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ABSTRACT

The view that the strength of the dollar in the early 1980s was associated with persistent restructuring of United States industry is supported by correlations between exchange rate patterns and data on business formation, business failure and sectoral investment in new plant and equipment. Short term trend depreciations of the dollar are associated with reallocation of resources across sectors, while longer term trend depreciations are associated with investment expansions in many sectors of industry. Persistent exchange rate volatility is strongly associated with investment contractions, with this effect weakest during depreciation periods. This suggests a second order effect of depreciation trends: during trend depreciation periods the negative and significant correlation between exchange rate volatility and investment is reduced.

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NTRODUCTION:[1] While business cycle theorists continue to debate the enigmatic lationship between investment, output and the cost of capital, the linkage between real vestment in the United States and international influences is largely ignored. Recent eoretical research in international economics emphasizes that exchange rate patterns have nportant influences on activity within United States industry, including the entry, exit and vestment of foreign and domestic firms across markets. This paper begins to address the mpirical content of such propositions by testing whether the data reveal a sensitivity of ggregate business indicators and sectoral investment activity to contemporaneous exchange tes and measures of exchange rate trend and volatility. First tests for statistical causality etween exchange rate patterns and real physical investment, business formation and usiness failure in United States industry are performed. Next sectoral and aggregate vestment, entry and exit response elasticities with respect to measures of exchange rate end and volatility are estimated. Exchange rate depreciations and appreciations enter the sts symmetrically, but distinctions are made between the effects of exchange rate trends hen volatility is exceptionally high and the effects of volatility when the dollar is on ppreciation and depreciation paths. These variate relationships are examined for separately r the 1970s and the 1980s.

Our primary intent is to provide general insights into the effects of nominal xchange rate movements on aggregate entry and exit activities and investment resource eallocation in an uncertain world. Three forces are triggered by exchange rate activity: (i) roduct demand changes through relative price effects; (ii) location effects as dollar ealignments and volatility change the relative attractiveness of production locations

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[Dixit(1989), Baldwin and Krugman (1988), Lipsey (1988)]; and (iii) wealth effects as exchange rate changes redistribute relative wealth across countries [Froot and Stein (1989)].

Both the demand effect for normal goods and the location effect imply that trend depreciations (appreciations) of the dollar should stimulate (depress) investment and entry in the (traded goods sectors of the) United States economy. Increased product demand arising from depreciations leads to capacity expansions independent of the conventionally studied forces arising from expansion of domestic demand. In addition, further investment stimuli occurs as the attractiveness of the United States increases as a location for home and foreign based production activities. By the wealth redistribution effects attributed to exchange rate movements, the effects on investment, exit and entry depend on the determinants of direct investment flows. Specifically, under wealth transfers the effects on gross domestic investment, entry and business failures depend on country characteristics risk aversion and home asset preference levels.[2]

These effects of exchange rate depreciations may be moderated or amplified by exchange rate volatility. The influence on investment of exchange rate volatility depends on the specific volatility facing investors in different countries, the currency of invoicing used in trade, the composition of inputs into production, and the elasticities of demand and supply within each industry. This issue is elaborated further in section I.

Controlling for aggregate output movements, the results suggest that both nominal exchange rate trend and volatility are significantly correlated with entry, exit and investment in new plant and equipment in many sectors of United States industry. The patterns of these correlations change across time in ways consistent with the argument that exchange rate activity triggers deindustrialization and reindustrialization in U.S. industry

[2]Conditions for the balance of effects are coneptually similar to the Henderson and Rogoff (1982) study of changes in asset demands under negative net foreign asset holdings.

(Krugman (1989)). The results also suggest that industrialization activity is correlated with patterns in exchange rate volatility and that this correlation has changed over time.

Section I discusses theoretical explanations behind the implications of exchange rate trend and volatility for business activity and investment. Section II presents the data, the methodology for deriving trend and volatility measures, the results from stationarity testing, and the results of causality and model testing. Section III concludes, suggesting directions for future research.

I. BACKGROUND: Firms may respond to exchange rate patterns by expanding or contracting existing production operations, entering or exiting foreign markets, changing the location of their production facilities, or may consolidate market power through mergers and acquisitions. The response may be reflected in prices (pass–through), inventories, employment, capacity utilization, and investment and depends on the planning horizon of the producer, the scale of sunk costs of investments, and the structure of the demand and supply side of the markets. If exchange rate depreciations imply strong relative price effects which spur demand, a firm may expand investment in capacity and new plant and equipment. An appreciation could lead to investment contractions or more severe problems leading a firm to close its doors due to a loss of international competitiveness. Generally, demand for traded goods increases when the home currency depreciates. Perverse effects could occur if the income reducing effects of devaluation lead to demand contractions which exceed the demand expansions attributed to relative price changes, or if the increased cost of intermediate inputs into production leads to a dominant domestic supply contraction. In this case, the net effect of the shock is higher prices and ambiguous quantity movements.

Industries involved in external trade are not uniquely affected by exchange rates. Other industries less involved in external trade may be indirectly affected by exchange rates if demand is redirected between traded and nontraded goods sectors. If demand for a

traded good rises due to depreciation, reallocation of capital toward this industry and away from the production of nontradeables may occur. Of course, short term tendencies in exchange rates are not always sufficient stimuli for investment decisions. Since the reallocation of resources across sectors is costly, the greater the amount of uncertainty surrounding exchange rate movements, the more reluctantly will resources be transferred [Krugman (1989)].[3]

A firm's exposure to exchange rate shocks also depends on it's reliance on imported intermediate goods. This channel for exposure can dominate exposure through final product trade. An exchange rate depreciation may improve the competitiveness of a firm which produces for export and relies mainly on domestic inputs. However, a firm which relies heavily on imported intermediates may lose competitiveness as the depreciation raises relative production costs. For these industries, depreciations may depress rather than stimulate entry and investment.

Exchange rate movements may also trigger relocation of production facilities across countries. The "location effect" of exchange rates on investment refers to the entry and exit of firms from a market in response to exchange rate trend and volatility patterns. The significance of this effect depends on the nature of barriers to entry and nonrecoverable costs of exiting an industry. As exchange rate volatility rises foreign and domestic firms are expected to be more hesitant to enter or exit industries in response to trend exchange rate changes.[4] Therefore the elasticity of investment response to exchange rate trends is expected to be lower in high volatility periods.[5]

After initial entry into a market via exports, foreign firms may seek to switch to local production after actual or anticipated depreciations of the domestic currency. This

[3]Dixit (1987), Dumas (1989) and Krugman (1988) all show that such uncertainty engenders a wait–and–see attitude among investors.
[4]The noise to signal ratio on exchange rate movements rises.
[5]In addition, all else equal, those industries with the highest sunk costs of investment are expected to have investment patterns which are relatively unresponsive to exchange rate patterns.

elocation process would be slowed by "the possible loss of economies of scale, the fixed osts off setting up a new production facility in an unfamiliar location, and the risks of lealing with foreign currencies and foreign governments and institutions". (Stevens and Lipsey (1988) pp.11) Relocation is magnified by the incentive to retain or increase market hare following the imposition of tariff or nontariff barriers.

