of lagged investment or its instrument variables estimator. The coefficients were estimated by ordinary least squares or instrumental variables.

Despite the theoretical shortcomings of this linear approach, the use of dummy variables for political and non-standard economic variables does improve the explanatory ability and statistical properties of the equations for *all* three countries. This can be verified by comparing the R^2 or SER of the last equation for each country in Table 3 (equations 5, 8, 10), with those in Table 2. The equation for Argentina improves the most: the percent of the variance explained rises from 19 to 77 percent. However, the results for Brazil and Mexico also improve, by 6 and 15 percentage points, respectively.

V.A. Variables Dealing with the Exchange Market

Argentina and Mexico were significantly affected by what loosely can be called exchange market phenomena. Of the three countries, Argentina has had the most extensive controls on the availability of foreign exchange for the repatriation of dividends. For parts of two years, in 1970 and 71, there was a complete freeze on remittances (indicated by the FREEZ variable). During all or parts of many other years in the sample period, as discussed at length above, there were other restrictions that made the exchange market substantially less than free -- the so-called Bonex system. Irrespective of the equation, the effect of exchange controls in Argentina was significantly negative, although the separate effects of BONEX and FREEZ variables varied somewhat depending on the particular equation. When measured as a constant effect, a Bonex-style system reduced P&E spending by between \$41 and \$86 million (real 1982 dollars), with a lag of one to two years; the total freeze on remittances -- present only for two years -- seemed to reduce spending by another \$50 to \$125 million. Given that P&E expenditures averaged \$214 million for the whole period, these exchange restrictions seemed to have had an enormous impact on investment spending -- from a minimum of 42 per cent of the average to a maximum estimate of over 100 per cent.

All three countries had taxation systems that penalized remittances to the United States, with progressively higher taxes on remittances as compared with retained earnings. Although the tax rates varied somewhat over time and between countries, no significant effect of dividend taxes on P&E spending has so far been detected.

Mexico had a fixed exchange rate system with respect to the dollar until 1982, when the

TABLE 3: LINEAR RESULTS FOR NON-TRADITIONAL VARIABLES[1]

EQ#	GDP_{-2}	ΔGDP	ΔGDP_{-1}	ΔGDP_{-2}	K_{-1}	$(1-\delta)^t$	I_{-1}	EXCHNG	MKT	GOVT	LAWS	DCRISIS	R^2	SER	lnSSR	DW	ρ
ARGENTINA								BONEX	FREEZ	YRS							
1)	.27	.13	.37		.01	913		-94	-88	11			.70	62	11.31		.71
	(1.3)	(1.1)	(2.3)		(.01)	(1.0)		(2.9)	(1.4)	(1.4)							(10.6)
2)	-.11	-.04	.17	.11	-.02	-546		-130	-95	13		-74	.76	57	11.12	1.8	
	(1.7)	(0.4)	(1.6)	(1.1)	(0.3)	(2.0)		(5.0)	(2.0)	(1.7)		(2.2)					
										GOVT<4							
3)	-.17	-.07	.03	.04	-.07	-709		-115		-98		-73	.74	58	11.21	1.6	
	(2.4)	(0.7)	(0.3)	(0.5)	(1.0)	(2.7)		(4.2)		(2.4)		(2.2)					
										YRS							
4)	.06	.18	.26	.05			.51	-67	-113	15		-42	.76	55	11.14	1.9	
	(1.7)	(1.9)	(2.8)	(0.6)			(3.9)	(2.4)	(2.4)	(2.1)		(1.5)					
5)	.04	.11	.22	-.01			$.65\hat{I}$	-44	-140	19		-65	.77	55	11.09	1.9	
	(1.1)	(1.2)	(2.3)	(0.2)			(4.2)	(3.0)	(2.6)	(2.2)		(2.3)					
BRAZIL										G-Q							
6)	.03	.02	.03	-.01	-.06	-1614				-37		-445	.95	122	12.66		.74
	(1.9)	(1.4)	(2.4)	(0.6)	(0.6)	(0.9)				(0.4)		(3.1)					(9.9)
7)	.01	.03	.03				.53			-138		-272	.96	110	12.59	1.8	
	(3.4)	(2.7)	(2.6)				(4.3)			(2.0)		(3.2)					
8)	.01	.03	.02				$.67\hat{I}$			-124		-214	.94	124	12.86	1.4	
	(1.3)	(2.9)	(1.7)				(3.0)			(1.5)		(1.7)					
MEXICO								DEVAL		L-P	73LAW						
9)	1.1	.77	1.7	1.9	-.35	-305							.89	74	11.83	1.7	
	(3.0)	(2.8)	(7.0)	(4.8)	(2.1)	(1.3)											
10)	1.7	.90	2.0	2.1	-.54	-335		210		-90	-168	-44	.95	50	10.91	2.1	
	(3.7)	(4.4)	(10.9)	(5.9)	(3.0)	(1.8)		(4.6)		(1.7)	(3.1)	(0.6)					

1. In addition to the symbols introduced in Table 2, lnSSR is the log of the sum of squared residuals from the regression (to be used in Liklihood Ratio tests in section VI); ρ is the estimated serial correlation coefficient, and $\hat{I}$ the instrumental variables estimator of lagged P&E. All regressions in Tables 3-6 use 32 observations (1958-89). The constant term is not reported.

peso was floated. Surprisingly, the move to a float seemed to have no significant impact -- even though this period was identical to the period of Mexico's debt crisis. However, the three times Mexico devalued its fixed exchange rate, in 1976, 77, and 81, we observe a significant *positive* impact on the flow of P&E expenditure by U.S. subsidiaries. I have yet to craft a compelling explanation for this effect: one might suspect that it just signalled the end of periods of turmoil, when investors held off either because of uncertainty or the desire to capitalize on an anticipated improvement in the exchange rate for importing capital. One might also hypothesize that, after a devaluation, exports from U.S. affiliates in Mexico would become more competitive internationally, or that competing imports would be more expensive; however, U.S. affiliates in Mexico exported relatively little during the period, and competitive imports were already severely limited by tariffs and quotas. At an average of $210 million, the estimated linear effect was substantial -- an increase of over 50% of the average real P&E expenditure during the period.

V.B. Effects Related to Governments

Extensive tests were run to determine whether a government's posture, reputation, or actions affected direct investment spending. Some significant effects appear in Table 3, but, to me, a surprising number of political (and social) indicators were statistically insignificant. So far, indicators measuring a regime's posture toward direct investment have proved universally insignificant: this included ratings of regimes with respect to their orientation toward direct investment prior to or during their tenure, measures of pro- or anti-direct-investment statements and actions, and measures of statements and actions vis-a-vis the United States. Despite many quite anti-American and anti-foreign investment regimes in the three countries, there was only two cases when a dummy covering the span of the regime turned out to be significant (and each was either barely significant at the 5% level or significant in only some regressions). These two were the case of the Goulart-Quadros governments in Brazil (1961-64) and the Lopez-Portillo regime in Mexico (1976-82).[20] Both regimes were notable for their negativity toward direct investment, particularly from the United States. The Quadros-Goulart regime was also a time of extreme

[20] Quadros was elected in 1961, but shortly thereafter resigned abruptly in favor of his Vice President Goulart; he, in turn, lasted in office until 1964, when he was overthrown by a military coup -- thus initiating years of military rule.

repatriation restrictions.[21] The point estimates of the Goulart effect vary widely in Table 3; probably the most reasonable are in the last two equations for Brazil, from $124 to $138 million (real 1982 dollars); these are at most 16 per cent of the average flow for the sample period, but also represent a reduction of approximately a third from highs prior to 1961. For Mexico the $90 million falloff attributable to the Lopez-Portillo tenure was somewhat less than 25 percent of both the average flow for the sample and for that regime.

This is not to say that specific acts, beyond those already discussed with respect to the exchange market, do not affect the investment flow. In 1973, Mexico passed a comprehensive *Law to Promote Mexican Investment and to Regulate Foreign Investment.*[22] Although proponents claimed that the Act did nothing but codify rulings and practices already in place, American investors at the time interpreted it as hostile to direct investment. A dummy variable, for the period from 1973 to the end of the sample period, shows a significant negative coefficient of $168 million per year; this would represent a substantial negative impact of more than 40 percent of the average flow to Mexico.

The other statistically significant effect related to government, primarily showing up in Argentina, but also, to a lesser extent, in the other countries, seemed to relate, not to a particular government or orientation toward foreign investment, but toward a change in government or a government's length of time in office. In Argentina, despite a wide variety of democratic and military governments, the major impact of the government seemed to be the length of time the government was in office (the YRS variable); for each year in office, whatever the nature of the government, P&E expenditures appeared to be $10 to $20 million higher than they otherwise would have been. A similar variable in equation 2, a dummy variable for governments in power less than four years, had a similar impact. Apparently, in Argentina, foreign business responded positively to a familiar and stable regime, whatever its ideological posture.

VI. The Impact of Political Factors: Nonlinear Estimates

The linear results in Table 3 verify that incorporating non-traditional variables such as the

[21] See Weigel (1970) for an excellent discussion and modeling of Brazilian exchange restrictions.
[22] For details, see Whiting (1982).

existence of exchange controls and changes in governments and laws can significantly improve the explanatory ability of investment functions for U.S. foreign affiliates in Argentina, Brazil and Mexico. The theory developed in section III shows, however, that changes in these variables should introduce nonlinearities into the investment function. The purposes of this section are to re-estimate the investment functions in a manner consistent with the theory, and to determine whether these new results improve upon those in Table 3.

VI.A. Restrictions, Predicted Signs, and Tests

Contrary to the strictly additive or linear effects of the dummy variable approach used above, the theory implies that a change in the probability of events such as an expropriation or a shutdown changes *all* the coefficients in the equation; thus, the quantitative impact of a variable associated with a change in one of these probabilities has a nonlinear effect, a function of the levels of all the other variables -- output and output changes, capital stocks, etc. -- that also affect investment.

Further, the theory may also imply the existence of restrictions among subsets of coefficients in the investment function. In particular, assuming that specified structural coefficients do not change among different states of the world, certain coefficients change in proportion to each other as the probability of political events changes. Let us illustrate the proportionality concept with the coefficients of the two variables making up the capital stock term in the investment function, e.g. in equation (4). As seen in Table 3 and discussed at more length in Stevens (1994) and the Appendix, the lagged capital stock is proxied empirically by two variables: a weighted average of past investment levels, K_{-1}, and a power of 1 minus the depreciation rate, $(1-\delta)^t$. In a given state of the world, however, their coefficients are not independent, but proportional to each other: being $-(1-\lambda_1-\delta)$ for K_{t-1} and $-\alpha(1-\lambda_1-\delta)$ for the variable $(1-\delta)^t$, where α is a positive constant. When the probability of something like a shutdown or the imposition of repatriation restrictions changes, both of these coefficients also change -- because λ_1, the smaller root of the characteristic equation, changes. However, since the the ratio, α, of the two coefficients is a technically-determined constant related to the measurement of the capital stock, we can assume that it remains unchanged. By imposing this restriction one reduces the estimation problem by one coefficient.

A similar story holds for the distributed lag of GDP terms, used in Table 3 and the tables below to approximate the expectation of the intercept of the firm's demand curve, $E_t(a_t)$. With up to four coefficients for GDP terms in Table 3, the existence of "non-normal" or non-standard states could potentially add four new GDP coefficients per state. However, if we can assume that the lag *structure* or weights do not change, then only one new coefficient per state is required.[23]

In addition to these proportionality implications, other testable implications of the theory are predictions of the direction of change of certain coefficients as the characteristic roots change. Refer for a moment to equation (10), our most general Euler equation. We have noted above the well-known fact that the product of the two characteristic roots equals the coefficient of K_{t+i-1} divided by that of K_{t+i+1}; for equation (10) this ratio is $1/[D(1-P(E))] = (1+\rho)/(1-P(E))$, which again illustrates how the probability of expropriation acts in many ways like an increase in the firm's discount rate. Moreover, it was noted also that the *sum* of the two roots equals the absolute value of the coefficient of the K_{t+i} term divided by $d(1-\delta)$.

