Financial Constraints and Growth: Multinational and Local Firm Responses to Currency Depreciations

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ABSTRACT

This paper examines how financial constraints and product market exposures determine the response of multinational and local firms to sharp depreciations. U.S. multinational affiliates increase sales, assets, and investment significantly more than local firms during, and subsequent to, depreciations. The results indicate that product market exposures offer an incomplete explanation for this relative performance as multinational affiliates exclusively serving local markets and those with similar operating exposures as local firms expand operations considerably more than local firms. A differential ability to circumvent financial constraints contributes significantly to the observed differential investment performance. Investment specifications illustrate that increases in leverage induced by sharp depreciations constrain local firms from capitalizing on profitable investment opportunities but do not constrain multinational affiliates. Multinational affiliates also access parent equity when local firms are the most constrained. These results indicate another role for foreign direct investment in emerging markets—multinational affiliates expand economic activity during currency crises when local firms are most constrained.

JEL Classifications: F23, F31, G15, G31, G32.

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1. Introduction

Do firms respond to sharp depreciations differentially based on the opportunities provided by their internal capital markets and product market exposures? Currency depreciations are hypothesized to provide benefits to firms in the tradable sector by making them more competitive in world markets. Available aggregate evidence for emerging markets, however, provides little support for this claim suggesting that either such mechanisms are not operative or that simultaneous difficulties in accessing world product markets or capital to finance operations offset the benefits of depreciations. Given the frequency of sharp depreciations, investigations of the role of product and capital market imperfections in hindering firm responses to these depreciations seem warranted.

This paper compares the response of the affiliates of U.S. multinational parents and local firms to sharp depreciations in the tradable sector in emerging markets. This comparison is useful for several reasons. First, multinational affiliates constitute significant fractions of output in these emerging markets and measuring how they respond sheds light on the possibility that they mitigate deleterious effects of depreciations – an underappreciated consequence of foreign direct investment. Second, such a comparison can illuminate the degree to which product or capital market imperfections account for the muted aggregate response to sharp depreciations as multinational affiliates and local firms are distinctive in their ability to access internal product and capital markets. Finally, the setting of sharp depreciations can also help identify the role of financial leverage in constraining investment since depreciations simultaneously increase leverage and financial constraints and improve, or at least do not reduce, investment opportunities.

In order to perform this empirical analysis, we pool data on local firms and multinational affiliates. This new data set permits us to control for a variety of industry effects and to identify the relative performance of the two types of firms. We begin by investigating if multinational firms respond differently than local firms by examining changes in sales, assets, and investment around sharp depreciations. The results indicate that, after depreciations, multinational affiliates increase sales and assets 5.4% and 7.5%

more, respectively, than local firms. The improved relative performance of multinational affiliates is even more striking in investment. Capital expenditures are 34.5% higher for multinational firms than local firms in the aftermath of large depreciations.

What accounts for this sharply divergent performance? These differences in performance may reflect distinctive changes in investment opportunities stemming from either differential access to global product markets or a disproportional reliance on local markets. For example, multinational affiliates may make use of sales outlets within a parent system, and depreciations might disproportionately increase the profitability of these outlets. In order to consider this possibility, we compare multinational and local firms with similar product market exposures. First, we investigate if where a multinational affiliate sells to, or sources inputs from, can explain their differential performance. If product market imperfections account for the inefficacy of sharp depreciations in stimulating output, then multinational affiliates with differential product market exposures should differentially benefit from the depreciation. Second, we compute measures of the operating exposures of firms and match local firms and affiliates on these measures and other firm characteristics. If differences in product market exposures are important in explaining differences in the response of affiliates and local firms to crises, then matching on measures of operating exposure should reduce estimates of the extent to which affiliates outperform local firms.

These tests provide little evidence that the relative growth of affiliates around sharp depreciations can be traced to differential investment opportunities. Affiliates that exclusively serve the local market increase investment by considerably more than local firms. Additionally, the matching estimators reveal that affiliates invest more than local firms that have similar operating exposures. The only evidence that product market exposures account for the differential performance is that affiliates with higher shares of foreign sales prior to crises increase investment by larger amounts.

A differential ability to overcome financing constraints might also explain the relative performance of multinational affiliates and local firms. In order to investigate this possibility, we employ several tests. First, differences in the level of leverage and its duration across firms prior to crises are used to identify if local firms most vulnerable to

financing constraints are those that invest and grow the least. Second, it is possible to employ the framework of Lang, Ofek and Stulz (1995) to link changes in leverage with investment responses. In this setting, it is possible to compare this relationship for multinational firms and local firms and to employ the depreciation episodes as instruments to identify if changes in leverage or operating profits arising from the depreciations are influencing investment. Finally, it is possible to directly examine a multinational parent's internal capital markets to see if more resources are being allocated to affiliates in countries going through severe depreciations.

These tests provide strong evidence that a differential ability to overcome financing constraints helps explain the differential investment response of multinational affiliates and local firms. Local firms with the most leverage and with the shortest term debt reduce investment the most. The IV tests indicate that the investment response to the beneficial competitiveness effects of depreciations is not significantly different for the two types of firms. The investment response by local firms, however, is significantly constrained by increases in leverage caused by depreciations. In contrast, the investment response by multinational firms is not constrained by changes in leverage. Finally, the examination of the internal capital markets of multinationals indicates that multinational parents provide additional financing through equity infusions in response to sharp depreciations. These results indicate that multinational firms overcome the negative consequences of large depreciations by ameliorating the financial constraints that handicap local firms.

In identifying the role played by access to capital in explaining the explanation for the enhanced performance of multinational affiliates, this paper contributes to the extensive literature on financial constraints and growth. This literature struggles with several identification issues that are mitigated by comparing the responses of two types of firms to the same shock. For example, many cross-country studies use country level variables to proxy for financial development and are therefore subject to concerns of omitted variable bias. Similarly, many analyses of the effects of leverage on investment policies struggle with endogeneity; a negative relationship between leverage and growth may merely reflect the fact that managers facing poor growth opportunities choose high

levels of leverage. Increases in leverage also may reflect a response to unobserved variation in investment opportunities.

This paper addresses these concerns by isolating a situation within a country in which an economic event that is exogenous to any individual firm simultaneously (i) improves (or at least does not reduce) investment opportunities, (ii) increases firm leverage or financing constraints, and (iii) increases financing constraints differentially across types of firms. In addition to providing a test of how financial constraints influence investment, this differential reaction illustrates an effect of FDI not previously emphasized. FDI can mitigate output contractions during currency crises, since multinational affiliates expand activity precisely when local firms are most constrained.[1]

Although the data set created for this analysis permits a novel approach for examining the relationship between financial constraints and investment decisions, it also has shortcomings. In particular, we do not observe the currency denomination of debt. As a result, we are unable to document if local and multinational firms differentially use foreign currency denominated debt, and therefore we are unable to determine the extent to which increases in leverage are due to revaluations or other factors associated with currency crises.[2] To overcome this difficulty, our empirical approach uses measures of the total change in leverage in local currency terms around the time of depreciations to reflect changes in leverage arising from revaluations. Since we are interested in the effect of changes in leverage on investment, our identification strategy should not depend on how borrowing decisions are denominated.