The effects of exchange rate volatility on investment also depend on maintained industry exposure to exchange risk maintained through invoicing practices and imported intermediates. Hooper and Kohlhagen (1978), Giovannini (1988) and Mann (1989) all note, in the context of export pricing decisions, that the effects of exchange rate risk depend on the risk–taking nature of a firm and its export invoicing strategy. While exchange risk randomizes profits regardless of the choice of invoicing currency, the choice affects the degree to which risk enters the profit function. If the domestic firm invoices exports in the home currency, exchange rate variability translates into an uncertain foreign currency price and uncertain quantity demanded of the home product. Under domestic currency invoicing and competitive supply, or foreign currency invoicing and elastic supply, exchange rate variability implies strong quantity responses which increase production and inventory management costs. However, a producer's expected revenues may also increase as demand variability rises with exchange rate variability. While the net effect of these forces is expected to be contractionary, it is also possible for the positive effects of variability on expected profits to dominate the negative effects. If the increased costs of volatility are high enough, the producer may prefer to hedge against exchange rate risk by constructing part of his production facilities abroad, essentially entering new markets by establishing beachheads on foreign shores. In these industries, increased exchange rate volatility might lead U.S. firms to substitute foreign investment for domestic investment. This activity would be least prevalent in industries with high economies of scale, highly specific labor forces, and relatively inelastic foreign demand for domestic goods.

The location effect is also expected to be least prevalent in industries predominantly exposed to price uncertainty. In this case a risk averse firm can partially hedge against the short term volatility of exchange rates using futures markets. Relocation would occur in response to exchange rate trends rather than for diversification against exchange risk. The ability of the firm to successfully hedge against price uncertainty depends on the nature of its contracts and the undiversifiable risk surrounding expected revenues and costs. For example, hedging in forward foreign exchange markets is likely to be more costly for producers who enter into sales contracts applicable to longer periods (aircraft for example) which are more difficult to effectively secure against risk. Industries with long lags between orders and delivery may be more sensitive to long run volatility than short run volatility. The greater the access to closed positions in foreign exchange markets, the lower the expected effects of exchange rate variability. By this argument, we expect that the establishment of forward markets for foreign exchange would reduce the impact of volatility on industry.

The location channel for exchange rate volatility to affect investment in U.S. industries depends on the exposure of both domestic and foreign producers. If the exchange rate risk faced by foreign producers is positively correlated with that faced by domestic producers, the net effect on U.S. foreign investment is ambiguous. Specifically, the volatility spurs domestic agents to relocate production abroad and foreign producers to relocate their facilities in the U.S.. In this case, volatility changes the composition of investors in U.S. but has an undetermined effect on investment quantity. If the volatility facing domestic and foreign producers are negatively correlated, increased dollar volatility leads both domestic and foreign producers to contract investment in the U.S.. Both positive and negative correlations between exchange rate variability measures have been observed for the 1975 to 1984 interval. Kenen and Rodrik (1986) conclude that volatility of the U.S. real rate was positively correlated with that of the yen but negatively correlated with the

volatility facing Italians and Canadians. By the location effect, we would expect increased dollar volatility to yield outflows of investment capital by U.S., Italian and Canadian producers and inflows by Japanese producers.

The literature on hysteresis in trade and exchange rate pass–through also highlights the role of exchange rate volatility, but concentrates on the weakened industry response to trend and contemporaneous exchange rate movements when volatility of exchange rates is high. This proposition is indirectly studied in our empirical work. We add another dimension to that argument by emphasizing first order and direct effects of volatility. Because of the range of forces triggered, exchange rate volatility can be either expansionary or contractionary. It may also be that the relationship between risk and investment is nonlinear: at low levels of volatility firms incur costs which are generally not sufficient to justify relocation of production; at high levels of volatility can be costly enough to lead to resource reallocation across countries which can have either a positive or negative effect on net domestic investment. Another possible result is that the risk–investment relationship reverses in sign: at low levels of volatility expected profits increase thereby stimulating investment, while high levels of volatility lead to cost increases sufficient to reduce profits and investment.[6]

Portfolio theory suggests another channel through which exchange rates may redistribute resources available for investment demand. If the dollar depreciates against the yen, the Japanese gain wealth relative to Americans. Aggregate portfolio and direct investment demand shifts, reflecting the increased weight of Japanese preferences and reduced weight of U.S. preferences. If the Japanese have strong home asset preference, this wealth redistribution may reduce overall investment in the U.S.. However, if U.S. assets are

[6]While volatility theoretically affects investment flows, it is unlikely to be the most important cause of resource reallocation. As suggested by neoclassical and neo–Keynesian theories of investment, demand conditions, productivity and other supply shocks, the replacement cost and market value of capital are among the forces which drive the investment component of the business cycle.

highly desirable to the Japanese, the wealth effect of a dollar depreciation might actually stimulate investment in the U.S.. Froot and Stein (1989) highlight another dimension of wealth effects in the context of foreign direct investment: exchange rate realignments influence the ability of competing domestic and foreign investors to leverage their bids for companies. Dollar depreciations make it easier for foreign firms to outbid domestic firms in competition for assets. While possibly significant in bidding for the purchase of existing facilities, this effect is probably of second order importance in influencing investment in new plant and equipment. This type of wealth effect might surface more readily in data on mergers and acquisitions than in total investment statistics. The more relevant effect on investment occurs when realignments provide for the establishment of new business structures.

Our analysis does not distinguish between domestic and foreign investors. Instead it studies aggregated and disaggregated time series data on entry, exit and investment. The aggregate data includes time series on small and large business failures (monthly), net business formation (monthly), new business incorporations (monthly) and aggregate investment in new plant and equipment (quarterly). The disaggregated data represent investment in new plant and equipment broken down into thirty–one industrial sectors (quarterly). Instead of testing a specific structural equation, sample correlations are examined for insights to motivate further theoretical and empirical study. The causality tests are designed to identify significant correlations between exchange rate changes and market activity with up to two years of lagged effects. Other regressions analyze the response of the measures of entry, exit and investment to contemporaneous exchange rates, and measures of exchange rate trend and volatility. Distinctions are made between: i) the effects of volatility across appreciation and depreciation periods; and ii) the effects of trends across high and low volatility periods. Results for both the 1970s and the 1980s are compared to highlight structural shifts in response elasticities. All data are checked for nonstationarity, and where necessary, adjusted to eliminate unit root properties.