Consider the case of a state that increases the probability of a shutdown, P(S), as analyzed in section III.B, or the probability of the institution of a Bonex system (section III.D). According to equation (10), since neither the probability of an expropriation nor the discount rate changes, the product of the two characteristic roots is left unchanged. However, the increase in either of these probabilities lowers the coefficient of K_{t+i} and, therefore, the sum of the two roots; since their product is unchanged, this can only occur if the roots move closer together -- i.e. if the larger root is reduced and the smaller increased in size. A change in P(S) or P(BONEX) would, then, increase the coefficient of the lagged capital stock $[-(1-\lambda_1-\delta)]$; in the great majority of cases this implies a movement of a negative coefficient towards zero. One cannot be sure, on the other

[23] The constancy of the lag structure across states is a behavioral assumption unrelated to the theory developed in section III; hence, the rejection or acceptance of this hypothesis says nothing about the usefulness of taking non-standard states into account. What accepting this hypothesis does is save many degrees of freedom. For example, assume that, in the normal state, P&E is affected by contemporaneous and lagged GDP according to the following lag structure: $\sum_{i=0}^{M} b_i GDP_{t-i}$; assuming that the structure of this lag does not change implies that the ratios b_i/b_j do not change (or, alternatively, that the weights on the various terms do not change). A convenient way to impose this restriction is to posit that the lag structure for a *non-standard* state can be represented as: $(1 + f_k) \sum_{i=0}^{M} b_i GDP_{t-i}$, where the differential effect for the state k is measured by the single added coefficient f_k.

hand, about the size of the coefficients of the output and other forcing terms, because the ultimate size of the coefficient of these terms is ambiguous: the coefficient of the forcing term falls, but the weight, $\lambda_1 \backslash \lambda_2^i$, by which these output terms is discounted, rises. Numerical examples suggest, however, in this case, as well as for an increase in the probability of an expropriation, that the overall effect on the coefficients of the output terms is negative.[24]

As noted, an increase in the probability of expropriation, like an increase in the discount rate, raises the product of the two characteristic roots. It can also be shown that, like the previous case, it increases the sum of the two roots, and numerical examples in the Appendix indicate that both roots rise in value.

Estimating an investment function such as equation (4), where the characteristic roots shift as functions of variables that reflect the changing probabilities of such events as expropriation, repatriation restrictions, and shutdowns, at a minimum introduces a host of multiplicative effects and, with only 32 observations per country, may quickly exhaust available degrees of freedom. However, by imposing some or all of the restrictions discussed above, many degrees of freedom can be preserved -- but at the cost of moving to a fully nonlinear regression framework. We do this in this section, applying nonlinear least squares to the appropriate equations, while concurrently testing the various restrictions and comparing the fit and other properties of the equation to the linear results in Table 3. Because of the nonlinearity of the estimated equations, one can only apply tests based on the asymptotic normality of the estimated coefficients and the residuals. Below we use a likelihood ratio test to test for significant differences among residual sum of squares for regressions with different restrictions.[25]

As contrasted with equation (18) above, the prototype for the results in Table 3, a typical nonlinear equation estimated for Tables 4-6 would look like the following:

$$P\&E_t = a_0 + \sum_{i=1}^{s} a_i S_i + \{[b_0 GDP_{t-k} + \sum_{i=0}^{M} b_i \Delta GDP_{t-i}\}\{1 + \sum_{i=1}^{s} f_i S_i\}$$

$$+ \{d_0 K_{t-1} + d_1 (1-\delta)^t\}\{1 + \sum_{i=1}^{s} g_i S_i\} + u_t. \tag{19}$$

[24] See the Appendix, section V.

[25] For details, see Judge et. al. (1985), pp. 215-217.

Although apparently complicated, the only new variables in (19) are the set of *s* state variables labeled S_i, each indicating that a particular event has occurred which has changed the probability of future occurrences of a given non-normal or non-standard state. With only a couple of exceptions that are explained below, the occurrence of the non-traditional variables found significant for the linear results in Table 3 were used to trigger the appropriate state variable in (19); thus, for example, when Bonex restrictions were imposed in Argentina, the appropriate Bonex state variable was switched from 0 to 1.

Equation (19) imposes the restrictions noted above in a fairly transparent manner and makes it particularly easy to test for significant differences between the coefficients in the standard or normal state -- when all the S_i variables s are zero -- and the non-standard states. When the standard state occurs, present and past levels of GDP have the following effect on P&E expenditures: $b_0 GDP_{t-k} + \sum_{i=0}^{M} b_i \Delta GDP_{t-i}$. If the first non-standard state, S_1, occurs, the GDP effect is the standard one times $1+f_1$. Thus, as desired, the lag structure for the two states remains unchanged. A similar story holds for the coefficients of K_{t-1} and $(1-\delta)^t$. Finally, to determine whether the coefficients for a given non-standard state are significantly different from those for the standard state, one need only test whether the corresponding coefficient f_i or g_i is different from zero.

Tables 4 through 6, below, present the nonlinear results for each country. Each table is divided into two panels: results for specific regressions are presented in the upper panel, while the likelihood ratio tests for specific hypotheses are found in the lower. Because the alternative equations using the lagged capital stock or the lagged value of P&E differed little for the nonlinear equations, only the former are presented below. Since the results for Brazil have fewer non-traditional states to consider and are, therefore, more straightforwardly discussed, we will begin with these.

VI.B Nonlinear Results for Brazil

Let us recall that, for the linear results reported in Table 3, real P&E expenditures for U.S. affiliates in Brazil were strongly related to output and its changes and insignificantly to the lagged capital stock; when lagged investment or its instrument was substituted for the lagged capital stock, this variable was very significant and the output variables improved somewhat in significance. In all three regressions, investment was negatively related to a dummy variable identifying the tenures of presidents Quadros and Goulart, interpreted as measuring effects associated with repatriation restrictions and even an increased threat of expropriation; however, the coefficient was significant in only one case. Further, in all three regressions, a dummy variable standing for the period of the Debt Crisis had a very significant negative coefficient.

In the top panel of Table 4 one finds three equations, the end result of the various tests reported in the bottom panel. All of the equations allow for three states of the world -- a standard or normal state (NORM), a Quadros-Goulart (G-Q), and a Debt Crisis (DCRISIS) state -- and all impose proportionality restrictions across states on the GDP variables. The only entries in the panel that are different from those in Table 3 are found under the heading "Factors," where an entry is found for the Goulart-Quadros regimes and for the period of the Debt Crisis. In terms of the coefficients of equation (19), a factor equals $1+f_i$. Thus, to obtain the coefficient for a given GDP or ΔGDP variable during, say, the Debt Crisis regime, one multiplies the Debt Crisis factor by the coefficient under the GDP column (which lists the coefficient for the "normal" or standard state, when neither factor is operational).[26] For example, with a factor in the first equation of only 0.23 for the period of the Debt Crisis, an increase in Brazilian GDP or its change will have an impact on affiliate investment that is less than one quarter of the effect during normal times. Similarly, the estimated Goulart-Quadros factor is -.08, implying that, during the period 1961-64, the impact of GDP and its changes on investment was zero or even negative.[27] As noted by the symbol * in the table, the GDP coefficients for these two states are statistically different from those for the normal state.

The discussion in section III concluded that it is likely that an increase in the probability of either non-standard states would lead to an increase in the size of the smaller characteristic root, λ_1. Since the coefficient of the lagged capital stock, $(1-\lambda_1-\delta)$, contains λ_1 directly, this is an explanation for the fact in Table 4 that the coefficients on K_{-1} rise for the two non-standard states. For Brazil, however, although not for some of the other countries discussed below, these capital

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[26] It perhaps bears repeating that the "normal" or "standard" state may in fact be far from what impartial observers would call desirable or even normal. The state is defined only by a process of elimination, as years where non-traditional factors identified in Table 3 *are not* operative.

[27] While negative, the factor is insignificantly different from zero.

TABLE 4: NONLINEAR RESULTS FOR BRAZIL[1]

EQ#	FACTORS		GDP_{-2}	ΔGDP	ΔGDP_{-1}	ΔGDP_{-2}	K_{-1}			$(1-\delta)^t$	CONSTANTS		
	G-Q	DCRISIS					NORM	G-Q	DCRISIS		NORM	G-Q	DCRISIS
1)	-.097*	.16*	.083 (2.8)	.056 (4.0)	.086 (5.2)	.158 (4.5)	-.278 (1.9)	.956*	.153*	915 (3.0)	-1007 (2.7)		
			R^2 = .97, SER = 98, lnSSR = 12.21, #COEF = 11, #OBS = 32.										
2)	-.081*	.23*	.078 (2.5)	.055 (3.9)	.085 (5.0)	.152 (4.1)	-.256 (1.6)	.756	.551	868 (2.7)	-949 (2.4)	-812 (1.1)	-4658 (1.0)
			R^2 = .99, SER = 101, lnSSR = 12.17, #COEF = 13, #OBS = 32.										
3)	.013	.20	.015 (0.8)	.038 (2.6)	.057 (3.7)	.093 (3.2)	.042 (0.4)	.177	.067		-30 (0.2)		
			R^2 = .96, SER = 116, lnSSR = 12.59, #COEF = 10, #OBS = 32.										

MAINTAINED HYPOTHESIS	R^2	SER	lnSSR	#COEF	LIKLIHOOD RATIO	(d.f.)[2]
1. Test of Restrictions on Eq. 1 of Table 3 vs. Eq. 2, Above.						
1a. Eq.6, Table 3, Without Serial Correlation Correction.	.93	148	13.13	9	30.81**	(4)
1b. Eq.6, Table 3, With Serial Correlation Correction.	.95	123	12.66	10	15.71**	(3)
2. Relaxation of Proportionality Restrictions on First Equation (Restrictions Required on Goulart-Quadros state).	.98	97	12.04	13	5.23	(2)
3. Separate State Intercepts (Equation 2 vs. Equation 1).	.99	101	12.17	13	1.26	(2)
4. Elimination of Debt Crisis Effects vs. Equation 1.	.87	197	13.71	9	48.00**	(2)
5. Elimination of Goulart-Quadros Effects (vs. First Equation).	.94	139	13.00	9	25.40**	(2)

1. The symbols * and ** refer to significance at the 5% and 1% level, respectively, for the following tests: (a) *t*-tests of the hypotheses that the various "factors" are different from one; (b) *t*-tests that coefficients of the lagged capital stock for non-standard states are significantly different from that of the normal or standard state; (c) χ^2 tests for the significance of the liklihood ratios. For other definitions, see the footnotes for Tables 2 & 3.

2. The Liklihood Ratio for the tests in this panel are asymptotically chi-squared distributed with degrees of freedom (d.f.) given in the last column of the panel.

stock coefficients are not statistically different from each other.

All three nonlinear regressions in Table 4 tell the same *qualitative* story as those for Brazil in Table 3, although in a very different way. For a given level of GDP and its (positive) changes, the level of predicted P&E expenditures would be lower than normal during the periods of the Debt Crisis and the Goulart-Quadros period. On an intuitive level this corresponds to the negative additive effects estimated in Table 3. One can calculate a quantitative estimate of the impact of the two factors by comparing the investment predictions of, for example, equation 1 during either the Goulart-Quadros or Debt Crisis periods with what the equation's prediction would have been, had the period been a "normal" one. Thus, for the four-year Goulart-Quadros period, equation 1 predicts a negative effect averaging $300 million per year -- an estimate more than double the maximum additive effect estimated in equation 7 of Table 3. For the Debt Crisis period, the predicted average effect was a negative $407 million, close to the additive effect of -$414 for the comparable equation 6 in Table 3. The average effects tell only part of the story, however, in equations such as these where the effects of the non-standard states depend on the values for a number of the exogenous *variables.* The estimated effects during the Quadros-Goulart period varied from -$176 million at the start of the period in 1961, peaked at a perhaps an implausibly high -$543 million in 1963, and fell to -$193 million in 1964 when the Goulart regime was overthrown by a military takeover; the high estimate of the impact in 1963 comes because of the equation's prediction that, had the Quadros-Goulart regime not occurred, investment would have boomed as a result of the lagged effects of large GDP changes in 1960-62.