The remainder of the paper is organized as follows. Section 2 motivates the subsequent analysis and empirical specifications in the context of a review of the existing

[1] Analyses of the consequences of foreign direct investment (FDI) for host economies typically center on the presence of technology spillovers, the labor and environmental practices of multinational firms, or the effects of tax competition on the fiscal base of areas hoping to attract foreign direct investment. See, for example, Aitken and Harrison (1999), Harrison and McMillan (2003), Eskeland and Harrison (2003), and Figlio and Blonigen (2000).

[2] The existing literature does not provide any direct guidance on whether multinational or local firms might be more likely to have dollar-denominated debt. Allayannis, Brown and Klapper (2003) study how firms choose between foreign and local debt but do not distinguish between local firms and multinational affiliates. This paper also points out how illiquidity in derivative markets might affect the capital structure and performance of firms during currency crises. Caballero and Krishnamurthy (2003) and Bris and Koskinen (2002) also indicate theoretically how different investment opportunities might motivate different currency denominations for financings.

literature. Section 3 identifies the depreciation episodes and describes the data set for local firms and multinational affiliates. Section 4 presents results on the relative performance of local and multinational firms around the depreciation episodes. Section 5 considers the role of product market exposures in dictating the differential performance of local firms and multinational affiliates while Section 6 considers the role of financial constraints. Section 7 briefly discusses some additional explanations, and Section 8 concludes.

2. Related Literature and Empirical Methodology

The comparison of local and multinational firms in the wake of depreciations helps clarify the conflicting evidence on whether depreciations stimulate economic growth and addresses more general questions about the extent to which financial constraints limit growth. This section outlines our empirical approach and links our work to the relevant literatures.

2.1 Firm Performance During Currency Crises

Since firms based in a particular country in the tradable sector incur at least some costs in local currency terms, sharp depreciations are believed to increase competitiveness by raising the price of imports (causing consumers to substitute toward domestically-produced goods) and by lowering production costs relative to foreign competitors (providing a cost advantage in export markets).[3] As a consequence, depreciations are expected to create incentives for both affiliates and local firms in the depreciating country to expand. There is some evidence that firms do respond to these competitiveness effects. Krueger and Tornell (1999) provide empirical evidence at the sectoral level, and Aguiar (2002) and Forbes (2002a, 2002b) provide empirical evidence at the firm-level.[4] In particular, Forbes (2002b) shows that firms with greater foreign sales exposure are more likely to have higher growth in sales, net income, market capitalization, and assets after depreciations.

[3] An important determinant of the magnitude of these effects is the extent to which exchange rate movements are "passed through" into local prices. Numerous studies, many of which are summarized in Goldberg and Knetter (1997), find that exchange rate pass through is incomplete.

[4] Johnson et al. (2000) and Mitton (2002) emphasize the importance of corporate governance in determining how devaluations affect firm stock prices during the Asian crises.

Given these findings, it is somewhat puzzling that evidence on the aggregate effect of sharp devaluations on output is mixed. Agénor and Montiel (1996) and Gupta, Mishra and Sahay (2000) find that sharp depreciations do not have an unambiguously expansionary effect. Calvo and Reinhart (2000) distinguish between emerging and developed markets and conclude that currency crises in emerging markets are more likely to have large contractionary effects.

These mixed results, and especially the differential effect of devaluations in emerging and developed markets, have motivated several papers investigating factors that might offset the positive competitiveness effects described above. Most of this work considers how sharp depreciations can increase financial constraints.[5] In a costly state verification model, Bernanke and Gertler (1989) show how deteriorating balance sheets can play an important role in explaining patterns of macroeconomic activity. When a large share of liabilities is denominated in a foreign currency, as is common in emerging markets, depreciations can aggravate credit constraints and worsen balance sheets, thereby hindering investment.[6]

As noted by Stein (2003), these macroeconomic models are closely related to the larger literature that links financial constraints, stemming from various factors, to investment. This literature typically isolates a shock to one part of a firm and examines how leverage, stock prices, or cash flow (as in Lang, Ofek and Stulz (1995), Peek and Rosengren (1997) and Lamont (1997), respectively) determine a firm's subsequent investment behavior. A comparison of the responses of local and multinational firms has an advantage relative to these studies. The shock is expected to improve investment opportunities while increasing leverage at the same time, thus providing more robust identification of the link between financial constraints and investment. Indeed, Lamont

[5] Several papers, such as Edwards (1989) and Reif (2001), instead focus on how depreciations can raise the cost of imported inputs, thereby diminishing any positive competitiveness effect on firm performance.
[6] See Aghion, Bachetta and Banerjee (2001) and Caballero and Krishnamurthy (2001) for formal models of how depreciations can interact with credit constraints to cause large output contractions. For a review of the extensive evidence on capital market imperfections and investment, see Hubbard (1998).

(1997) concludes with the suggestion that sharp depreciations might usefully be employed to investigate how financing constraints restrict investment.[7]

Existing work that investigates currency crises and the interaction of competitiveness effects and credit constraints has not reached definitive conclusions. Both Aguiar (2002) and Bleakley and Cowan (2002) attempt to determine which effect dominates, but the two papers reach opposing conclusions.[8] Comparing the responses of multinationals and local firms provides further insight on this question since multinational firms have greater access to internal international product and capital markets than local firms. Detailed data on the extent to which multinational firms actually access these international markets allow us to test the extent to which distinct mechanisms drive differential responses.[9]

2.2 Firm Performance and Access to International Markets

One hypothesis which may explain differential performance following depreciations is a differential ability to overcome financial constraints. A large body of work indicates that access to international sources of capital can allow firms to overcome constraints associated with local capital markets, especially in emerging markets. Some of this evidence comes from changes in financial openness. Stulz (1999) shows that financial market liberalizations can reduce the cost of capital for local firms. Henry (2000a) and Bekaert and Harvey (2000) show that liberalizations increase stock market valuations, and Henry (2000b) shows that they also are associated with investment booms.

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[7] This link between investment and leverage is modeled as a debt overhang problem in Myers (1977), and examined empirically in Whited (1992), Lang, Ofek and Stulz (1995) and Hennessy (2003). A related literature attempts to describe the effect of financing constraints by analyzing investment-cash flow sensitivities as detailed in Fazzari, Hubbard and Petersen (1988, 2000) and Kaplan and Zingales (1997, 2000). Currency crises provides a setting where investment opportunities improve and, as argued below, financing constraints are differentially increased across types of firms, thereby circumventing some of the difficult identification issues described in those papers.

[8] Aguiar (2002) shows that balance-sheet effects significantly constrained investment in Mexican firms after the 1994 peso crisis. On the other hand, Bleakley and Cowan (2002) find that any balance-sheet effects are outweighed by the positive competitiveness effects of depreciations for firms from 5 Latin American countries between 1990 and 1999. In related work, Allayanis, Brown and Klapper (2003) find no relationship between stock market performance and the use of foreign currency debt.

[9] By comparing the investment responses of firms differentially impacted by leverage within a given industry, this empirical strategy mirrors that of examining entry by supermarket chains in regions dominated by LBO-supermarkets in Chevalier (1995). As with the results in that paper, our results indicate that differential changes in leverage lead to changes in the competitive environment of firms.