II. METHODOLOGY AND RESULTS:

Since investment decisions are forward-looking, they rely on projections of future economic conditions. Projecting exchange rate trend and volatility is a highly subtle task which is crudely approached in this paper by using a univariate forecasting procedure. The obvious shortcoming of this approach is that the exchange rate process is modelled as evolving independently of economic variables rather than determined in a broader general equilibrium model. While many alternative measures of trend and volatility could have been constructed, two univariate methods are chosen for their simplicity and intuitive appeal, expecting either procedure to yield reasonable proxies for more sophisticated constructions of trend and volatility.[7]

The first set of measures are based on the assumption that percentage changes in exchange rates follow historical averages; the second set of measures are based on the assumption that percentage changes in exchange rates evolve according to past time trends. Two versions of each trend and volatility measure are constructed using rolling samples of either twelve or twenty-four months of data (j=1 or 2) preceding and inclusive of the reporting period. Admittedly, these intervals are arbitrarily chosen. Nonetheless these are reasonable assumptions about the amount of historical data a producer uses to forecast future trends and the uncertainty surrounding them.

The U.S. dollar exchange rate is the Federal Reserve's trade weighted basket of G-10 currencies. Appreciations are upward movements of this index and depreciations are downward movements. Defining S_t as the period t exchange rate and $S'_t=(S_t-S_{t-1})/S_{t-1}$ as the percentage change in the exchange rate, the first set of volatility and trend measures ($M1N_{jt}$ and $T1N_{jt}$) are:

[7]Similar measures have been used in a range of studies, including de Grauwe et al. (1986), Kenen and Rodrik (1986), and Mann (1989). Kenen and Rodrik (1986) derived volatility measures to study the effects of exchange rate volatility on the imports of industrial countries. Mann (1988) used similar measures to study the effects of exchange rate volatility on pass-through.

$$T1N_{jt} = 1/j \; \Sigma^{t}_{t-(j-1)} \; S\cdot_{t} \qquad (1)$$

$$M1N_{jt} = \Sigma^{t}_{t-(j-1)} \; (S\cdot_{t} - T1N_{jt})^2/(j-1). \qquad (2)$$

Trend measure 1 ($T1N_{jt}$) represents the average monthly growth rate of the exchange rate over an interval where j=12 months or 24 months. Volatility measure 1 ($M1N_{jt}$) is interpreted as the average volatility over an interval.

The second trend and volatility measures ($M2N_{jt}$ and $T2N_{jt}$) are based on the assumption that the exchange rate evolves according to an exponential growth rule subject to shift and altered shape as time passes. First $\ln(S_t) = \alpha_t + \beta_t t + \epsilon_t$ is estimated over rolling samples of twelve or twenty–four months of data. Trend is defined as estimated $\tilde{\beta}_t$ and volatility is the variation of the exchange rate from the fitted trend,

$$M2N_{jt} = \Sigma^{t}_{t-(j-1)} \; (\ln(S_t) - \ln(\tilde{S}_j))^2/(j-1) \qquad (3)$$

Trend measure 2 ($T2N_{jt}$) represents the trend growth rate of the exchange rate over an interval. Volatility measure 2 ($M2N_{jt}$) is interpreted as the volatility of the rate of change of the exchange rate about its time trend (and corresponds to an exponential growth rule for the exchange rate).

The dollar's behavior across the 1970s and 1980s is reflected in the trend and volatility measures. Trend measures indicate both periods of depreciations and appreciations over the first half of the 1970s, followed by a sharp decline in dollar value between 1977 and 1980. The dollar rose sharply in the first half of the 1980s, peaked in 1985 and lost considerable strength by the end of the sample, 1988:12. While exchange rates were highly volatile in 1973 and 1974, volatility dropped off in the mid 1970s, increased in 1979, and moved variably upwards until its sample peak in 1985. All volatility measures reflect roughly the same patterns of exchange rate shocks.

For the study of the relationship between exchange rates and entry, exit and investment a nominal exchange rate index rather than a real index is applied. There are several important reasons for this choice. The real effects of exchange rates generally hinge

on relative price or wealth effects associated with changes in a real rate. This presents the choice of using general real rate indices or industry specific real exchange rates. The appropriate construction of industry specific indices is subject to considerable debate (see Kravis, Lipsey and Molinari (1989)). Furthermore, if one were to deflate nominal indices using industry specific domestic and foreign prices, the subsequent real index would reflect more information than is desirable for our analysis. Specifically, the pass–through of exchange rate changes into prices is a choice variable as is the investment response to exchange rate changes. It may by undesirable to construct a real index by prices which already encompass part of the firm's response to the stimuli.

While it could be argued that general real rate indices are still more appropriate for our purposes than the nominal rate index, the validity of our results still holds. This is due to the extremely high correlations between the standard real rate indices constructed using CPIs or unit labor costs and with nominal exchange rate indices: for the subsample 1978 through 1988 the correlations between the nominal weighted rates and their real counterparts, using either CPI or ULC, were in excess of 0.98.

Responsiveness of Net Aggregate Entry and Exit to Exchange Rates

Proxies for aggregate "entry" into U.S. industry include the number of new business incorporations (monthly), an index of net business formation (monthly), and an aggregate measure of investment in new plant and equipment (quarterly). New business incorporations differ from total entry into the business population by unincorporated businesses. These are on average smaller than incorporated businesses and are biased toward services rather than toward manufacturing (since incorporated businesses are likely to have a greater need for capital financing). New business incorporation statistics are viewed as reflecting the entry activity of capital intensive, relatively larger firms. Net business formation differs from new business incorporations by the number of business failures. The business failure

data do not include firms which are liquidated, merged, sold, or otherwise discontinu without loss to creditors. Therefore, while reflecting "exit", the full extent of th phenomenon is missed by our proxy. Net business formation is interpreted as reflecting n entry into industry.