Similarly, the average effect for the Debt Crisis masks considerable variation in the effect within the 1983-89 period. In fact, no negative effect at all was detected for 1983-85, where the fall in Brazilian GDP was more than enough to explain the more than 25% reduction in the real investment of U.S. affiliates. By 1988 and 1989 the fall attributable to the Debt Crisis averaged almost $1 billion per year.

Not only do these regressions incorporate the nonlinearities implied by the theory, but they fit considerably better that their counterparts in Table 3. The multiple correlation coefficients for equations 1 and 2 in Table 4 are somewhat better, and the standard errors of the regression are from 10% to 20% lower than any of the linear regressions. Moreover, for the only regression in Table 3 using the lagged capital stock as an independent variable, a significant serial correlation correction was necessary to get the SER down to 120 million (equation 6); none was required for the equations in Table 4. In addition, the significance of the coefficients for the GDP terms was improved, and the coefficient on the lagged capital stock for the normal period was more reasonable in size and statistically significant.

A more rigorous comparison of the fit of the equations in the two tables keys on the fact that equation 6 in Table 3 can be related to a nested or constrained version of equation 2, above, in Table 4.[28] The separate intercepts in equation 2 correspond to the additive effects under the columns G-C and DCRISIS in equation 6 of Table 3. Thus, if equation 6 is fitted without a serial correlation correction, it corresponds to a version of the nonlinear equation 2 with the "factors" constrained to one and the coefficients of the lagged capital stock constrained to equal each other. Hypothesis 1 in the lower panel of Table 4 presents the likelihood ratios for testing the nonlinear equation 2 against the null hypothesis of one of two alternative forms of equation 6. The first null, and the one exactly comparable to equation 2, has no serial correlation correction; as shown on line la, despite an R^2 of .93, the log of its sum of squared residuals is 13.13, leading to a likelihood ratio of over 30 -- easily rejecting equation 6 at the 1% level of significance. Even allowing for the serial correlation correction present in equation 6 and the significant reduction of the squared errors, the likelihood ratio, shown on line 1b, still rejects the constraints implied by equation 6.

As in Table 3, there are still, however, problems with the capital stock coefficients in Table 4. The most obvious drawback for the first two equations is the positive and significant sign on the power of the depreciation rate, a coefficient that should be the same sign as the coefficient on the lagged capital stock for the normal period. However, when this variable is dropped, as shown for equation 3 in the table, the basic implications are the same as for the preceding equations. A second problem is that for both of the first two equations the capital stock coefficient of the Goulart-Quadros state, while different from the normal state in the correct direction, is so large

[28] We will focus on equation 1 in Table 3 because it is the only equation there than uses the lagged capital stock as an exogenous variable -- comparable to all the equations in Table 4. The same sort of comparisons could be made using the other equations in Table 3; the results would be the same, so, as noted above, we have reported in Tables 4-6 only nonlinear regressions using the lagged capital stock.

that it suggests that the smaller root, λ_1, could be greater than 1. Although this restriction is not violated at the 95% level of significance, the point estimate seems implausibly large.[29]

The equations in the upper panel of Table 4 were arrived at as the result of a series of likelihood ratio tests comparing them to both more and less restricted, but still nonlinear, formulations. In line 2 of the lower panel are reported the characteristics of the most general alternative possible: a generalized version of equation 1 allowing for the three separate states with as few proportionality restrictions imposed as possible.[30] This equation has a standard error of the residual of $97 million and a log of the sum of squared errors of 12.04. The corresponding likelihood ratio of 5.23 with two degrees of freedom, fails to reject the proportionality restrictions embodied in equation 1. The third line tests whether the common intercept for all states in equation 1 should be rejected for separate state intercepts as shown for equation 2. With a likelihood ratio of only 1.26, the common intercept in equation 1 cannot be rejected.

The final and perhaps most interesting question addressed in the bottom panel is: Are both of these "non-normal" states necessary? Their necessity is certainly suggested by the statistical significance of the factors in equations 1 and 2, and by the size of the estimated effects of the Goulart-Quadros regime and the Debt Crisis; however, only a likelihood ratio test or the equivalent can statistically test for the *overall* significance of breaking out one or more periods from the normal or standard state. Hypothesis 4 in the panel folds the debt crisis state into the normal state, assuming no difference between the two, while maintaining separate coefficients for the Goulart-Quadros regimes. The sum of squared errors more than triples, the SER almost doubles, and the likelihood ratio test soundly rejects this hypothesis at the 1% level. Similarly, as seen in the next line, the hypothesis that the Goulart-Quadros regime was insignificantly different from the normal period is also strongly rejected.

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[29] The coefficient for the lagged capital stock for the first equation in the Goulart-Quadros state is +.956 and is an estimate of $-(1-\lambda_1-\delta)$. Taking δ to be, for example, .13 (as used in the calculation of our capital stock measures), would imply a point estimate of λ_1 of 1.822. However, taking λ_1 at .99, just under its limit would lead to a value of the coefficient of +.12. Given the standard error for the coefficient of .614, a *t*-test indicates that the estimated coefficient of .956 is not significantly different from .12 at the 5% level.

[30] It was impossible to relax the proportionality restrictions during the Goulart-Quadros state because there were only four observations for this state; thus, even with the restrictions imposed for this state, in the first equation for in the table, there was only one degree of freedom left for the period: one coefficient was estimated for the Goulart-Quadros factor, one for the coefficient of the lagged capital stock, and a third for the separate state intercept. Since the test reported on line 3 in the bottom panel shows that a common intercept cannot be rejected at the 5% level of significance, equation 1, with a common intercept, is taken as the best form of the equation against which to test for the significance of the proportionality restrictions.

The nonlinear results, therefore, in explaining the fixed investment spending of U.S. foreign affiliates in Brazil, strongly support the maintenance of a distinction between a normal or standard state and the periods of the Goulart-Quadros regimes and the Debt Crisis. This confirms the findings of the linear regressions reported in Table 3, but with an equation that is superior statistically and more consistent with the theory developed above.

VI.B. Nonlinear Results for Argentina

In Table 3, real P&E expenditures for U.S. manufacturing affiliates in Argentina were fairly weakly related to output and its changes and the lagged capital stock; if lagged investment or its instrument was substituted for the lagged capital stock, the overall statistical properties of the equation and the significance of the output variables improved somewhat. All five Argentine equations showed evidence of a strong negative impact of repatriation restrictions; there also was significant evidence of a positive impact as a regime's lifespan increased and of a negative effect during the period of the debt crisis.

The first equation in Table 5 distinguishes 3 states in addition to the standard state and imposes the proportionality restrictions throughout. The three non-standard states correspond broadly to the additive dummy variables that were found statistically significant in Table 3: one distinguishes the period the Bonex repatriation restrictions were in force, a second the years of the Debt Crisis, and a third the number of years a particular government was in power. With respect to this latter variable, since it was impossible to establish a separate state for *each* year a government was in power (a total of six states and a minimum of 12 to 18 more coefficients), I compromised on a division into 3 discrete classes: governments that were in power less than two years, more than two and less than four years, and four years or longer. In equation 1, the latter class is incorporated into the intercept; moreover, statistical tests showed that there was no significant difference between the coefficients in the first two classes, so both classes were combined into one -- governments in power 3 or less years (GOVT<4). In order to facilitate comparisons between the linear and nonlinear results, this latter variable was entered linearly in equation 3 of Table 3.

The first set of tests in the lower panel of Table 5 tests whether the proportionality restric-

TABLE 5: NONLINEAR RESULTS FOR ARGENTINA[1]

EQ#	FACTORS: BONEX	FACTORS: DCRISIS	FACTORS: GOVT<4	GDP_{-1}	ΔGDP	ΔGDP_{-1}	ΔGDP_{-2}	K_{-1}: NORM	K_{-1}: BONEX	K_{-1}: DCRISIS	K_{-1}: GOVT<4	$(1-\delta)^t$	CONSTANTS: NORM	CONSTANTS: BONEX	CONSTANTS: DCRISIS	CONSTANTS: GOVT<4
				NORM												
1)	.12	1.03	.73	.049	.206	.581	.783	-.644	-.765	-.195	-.007	-176	1289	1584	390	167
				(0.4)	(0.8)	(1.3)	(1.7)	(1.7)				(0.6)	(1.6)			
	R^2 = .74, SER = 68, lnSSR = 11.21, DW = 1.48, #COEF = 16, #OBS = 32.															
2)	-.59			.081	.068	.210	.502	-.686	-.419*	-.295*	-.296*	-1187	1335			
				(1.3)	(0.6)	(1.1)	(1.7)	(2.8)				(4.4)	(4.9)			
				GOVT<4												
				-.199**	.122	.508	.534									
				DCRISIS												
				-.218*	-.242	.001	.787									
	R^2 = .90, SER = 47, lnSSR = 10.28, DW = 2.30, #COEF = 19, #OBS = 32.															
3)				.049	.252	.787	.659	-.135	-.051			-562	381	959		
				(0.5)	(1.5)	(3.8)	(3.1)	(1.0)				(1.4)	(0.9)			
				BONEX												
				-.225	.068	-.114	.032									
				(1.9)	(0.4)	(0.7)	(0.2)									
	R^2 = .94, SER = 69, lnSSR = 11.42, DW = 1.80, #COEF = 13, #OBS = 32.															

MAINTAINED HYPOTHESIS	R^2	SER	lnSSR	#COEF	LIKLIHOOD RATIO	(d.f.)
1. Relaxation of Proportionality Restrictions on Equation 1.						
1a. Free GDP coefficients for GOVT<4 state.	.88	51	10.45	19	24.35**	(3)
1b. Free GDP coeficients for DCRISIS & GOVT<4 vs. 1a.	.91	50	10.13	22	10.39*	(3)
1c. Free GDP coefficients for all states vs. 1b.	.91	59	10.13	25	0	(3)
2. Significance of Separate State Intercepts on Equation 2.	.91	50	10.13	22	4.88	(3)
3. Tests of Restrictions on Eq. 3 of Table 3 vs. Eq. 2.						
3a. Eq.3 vs Version of Eq.2 with Separate State Intercepts (line 2).	.74	58	11.21	10	34.47**	(12)
3b. Eq.3 vs Eq.2 with no correction for absence of state intercepts.	.74	58	11.21	10	29.76**	(12)
4. Elimination of BONEX state vs. Equation 2.	.82	61	10.86	17	18.56**	(2)
5. Elimination of DCRISIS state vs. Equation 2.	.77	61	11.11	14	26.71**	(5)
6. Elimination of GOVT<4 state vs. Equation 2.	.58	84	11.68	14	44.80**	(5)

1. For the explanation of symbols, see the footnotes for Tables 2, 3 and 4.

tions on the GDP effects in equation 1 violate the data. Unlike the Brazilian results, these tests in large part *reject* the restrictions. The first of the set (1a) allows separate GDP coefficients for the GOVT<4 variable; with a likelihood ratio of 24.35 for three degrees of freedom, the restrictions in question are resoundingly rejected by the data. When the restrictions on other states are relaxed, in addition to those for the GOVT<4 state, those for the period of the Debt Crisis are also rejected (1b). Test 1c shows that, given the relaxation of the restrictions for the Debt Crisis and GOVT<4 states, imposing the proportionality restrictions during the Bonex period is not rejected by the data.

Hypothesis 2 in the bottom panel examines the significance of the separate state intercepts, shown in the first equation, versus the null hypothesis of a single common intercept. Despite their disparate sizes, none of the intercepts in equation 1 are statistically different from the common one, and the likelihood ratio for test 2 supports the suppression of all three.