Access to global capital markets may also affect the relative performance of the subset of firms in an economy that can access those markets. Desai, Foley and Hines (2003) analyze how multinationals capitalize affiliates around the world and demonstrate that multinational affiliates substitute internal borrowing for costly external finance stemming from adverse capital market conditions. In a related vein, Desai, Foley and Hines (2004) demonstrate that affiliates of multinationals firms employ internal capital markets to circumvent capital controls in a manner that is unlikely to be available to local firms.

Differential access to global markets may also help explain aggregate patterns of FDI. Froot and Stein (1991) explain the correlation between FDI inflows and currency devaluations with a model in which capital market imperfections limit the ability of local firms to access external markets, thus giving foreign firms an advantage in bidding for assets. Aguiar and Gopinath (2003) study the frequency and terms of cross-border mergers and acquisitions subsequent to currency crises in Asia. They present evidence that foreign firms buy assets at times that local firms may be liquidity constrained.

An alternative, although not mutually exclusive, hypothesis is that affiliates outperform local firms following depreciations as a consequence of their unique product market exposures. A number of papers, including Cushman (1985), McCulloch (1989), and Lipsey (2001), present theoretical arguments and empirical evidence that imply that affiliates that direct sales to foreign markets and do not make extensive use of imported inputs benefit the most from sharp depreciations. If affiliates are more export oriented than local firms, then they might face better investment opportunities than local firms following depreciations.[10] Blonigen (1997) offers another explanation for why product market exposures might induce foreign direct investment after depreciations. In his framework, firm-specific assets (such as intangibles) become more highly valued by foreign acquirers during depreciations, since product market imperfections allow these acquirers to better mobilize those assets abroad in the more highly valued currency.

[10] There is reason to believe that affiliates are more involved in international product markets than local firms, although not more export oriented than local firms. Using aggregate data on U.S. multinational affiliates, Zeile (1997) and Mataloni (2003) point out that these affiliates account for a large fraction of U.S. trade and that they have imported more from the U.S. than they have exported to the U.S. in most years over the last two decades.

2.3 Empirical Methodology

In order to identify if multinational affiliates and local firms perform distinctively in the aftermath of depreciations, we begin our empirical analysis by evaluating firm sales, assets, and investment using the following specification:

$$
\begin{aligned}
Y_{i,j,k,t} &= \theta_1 Depreciation(t\text{-}1)_{k,t} + \theta_2 Depreciation(t)_{k,t} + \theta_3 Depreciation(t+1)_{k,t} + \theta_4 Depreciation(t+2)_{k,t} \\
&+ \theta_5 Multinational_i * Depreciation(t\text{-}1)_{k,t} + \theta_6 Multinational_i * Depreciation(t)_{k,t} \\
&+ \theta_7 Multinational_i * Depreciation(t+1)_{k,t} + \theta_8 Multinational_i * Depreciation(t+2)_{k,t} \\
&+ \theta_9 X_{i,j,k,t} + \eta_{j,t} + \alpha_i + \varepsilon_{i,t}
\end{aligned} \tag{1}
$$

where *i* is a subscript for each firm, *j* is a subscript for each industry, *k* is a subscript for each country, *t* is a subscript for each year; $Y_{i,j,k,t}$ is a measure of operating activity (such as sales growth or capital expenditures); the depreciation dummy variables are respectively set equal to 1 for observations from one year before (t-1), the year of (t), one year after (t+1), and two years after (t+2) a depreciation in country *k*; $Multinational_i$ is a dummy variable equal to 1 if company *i* is a multinational affiliate; $X_{i,j,k,t}$ is a set of firm-specific, time-varying controls including variables that account for producer-price inflation; $\eta_{j,t}$ is a set of industry-year dummy fixed effects; α_i is a firm-specific effect; and $\varepsilon_{i,t}$ is an error term. Industries are defined at the three-digit SIC level. All standard errors are clustered at the firm level to correct for serial correlation.[11]

The key variables of interest are the coefficients on the depreciation dummy variables and on these dummies interacted with the dummy variable for multinational affiliates. The depreciation dummies measure the response of local firms to depreciations, and the interaction terms capture the incremental performance of multinational affiliates relative to local firms. To facilitate calculations of the persistent effects of depreciations, we also estimate some specifications with only two depreciation dummies; the first is equal to one for observations in the year before a depreciation, and the second is equal to one for observations in the year of and each of the two years

[11] See Bertrand, Duflo, and Mullainathan (2004). Results are qualitatively similar if standard errors are clustered by country. As a robustness test, we also estimate specifications which include country/industry/year fixed effects, using industry groupings similar to two-digit SIC codes. In these specifications, it is only possible to identify a set of depreciation dummies that capture the difference between the response of multinationals and local firms to depreciations, and the sample only includes firms in countries that experience depreciations. These specifications confirm the results presented in the paper.

following a depreciation. Following Evans (1987a) and other empirical work on the growth of firms, we include the initial value of the relevant measure of operating activity when the dependent variable is measured as a growth rate.[12] All specifications include a fixed effect for each industry/year pair in order to control for time varying patterns in industry performance and investment opportunities.

Evidence of distinct responses for multinational and local firms does not, by itself, indicate the extent to which competitiveness benefits or changes in financial constraints explain differences in performance. Two kinds of tests are used to study the role of competitiveness effects. First, employing interactions with variables that measure product market exposures in the basic specification can help isolate if certain types of firm respond differentially to the depreciation. Specifically, ratios of foreign sales to sales and net foreign sales (foreign sales less inputs from abroad) to sales are created for multinational affiliates and interacted with the multinational depreciation dummies to ascertain if affiliates that are export oriented are performing distinctively. This specification also employs country/industry group/year fixed effects to better control for investment opportunities that are unique to industries within a country and year.

To provide further evidence of the extent to which differential product market exposures explain differences in the response of currency crises, we also use nearest neighbor matching estimators.[13] These estimators compare patterns in investment of affiliates and local firms that are individually matched using a set of firm characteristics. Specifically, the matching analysis uses operating exposure, measured as the correlation between a firm operating profits and the real exchange rate in the years prior to a currency crisis, and firm size. This measure of operating exposure follows the large literature on exchange rate exposures pioneered by Adler and Dumas (1984) but substitutes operating profits for firm value. Firm size is also used to match given the evidence on hedging activities and firm size, as in Allayannis and Ofek (1998). Matching affiliates and local firms on operating exposure and size allows us to test explicitly if these characteristics account for the differential performance of affiliates. Matching

[12] For other work on the growth of firms, see Evans (1987b) and Hall (1987).
[13] Abide and Imbens (2004) and Imbens (2003) detail the properties of matching estimators and the techniques that can be used to obtain them. We thank David Weinstein for the suggestion that we use this approach.

estimators are particularly advantageous in this setting as they do not require the parametric assumptions made in regression analysis.

In order to consider the role of financial constraints in explaining the differential performance of affiliates and local firms, we employ several additional tests. First, we employ interaction terms in the basic specification to determine if local firms that are most likely to face financial constraints, those that are highly levered with short term debt, are the firms that reduce investment the most. In order to consider the role of leverage changes more directly, we then link changes in operating profits and leverage to changes in investment through a specification that builds closely on the debt overhang specification of Lang, Ofek, and Stulz (1995). Since investment, leverage, and operating profits may be jointly determined, we employ depreciation episode dummies and these dummies interacted with the multinational dummy as instruments for changes in leverage and operating profits in order to obtain unbiased estimates. Firm investment in a particular year is the dependent variable in this specification, and predicted values of operating profits and leverage are independent variables. Predicted values are based on specifications using equation (1) for operating profits and leverage. These instruments should be valid if depreciations impact investment exclusively through changes in competitiveness and financing constraints, as suggested in the literature.[14] In these specifications, the coefficient on operating profits indicates the importance of changed investment opportunities arising from competitiveness effects, and the coefficient on leverage indicates the changed importance of financing constraints. As in the specification outlined in equation (1), we also include interactions with a dummy variable for multinational firms to isolate any distinct financing constraints and competitiveness effects for multinational firms.