Proxies for aggregate "exit" include average weekly number of business failures f businesses with liabilities in excess of $100,000 (monthly), and average weekly number business failures for businesses with liabilities less than $100,000 (monthly). These "exit data reflect commercial and industrial failures, excluding failures of banks, railroads, re estate, insurance, holding and financial companies, steamship lines, travel agencies, etc While these date are referred to as failures of large and small businesses, this reference made with a strong caveat: since the data connote failures of large and small debtor without adjusting for the respective asset positions of the firms, a complete picture c characteristics of failing firms is not provided. Small business failure may be understated b this series since it excludes real estate, insurance, travel agencies, etc.. Another shortcomin of these failure measures is that they do not capture other important avenues by which firm can exit a market, including mergers and acquisitions.

Effects of Exchange Rates on Aggregate Entry and Exit: Using data for 1971:1 throug 1988:12, causally tests between twelve months of lagged exchange rates and the aggregat entry and exit proxies use estimating equations of the form:

$$y_t = a_0 + a_1 y_{t-1} + a_2 y_{t-2} + a_3 er_t + a_4 er_{t-1} + \ldots + a_{15} er_{t-12} + \epsilon_t \qquad (4)$$

where the y_t are logarithms of entry and exit proxies, the er_t are the logarithms o exchange rates, and the residual ϵ_t is assumed to have standard properties.[9] The number o

[8]The business failure data are available only through the end of 1983. More recent data are not included in this study since they are based on expanded coverage and are generally not compatible with the earlier series. All the exit, entry and investment data are available either from the U.S. Department of Commerce or from Dun & Bradstreet.

[9]All of the y_t enter as logarithms of levels since results from Augmented Dickey–Fuller tests suggest that none of these aggregate entry or exit series are nonstationary.

lagged "endogenous" variables is chosen to eliminate serial correlation in the residuals. Causality is interpreted in the Granger sense, where statistical significance of right hand side variables reflects simple correlation. Tests for asymmetric responses to positive or negative shocks are not conducted: this implies that effects of appreciations and depreciations are treated as effecting y_t with equal and opposite sign. Table 1 summarizes the results from tests on aggregate data for the 1970s and the 1980s.

The impact elasticity of response to the exchange rate is the coefficient on the contemporaneous exchange rate (a_3). Significant coefficients on lagged exchange rates permit delayed response of the "endogenous" variable to shocks, such as those arising from delays in registering or disbanding production operations. The total correlation between exchange rates and y_t is the sum of statistically significant coefficients on exchange rates, where statistical significance is defined at the 10 percent level.

During the 1970s exchange rate depreciations were associated with increased business incorporations, while net business formation was generally uncorrelated with exchange rate levels. For the 1970s, depreciations are associated with increased large business formation but are not associated with changes in the overall number of businesses. In the 1980s dollar depreciations remained uncorrelated with net business formation, but were significantly correlated with decreases, rather than increases, in new business incorporations. Both results suggest that business failures move in the same direction as business formation: this implies stability in numbers of businesses achieved by altering the composition of firms. Oddly, the direction of entry and exit response to exchange rates appears to have been reversed across the 1970s and 1980s.

Correlations between classes of business failures and exchange rates also differ greatly across the 1970s and the 1980s. In the 1970s depreciations are associated with increased entry and reduced exit of large businesses. In contrast, in the 1980s depreciations are associated with reduced entry and increased exit of large businesses. In the 1970s

depreciations reduced exit of small businesses, whereas in the 1980s these series were urcorrelated.

The next set of tests for correlation between aggregate measures of entry and exit and exchange rate trend and volatility are based on regressions of the form

$$y_t = a_0 + \Sigma_k \alpha_k y_{t-k} + a_1 Mij_t + a_2 DUMA_t \cdot Mij_t + a_3 Tij_t + a_4 DUMB_t \cdot Tij_t + a_5 IP_t \quad (5)$$

where i=1,2 depict the choice of trend and volatility pair, j=12, 24 represents the number of months used in construction of the pair, IP_t is an index of U.S. industrial production, and all data are in logarithms.[10] DUMA equals 1 during trend appreciations and equals 0 otherwise. It captures whether correlations between entry and exit and volatility differ across appreciation and depreciation periods. DUMB equals 1 during periods of higher than average volatility and equals 0 otherwise.[11] DUMB captures whether entry and exit measures have different correlations with exchange rate trend during high and low volatility periods. Table 2 summarizes the estimation results for the 1970s and 1980s aggregate business activity data.

In the 1970s contemporaneous exchange rate depreciations were associated with increased net business formation and increased large business failures. In the 1980s, correlations with contemporaneous exchange rate changes were more widespread: depreciations were associated with decreased new business incorporation, but were also associated with reductions in small and large business failures. It is possible that the increased use mergers and acquisitions of U.S. firms in the 1980s mask what would have appeared as business failures in the 1970s.[12]

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[10]The industrial production index had explanatory power only in the small business failure data and remains in regressions for that index only.

[11]Each of the dummy variables used in regressions is specific to the interval and measure to which it is applied.

[12]It is unlikely that business formation and failure decisions are made on the basis of contemporaneous exchange rate levels. Interpretations of correlations between the business activity data and measures of exchange rate trend and volatility are more solidly grounded in intuition and in economic theory.

In the 1970s short term trend depreciations were associated with reduced business incorporations (which were weakened in high volatility periods) and reduced large business failures, but had insignificant net effects on net business formation. In the 1980s short term trend depreciations were weakly correlated with reduced net business formation and increased rather than decreased small and large business failures. The sensitivity of business failures to short term trends was only apparent in high volatility periods.

In both the 1970s and the 1980s long term trend depreciations were uncorrelated with net business formation. In the 1970s long term trend depreciations were associated with increased failures of small businesses, and decreased entry and exit of large businesses. In the 1980s, long term trend depreciations were associated with significant increases in entry of large businesses and insignificantly correlated with exit numbers.

In the 1970s the aggregate effects of short term volatility of exchange rates appears to differ across appreciation and depreciation periods. In depreciation periods, entry and exit of large businesses declined with short term volatility, while significant net effects were not observed. In appreciation periods, increased short term volatility is associated with reduced entry but increased exit of large firms, and reduced exit of small firms. In the 1980s short term volatility contracted net business formation and the exit of small firms from the market.

In the 1970s increases in long term volatility of exchange rates were associated with reduced net business formation which appears to be attributed to increased large and small business failures. In the 1980s, long term volatility increases werre still associated with contractions in net business formation. Large business entry and exit increases were associated with higher volatility. Entry response was higher and exit response lower during appreciation periods.