The net result of the preceding tests is equation 2. At .90, the multiple correlation coefficient for this equation is almost 15 percentage points better than any linear alternative in Table 3, the SER of $47 million is significantly lower, and, as in the Brazilian case, there was no need for a serial correlation correction. Testing the nonlinear versus the linear equations more formally, note that equation 3 in Table 3 is a constrained version of the variant of equation 2 with separate additive intercepts (the basis of tests under hypothesis 2). The likelihood ratio test reported in line 3a shows that the constraints embodied in the linear equation 3 are rejected at the 1% level. Moreover, a linear equation rejected even if the alternative hypothesis is equation 2 itself (without separate state intercepts).

As it turns out, equation 2, above, is the most parsimonious representation of states and coefficient restrictions consistent with the theory and the data. As shown in tests 4 through 6 in the lower panel, any attempt to eliminate one of the three non-standard states is rejected at the 1% level.

The various coefficients in equation 2 are of the sign and size suggested by the fact that all three states are theorized to be *less* favorable to direct investment than the standard state. For all three, the major GDP coefficients are less than those for the standard state; in fact, the coefficient on the level of lagged GDP is *negative* for all three, significantly different from the standard state in two of the three. The lagged capital stock variable performs much better in equation 2 than in the linear counterparts in Table 3: the coefficient for the standard state is significantly different from zero, and that for the power of the depreciation rate is significant and negative. Moreover, as discussed at length in the previous section, we expect the lagged capital stock coefficients for the non-standard states to be larger than -0.686, the value for the "normal" state; this is the case for each such state, and each corresponding coefficient is significantly greater than -0.686 at the 5% level.

Finally, let us calculate the *overall* impact of the non-standard states on plant and equipment expenditure. As shown for the Brazilian case, the mean effects of any such state can be quantitatively quite different from the additive effects in Table 3. In fact, none of the calculated effects for Argentina are quantitatively close to those in Table 3. *Qualitatively,* the impact of the Debt Crisis and government longevity are in the predicted direction; the average effect attributed to the Debt Crisis was a negative $172 million per year, starting at -$122 million in 1983 and in 1987 hitting a maximum of almost -$300 million; the average is over twice the maximum effect measured in Table 3 (-$74 million in equation 2).

It is hard to compare the quantitative estimates of the two approaches with respect to the impact of government longevity, because, as explained above, the variables had to be measured somewhat differently. The impact of government longevity of 3 or less years, as opposed to those few governments that were in power 4 or more years averaged -$211 million; this is about two times the effect measured in equation 2 of Table 3, the one equation that used the same variable as used in the nonlinear equations. This average effect of -$211 million is also much more than the alternative effects in Table 3 that added approximately $25 million of investment for each additional year a government stayed in power. This average effect for the nonlinear equation was probably biased downward by implausibly large negative estimates of the effect in early years of the sample period.

Probably the most surprising calculated effect from the nonlinear equations was that for the Bonex repatriation restrictions: for equation 2 the average effect was a small, but *positive* $25 million per year -- as contrasted with the estimated effect in Table 3 that was not less than -$115 million (equation 3), and rose to -$225 (all including the added impact of the FREEZ variable where present). Thus, for the nonlinear results, a very reduced impact of the GDP variables when Bonex style restrictions were in place was more than offset by the impact of the higher coefficient on the lagged capital stock. The pattern of the estimated effects during this state suggests that the theoretical model of the Bonex system may need modification. Two distinct sub-periods stand out: a period from 1970 through 1976 where the Bonex effects were significantly negative and in the quantitative range expected from Table 3; and a second period coincident with the Debt Crisis where the effects were almost as significantly *positive*. It is possible that repatriation restrictions varied enough across these sub-periods that the data were not able to distinguish clearly those effects during 1983-89 that were due to repatriation restrictions and those residual effects attributable to unknown factors associated with the Debt Crisis. This conjecture is supported by calculations of the effect of the Bonex restrictions using the last equation, equation 3, in Table 5 -- an equation that distinguishes only between the Bonex state of repatriation restrictions and the standard state. Although the equation fits the data fairly well, the standard error of the residual is much higher at $69 million than equation 2 in the Table, and the restrictions on it would be rejected in favor of equation 2. However, without the presence of the other non-standard states, the average effect of the Bonex state turns negative as expected: -$69 million per year. Although negative, it is still considerable less than the effects found in Table 3.

VI.D. Nonlinear Results for Mexico

The linear results for Mexico in Table 3 showed both a strong performance for traditional economic variables and a significant effects of non-traditional variables included devaluations of the peso, the passage of legislation in 1973 codifying the regulations on direct investment, and, possibly, the political regime of President Lopez-Portillo.

The nonlinear results reported in equation 1 of Table 6 include variables measuring these three non-traditional factors and, as well, the debt crisis. Although the error sum of squares of the nonlinear equation 1 is about 11% lower than its linear counterpart, equation 10 in Table 3, when adjusted for degrees of freedom, both equations performed about equally; equation 10 in Table 3

TABLE 6: NONLINEAR RESULTS FOR MEXICO[1]

EQ#	FACTORS				GDP_{-3}	ΔGDP	ΔGDP_{-1}	ΔGDP_{-2}	K_{-1}					$(1-\delta)^t$	CONSTANT
	73LAW	DEVAL	LPGOVT	DCRISIS	NORM				NORM	73LAW	DEVAL	LPGOVT	DCRISIS		NORM
1)	.92	1.3	.99	1.1	1.69	.842	1.91	2.08	-.529	-.469	-.849	-.545	-.641	-347	-1832
					(2.1)	(4.0)	(3.9)	(2.8)	(2.8)					(3.2)	(1.9)
2)	.91	1.3			1.41	.806	1.96	1.89	-.419	-.374	-.695			-265	-1542
					(4.1)	(3.8)	(8.2)	(5.1)	(2.9)					(1.4)	(3.9)

Equation 1: R^2= .96, SER = 54, lnSSR = 10.80, DW = 1.81, #COEF = 15, #OBS = 32.

Equation 2: R^2= .95, SER = 52, lnSSR = 10.96, DW = 1.84, #COEF = 11, #OBS = 32.

MAINTAINED HYPOTHESIS	R^2	SER	lnSSR	#COEF	LIKLIHOOD RATIO	(d.f.)
1. Relaxation of Proportionality Restrictions on Equation 1.						
1a. Free GDP coefficients for 73LAW state.	.96	57	10.71	18	2.75	(3)
1b. Free GDP coefficents for 73LAW & DCRISIS states.	.97	55	10.42	21	11.80	(6)
1c. Free GDP coefficients for 73LAW, DCRISIS & LPGOVT states.	.97	61	10.32	24	15.36	(9)
2. Equation 1 vs. Free State Intercepts.	.97	54	10.54	19	8.32	(4)
3. Reductions of States from 5 (Equation 1) to 4.						
3a. Elimination of LAW73 State.	.94	60	11.12	13	10.51**	(2)
3b. Elimination of DVAL State.	.92	71	11.47	13	21.76**	(2)
3c. Elimination of LPGOVT State.	.95	54	10.93	13	4.17	(2)
3d. Elimination of DCRISIS State.	.96	52	10.83	13	1.07	(2)
4. Reductions of States from 5 (Equation 1) to 3 (Equation 2). Elimination of LPGOVT & DCRISIS States.	.95	52	10.96	11	5.12	(4)
5. Reductions from Equation 2.						
5a. Elimination of DVAL State.	.90	71	11.65	9	22.08**	(2)
5b. Elimination of LAW73 State.	.93	62	11.38	9	13.44**	(2)
6. Test Restrictions on Eq.10 (Table 3) vs. Version of Eq.1 with Free State Intercepts (reported in line 2, above).	.95	51	10.91	11	11.84	(8)

1. For explanations of symbols, see the footnotes for Tables 2, 3 and 4.

has an adjusted R^2 almost equal to the .96 for equation 1 and an SER slightly superior at $51 million. Given the essential equivalence of the two sets of results, it is not surprising that the coefficients of the GDP and capital stock terms for the standard state in equation 1 of Table 6 are very close to the comparable coefficients found in Table 3.

As far as the properties of equation 1 in Table 6 are concerned, the likelihood ratio tests reported in line 1 of the bottom panel show no rejections of the the proportionality restrictions on the GDP variables.[31] Line 2 shows that a common intercept for all states could not be rejected against the alternative of 5 separate state intercepts (nor, in fact, against any combination of the five).

The facts that values for 3 of the 4 factors listed for equation 1 were close to 1.0, and that none was significantly different from 1, suggest that some of the four non-standard states may be redundant. This conjecture is also supported by the linear results in Table 3, given the insignificance there of the additive Debt-Crisis dummy and the marginal significance of the dummy for the Lopez-Portillo regime; however, one must remember that significance or even the sign of the effects for the linear results was not an infallible guide in the case of Argentina.

The likelihood ratio tests for the reductions from 5 to 4 states appear on line 3 in the bottom panel. For only two of the four non-standard states could redundancy be rejected: the effect of the 1973 law and the devaluation of the peso (during the fixed rate period). Contrary to the results for both Brazil and Argentina, there seems no significant overall effect associated with the Debt Crisis (3d) -- a consistent finding for both the linear and nonlinear results in Mexico. Moreover, the negative, but statistically marginal effect for the Lopez-Portillo regime in Table 3 vanishes for the nonlinear equations (test 3c) -- as presaged by the closeness of the Lopez-Portillo factor to 1.0 in equation 1. Proceeding further, with a likelihood ratio of 5.12, distributed as $\chi^2(4)$, the hypothesis that both of these two latter factors can be eliminated simultaneously also cannot be rejected. The Mexican equation most consistent with the data and theory becomes, therefore, equation 2.

Efforts to reduce the equation further by eliminating either the positive effect associated devaluations or the overall negative effect associated with the 1973 law are easily rejected (line 5a

[31] The proportionality restrictions could not be loosened for the DEVAL state because only 3 observations fell into this class.

and 5b); this is so despite the fact that none of the factors for these states is significantly different from 1.0 at the 5% level in equations 1 or 2 (although both approach significance at the 15% level). Nor are the capital stock coefficients for either of these two states significantly different from the coefficient for the normal state, -0.419. However, as seen in virtually all cases for the Brazilian and Argentine results, the capital stock coefficients for the non-standard states vary from -0.419 in the direction predicted by the theory in section III; assuming that the 1973 investment law was interpreted by U.S. direct investors as raising the probability of additional taxes and restrictions -- but not necessarily changing the probability of expropriation -- one would expect the two characteristic roots to move closer together, as discussed above, and the capital stock coefficient to rise. In parallel fashion, whatever beneficial effect for direct investment might occur from an exchange-rate devaluation could be expected to move the capital stock coefficient in the opposite direction, i.e. more negative.

Finally, calculating the net effects of these non-standard states (from equation 2), one finds that the effect attributed to the passage and continuance of the 1973 law varied fairly closely around its mean of -\$170 million for the whole of the period 1973-1989; given the limited variability calculated for this effect in the nonlinear equation, it is satisfying and not surprising that this average was close to the additive estimate in Table 3 of -\$168 million. Such an effect, equaling approximately a third of the average flow of real investment during the period, should not be mistaken as small.

The estimated impact of Mexican devaluations during the fixed exchange rate period was positive, like the estimate in Table 3, and, at an average of \$155 million, not far from the former estimate of a positive \$210 million. However, for the nonlinear equation, the estimate was not nearly constant, varying from \$74 million to \$222 million depending on the year.

The comparative results for the overall fit of the linear and nonlinear equations suggest that for Mexico, unlike for Argentina and Brazil, there is little statistically to choose between the two. This conjecture is confirmed by the results of the likelihood ratio test on line 6 of the restrictions required to reduce equation 1 to the linear equation 10 in Table 3. At 11.84 for a an asymptotic χ^2 distribution with 8 degrees of freedom, the restrictions implied by the linear equation 10 are *not* rejected at the 5% level.