Finally, we employ more detailed data on multinational affiliates to examine if changed financing patterns might explain the distinct reactions to currency crises. The empirical setup is similar to the one outlined in equation (1), with the exception that the

[14] One potential shortcoming of this setup is that operating profits may not adequately capture investment opportunities. If local firms increase leverage because they face poor investment opportunities, then the coefficient on leverage may simply reflect the choice of leverage in response to competitiveness effects and not the consequences of changed financial constraints. This is unlikely to be the case since depreciations should boost the competitiveness of the tradable sector, thus creating limited incentive to increase leverage.

dependent variables are measures of intrafirm financing – such as related party lending and paid-in capital. There are also no multinational dummy variables since similar data are not available for local firms.

3. The Firm-level Dataset and Depreciation Episodes

3.1. The Firm-Level Dataset

The firm-level data set used in this paper is compiled from two major sources: the Bureau of Economic Analysis (BEA), which provides information on affiliates of U.S. multinationals, and Worldscope, which provides information on local firms. The Bureau of Economic Analysis (BEA) annual survey of U.S. Direct Investment Abroad from 1991 through 1999 provides a panel of data on the financial and operating characteristics of U.S. firms operating abroad. These surveys ask reporters to file detailed financial and operating items for each affiliate, as well as information on the value of transactions between U.S. parents and their foreign affiliates. The International Investment and Trade in Services Survey Act governs the collection of the data. The Act ensures that "use of an individual company's data for tax, investigative, or regulatory purposes is prohibited." Willful noncompliance with the Act can result in penalties of up to $10,000 or a prison term of one year. As a result of these assurances and penalties, BEA believes that coverage is close to complete and levels of accuracy are high.

U.S. direct investment abroad is defined as the direct or indirect ownership or control by a single U.S. legal entity of at least ten percent of the voting securities of an incorporated foreign business enterprise, or the equivalent interest in an unincorporated foreign business enterprise. A U.S. multinational entity is the combination of a single U.S. legal entity that has made the direct investment, called the U.S. parent, and at least one foreign business enterprise, called the foreign affiliate.[15] The foreign affiliate survey forms that U.S. multinational firms are required to complete vary depending on the year, the size of the affiliate, and the U.S. parent's percentage of ownership of the affiliate. The most extensive data are available for 1994 and 1999, when BEA conducted

[15] In order to be considered as a legitimate foreign affiliate, the foreign business enterprise should be paying foreign income taxes, have a substantial physical presence abroad, have separate financial records, and should take title to the goods it sells and receive revenue from the sale. In order to determine ownership stakes in the presence of indirect ownership, BEA determines the percentage of parent ownership at each link and then multiplies these percentages to compute the parent's total effective ownership.

Benchmark Surveys.[16] BEA collects identifiers linking affiliates through time, thereby permitting the creation of a panel.

The second major source of firm-level data is the Worldscope database produced by Thompson Financial. This database provides information on local firms and contains annual balance sheet, income statement, cash flow, and general company information for companies based around the world. Firms are identified as local based on the country in which they are incorporated. Since the database is derived from publicly-available information, virtually all of the sample consists of publicly-traded companies, so that smaller and government-owned companies are underrepresented.[17] Worldscope coverage of public companies, however, is fairly extensive. For example, the September 2002 CD-ROM includes information for over 20,000 firms from 55 countries, representing over 96% of global market capitalization. While most of the Worldscope data used in this paper are drawn from the September 2002 CD-ROM, we augment these data with information from the September 1997 CD-ROM, since Worldscope reports no more than 10 years of historical company information on each CD-ROM.[18]

We merge the Worldscope and BEA data. Then we create a common set of industry codes by translating the SIC codes in the Worldscope data into the ISI codes used by the BEA, which are roughly equivalent to three-digit SIC codes. In order to limit the sample to those firms that are likely to experience competitiveness effects from

[16] In non-benchmark years, reporting exemption levels were higher and less information is collected. Although wholly-owned and majority-owned affiliates report many accounting items and information concerning operations each year, minority-owned affiliates need only file information about sales, net income, assets, employment, employment compensation, and trade with the United States in non-benchmark years. Majority-owned affiliates are foreign affiliates in which the combined direct and indirect ownership claim by a U.S. parent exceeds 50 percent.

[17] There are several limitations with this data. First, although Worldscope attempts to correct for major differences in cross-country accounting standards, significant differences may still exist for certain variables. The analysis below addresses this problem by controlling for firm fixed effects. Second, there are a number of extreme and unrealistic outliers that undoubtedly represent reporting errors. The analysis below addresses this problem by performing an extensive set of sensitivity tests that includes removing outliers. Third, there is some chance that local firms are actually affiliates of multinationals based elsewhere in the world. Since U.S. parents wholly own more than 80% of their affiliates and affiliates are rarely publicly traded, however, there is little chance that firms classified as local are in fact U.S. MNEs.

[18] We match companies across datasets based on company numbers, sedol numbers, and/or company names. Then we test if the time series across the two datasets is consistent for seven data series: cash and equivalents, total assets, total liabilities, equity, sales, net income, and sales in U.S. dollars. If the time series for each of these variables is not consistent across the two CD-ROMs, the company is not treated as a "match" across the two data sources.

depreciations, we exclude all firms that produce non-tradable goods and services.[19] We also limit the sample to data from 1991 through 1999, which is the time period available for both data sources. Finally, we exclude firms missing information for key variables, such as sales.

3.2. Depreciation Episodes

In order to identify how depreciations affect multinational affiliates and local firms, it is necessary to identify a series of depreciation episodes in emerging markets. We compute real exchange rates by first obtaining daily U.S. dollar exchange rates reported by Datastream for all available emerging markets from January 1990 through January 2000. Then we adjust these nominal exchange rates for inflation differentials using interpolated price data drawn from the IMF (2003).[20] We define depreciation episodes as periods when the real exchange rate increases by over 25% compared to the value of the exchange rate one year earlier.[21] Therefore, depreciation episodes include not only "currency crises" when a country's real exchange rate depreciates abruptly by at least 25% within a short window of time, but also periods when a country's exchange rate depreciates slowly for a cumulative depreciation of at least 25% within a year.[22]

This method of identifying depreciation episodes has two advantages over the strategies frequently used in past work. First, by focusing on depreciations over longer periods of time, it captures any large depreciations that occur in small increments (such as a 5 percent depreciation each month for several months) rather than just one-time large depreciations. Second, previous work using high frequency exchange rate data has not

[19] More specifically, the resulting sample includes firms whose main BEA industry classification is in any industry between 010 and 0390 except for 070, 108, 124, 138, 148, and 150. The sample therefore includes firms that are active in the following broad categories of activity: agriculture, forestry, and fishing; mining; and manufacturing.