In sum, there appears to have been some fundamental changes in the relationships between exchange rates and business entry and exit across the 1970s and 1980s. In the

1970s depreciation trends are associated with reduced entry and reduced exit of larg businesses, and increased exit of small firms. However, in the 1980s long term trend dolla depreciations were associated with increased large business formation and increased failures This surprising change in the entry response of large business formation could reflect fundamental restructuring of the U.S. economy: however, it is difficult to reach an conclusions from our simple tests. There remain numerous issues unexplored in the previou analysis: the data do not provide insights into sectoral responses; the data do not reflec the dynamics of ownership patterns over U.S. businesses, nor do they reflect industry restructurings such as those that occur when existing businesses establish offshor production facilities while remaining based in the U.S.. To provide more detailed evidence on the sectoral impact of exchange rates, the next section examines the correlations between changes in sectoral investment and exchange rate patterns.

Before moving ahead to the disaggregated data, it is interesting to note the association between entry, exit and variability of exchange rates. Option theory, as applied to hysteresis in investment and international trade suggests that the entry and exit response to price signals, such as exchange rate movements, will be slowed when increaseed noise surrounds these signals.[13] In the aggregate series, this would suggest that the higher the variability of exchange rates, the more likely that investors and producers will adopt a wait and see attitude toward expanding capacity or entering and exiting markets. Only the new business incorporation data for the 1970s clearly support this hypothesis: as the volatility of the dollar increased in the 1970s, the contractionary stimuli of exchange rate trend depreciations on new business incorporations was reduced. Other correlations between trend measures and exit and entry were higher or more significant during high volatility periods compared with low volatility periods.

[13]Recent research by Dixit, Dumas and Krugman emphasize this point.

Sectoral Investment Elasticity of Response to Exchange Rates

The sectoral effects of exchange rate patterns are explored using two sets of tests on data for real expenditure on new plant and equipment in the U.S. disaggregated by broad manufacturing and nonmanufacturing categories.[14] The first set are simple bivariate causality tests which use only lagged values of investment and exchange rates:

$$I^j_t = b_0 + b_1 I^j_{t-1} + b_2 I^j_{t-2} + \Sigma_k \beta_k er_{t-k} + \epsilon_t \qquad (6)$$

where the I^j_t are logarithms of investment series by industry j and the er_t are the logarithms of exchange rates, with k=0,..,8.[15] Table 3 summarizes the results for the 1970s and 1980s. It reports significant impact coefficients, the total summed significant coefficients over two years of lagged exchange rates, and the share of the total of two year exchange rate effects realized within the first year following an exchange rate impulse.

Results from Straight Causality Tests on Sectoral Investment[16]

·In the 1970s, while the impact correlations between exchange rates and investment appear insignificant (with the exception of transportation), cumulative lagged correlations between exchange rates and real investment were significant for many sectors. Dollar depreciations were associated with increased investment in durable goods manufacturing and chemicals, and depressed investment in textiles, rubber, and commercial and other service related industries (wholesale and retail trade, finance and insurance, and personal and business services).

·Over the 1980s, on impact dollar depreciations were associated either with investment contractions or were uncorrelated with investment flows. The total elasticity of

[14]The investment categories are presented in Table 5. All expenditure figures are quarterly data reported in constant dollars.

[15]As in the analysis of aggregate measures, the impact elasticity of exchange rates are taken to be the coefficients b_3 on the contemporaneous exchange rate variable. The total effect of exchange rates on y_t is represented by the sum of statistically significant coefficients on the exchange rate variables, where statistical significance is defined at the 10 percent level.

[16]Further econometric results and regression statistics are available upon request.

response of investment to dollar movements differed markedly from behavior in the 1970s and from expectations. In the 1980s dollar depreciations were associated with reduced investment in many sectors of the United States economy[17] and expanded investment in a few industries:[18] in the 1980s more sectors have contractions of investment associated with dollar depreciations.

The timing of exchange rate effects differed across the 1970s and the 1980s. In both intervals, if investment changes are not correlated with exchange rate changes within a year, it is unlikely that a correlation will appear within two years. In the 1970s, only four of the thirty–one industrial categories showed only significant second year correlations. In the 1980s only two of thirty–one industries showed only second year correlations. In contrast to the 1970s, in the 1980s it took longer for the effects of exchange rates to surface.[19] The next set of tests suggest whether this sluggish response is attributable to increased exchange rate volatility which delayed market response to exchange rate signals.

Recall the results for aggregate variables: straight causality tests suggest that for the 1970s depreciations were associated with increased entry, increased exit, and redistributed investment sectorally. In the 1980s, causality tests suggest that depreciations were associated with depressed entry, increased exit, and reduced investment in many more industries than those in which investment expanded. The next set of tests consider whether these results hold up in regressions with greater structure.

The second set of tests relates sectoral investment to exchange rates, exchange rate trend and volatility:

$$I^j_t = b_0 + \Sigma_k \beta_k I^j_{t-k} + b_1 DUMA \cdot Mij_t + b_2 Mij_t + b_3 DUMB \cdot Tij_t + b_4 Tij_t + b_5 GDP82_t + \epsilon_t \quad (7)$$

[17]Including electrical machinery, aircraft, stone, clay and glass, other durables, textiles, and some elements of nonmanufacturing.

[18]finance and insurance, personal and business services, communications, food, rubber, mining and steel

[19]Lagged correlations with exchange rate changes exceeded first year correlations in a number of industries [other durables, blast furnaces and steelworks, rubber, nonmanufacturing, mining and finance and insurance].

where i=1,2 depict the choice of trend and volatility pair, j=12, 24 represents the number of months used in construction of the measure, and all variables are in logarithms. Right hand side variables include lagged investment, aggregate demand, and the exchange rate variables: contemporaneous exchange rates, short or long term exchange rate trends, and short or long term exchange rate volatility. Dummy variables indicate whether investment responds differently to volatility across appreciation and depreciation periods (DUMA), and differently to trend across high and low volatility periods (DUMB). DUMA equals 1 during trend appreciations and equals 0 otherwise. DUMB equals 1 during periods of higher than average volatility and equals 0 otherwise. Once again, the model is estimated separately for the 1970s, the 1980s and the complete sample to indicate whether there appears to be an altered relationship between investment and exchange rates.