VI. Summary and Conclusions

Few economists or laymen would deny that political events can have an important, sometimes even overwhelming, impact on economic decisions in general, and investment decisions in particular. The first goal of this paper was to integrate a number of political and non-traditional economic variables into the standard theory of investment based on the maximization of the expected value of the firm. The second goal was to test this generalized investment theory on a particularly fertile field for gauging the interaction of political and economic factors: the plant and equipment spending of foreign manufacturing affiliates of U.S. multinationals in Argentina, Brazil, and Mexico.

The empirical results show that the generalized theory is far superior to the traditional alternatives in explaining real P&E expenditures for the 1958-89 period. Depending on the country, between 90 and 97 percent of the variance of the dependent variable was explained. Variables related to the traditional concepts of the demand and supply for capital played a large role in this explanatory ability, to be sure, but there was strong evidence of an impact of political factors -- both independently and in interaction with the economic variables. The hypothesized role of some of these political variables was to trigger changes in investors' subjective probabilities of a shift to a lower or higher profit function -- functions that, in extreme cases, could even imply a temporary or permanent shutdown of production.

The following political or non-traditional economic variables were significantly related to the investment in one country or another: (1) exchange controls or repatriation restrictions on dividends to the parent firm; (2) devaluations in a fixed exchange rate system; (3) occasionally, but not uniformly, specific governments that appeared hostile to U.S. direct investment; (4) the number of years a government, whatever its orientation, was in power; (5) at least one piece of pertinent legislation: the 1973 Mexican law regulating the activities of direct investors; and (6) the Debt Crisis from 1982 to 1989.

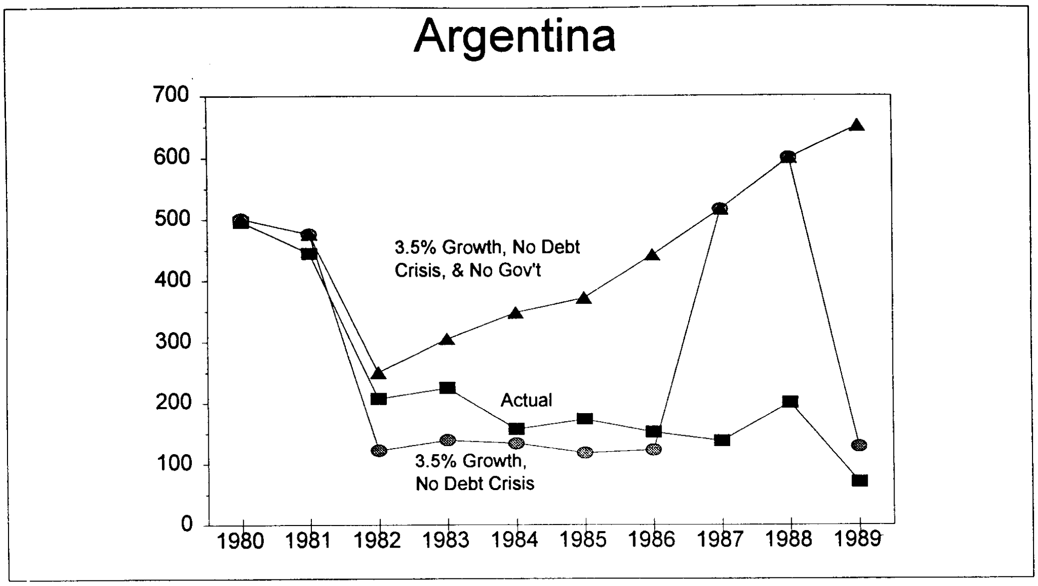
Armed with these findings, one can at least attempt answers to some of the more specific questions raised in the introduction to this paper. A particular question bedeviling policymakers who hoped for a larger role for direct investment is the cause of the downturn -- perhaps, even, collapse -- of direct investment flows during the 1980s. A more general and, as it turns out, more difficult question is whether and to what degree direct investment can be increased to provide a substitute for lost flows of bank and public capital.

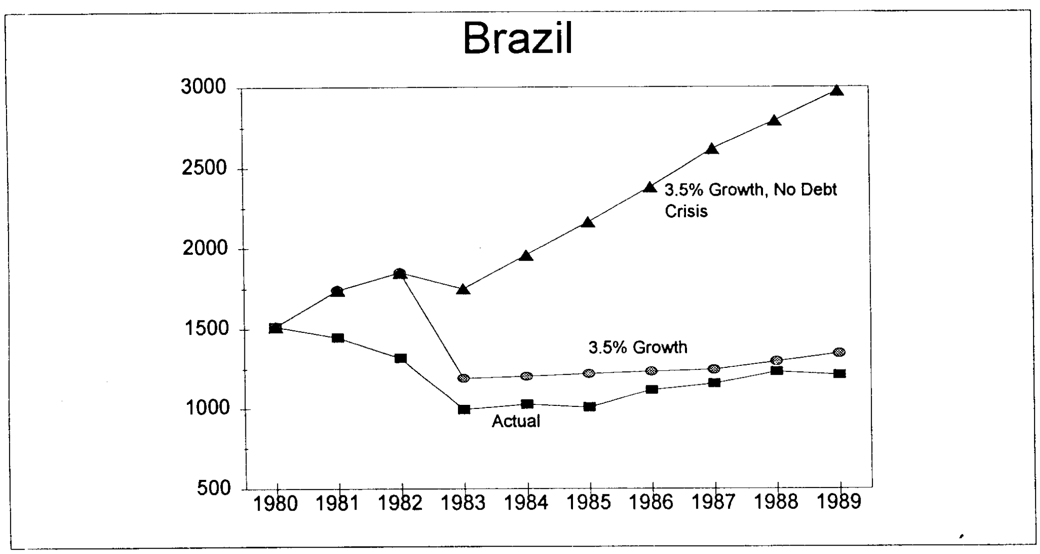
The falloff of direct investment during the decade of the 1980s, according to my best equations, had two major and probably interrelated causes: the economic downturn experienced in each of the three countries and the Debt Crisis. Using the best of the estimated equations in Tables 4-6, one can calculate what investment would have been, had the GDP path been more favorable and/or had there been no Debt Crisis.[32] I have already given in section VI estimates of the *direct* impact of the Debt Crisis -- on the obviously implausible assumption that *it had no impact on the country's GDP*. These direct estimates averaged -$407 million per year for Brazil (1983-89), -$172 million per year for Argentina, and zero for Mexico. Without the drag of the Debt Crisis, these estimates suggest that the average flow of real P&E expenditures would have been almost 40% higher in Brazil and 108% higher in Argentina.

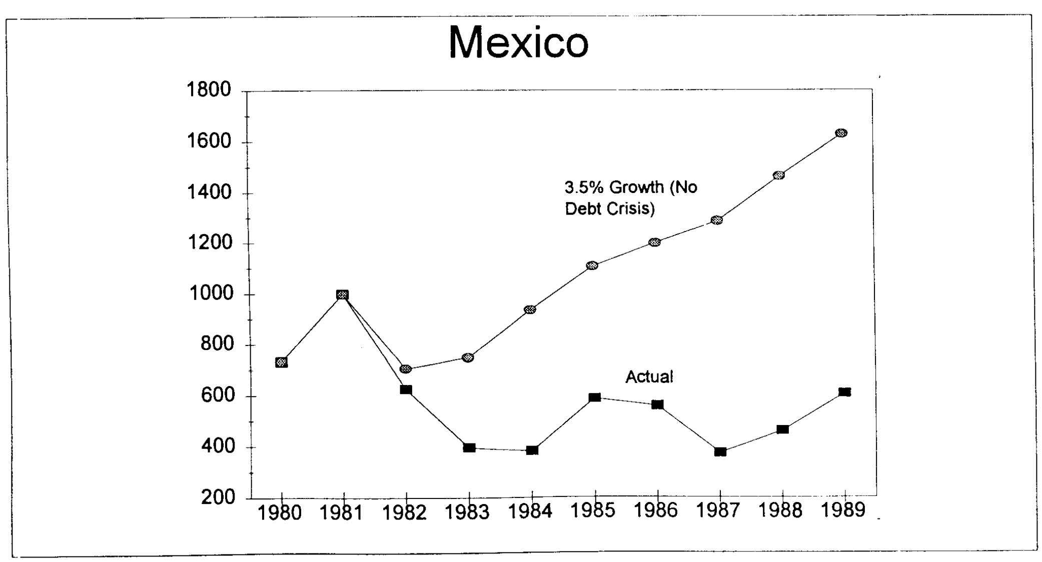
The above effects calculated for the Debt Crisis assume no interaction with the country's GDP. It is generally agreed, however, that a significant and, possibly, large part of the sluggish GDP growth for these countries in the 1980s was the direct or indirect result of the Debt Crisis. Over the 10 year period 1980-89, Argentina had negative growth of about 1% per year, and Brazil and Mexico, at 1.9% and 0.9%, had growth rates far below their postwar averages. Over the previous 30 years, the three countries had GDP growth rates of approximately 1.8%, 4.1%, and 3.0%, respectively. Using again the best estimated equations, Chart 1 depicts what P&E spending would have been in the 1980s given both a more favorable GDP path and the absence of the Debt Crisis and repatriation restrictions. A common GDP path of 3.5% per annum throughout the 1980s is used for each country -- a path significantly higher than the depressed, actual path for each country, but, except for Argentina, not far from the pre-1982 longrun path. The panels for Brazil and Mexico show exactly what one would have expected: robust growth of real P&E expenditures

[32] Equation 1 in Table 4 for Brazil; for Argentina, equation 2 in Table 5; and equation 2 in Table 6 for Mexico.

Chart 1: P & E with 3.5% Growth & No Debt Crisis







by U.S. affiliates. Over the decade, the cumulative total for real spending was 81% greater for Brazil and 89% for Mexico. The Argentine case turns out to be more complicated; when the negative effect of short-lived governments is maintained (the GOVT<4 variable), the overall effect of the experiment is to raise cumulative P&E spending by 23% -- but with some negative effects in early years. When this government effect is eliminated, the Argentine results are similar to the others, with cumulative investment rising by more than 90%.

Finally, given this attempt to explain past P&E flows, it is only natural to ask whether these results can be used to address the question of how to increase the flow. It seems clear that P&E spending is, to a significant extent, explainable, and it appears to be affected by government policy. However, the present study has not been able, nor gone far enough to detect any *positive* impacts of government actions on the flow: except for Mexican devaluations, which may have restored the competitiveness of Mexican production, all government actions found to affect direct investment significantly, affected it *negatively.*[33] Moreover, my inability to detect any impact for real wage rates or the cost of capital suggests that the real flows may be rather insensitive to moderate price or tax changes.

On the basis of the results here -- admittedly tentative and incomplete with respect to this question -- the best advice one could give a country wishing to increase its flow of real direct investment would be to keep the domestic economy growing and to avoid government actions such as the imposition of exchange controls, repatriation restrictions, or regulations that are interpreted as hostile to direct investment. Given these findings, and our knowledge of the determinants of investment in a wider context, it does not appear that real investment spending by direct investors in these countries can be easily used as a primary locomotive of growth.

[33] But it must be emphasized that this paper did not attempt a detailed study of positive programs available, either in the three countries or internationally, to induce the real or financial flows associated with direct investment. In Mexico, rather superficial attempts to detect an impact for the Maquiladora program proved futile; none of the countries participated significantly in OPIC's Investment Guaranty Program. Moreover, any positive effects of direct investment from recent privatization and debt-equity swap programs in the countries came after 1989.

APPENDIX

I. Variable Definitions and Sources

Argentina

P&E: Real plant and equipment expenditures by U.S. manufacturing affiliates. Calculated by deflating nominal, annual data provided by the U.S. Department of Commerce in the *Survey of Current Business*, e.g. Belli (1973). The original, nominal data are expressed in current dollars. After 1966, the coverage of the series was changed, eliminating spending of all affiliates that are less than 50% owned by the U.S. parent firm. Since there were 5 years of overlap, 1966 to 1970, the author adjusted the data prior to 1966 by interpolating from a multiple regression equation run on the two series during the period of overlap; a one variable regression with no intercept showed majority-owed P&E spending equal to 0.8842 times total P&E spending of U.S. affiliates in manufacturing -- with an R^2 of 0.986. The interpolated nominal values for majority-owned manufacturing affiliates are as follows (with the old values in parentheses): 1957: 18.6 (21); 58: 24.8 (28); 59: 25.6 (29); 60: 45.1 (51); 61: 78.7 (89); 62: 101.7 (115); 63: 78.7 (89); 64: 79.6 (90); 65: 89.3 (101). All regression results using the revised series were very close to those for the original series; in most cases the use of the revised series led to somewhat higher multiple correlation coefficients.