[20] Price adjustments are based on annual producer prices (line 63..zf) whenever possible. If producer prices are not available, we use consumer prices (line 64..zf), or the most relevant price data available. Quarterly or monthly price information is not available for a majority of countries in the sample.

[21] If a country experiences a depreciation episode in a given year, the next year is excluded, so that a country can experience, at most, one depreciation event in any 2-year period. Moderate adjustments to the cutoff to qualify as a depreciation episode do not significantly affect the key results.

[22] Many other macroeconomic changes often accompany currency crises. For example, Beck, Demirguc-Kunt, and Levine (2003) and Caprio and Klingebiel (1999) demonstrate that banking crises often occur at the same time as currency crises in emerging markets. We emphasize large depreciations in order to identify events when firms in the tradable sector have incentives to expand, but local financial conditions may prevent firms from capitalizing on those new investment opportunities.

directly accounted for inflation. Studies often just exclude high-inflation countries, since large nominal depreciations combined with high inflation can be poor measures of real changes in competitiveness. By focusing on longer depreciation windows it is possible to adjust for differences in relative price movements and thereby calculate real, instead of nominal, depreciations. Moreover, since this analysis focuses on testing how depreciations affect firm activities, real depreciations are more relevant than nominal ones.

Next, in order to identify which countries are emerging markets, we use the classification from the back of the *Economist*.[23] We then exclude all countries for which there is no information in either of the two sources of firm-level data. Finally, we also exclude any country-years in which a country experiences inflation of over 100 percent, because it is difficult to accurately measure firm operating activity during periods of hyperinflation.

3.3. Summary Information

The resulting sample includes firms in 25 emerging markets, 15 of which experience a depreciation episode. Table 1 provides information on country coverage and the share of firms drawn from the BEA and Worldscope samples. The first column of the table shows that there is a strong clustering in depreciation episodes, with several depreciations around the time of the 1994 Mexican Peso Crisis, and another set of depreciations around the 1997-98 Asian/Russian crises.

The right-hand columns in Table 1 also show that there are roughly equal numbers of local and multinational firms across the sample period. In the group of countries that experience depreciations, 49% of the sample is classified as local firms. In the control group of countries (which do not experience depreciations), 45% of the sample is classified as local firms. No more than 15% of the total observations are drawn from any single country. Although multinational affiliates dominate the samples in Mexico and Venezuela, local firms and multinational affiliates each comprise at least 20% of the sample in every other country.

[23] The only exception is the Slovak Republic that is not included in the section on emerging markets or developed countries in the back of the *Economist*. We classify the Slovak Republic as an emerging market (which is the same classification as the Czech Republic).

Table 2 provides descriptive statistics for the variables used in the empirical analysis, separated for local firms and multinational affiliates. The bottom of Table 2 also reports descriptive statistics for the variables only available for multinational affiliates and used in Section 5. Appendix Table 1 provides information on the number of affiliates and local firms by industry.

4. Firm Performance during Currency Crises

In order to investigate the relative performance of multinational affiliates and local firms during currency crises, we begin with a simple, bivariate comparison of their differential reactions. Figure 1 suggests that the response of multinationals to depreciations, as measured by the growth in sales and assets, is quite distinctive from that of local firms. Panel A shows that the median sales growth of multinational affiliates is almost identical to that of local firms in the year prior to depreciations. In the year of, and each of the two years following depreciations, however, the median sales growth of multinational affiliates exceeds that of local firms by considerable margins. While median sales growth for multinational affiliates is higher after depreciations than before, median sales growth for local firms is lower after depreciations than before.

Panel B illustrates similar patterns for median asset growth rates. Although multinational affiliates have slightly lower asset growth than local firms in the year before depreciations, multinational affiliates have median asset growth more than twice as large as local firm asset growth in the year of and the two years after depreciations. The asset growth of multinational affiliates exceeds its pre-depreciation level in the year of and the two years after depreciations, but the asset growth of local firms increases by only a modest amount in the year of a depreciation, and then falls below its pre-depreciation levels.

A similar analysis of leverage and operating profitability presented in Figure 2 also shows substantial differences across the two types of firms. These patterns support a potential role for both financing constraints and competitiveness benefits in explaining why affiliates increase assets and sales more than local firms during depreciations. Leverage is measured as the ratio of current liabilities and long term debt to assets and Panel A shows that affiliates have slightly lower levels of leverage than local firms in the

year before depreciations. Although local firms experience increases in leverage in the year of a depreciation that persist in the following two years, affiliates experience only a temporary increase in leverage in the year of a depreciation.

Panel B of Figure 2 shows patterns in operating profitability, which is defined as the ratio of sales less operating expenses to sales.[24] It shows that in the year before depreciations, affiliates experience operating profitability that is approximately 1 percentage point greater than local firms. Operating profitability increases for both types of firms in the year of depreciations, suggesting that companies immediately benefit from competitiveness effects. In the year following depreciations, median operating profitability of both types of firms contracts, but remains above pre-depreciation levels. The descriptive data for the two years after depreciations indicate that the operating profitability of local firms and affiliates diverge. Since firms drop in and out of the sample in this bivariate analysis, it is critical to employ firm fixed effects in the following regression framework to see if these patterns persist in a more thorough analysis.

Table 3 analyzes the levels and growth of sales and assets around the time of depreciations using the specification in equation (1). The dependent variable in columns 1 and 2 is the log of sales (measured in nominal local currency units), so that the coefficients on the depreciation dummies are interpreted as the value of sales relative to mean firm sales, after controlling for individual industry/year fixed effects. The coefficient estimates in column 1 indicate that sales of local firms increase slightly at the time of depreciations, and then fall below their pre-depreciation levels in the year after and two years after a depreciation. The coefficient estimates of -0.0787 and -0.1270 on the $\text{depreciation}_{t+1}$ and $\text{depreciation}_{t+2}$ dummies imply, relative to the -0.0712 coefficient on the $\text{depreciation}_{t-1}$ dummy, that sales are 0.7 and 5.6 percentage points lower in the year following and two years following a depreciation, as compared to the year before a depreciation. An F-test indicates that the difference between the level of local firm sales in the year before a depreciation and the level two years after a depreciation is only marginally significant at the 10% level. The coefficients on the multinational depreciation interactions, however, indicate that sales of multinational affiliates do not

[24] Operating expenses include selling, general, and administrative expenses but exclude interest expenses. Therefore, they do not reflect financing costs but do include some fixed costs.

decline after depreciations. The large, positive and significant coefficients on the post depreciation dummies for multinationals imply that affiliate sales increase relative to the sales of local firms after depreciations.

Column 2 of Table 3 presents results for the same specification as in Column 1, except the dummies for the year of a depreciation and the two subsequent years are combined into a single dummy variable that is equal to one for all three of these years. The -0.0852 coefficient on the post depreciation dummy is slightly less than the dummy capturing the pre-depreciation level of sales, indicating a small but statistically insignificant decline in sales for local firms, on average, after depreciations. The level of sales of multinational affiliates is indistinguishable from that of local firms in the year before a depreciation. The 0.0841 coefficient on the interaction between the multinational and post depreciation dummy, however, implies that the sales of affiliates are 8.4 percentage points higher than the sales of local firms after depreciations.