The impact of demand and business cycle conditions on investment enters the regressions through real gross domestic product. Investment variations have been shown to be strongly positively related to variations in output through the accelerator model of investment: investment responds to desired stocks of capital which are themselves determined by demand conditions. While it is also desirable to include the cost of capital in regression equations, the empirical validity of this choice is questionable. In the context of a preponderence of shocks to aggregate production [Shapiro (1986),Tobin (1986)] positive productivity shocks may raise both output and the marginal product of capital. Such productivity shocks are offered as explanations for the strong correlation of investment and output, and the much weaker correlation between investment and the cost of capital. Although the market valuation of capital relative to its replacement cost, denoted by q, may be a better measure of investment motivation than the cost of capital, the evidence

supporting this measure is also relatively weak. For these reasons, despite firm theoretical foundations, the cost of capital is excluded from the regressions.[20]

Augmented Dickey Fuller tests for nonstationarity applied to the logarithms of investment suggest that six of the thirty–one investment series have unit roots: electrical machinery, aircraft, stone clay and glass products, textile mill products, chemical products, and communications. For these series first differences of the log–levels are used as right hand side variables.

Trend depreciations are expected to increase the competitiveness of United States goods in international markets and the competitiveness of the United States as a location for industrial facilities. The location effect is expected to be strongest for firms with low specific labor forces and low sunk costs of investment. For traded goods sectors, depreciations are expected to stimulate investment. To the extent that resources flow out of nontraded goods sectors, depreciations may depress investment in nontradables. Perverse effects of trend depreciations on investment may arise if depreciations increase (imported intermediate) costs more than (final product) revenues, or if depreciations lead to strong Laursen–Metzler effects on real income. Exchange rate volatility can directly stimulate investment if it increases net expected revenues or depress investment if the increased costs associated with volatility dominate. Volatility can either stimulate or depress investment through the location effect. An indirect efect of exchange rate volatility on sectoral response

[20]The empirically weak response of investment to changes in the cost of capital is somewhat puzzling given neoclassical and neo–Keynesian theories of investment: Allowing for delivery lags or adjustment costs, place heavy emphasis on the importance of factor prices and investor rates of return for determining changes in investment. Clark (1979) concludes that capital aggregation problems and slow adjustment of the capital stock rather than defects of the theory account for the poor performance of the neoclassical model. Bosworth's (1985) examination of data through 1985:3 finds little support for the hypothesis that the cost of capital affects investment. Abel and Blanchard (1986) note that studies which regress investment on q typically find that q does not explain a large part of the variation in investment and that the unexplained movement in investment is highly serially correlated. While these studies generally rely on average rather than marginal q, their analysis using marginal q reaches the same conclusion.

to exchange rate trends is also expected: the higher the volatility, the more sluggish are producers to respond to price signals.

Significance of Trend, Volatility and Contemporaneous Exchange Rates on Investment

Summarized in Table 4, the main results on the correlations between investment and exchange rate patterns are presented below. The section which follows provides interpretations of these results.

i. Investment Responsiveness to Contemporaneous Nominal Exchange Rates

While investment was correlated with contemporaneous exchange rate changes for half of the industrial categories examined, the pattern of response changed across the 1970s and the 1980s. In the 1970s a contemporaneous depreciation of the dollar was correlated with investment expansion in eleven industries and contraction in four industries. Aggregate levels of investment were uncorrelated with exchange rate changes, although in manufacturing dollar depreciations were associated with investment contractions in durables and investment expansions in nondurables. In the 1980s, dollar depreciations were correlated with investment expansions in only two industries, while investment contracted significantly with depreciations in 15 industrial categories.

ii. Investment Responsiveness to Short-Term Trends in Nominal Exchange Rates

In the 1970s investment was significantly correlated with some measure of short term trend in only 7 of 31 categories. In low exchange rate volatility periods trend depreciations were associated with investment expansions in 2 industry and contractions in 2 industries. In high dollar volatility periods, trend depreciations were associated with investment contractions in 3 industries and expansions in 2 industries.[21]

In the 1980s investment in many more industries (13 of the 31 categories) was significantly correlated with some measure of short-term trend. In periods of below average

[21]The results for mining vary in sign and significance and are not included in the tally.

volatility, trend depreciations were correlated with investment contractions in 8 industries and expansions in 2 industries. In periods of above average volatility short term trend depreciations are correlated with contractions in 8 industries and expansions in 5 industries.

iii. Investment Responsiveness to Long–Term Trends in Nominal Exchange Rates

Comparisons of investment response to short and long term trends differ substantially. In the 1970s investment in 14 of the 31 categories responded significantly to some measure of long term exchange rate trend. Longer term trend depreciations were associated with investment expansions in 9 industries and contractions in 4 industries. While the qualitative response to trend did not vary across high and low dollar volatility periods, 7 industries exhibited statistically significant differences in response elasticities.

In the 1980s investments in 16 of the 31 categories were significantly correlated with changes in some measure of long term trend. In low dollar volatility periods, trend depreciations were associated with significant investment expansions in 7 industries and contractions in 4 industries. In periods of high dollar volatility trend depreciations were correlated with significant investment expansions in 15 out of 16 responsive industries.

iv. Investment Responsiveness to Short–Term Nominal Exchange Rate Volatility

For the 1970s, during periods of trend depreciations, investment was correlated with changes in short term exchange rate volatility was correlated with investment changes in few industries (of the 3 responsive industries, 1 contracted and 2 expanded investment.) Investment correlations with short term volatility were significantly broader during trend appreciation periods. Of the 11 industries in which investment changes were associated with increases in short term volatility, investment expanded in 9 and contracted in only 1.

During the 1980s, investment was significantly correlated with altered volatility in 10 of 31 industries. In trend depreciation periods increased short term volatility was

associated with expanded investment in 4 industries and contracted investment in 1 industry. In trend appreciation periods increased volatility was associated with expansions in 6 industries and contractions in 4 industries.

v. Investment Responsiveness to Long–Term Nominal Exchange Rate Volatility

In the 1970s, investment was correlated with long term volatility in 13 of the 31 industrial categories. During dollar depreciation periods, increased volatility was associated with investment contractions in 5 industries and expansions in 3 industries. During appreciation periods, higher volatility was correlated with investment expansion in 2 industries and contractions in 10 industries.

In the 1980s investment exhibited significant correlations with long term exchange rate volatility in 18 of 31 industrial categories. The association between increasing volatility and decreasing investments were quite strong: investment contracted significantly in 17 industries during trend appreciation periods and in 14 industries during trend depreciation periods. Investment expanded with increased volatility in only 1 industry.

Some general conclusions can be drawn from these results.

i) Contemporaneous dollar depreciations generally were associated with investment expansions in the 1970s and investment contractions in the 1980s. A possible explanation is that contemporaneous depreciations increased goods demand and industry profits in the 1970s, whereas in the 1980s contemporaneous depreciations meant significantly increased costs of inputs into production.

ii) Correlations between investment and short term exchange rate trends were stronger in the 1980s than in the 1970s. Short term exchange rate trend depreciations were associated with both contractions and expansions (resource redistribution) in the 1970s, but were more generally associated with investment contractions in the 1980s. The greater the

dollar volatility, the stronger the investment expansions associated with short term trend depreciations.