As discussed in the main body of the paper and in the next section of this appendix, two alternative measures of *real* P&E spending were calculated, corresponding to alternative assumptions as to how the investment goods were priced. Since the original data are provided in current U.S. dollars, the most straight-forward way of moving from nominal to real values is to deflate by a U.S. investment goods deflator. Insofar as investment goods are produced in the United States and shipped by the parent or other U.S. firms to the foreign affiliates, this is the optimal deflator; it would also be the correct deflator in the case that purchasing power parity held between investment goods prices in Argentina and the United States. The U.S. deflator used was a weighted average of the U.S. structures and equipment deflators, with weights of 0.5 for both. Alternatively, on the assumption that most or all of the investment spending was on locally produced goods and services, one can change the dollar-denominated nominal data into local currency, by using the appropriate exchange rate, and then deflating by the local investment deflator. The (annual) series for the exchange rate and the national investment goods deflator were obtained from Summers and Heston (1991). Results using this alternative real P&E measure are presented in Section II of this Appendix.

BONEX: Dummy variable taking a value of 1 for years when repatriation restrictions of the Bonex type were present or when there was a total freeze on dividend repatriations to U.S. parent. Source: International Monetary Fund (IMF), *Annual Report on Exchange Arrangements and Exchange Restrictions* (annual issues); New York Times Co., *The New York Times Index* (annual issues).

DCRISIS: Dummy variable with value 1 for 1982-89, the approximate period of the Debt Crisis.

FREEZ: Dummy variable taking value of 1 for years, 1970 and 1971, when there was a complete freeze on dividend repatriations for all or part of year. Source: IMF (see Bonex variable, above).

GDP: Real gross domestic product. Source: Summers and Heston (1991) and Banco Centrale de la Republica Argentina [as reported in *Carta Economica* (October, 1990)].

GOVT<4: Dummy variable taking on value 1 when the current government was in power less than four years. Source: *New York Times Index, Britannica Book of the Year* (Encyclopedia Britannica, annual issues).

K: Real capital stock. Calculated, using series for real P&E expenditure, by applying the recursive equation: $K_{t+i} = P\&E_{t+i} + (1-\delta)K_{t+i-1}$, with $\delta = 0.13$. A starting value of 0 was used for the capital stock in 1956; see section III of this appendix for the use of the variable $(1-\delta)^t$ in order to eliminate the bias caused by the lack of knowledge of the initial capital stock in 1956.

YRS: Number of years the current government has been in power. Source: see variable *GOVT<4*.

$(1-\delta)^t$: 1 minus the depreciation rate (0.13) to the *t*th power; see section III, below, for details.

Brazil

P&E: Real plant and equipment expenditures by U.S. manufacturing affiliates in Brazil. See the P&E entry for Argentina for sources and methods of deflation. Unlike the cases for the other two countries, there was no systematic bias between the pre- and post-1966 nominal data; hence no adjustment was made for majority ownership.

DCRISIS: Same dummy variable as defined for Argentina and Mexico.

GDP: Gross Domestic Product. Source: Summers and Heston (1991).

G-Q: Dummy variable taking value of 1 for years when either President Goulart or Quadros was in power (1961-64). Source: *New York Times Index.*

K: Real capital stock for U.S. majority-owned affiliates in manufacturing. For calculation procedure, see entry under Argentina.

Mexico

P&E: Real plant and equipment expenditures by U.S. manufacturing affiliates. See the P&E entry for Argentina for sources and methods of deflation. As in the Argentine case, the original series had to be adjusted prior to 1966 to reflect P&E spending by *majority-owned affiliates* only. The linear equation estimated for the 5-year period when the two series overlapped showed majority-owned P&E equal to 0.871 times total P&E in manufacturing, with a multiple correlation coefficient of 0.99. The interpolated nominal values for majority-owned P&E in manufacturing are as follows (with the old, total values in parentheses): 1957: 31.37 (36); 58: 40.95 (47); 59: 39.21 (45); 60: 32.24 (37); 61: 38.34 (44); 62: 43.56 (50); 63: 52.28 (60); 64: 97.58 (112); 65: 112.85 (141).

DCRISIS: Same dummy variable as defined for Argentina and Brazil.

DEVAL: Dummy variable taking value of 1 for years during fixed exchange-rate period when peso was devalued (1976-77, 1981). Source: IMF.

GDP: Real Gross Domestic Product. Source: Summers and Heston (1991); Bank of Mexico (1989), p.235.

K: Real capital stock for U.S. majority-owned affiliates in manufacturing. For calculation procedure, see entry under Argentina.

L-P: Dummy variable taking value of 1 for regime of President Lopez-Portillo (1975-80). Source: *New York Times Index.*

<u>$(1-\delta)^t$</u>: 1 minus the depreciation rate (0.13) to the tth power.

<u>73LAW</u>: Dummy variable with value of 1 from 1973 to end of sample period, indicating period under 1973 *Law to Promote Mexican Investment and to Regulate Foreign Investment.* Sources: Whiting (1982); *New York Times Index.*

II. Alternative Deflators

In Section IV.A of the main body of the paper, we discussed briefly the alternative possibilities for transforming the original data on P&E expenditures for U.S. manufacturing affiliates, expressed in nominal U.S. dollars, into *real* P&E expenditures. As discussed there, the regression results reported in Tables 3 through 6 were based on a dependent variable calculated by deflating the original dollar values by a U.S. investment deflator. In this section, we present regression results -- quite similar to those reported above -- using an alternative measure of real investment, based on translating the original dollar values for P&E into the local currency and then deflating by an investment deflator for the foreign country. The exchange rates and investment deflators were obtained from Summers and Heston (1991). The original and alternative real investment series are plotted in Chart A1.

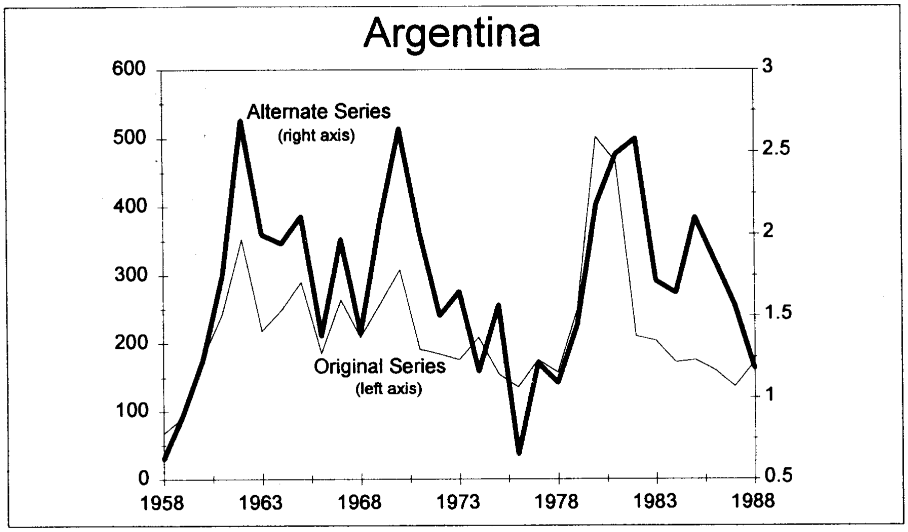
The key regression results for this alternative measure of real P&E expenditures are reported in Table A1. Two empirical equations are presented for each country, equations that duplicate key equations appearing in Tables 3 though 6 above.

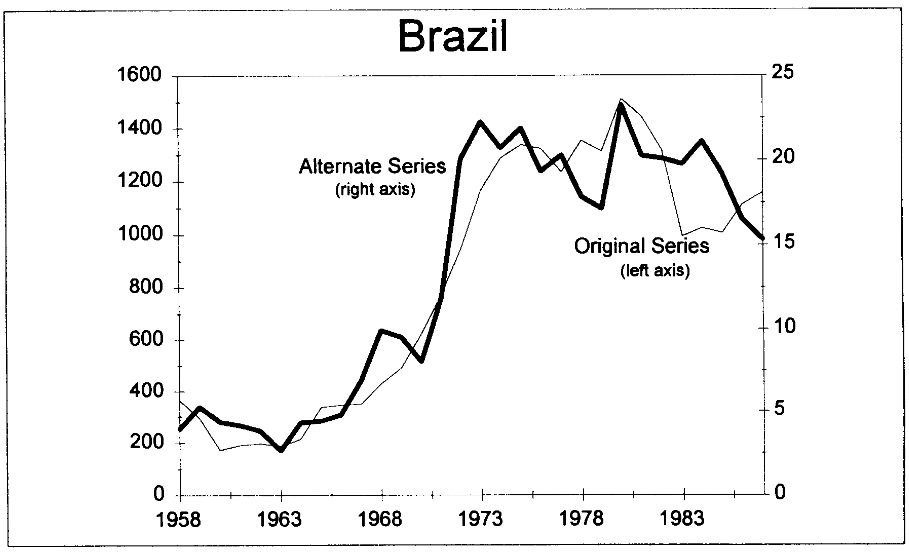
The upper panel considers results for Mexico. Equation (1) is a linear equation containing the significant variables appearing in equation (10) of Table 3. Although the overall fit is approximately 10 percentage points worse than equation (10), the corresponding independent variables in equation (1) are significantly different from zero and of the same sign. Thus, the effects of GDP variables and the lagged capital stock are comparable between the two equations; moreover, the effect of the 1973 law continues to be negative and significant, while the effect of the devaluations of the peso continue to be positive and (borderline) significant. Only the power of the depreciation rate loses its significance.

The second equation in the panel is identical to equation (2) in Table 6. Although the

Chart A1

Original & Alternative Measures of Real P&E Spending





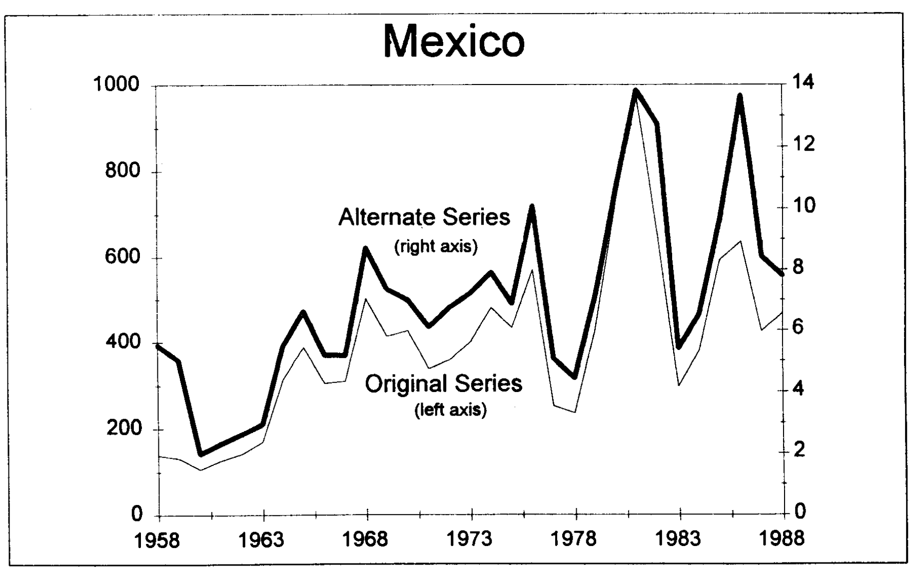


TABLE A1: RESULTS FOR ALTERNATIVE DEFLATORS[1]

EQ#	GDP_{-i}	ΔGDP	ΔGDP_{-1}	ΔGDP_{-2}	FACTORS		K_{-1}			$(1-\delta)^t$	I	CONSTANTS		
MEXICO					73LAW	DEVAL	NORM	73LAW	DEVAL			NORM	73LAW	DEVAL
1)	.02	.01	.03	.03			-.31			2.7		-22	-2.2	1.6
	(3.0)	(1.5)	(5.9)	(4.4)			(1.7)			(0.7)		(3.4)	(1.9)	(1.7)
	R^2= .85, SER = 1.4, DW = 1.80, #COEF = 9, SAMPLE: 1958-88.													
2)	.02	.01	.03	.03	.93	1.2	-.35	-.32	-.50	2.2		-23		
	(2.9)	(1.0)	(4.3)	(3.7)			(1.7)			(0.4)		(2.9)		
	R^2= .85, SER = 1.4, DW = 2.30, #COEF = 11, SAMPLE: 1958-88.													