Columns 3 and 4 of Table 3 analyze sales' growth rates (measured as the difference in log values) instead of the level of sales.[25] This approach has the advantage of automatically excluding multinational affiliates that are extremely small and only appear in benchmark years, thereby ensuring that the results are not merely a byproduct of large changes in small affiliates. The coefficient estimates are deviations from average growth rates. The estimates suggest that multinational affiliates have faster sales growth than local firms after depreciations. More specifically, column 3 indicates that in the year of and year after depreciations, local firms experience significantly lower average sales growth than before depreciations. In contrast, multinational affiliates have higher sales growth than local firms after depreciations, and this difference is highly significant in the year following depreciations. These patterns are even clearer in Column 4 when the years following depreciations are considered jointly. Local firms have significantly lower sales growth after depreciations while the sales growth of multinational affiliates is 5.4 percentage points faster than that of local firms following depreciations.

[25] Since lagged values are required to compute growth rates, all observations from 1991 and all other observations of local firms and multinational affiliates that did not report in the previous period are dropped from the analysis.

The last four columns of Table 3 repeat this analysis but employ the log of assets instead of sales as the dependent variable. Using firm size, as measured by assets, allows us to investigate if the output effects identified above are also associated with greater firm scale. The results indicate that multinationals expand assets more than local firms subsequent to depreciations. Column 5 shows that local firms' asset levels increase in the year of a depreciation, and then contract in the two subsequent years, so that after a depreciation asset levels for local firms are statistically indistinguishable from their pre-depreciation levels. In contrast, multinational affiliates' asset levels increase significantly after depreciations and remain significantly above their pre-depreciation levels in the two years after depreciations. The results in column 6 confirm that the asset base of multinational affiliates expands by significantly more than the asset base of local firms after depreciations.

The last two columns in Table 3 employ asset growth as the dependent variable, instead of the log of assets. Column 7 suggests that average asset growth for local firms was slightly higher in the year of depreciations than before, but significantly below average (by 6.2 and 5.0 percentage points, respectively) in the two years following depreciations. In contrast, asset growth for multinational affiliates significantly exceeded that for local firms in the year of depreciations. The difference in growth rates is a statistically significant 15 percentage points. Column 8 confirms that the asset growth of multinational affiliates was significantly greater than that of local firms in the period during and after depreciations.

Table 4 analyzes the investment behavior of local and multinational firms during depreciations. It uses two measures of investment as dependent variables: the log of capital expenditures and capital expenditures scaled by net property plant and equipment. Column 1 shows that although capital expenditures are not significantly different from their mean levels for local firms in the year before or year of depreciations, investment falls significantly in the two years following depreciations. In contrast, capital expenditures increase significantly for multinational firms in the two years after depreciations. The results in column 2, using a single post-depreciation dummy, confirm these conclusions. Investment by local firms is 21 percentage points below pre-depreciations levels after depreciations. Investment by multinational affiliates after

depreciations, however, is 34 percentage points higher than investment by local firms, and F-tests indicate that the level of affiliate capital expenditures in the year of and year following a depreciation differ from the level in the year before a depreciation by amounts that are statistically significant at the 5% level.

Different levels of investment between multinational affiliates and local firms may simply reflect differences in their scope of activity following depreciations, instead of differences in the investment responses of entities of a similar size. To rule out this possibility, columns 3 and 4 of Table 4 use capital expenditures scaled by end-of-period net property, plant and equipment (PPE) as the dependent variable. The results confirm those reported in columns 1 and 2. After scaling by net PPE, local firm investment falls below pre-depreciation levels after depreciations, but multinational affiliate investment does not.

The evidence presented in Tables 3 and 4 demonstrates the differential reaction of multinational affiliates and local firms to currency crises. As discussed in Section 2, the competitiveness benefits of sharp depreciations would be expected to boost firm sales, assets and investment, but these effects could be outweighed by changed financing constraints. The results showing the distinctive response to currency crises between these two types of firms are consistent with two hypotheses. First, it is possible that both types of firms benefit from competitiveness effects, but local firms experience large changes in financial constraints that counteract any competitiveness effects from depreciations. Alternatively, competitiveness effects may be stronger for multinational affiliates, and these effects alone may drive the differences in relative performance.

5. Product Market Exposures and Differential Investment Responses

We employ two related, but distinct, approaches to investigate if differential investment opportunities arising from product market exposures explain the observed differential investment response of local firms and multinational affiliates.

5.1. Affiliate Product Market Exposures

If multinational affiliates are outperforming local firms because of differential product market exposures, relative performance *amongst* affiliates should be a function of

their product market exposures. Fortunately, the detailed multinational affiliate data allow for the creation of ratios of foreign sales to sales and net foreign sales (foreign sales less imported inputs) to sales to capture the degree to which affiliates are well-positioned to capitalize on the depreciations. We use these ratios as part of interaction terms in tests based on the specifications employed above. In these specifications, we also include more stringent fixed effects to further control for investment opportunities. Specifically, country/industry group/year fixed effects are included. Since these fixed effects are collinear with the depreciation dummies, these specifications only yield estimates of the activities of affiliates relative to local firms in years around the time of depreciations, and these estimates are the coefficients on the depreciation dummies for multinationals. Interaction terms using the ratios described above capture the extent to which the relative performance of affiliates differs for export oriented affiliates. The sample only includes firms in countries that experience crises since firms in other countries do not help identify the magnitude of the industry effects that are now country specific. Table 5 displays results of tests using this approach.

The dependent variable in the specifications presented in columns 1 and 2 is the log of firm capital expenditures, as in columns 1 and 2 of Table 4. The specification in column 1 includes the foreign sales share of affiliates, defined as the average share of affiliate sales outside of the affiliate's host country in the three years preceding a depreciation, interacted with the depreciation dummies for affiliates. In this setting, the coefficients on the multinational depreciation dummies indicate the relative performance of multinational affiliates that have no foreign sales, and the interaction terms indicate the extent to which the relative effects of depreciations differ for affiliates that sell abroad. Specifically, the 0.0411 coefficient on the dummy for multinationals in the year prior to depreciations and the 0.3917 and 0.3520 coefficients on the dummies for multinationals in the year following and two years following depreciations imply that affiliates with no foreign sales increase investment by about 30% more than local firms, a result that approximates the basic results presented in Table 4. The –0.4308 coefficient on the foreign sales share variable interacted with the dummy that is equal to one for affiliates in the year before a depreciations and the small and insignificant coefficients on these interaction terms for years after the depreciations indicate that affiliates focused on

serving markets outside of their host country have low levels of depreciation relative to other affiliates (and local firms) prior to depreciations, but levels of investment that are similar to those of other affiliates (and higher than local firms) following depreciations.

The specifications presented in columns 2-4 provide additional evidence that product market exposures provide an incomplete explanation for differences in how depreciations affect the investment of affiliates and local firms. In the specification presented in column 2, the net foreign sales share, defined as the average affiliate share of sales outside the host country less the average affiliate sales share of imports from the U.S., is used in place of the foreign sales share in interaction terms. This variable captures not only the extent to which affiliates serve export markets but also the extent to which affiliates make use of a key source of imported inputs.[26] The results also reveal that affiliates that are exclusively locally focused outperform local firms by margins that approximate the results provided in Table 4. Again, affiliates with large net foreign sales invest less than locally-focused affiliates in the period prior to the depreciation, but, following depreciations, affiliates that are export oriented and affiliates that exclusively serve local markets both invest considerably more than local firms. Columns 3 and 4 provide specifications that parallel the specifications in columns one and two with the exception that capital expenditures scaled by beginning of period net ppe is the dependent variable. Again, locally focused affiliates appear to increase investment by more than local firms following depreciations by margins that are similar to those provided in Table 4.