The perverse finding of contemporaneous and short term depreciations associated with contractions of investment in the 1980s suggests that further study should be given to factors such as increased costs of imported intermediates and Laursen–Metzler negative real income effects of depreciations which leads to depressed demand for domestic goods.

iii) During the 1970s, long term exchange rate trends also were associated with the redistribution of investment resources across sectors. This reallocation was largely independent of the uncertainty surrounding exchange rates. During the 1980s, long term trend depreciations were associated with sectoral resource redistribution only during low volatility periods. During high volatility periods, long term trend depreciations were strongly associated with overall investment expansions. Reduced contractions during high volatility is consistent with two opposite hypotheses: one hypothesis is that increases in dollar volatility increases industry profitability and shifts out the supply curve; alternatively, investment expansions may trigger net inflows of capital into the U.S. by foreign exporters seeking to avoid losses associated with high volatility.

iv) On balance short term volatility increases were associated with increased investment in a small set of industrial categories. This result is consistent with the hypotheses noted above.

Long term volatility, however, was associated with significant investment contractions in a broad range of industries suggesting negative effects on industry profitability and/or outflows of capital for hedging long term investment decisions. Since this correlation was strongest during trend appreciation periods when domestic industries were already weak, it suggests that risk averse producers may have more of a tendency to relocate their facilities when domestic production is least profitable and foreign inputs into production relatively cheap.

III. Concluding Observations:

Short term trend depreciations are associated with the redistribution of resources across sectors while long term trends are associated with investment expansions, or alternatively, the re–industrialization of many sectors of the United States economy. In the 1970s short term depreciation trends are associated with decreased entry and decreased exit of large, capital intensive businesses. In the 1980s short term trend depreciations are associated with increased entry and increased exit of large businesses. These patterns, along with the correlations between exchange rate patterns and sectoral investment, could be reflecting a sectoral restructuring in which firms in some industries have failed while firms in other industries prospered.

For the 1980s, the re–industrialization argument also is supported by the correlations between long term trends and business activity. Long term trend depreciations are associated with increased investment in new plant and equipment and increased business incorporations. The results suggest that long term trend depreciations also have a second order effect: during trend depreciation periods the negative and significant association between exchange rate volatility and investment is reduced, increases in business failures associated with long term volatility are higher, and increases in business incorporations associated with long term volatility are lower. Direct effects of volatility are also suggested by the results. Short term volatility is more generally associated with investment expansions, possibly reflecting increased short term expected profits. However, longer term volatility is strongly correlated with investment contractions suggesting the dominant effect of risk aversion and rising costs of production in an uncertain environment. Long term volatility was correlated with contractions in net business formation in both the 1970s and the 1980s, apparently dominated by increases in large business failures.

Many caveats apply to interpreting the results from these simple regressions. Since fully specified reduced form models of aggregate entry and exit or sectoral investment

have not been tested, the results represent correlations among variables rather than true cause and effect relationships. In addition, possible asymmetries in the coefficients on trends across appreciation and depreciation intervals have not been examined. Finally, as in all tests of this nature, possible problems of spurious correlation generate potentially misleading interpretations of results. The appropriate construction of exchange rate trend and volatility measures used in the regressions can also be debated.

This paper has attempted to further our understanding of the effects of exchange rates by documenting the empirical correlations between exit, entry and sectoral investment and exchange rate patterns. This paper paves the way for useful further research which should specifically focus on: the characteristics of the responsive and unresponsive sectors; the impact on two-way foreign direct investment flows of exchange rate patterns; the importance of increased reliance on intermediate inputs for perverse responses to exchange rate movements; the response of real income to dollar realignments; and the relationship between investment and pricing decisions by producers in response to exchange rate shocks.

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Table 1: Aggregate Elasticities of Response to Exchange Rate Depreciations

	Impact	% of Total Effect in Year One	Total Two Year Effect
Business Incorporations			
1971:06– 1979:12	0.0	100	+0.568
1980:01– 1988:06	0.0	0	−0.923
Net Business Formation			
1971:06– 1979:12	0.0	100	−0.020
1980:01– 1988:06	0.0	na	0.000
Small Business Failures[1]			
1971:06– 1983:12	0.0	0	−3.038
1971:06– 1979:12	0.0	0	0.000
Large Business Failures[2]			
1971:06– 1983:12	0.0	V(+,−)	−0.551
1971:06– 1979:12	−1.319	100	+1.015

Coefficients reported in summations as equal to zero unless statistically significant at the 10 percent level.

na: not applicable

V : sign of response elasticities vary between first and second year

[1] Small Businesses are defined as those with liabilities less than $100,000.

[2] Large Businesses are defined as those with liabilities greater than $100,000.

From regressions of the form: $y_t = c + \Sigma\alpha_i y_{t-i} + \Sigma\beta_j ER_{t-j}$ i=1,..6 j=0,..24

Table 2: Aggregate Exit and Entry Response to Exchange Rate Measures

Measure		Contemp. Deprec	Trend Depreciation S.T.	L.T.		Volatility S.T.	L.T.
Net Business Formation[a]							
	1970s	+**	low vol:	· ·	deprec.prd.:	·	-**
			high vol:	· ·	apprec.prd.:	+**	-**
	1980s	·	low vol:	· ·	deprec.prd.:	-**	-**
			high vol:	-* ·	apprec.prd.:	-**	-**
New Business Incorporation[a]							
	1970s	·	low vol:	-** -*	deprec.prd.:	-*	·
			high vol:	-∇** -*	apprec.prd.:	-*	·
	1980s	-**	low vol:	· +**	deprec.prd.:	·	+*
			high vol:	±** +**	apprec.prd.:	·	+Δ*
Small Business Failures							
	1970s	-**	low vol:	· +**	deprec.prd.:	·	+**
			high vol:	· +**	apprec.prd.:	-**	+∇**
	1980s	-**	low vol:	· ·	deprec.prd.:	-**	·
			high vol:	+* ·	apprec.prd.:	-**	·
Large Business Failures[a]							
	1970s	+**	low vol:	-** -*	deprec.prd.:	-*	+**
			high vol:	-** -*	apprec.prd.:	+*	+**
	1980s	-**	low vol:	· ·	deprec.prd.:	·	+*
			high vol:	+* ·	apprec.prd.:	·	+∇*

From regressions of the form:

$$y_{i,t} = c + \Sigma\alpha_k y_{i,t-k} + \beta_1 er_t + \beta_2 Tij_t + \beta_3 Tij_t * \text{High.vol.Dummy}_t + \beta_4 Mij_t + \beta_5 Mij_t * \text{Apprec.Dummy}_t + \beta_6 \text{Industrial.Prod.}_t$$

Notation Key:
low vol. = low volatility; high vol. = high volatility
apprec.prd. = appreciation period; deprec.prd. = depreciation period
· lack of statistical significance at 10 percent level.
* statistical significance at the 10 percent level.
** statistical significance at the 5 percent level.
+(-) positive (negative) correlation.
± significant correlations of mixed sign.
∇(Δ) smaller (larger) coefficient value.
a regressions exclude IP index because of its lack of explanatory power.