EQ#	GDP_{-i}	ΔGDP	ΔGDP_{-1}	ΔGDP_{-2}	FACTORS		K_{-1}			$(1-\delta)^t$	I	CONSTANTS		
BRAZIL					G-Q	DCRISIS	NORM	G-Q	DCRISIS			NORM	G-Q	DCRISIS
3)	.0001	.0004	.0001	-.0004							.77	1.2	-1.3	-3.5
	(1.2)	(1.6)	(0.3)	(1.1)							(4.8)	(0.9)	(1.0)	(1.7)
	R^2= .91, SER = 2.5, DW = 1.76, #COEF = 8, SAMPLE: 1958-87.													
4)	.001	.001	.002	.003	-.28*	-.17*	-.33	.45	.009	8.2		-12	12	41
	(2.4)	(4.2)	(4.3)	(3.6)			(1.9)			(1.7)		(2.0)	(1.3)	(0.7)
	R^2= .99, SER = 2.0, DW = 2.00, #COEF = 13, SAMPLE: 1958-87.													

EQ#	GDP_{-i}	ΔGDP	ΔGDP_{-1}	ΔGDP_{-2}	FACTORS			K_{-1}				$(1-\delta)^t$	I	CONSTANTS				
ARGENTINA					BONEX	DCRISIS	GOVT<4	NORM	BONEX	DCRISIS	GOVT<4			NORM	BONEX	FREEZ	DCRISIS	GOVT<4
5)	.0003	.0004	.0014	.0007									.55	0.5	-.53	-.58	.007	.14
	(1.1)	(0.6)	(1.8)	(0.9)									(3.5)	(0.5)	(2.5)	(1.5)	(0.2)	(0.5)
	R^2= .56, SER = 0.43, DW = 2.40, #COEF = 10, SAMPLE: 1958-88.																	
6)	.002	.011	.017	.012	.83	1.08	.15	2.2	2.3	1.6	.76	-.03		-11	-10.6		-10.7	-.26
	(0.5)	(0.5)	(0.6)	(0.5)				(0.8)				(.02)		(0.6)				
	R^2= .59, SER = 0.49, DW = 1.45, #COEF = 16, SAMPLE: 1958-88.																	

1. For the explanation of symbols, see the footnotes for Tables 2, 3 and 4.

overall fit is again worse, the qualitative results and their significance are virtually identical to those in Table 6. The factors for the two non-traditional variables are remarkable close between the two equations and the pattern of the coefficients for the lagged capital stock is the same.

The linear Brazilian equation (3) in the middle panel corresponds to equation (7) in Table 3. Although the results of the two equations are generally similar, the significance of individual coefficients is considerably reduced in the present table. Thus, although the effect of the Goulart-Quadros period is negative, it is no longer statistically significant; the effect of the Debt Crisis continues to be negative and significant, but the *t*-ratio is considerably reduced. On the other hand, the nonlinear equation (4) in Table A1 is quite similar, quantitatively and qualitatively, to its counterpart, equation (2) in Table 4. In particular, the multiple correlation coefficients are identical and the factors for the two non-traditional variables are significantly lower than the 1.0 for the normal state.

For Argentina, the linear equation (5) shows a significant negative effect associated with the imposition of a Bonex system of repatriation restrictions, but unlike its counterpart, equation (4) in Table 3, the effect of government longevity is insignificant; moreover, the multiple correlation coefficient falls off almost 20 points to 0.56. For the nonlinear equation (6), the factors are in the same relation to 1.0 as its counterpart, equation (1) in Table 5. However, the GDP and lagged capital stock variables are even less significant in the present case and the overall statistical fit is approximately 15 percentage points lower than equation 1.

III. Using the Variable $(1-\delta)^t$ to Counteract Estimation Bias Introduced by Measurement Errors in the Initial Value of the Real Capital Stock[1]

Virtually all measures of the capital stock appearing in fixed investment equations are constructed by the use of some form of the "perpetual inventory method," i.e., successive values are related by the well-known equation:

[1] This section is taken from Stevens (1994).

$$K(t) = I(t) + (1-\delta)K(t-1), \qquad \text{(A1)}$$

where K(t) is the measure of the real capital stock at time t, I(t) is the real rate of investment at t, and δ is the (constant) rate of depreciation of the capital stock; δ need not be a constant, but almost always is assumed to be. To construct a capital stock series, the analyst usually starts at some initial period zero with a measure of the initial capital stock, K(0), and then calculates successive values of K(t) by substituting the depreciation rate and the elements of an investment series into equation (A1).

By successive backward substitution for K(t-1) in equation (A1), one can relate K(t) directly to the initial value for the capital stock, K(0). K(t) becomes a weighted sum of all past levels of investment and the depreciated value of the initial real capital stock:

$$K(t) = \sum_{i=0}^{t-1} [I(t-i)(1-\delta)^i] + K(0)(1-\delta)^t. \qquad \text{(A2)}$$

Measurement error may be introduced into the capital stock series through any of the three components of equation (A2): the I(t) series, δ, or K(0). This section has nothing to say about avoiding errors in the choice of the first two, but it does argue that the estimation bias introduced by a poor choice of an initial value for the real capital stock can be substantial and, in many cases, can be eliminated entirely. A procedure that corrects for this important source of error is described below.

Various methods have been used to estimate this initial capital stock, but virtually all researchers acknowledge that the starting values are subject to large errors.[2] As a result, where at all possible, they have chosen starting dates for the capital stock calculation 10, 20 or more years before the beginning of the estimation period for any regression work -- relying on the implication of equation (A2) that the impact of K(0) on subsequent values of the capital stock decays exponentially. But this corrective is not always possible, particularly where the time series are relatively short -- as in the present paper -- or where cross-section data are being used.

Suppose we are interested in estimating the coefficient of the capital stock variable,

[2] See Stevens (1994) for an extended discussion.

but that no adequate measure of K(0) is available. Equation (A2) suggests that K(t) can be replaced by the *two* independent variables, $(1-\delta)^t$ and the weighted sum of past investment rates -- thereby avoiding the errors-in-variables problem associated with the use of K(t).

For concreteness, consider the simple linear investment function:

$$I(t) = \alpha + \beta Q(t) + \theta K(t) + \varepsilon, \qquad \text{(A3)}$$

where Q(t) is real output, I(t) and K(t) are investment and the capital stock as defined above, α, β, and θ are the unobserved constant coefficients, and ε is an independently distributed random error. If the regressors are measured without error, assuming the standard properties for ε, the least squares estimators of α, β, and θ will possess the usual collection of desirable small- and large-sample properties, among them unbiasedness. However, as discussed above, the measurement of the capital stock without error is unlikely in many situations.

Despite this potential errors-in-variables problem, equation (A2) implies that, insofar as measurement errors in the capital stock are caused by inaccuracies in the estimates of the initial capital stock, K(0), one can still obtain unbiased estimates of α, β, and θ. Let us substitute the alternative definition of the capital stock from equation (A2) for K(t) in equation (A3). Denoting the weighted sum of past investment rates in (A2) by WS(t), we get the first line of equation (A4) below. This, in turn, can be rewritten in the second line of (A4) as a linear regression of I(t) on the regressors WS(t), $(1-\delta)^t$, and Q(t), with constant coefficients α, β, θ, and $\theta K(0)$.

$$\begin{aligned} I(t) &= \alpha + \beta Q(t) + \theta[WS(t) + K(0)(1-\delta)^t] + \varepsilon \\ &= \alpha + \beta Q(t) + \theta WS(t) + \theta K(0)(1-\delta)^t + \varepsilon. \end{aligned} \qquad \text{(A4)}$$

It should be noted that the last coefficient in equation (4), $\theta K(0)$, is a constant like the other three -- the product of θ and the constant, initial capital stock, K(0). In this transformed version of the investment function, there is no measurement error in any of the three regressors, WS(t), $(1-\delta)^t$, and Q(t). Thus, given the previously assumed properties of the error term, ordinary least squares applied to (A4) will lead to unbiased estimators for α, β,

θ, and the product $\theta K(0)$.

IV. Substituting a Lagged Value of P&E Expenditure for the Capital Stock

The general form of the investment functions derived in this paper, such as equation (14) in section III.D, is:

$$I(t) = bZ(t) + cK(t\text{-}1) + \varepsilon(t), \qquad \text{(A5)}$$

where Z(t) stands for the infinite sum of forward expectations, $\{\sum_{i=0}^{\infty} (1/\lambda_2)^i E_t\{x_{t+i}[p_{c,t+i} fa_{t+i} - fw_{t+i} - cc_{t+i}]\}$, and the coefficient c equals $-(1-\lambda_1-\delta)$. We also, of course, have the identity:

$$I(t+i) \equiv K(t+i) - (1-\delta)K(t+i-1). \qquad \text{(A6)}$$

Equation (A5) can be a problem when we suspect that our measure for the lagged capital stock is subject to large errors. However, Coen (1971) offers a possible solution by providing a substitution for K(t-1) in terms of lagged values of investment, I(t-1). On the other hand, as we will see, there is a cost to his substitution.

First, use the version of the identity (A6) to express K(t-1) as a function of I(t-1) and K(t-2): $K(t-1) \equiv I(t-1) + (1-\delta)K(t-2)$. Using this substitution, eliminate K(t-1) from the basic investment function (A5):

$$I(t) = bZ(t) + c[I(t-1) + (1-\delta)K(t-2)] + \varepsilon(t). \qquad \text{(A7)}$$

Then, use the expression for *lagged* investment from (A5) -- $I(t-1) = bZ(t-1) + cK(t-2) + \varepsilon(t-1)$ -- in order to get rid of K(t-2) in (A7):

$$I(t) = bZ(t) - b(1-\delta)Z(t-1) + (1+c-\delta)I(t-1) + \varepsilon(t) - (1-\delta)\varepsilon(t-1). \qquad \text{(A8)}$$

Equation (A8) legitimately eliminates the potentially difficult-to-measure lagged capital stock -- but at the cost of introducing both serial correlation in the residuals and a simultaneous equation problem [I(t-1) being dependent on $\varepsilon(t-1)$]. Because of this latter problem, it is preferable econometrically to use a simultaneous equation or instrumental variable techniques to estimate (A8).

V. Effects of Political Events on the Characteristic Roots and the Coefficients of the Independent Variables

We discussed briefly in section VI.A of the paper what happens to the characteristic roots and the forcing terms when there occurs an increase in the probability of a political event such as a shutdown, the institution of repatriation restrictions, or an expropriation. We are primarily interested in predicting the changes in the signs of the coefficients of such variables as GDP, its changes, and the lagged capital stock in the regressions that appear in Tables 4, 5, and 6.

In some cases, knowledge of how the characteristic roots change is sufficient to determine how a coefficient changes. Thus the change in the coefficient of the lagged capital stock -- e.g., in equation (14) in section III of the paper -- is determined completely by the change in the smaller root, λ_1. However, in important cases, knowledge of how the roots change is not sufficient; thus, for a GDP term which is a proxy for the term $E_t(fa_{t+i})$ in equation (14), the change in its coefficient is a function of both the changes in the *two* characteristic roots -- as shown in the weights λ_1 / λ_2^i -- *and* the probability of the political event in question. This latter fact is shown clearly in the Euler equation (8) for the shutdown case; here the term that is proxied by GDP variables, $E(a_{t+i})$, is multiplied by 1-P(S). Thus the positive probability of a shutdown reduces the coefficient of the GDP variable directly, in addition to the separate effects coming from the changes in the characteristic roots.