5.2. Matching Analysis

The prior analysis of the extent to which the differential investment response of affiliates can be explained by affiliate product market exposures is informative but can be criticized on several grounds. The measures of product market exposure use data on the location of buyers and suppliers, not the currency denomination of sales and input purchases, and these may differ. Consequently, real exposures may not be fully captured by these measures. Furthermore, since detailed data on the sales and input purchases of individual local firms are not available, comparing effects for different kinds of affiliates

[26] Ideally, we would like to use data on imports of inputs from all foreign countries, but such data are not collected.

to average effects for local firms may not be appropriate. In order to address these concerns, we employ matching estimators that compare patterns of investment of individual affiliates and local firms that are matched according to their operating exposures to exchange rates.

Table 6 presents estimates of the average effects on investment of being a multinational affiliate as opposed to a local firm during a sharp depreciation. In parallel with the analysis in Table 4, capital expenditures scaled by net PPE in the year following a depreciation and the change in the log of capital expenditures from the year before a depreciation to the year following a depreciation are employed as outcome variables. Estimates of the differential response of affiliates relative to local firms are obtained using nearest neighbor matching across estimates of the operating exposure of firms to exchange rates prior to the depreciations in addition to firm size and country and industry characteristics.[27]

To obtain the results presented in the top panel, each affiliate is matched with the four nearest local firms and each local firm is matched with four affiliates.[28] Specification 1 includes the correlation of the real exchange rate and the ratio of operating profits to sales in the pre-depreciation period in order to ensure that affiliates are compared to local firms that have a similar exchange rate operating exposure. The log of firm sales, GDP per capita in the firm's country, and lagged values of the outcome variables (either the ratio of capital expenditures to PPE or the log of capital expenditures) as well as the squared values of all of these variables are also used as matching variables in specification 1 to ensure that matches incorporate differential size and country characteristics. In addition, each specification is run twice – once with and once without constraints that increase the likelihood that matches are drawn from within the same country/industry cells.[29]

[27] In order for use of matching estimators to be appropriate, it must be the case that assignment to multinationals during a crises is purely random for firms with similar pretreatment characteristics. These estimators are not subject to the biases that can result when using an OLS approach if there are wide differences between distinct types of firms studied.

[28] In the case of ties, there may be more than four matches.

[29] This technique includes country/industry group fixed effects as matching characteristics and places an arbitrary high weight on these characteristics. See Abide, Drukker, Herr, and Imbens (2001) for additional details on the "exact" matching technique.

The 0.1086 coefficient on the estimated difference in mean scaled capital expenditures implies that on average capital expenditures, as a share of net PPE, are 10.8% higher for affiliates relative to matched local firms in the year following depreciations. The 0.1008 coefficient in the third row illustrates that this result is robust across specifications that do and do not draw matches more heavily from within country/industry group cells.[30] Estimates of differences in changes the log of capital expenditures presented in the last column also indicate that affiliates respond differently to depreciations than matched local firms. Affiliates increase investment over pre-depreciation levels by approximately 60% more than matched local firms.

In order to consider the relevance of similar operating exposure to the differential investment performance of local firms and affiliates, specification 2 no longer includes the correlation that measures operating exposures and the square of this correlation as matching criteria. As such, firms are just being matched on size and country characteristics. If differences in operating exposures were driving differences in the investment responses of affiliates and local firms, then estimates of the effects of being an affiliate subsequent to depreciations obtained using specification 1 and 2 should differ. As Table 6 makes clear, estimates of the affiliate effect does not appear to be a function of matching on operating exposures. This is further evidence that differential product market exposures are not pivotal in explaining why affiliates outperform local firms in the aftermath of the depreciation.

Specification 3 and the specifications in the bottom panel of Table 6 provide robustness checks on the results from the first two specifications. Specification 3 no longer employs the squared terms from specification 1 and yields similar estimates of the affiliate effect. The bottom panel repeats the analysis of the top panel, but affiliates and local firms are now only matched with one other firm instead of four other firms, and the results do not differ in a significant way.

6. Financial Constraints and Differential Investment Responses

[30] When affiliates and local firms are matched using the technique that attempts to require matches be drawn from within country/industry group cells, characteristics of matched local firms differ in statistically significant ways from the characteristics of affiliates. Mean sales, country GDP per capital and operating exposure measures are all higher for local firms. However, when matching does not impose this constraint, these characteristics are indistinguishable across the matched groups.

Given the insufficiency of differences in investment opportunities arising from product market exposures in explaining differences in the effects of depreciations on affiliates and local firms, we now consider an explanation related to the onset of financial constraints.

6.1. Local Firms and Leverage Differences

If financial constraints contribute to the relative underperformance of local firms, then relative performance *amongst* local firms should be dictated by the level and composition of leverage prior to the depreciation. While data on the duration of debt is not available for multinational affiliates, data on the level and duration of debt is available for local firms. As with the analysis of foreign sales exposures of multinational affiliates, we employ interaction terms in the basic specifications from Table 4 to analyze if highly levered local firms, particularly those with short-term debt, experienced the sharpest reductions in investment subsequent to depreciations. Table 7 presents the results for this analysis.

The specifications presented in columns 1-3 employ the log of capital expenditures as a dependent variable and the interaction terms of interest are those that discriminate amongst local firms on the basis of the level and duration of their leverage prior to the depreciation. Specifically, the median level of leverage and the median ratio of short term debt to total debt are employed to create dummy variables that isolate if local firms above and below those medians feature distinctive performance. In these three specifications respectively, the coefficients on the post-depreciation dummy alone indicates how local firms with high leverage, high amounts of short term debt or firms with both characteristics respond to the depreciations. In turn, the interaction terms indicate how the remaining local firms respond relative to this baseline coefficients.

In column 1, the coefficients indicate that local firms with high leverage are the firms associated with the low investment response. Indeed, the coefficients on the post-depreciation dummy and that variable interacted with the low leverage dummies are of comparable absolute value indicating that local firms with low leverage do not experience a sharp investment drop. In column 2, the composition of debt is emphasized, and, similarly, firms with low amounts of short term debt do not experience a sharp

investment drop. Finally, in column 3, the roles of the level and composition of debt are jointly considered and the results are even more stark. Local firms with low leverage and low amounts of short term debt experience investment increases subsequent to the depreciation as the coefficient on the relevant interaction term is greater, in absolute value, than the coefficient on post-depreciation dummy alone. The coefficients on the depreciation dummies interacted with the multinational dummy indicate that the increase in investment experienced by this set of local firms is similar in magnitude to the increase in investment of affiliates.

As with the analysis in Table 4, columns 4-6 consider if these results are robust to consideration of the ratio of capital expenditure to net PPE. The results in these columns are similar to those provided in columns 1-3. The average investment experience of local firms obscures much heterogeneity that is associated with their level and composition of leverage prior to the depreciation.