Table 3: Elasticities of Investment Response to Exchange Rates

Industry	1970s Impact	-1yr shr-	Total	1980s Impact	-1yr shr-	Total
All industries	0.0	na	0.0	0.218	50.7	0.221(+,+)
Manufacturing	0.0	na	0.0	0.259	100.0	0.259(+,0)
Durable Goods	0.0	0.0	-0.472(0,-)	0.0	na	0.0
Primary Metals[1]	0.0	0.0	0.693(0,+)	0.0	94.3	1.058(+,+)
Blast.Furn&Steel	0.0	na	0.0	0.0	0.0	-0.106(0,-)
Nonferrous Metal	0.0	na	0.0	0.0	na	0.0
Fabricated Metal	0.0	V	-0.498(+,-)	0.0	na	0.0
Electrical Mach.	0.0	na	0.0	1.018	100.0	1.018(+,0)
Nonelectric.Mach.	0.0	V	-0.365(-,+)	0.0	na	0.0
Transport. Equip.	0.0	na	0.0	0.0	na	0.0
Motor Vehicle	.	.	.	.	.	.
Aircraft & Parts	0.0	na	0.0	0.0	100.0	1.465(+,0)
Stone,Clay& Glass	0.0	5.9	-0.846	0.661	100.0	0.661(+,0)
Other Durables[2]	0.0	na	0.0	0.694	V	0.970(-,+)
Nondurable Goods	0.0	na	0.0	0.317	32.4	0.977(+,+)
Food & Beverages	0.0	na	0.0	0.0	V	-0.534(-,+)
Textile Products	0.0	V	1.845(-,+)	0.712	100.0	0.712(+,0)
Paper Products	0.0	na	0.0	0.0	na	0.0
Chemical Product	0.0	100.0	-0.055(-,0)	0.0	na	0.0
Petroleum	0.0	na	0.0	0.0	na	0.0
Rubber Products	0.0	0.0	2.621(0,+)	0.0	0.0	-1.793(0,-)
Other Nondurable[3]	0.0	na	0.0	0.0	na	0.0
Nonmanufacturing	0.0	na	0.0	0.0	V	0.457(-,+)
Mining	0.0	na	0.0	0.693	V	-0.51 (+,-)
Transportation	-0.877	39.6	-2.213(-,-)	0.0	na	0.0
Public Utility	0.0	0.0	0.0	0.0	0.0	0.0
Commercial&etc	0.0	na	0.0	0.0	100.0	0.432(+,0)
Wholesale& Retail	0.0	100.0	1.259(+,0)	0.0	na	0.0
Finance&Insurance	0.0	0.0	1.564(0,+)	0.0	V	-0.192(+,-)
Personal&Bus.Svc.	0.0	0.0	1.638(0,+)	0.481	V	-0.532(-,+)
Communication	0.0	na	0.0	0.0	51.8	-2.148(-,-)

1-yr-shr: share of total significant response attributed to response within the first year. V: first year response direction departs from second year response direction. First and second year response pattern in parentheses. (1) includes industries not shown separately; (2) consists of lumber, furniture, instruments, and miscellaneous; (3) consists of apparel, tobacco, leather, and printing-publishing.

Only elasticities significant at the 10 percent level are reported as nonzero.

Table 4: Investment Correlations with Exchange Rate Measures: Summary

Measure	1970s				1980s			
	#significant industries		+	−	#significant industries		+	−
contemporaneous depreciation:	15		11	4	17		2	15
Short term trend depreciation:	7	Low Vol.	2	2	13	Low Vol.	2	8
		High Vol.	2	3		High Vol.	5	8
Short term volatility:	11	Deprec.	2	1	10	Deprec.	4	1
		Apprec.	9	1		Apprec.	6	4
Long term trend depreciation:	14	Low Vol.	9	4	16	Low Vol.	7	4
		High Vol.	·	·		High Vol.	15	1
Long term volatility:	13	Deprec.	3	5	18	Deprec.	1	14
		Apprec.	2	10		Apprec.	1	17

Results generated using regressions of the form
$y_t = \Sigma a_i y_{t-i} + b_1 GDP_t + b_2 \text{trend E.R.} + b_3 \text{trend E.R.*HVDummy} + b_4 \text{Volatility} + b_5 \text{Volatility*Appr.Dummy}$

Significant numbers of coefficients on investment in new plant and equipment categories, where a total of 31 categories were examined. Criterion for significance is the 10 percent confidence level.
Low Vol. (High Vol.) represents coefficients of significant trends in low and high volatility periods, respectively.
Deprec. (Apprec.) represents coefficients of significant volatility measures in appreciation and depreciation periods, respectively.

Table 5: Categories of Investment in New Plant and Equipment

All Industries
- Manufacturing
  - Durable Goods
    - Primary Metals
    - Blastfurnaces and Steelworks
    - Nonferrous Metal Products
    - Fabricated Metal Products
    - Electrical Machinery
    - Nonelectrical Machinery
    - Transportation Equipment
      - Motor Vehicles
      - Aircraft and Parts
    - Stone, Clay and Glass Products
    - Other Durables (Lumber, Furniture, Instruments and Misc.)
  - Nondurable Goods
    - Food including Beverages
    - Textile and Textile Mill Products
    - Paper and Allied Products
    - Chemical Products
    - Petroleum and Petroleum Products
    - Rubber and Plastics
    - Other Nondurables (Apparel, Tobacco, Leather and Printing–Publishing)
- Nonmanufacturing
  - Mining
  - Transportation
  - Public Utilities
  - Commercial and Other
    - Wholesale and Retail Trade
    - Finance and Insurance
    - Personal and Business Services
    - Communications