Despite a fair number of partial results, here and in Sargent (1979) and Tinsley (1971), I have not been able to derive analytically the *overall* effect of a change in a given political variable; however, the empirical examples below suggest that the effects are generally in the direction consistent with intuition.

V.A. A Baseline Solution with Political Probabilities Equal to Zero

As a baseline, we will find the characteristic roots for a standard case with no possibility of the occurrence of any political event. The Euler equation (3) and the investment function (4) apply -- both from section III of the paper. The basic investment function (4) is rewritten below as equation (A9):

$$I_t = (\lambda_1 / d)\{\sum_{i=0}^{\infty} (1/\lambda_2)^i E_t[fa_{t+i} - fw_{t+i} - cc_{t+i}]\} - (1-\lambda_1 - \delta)K_{t-1}. \qquad \text{(A9)}$$

The coefficients of the homogenous part of the Euler equation (3) determine the characteristic roots, λ_1 and λ_2. Taking these coefficients from (3), the second order difference equation in λ becomes:

$$Dd(1-\delta)\lambda^2 - [2bf^2 + d + Dd(1-\delta)^2]\lambda + d(1-\delta). \qquad \text{(A10)}$$

Let us set the following, one hopes, reasonable values for the elements of the coefficients of (A10):

$D = 1/(1+\rho) = .9167$, [3]
$1-\delta = .87$,
$d = .10$,
$f = .5$ (the output/capital ratio),
$b = .005$ (slope of the demand curve).

We thus have the coefficient, A, of $\lambda^2 = .1(.87).9167 = .07975$; the coefficient of λ, B = $-[2(.005).25 + 0.1 + .9167(0.1)(.87^2)] = -0.171885$; finally, the intercept, $C = 0.1(.87) = 0.087$. As is well known, the product of the two roots of (A10), $\lambda_1 \lambda_2$, equals $C/A = 1.091$, and the sum, $\lambda_1 + \lambda_2$, equals $-B/A = 2.155$. Using the standard formula for the roots:
$\lambda_i = -B/2A \pm (B^2 - 4AC)^{1/2}/2A = 1.07765 \pm (.029544 - .02775)^{1/2}/0.1595 = 1.07765 \pm 0.26536.$
Hence, for the baseline case the two roots are: $\lambda_1 = 0.812$, $\lambda_2 = 1.343$.

Applying these numerical values to the weights, λ_1 / λ_2^i, of the forcing terms in the investment function (A9) we get the progression: 0.812, 0.605, 0.450, 0.335, and so on; the sum of the infinite series of weights, $\lambda_1 \lambda_2/(\lambda_2 - 1)$, equals $1.091/.343 = 3.181$.

[3] Here we are assuming that $1+\rho$ is a real rate of discount. As elaborated in section III.D of the paper, constant nominal price changes at the rate g can be incorporated easily into the model. The value of .9167 for the real rate of discount is the result of assuming a g of 10% and a nominal rate of discount of 20%. Thus, $1.1/1.2 = 0.9167$.

V.B A Positive Probability of a Shutdown

With a positive probability of a shutdown, the analysis underlying Euler equation (8) in section III.B of the main text shows that a term [1-P(S)] multiplies both the element $E_t(fa_{t+i})$ in the forcing term of the investment function (A9), above, and the term $2bf^2$ in the coefficient B of the second order difference equation (A10). Thus, as noted many times throughout the paper, the coefficients of the variables (GDP) that proxy the term $E(fa_{t+i})$ change from those in the baseline case both because the characteristic roots change and because the new term 1-P(S) is introduced into the modified investment function. The modified investment function appears as follows:

$$I_t = \lambda_1 /[d(1-\delta)]\{\sum_{i=0}^{\infty} (1/\lambda_2)^i E_t[(1-P(S))\bullet(fa_{t+i}-hw_{t+i}) -cc_{t+i}]\} - (1-\lambda_1 -\delta)\cdot K_{t-1}. \qquad (A11)$$

The only new piece of data required is the probability of a shutdown; let us assume that it is large, say 0.5 -- a 50-50 chance of operating normally. In calculating the characteristic roots, only the coefficient B changes, becoming:

$$B = -[(1-P(S))2(.005).25 +0.1 + .9167(0.1)(.87^2)] = -0.17063.$$

As noted in the body of the paper, with only B changing, the product of the characteristic roots stays constant at the value, 1.091, determined for the baseline case. With B falling in absolute value, as it must as the probability of a shutdown increases, the sum of the two roots must fall. In this case it is easy to show that the smaller root must increase and the larger one decrease. This is enough to tell us that the coefficient of the lagged capital stock term in (A11) must move toward zero; however, it is not enough to tell us what happens to the coefficients of the GDP terms in the regression equations. This coefficient now is of the form: $[1-P(S)]\lambda_1/\lambda_2^i$. Given the numerical values for A, B, and C, the values of the characteristic roots change to: $\lambda_1 = 1.06978 - 0.023135 = 0.838$; $\lambda_2 = 1.06978 + 0.023135 = 1.301$. The numerical values for the weights multiplying the forcing term $E_t(fa_{t+i})$ in (A11) are: 0.419, 0.322, 0.248, 0.190, etc. These are only slightly more than half of the corresponding weights in the baseline case. Correspondingly, the sum of the weights, $[1-P(S)]\lambda_1 \lambda_2/(\lambda_2-1)$, equals only 1.812.

All cases of this nature that I have analyzed numerically lead to the same empirical result. It is probable that this uniform reduction in the coefficients is a result that could be derived analytically.

V.C. A Positive Probability of an Expropriation

In this case, the Euler equation (10) from section III.C. in the paper applies; by setting the probability of a shutdown in (10) to zero, one can see that the forcing terms in the investment equation return to the form of the baseline investment function (A9), but that coefficients A and B of the difference equation change. In fact, we have seen from equation (10) that an increase in the probability of an expropriation acts exactly like an increase in the discount rate ρ: the term 1-P(E) is always paired with the discount factor D. This observation tells us further that an increase in P(E) must, therefore, act to increase the product of the two characteristic roots, lowering A; this can be inferred also by noticing that the product $\lambda_1 \lambda_2 = C/A = (1+\rho)/(1-P(E))$. Inspection of equation (10) also shows that although a positive P(E) lowers B, it also raises the ratio -B/A and, therefore, the sum of the two roots.

To calculate the empirical effect of the risk of expropriation on the weights on the GDP terms and the coefficient of the lagged capital stock, let us assume a risk of expropriation of 25%. Coefficient A now becomes: $.1(.87).9167[1-P(E)] = .1(.87).9167[.75] = 0.0598$; similarly, B now equals $-[2(.005).25 + 0.1 + .9167(0.1)(.87^2)(0.75)] = [0.1025 + 0.0520] = 0.1545$. The product of the two roots now rises to 1.4548 (from the baseline of 1.091); the sum also rises to 2.5584. Applying the quadratic formula, the two roots become: $\lambda_1 = 0.8287$, $\lambda_2 = 1.7555$;

The weights of the GDP variables in the investment function in this case are simply the factors λ_1/λ_2^i: 0.829, 0.472, 0.269, 0.153, etc., with the sum 1.926. With the increase in the smaller root over the baseline case, the first weight in the investment function actually increases over the baseline; however, all later weights are smaller than the baseline, and the sum is considerably smaller as well.

References

Alesina, Alberto, Sule Ozler, Nouriel Roubini, and Phillip Swagel, "Political Instability and Economic Growth," NBER Working Paper No. 4173, September 1992.

Barro, Robert, "Economic Growth in a Cross Section of Countries," *Quarterly Journal of Economics*, May 1991, *106,* 407-444.

Banco Centrale de la Republica Argentina, *Estimaciones Trimestrales sobre Oferta y Demanda Global* (various issues).

Banco de Mexico, *Informe Anual* (Mexico City: Bank of Mexico, 1989).

Belli, R. David, Smith W. Allnut, and Howard Murad, "Property, Plant, and Equipment Expenditures by Majority-Owned Foreign Affiliates of U.S. Companies," *Survey of Current Business*, December 1973, 19-32.

Caves, Richard E., *Multinational Enterprise and Economic Analysis* (Cambridge: Cambridge University Press, 1982).

Coen, Robert M., "The Effect of Cash Flow on the Speed of Adjustment," in Gary Fromm, ed., *Tax Incentives and Capital Spending* (Washington: Brookings, 1971).

Dooley, Michael P., "Debt Relief and Leveraged Buy-outs," *International Economic Review,* February 1989, *30*, 71-75.

Encyclopedia Britannica, *Britannica Book of the Year* (Chicago: Encyclopedia Britannica, annual).

Frank, Isaiah, *Foreign Enterprise in Developing Countries* (Baltimore: Johns Hopkins, 1980).

Goldsbrough, David J., "Investment Trends and Prospects: The Link with Bank Lending," in Theodore H. Moran, ed., *Investing in Development: New Roles for Private Capital* (New Brunswick and Oxford: Transactions Books, 1986).

International Monetary Fund, *Annual Report on Exchange Arrangements and Exchange Restrictions* (Washington, D.C.: International Monetary Fund, annual).

Judge, George G., W. E. Griffiths, R. Carter Hill, Helmut Lutkepohl, and Tsoung-Chao Lee, *The Theory and Practice of Econometrics,* 2nd ed. (New York: Wiley, 1985).

Londregan, J. and K. Poole, "Poverty, the Coup Trap, and the Seizure of Executive Power," *World Politics,* January 1990, *42*, 151-183.

McCallum, Bennett, "Rational Expectations and the Natural Rate Hypothesis: Some Consistent Estimates,' *Econometrica*, January 1976, *44,* 43-50.

Moran, Theodore H., ed., *Investing in Development: New Roles for Private Capital* (New Brunswick and Oxford: Transactions Books, 1986).

Nankani, Gobind T., *The Intercountry Distribution of Direct Foreign Investment in Manufacturing* (New York: Garland, 1979).

New York Times Co., *The New York Times Index* (New York: New York Times, annual).

Organization for Economic Co-operation and Development (O.E.C.D), "The Climate for Private Investment in Developing Countries," O.E.C.D., DAC (58) 24, May 3, 1968.

Reuber, Grant L., with H. Crookell, M. Emerson and G. Gallais-Hamonno, *Private Foreign Investment in Development* (Oxford: Oxford University Press, 1973).

Sargent, Thomas J., *Macroeconomic Theory* (New York: Academic Press, 1979).

Stevens, Guy V.G., "U.S. Direct Manufacturing Investment to Latin America: Some Economic and Political Determinants," A.I.D. Research Paper, June 1969.

Stevens, Guy V.G., "Measurement Error in the Capital Stock and Its Effect on the Investment Function," *Applied Economics,* January 1994, *26*, 21-26.

Stevens, Guy V.G., and Robert E. Lipsey, "Interactions between Domestic and Foreign Investment," *Journal of International Money and Finance,* February 1992, *11,* 40-62.

Summers, Robert, and Alan Heston, "The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950-1988," *Quarterly Journal of Economics,* May 1991, *106,* 1-41.

Tinsley, Peter A., "A Variable Adjustment Model of Labor Demand," *International Economic Review,* October 1971, *12*, 482-510.

U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business* (Washington: U.S. Government Printing Office, monthly).

Weigel, Dale, "Restrictions on Dividend Repatriations and the Flow of Direct Investment to Brazil," *Journal of International Business Studies*, Fall, 1970, 35-50.

Whiting, Van. R. Jr., "State Intervention in the Mexican Economy: The Regulation of Foreign Direct Investment and Technology Transfer," *Working Paper #11, U.S.-Mexico Project Series* (Washington: Overseas Development Council, 1982).

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