6.2. Leverage and Investment: IV Analysis

In order to consider further the effect of financial constraints induced by depreciation on investment while controlling for competitiveness effects, we link changes in competitiveness and financial constraints to investment using depreciation episodes as instruments. We begin by examining specifications that serve as first stage regressions that estimate the effect of depreciations on operating profits, which is a measure of competitiveness effects, and leverage, which is a measure of changed financing constraints. The specifications in columns 1 and 2 of Table 8 employ the log of operating profits as the dependent variable in specifications similar to those presented in Tables 3 and 4. The results indicate that in the year of and two years after depreciations, operating profits of local firms exceed their pre-depreciation levels. F-tests indicate that these differences are significant at the 1% level for the year of depreciations, 10% level for the year after depreciations, and 5% level for the second year after depreciations. The operating profits of multinational affiliates also increase after depreciations, but are not significantly different from the levels for local firms in the year before, the year of, and the year after depreciations. In short, sharp depreciations are associated with significant

improvements in operating profits for both local firms and multinational affiliates, suggesting that competitiveness effects are important for both sets of firms.[31]

To test for the presence of distinctive changes in financial constraints across the two sets of firms, columns 3 and 4 of Table 8 employ leverage as the dependent variable in specifications similar to the specifications in columns 1 and 2. Leverage is measured as the ratio of a firm's current liabilities and long term debt to assets. The leverage of local firms increases significantly in the year of depreciations, but the leverage of multinational affiliates does not. In fact, local firm leverage increases to levels higher than both average and pre-depreciation levels in the year of and each of the two years following depreciations. These increases are expected if firms borrow in foreign currency and are not able to improve their balance sheets after a currency crisis. The coefficients on the interaction terms with the multinational dummy variables, however, show that leverage does not increase for affiliates. While both types of firms appear to experience similar competitiveness benefits after depreciations (as measured by changes in operating profits), only local firms experience large changes in leverage. This suggests that financing constraints are limiting local firm responses, but not multinational affiliate responses, to depreciations.

To more rigorously test this interpretation, we extend the above analysis by linking the changed operating profits and leverage arising from depreciations to observed patterns of investment. As discussed above, investment, leverage, and operating profits may be jointly determined. Therefore, depreciation episode dummies and these dummies interacted with the multinational dummies are used as instruments for changes in leverage and operating profits. The log of capital expenditures is the dependent variable in this specification, and predicted values of operating profits and leverage are independent variables. The first stage specifications used to obtain predicted values are the same as the specifications presented in Table 8. In the specifications provided in Table 9, the coefficient on operating profits indicates the importance of changed

[31] Since the results in Table 3 indicate that the sizes of local firms and affiliates change around the time of depreciations, it is informative to examine local firm and affiliate operating profitability, or operating profits scaled by sales. These results are broadly consistent with those presented for operating profits. Similarly, gross profits, a measure of profits that does not incorporate overhead expenses but is only available for local firms, also provides evidence of increased profitability subsequent to depreciations.

investment opportunities arising from competitiveness effects and the coefficient on leverage indicates the importance of changed financing constraints.[32] The interactions with a dummy variable for multinational firms isolate the distinct effect of financing constraints and competitiveness benefits for multinational firms.

We first estimate specifications that only include controls for either leverage or operating profits plus the standard controls for the prices, industry/year fixed effects and firm fixed effects. Column 1 of Table 9 indicates that firms with higher leverage after depreciations tend to have significantly lower levels of investment. Column 2 shows that firms with higher operating profits after depreciations tend to have significantly higher levels of investment. Column 3 controls for both effects simultaneously. The –2.04 coefficient on leverage implies that when depreciations increase the ratio of debt to assets by 10 percentage points, investment declines by more than 20%. The 0.98 coefficient on the log of operating profits implies that when depreciations increase operating profits by 10%, capital expenditures increase by 9.8%.

Columns 4-6 repeat the specifications from columns 1-3, but allow the coefficients on leverage and/or operating profits to vary across multinational and local firms. The results in column 6 demonstrate that changes in leverage inhibit investment for local firms, but not for multinational affiliates. The effect of operating profits is positive and significant for local firms, and is statistically indistinguishable for multinational affiliates. Results are similar if we scale capital expenditures by end-of-period net property, plant and equipment, or if we use operating profitability instead of operating profits. These results provide further support for the implications of the previous analysis. Both multinational affiliates and local firms receive competitiveness benefits after depreciations. These benefits motivate increases in investment, but leverage

[32] Tobin's Q is often used in investment specifications to characterize investment opportunities. Not only is this measure problematic—especially in emerging markets where stock market valuations may not reflect underlying fundamentals—but clean measures of Tobin's Q are unavailable for multinational affiliates since these firms are not publicly traded. Therefore, we rely on operating profits and industry/year fixed effects to proxy for changed investment opportunities. As a robustness test, we have also included fixed effects for each country/industry/year to capture investment opportunities more precisely. Specifications with these fixed effects are estimated using only firms in crisis countries and leverage and competitiveness effects are identified off of differences in the responses of local firms and affiliates. The results also show that changes in leverage induced by depreciations constrain investment.

constrains the ability of local firms (but not multinational affiliates) to take advantage of these benefits and actually increase investment.

6.3. The Financing of Multinational Affiliates During Sharp Depreciations

While more granular data on local firms is not available, a closer look at the behavior of multinational affiliates provides further evidence on precisely how they circumvent financing constraints. Table 10 presents regressions that examine growth in different components of affiliate financing subsequent to depreciations. The results in columns 1-3 demonstrate that local debt, foreign debt (debt borrowed from non-local persons), and related party debt (debt borrowed from an affiliate's parent) all increase significantly in the year of depreciations. There are two interpretations of these results. First, new capital may flow to affiliates in one of these forms of debt. Second, if debt is denominated in foreign currency, then the reported increase in debt may simply reflect a revaluation of existing loans to reflect the depreciation. This revaluation of existing debt would not necessarily include any new flows of capital. Since increases in debt occur in the year of depreciations and are larger for debt from foreign sources (which is more likely to be denominated in foreign currency), this revaluation effect may explain at least some part of the growth in debt to multinational affiliates.

Examining changes in paid-in-capital provides cleaner measures of new capital infusions from the parents of affiliates. Paid-in-capital consists of the initial capital stock of an affiliate and any new equity infusions. This measure does not include retained earnings. Since this component of financing is measured in dollars, using historic exchange rates for translation when necessary, changes in the growth of paid-in-capital cannot be explained by changes in currency valuations.

Column 4 of Table 10 reports regression results where the dependent variable is the growth in paid-in-capital. The paid-in-capital of multinational affiliates increases in the years following depreciations, although this increase is only significant in the year after a depreciation. The coefficient estimates suggest that the paid-in-capital of multinational affiliates increases by 10.8% in the year after depreciations. This result provides direct evidence that new equity infusions from parent companies enable multinational affiliates in emerging markets to capitalize on investment opportunities

after depreciations. In combination with the evidence provided on changes in leverage and its role in influencing investment, this evidence further confirms the role of internal capital markets in allowing multinational firms to overcome financial constraints that handicap local firms.

7. Alternative Explanations

It is also possible that the relative performance of multinational affiliates and local firms reflects other factors associated with the two types of firms. First, the differential response of multinational firms could reflect over-investment by multinational firms in the aftermath of currency crises rather than constrained under-investment by local firms. In this case, the operating profitability of affiliates would likely fall relative to the operating profitability of local firms. This does not appear to be the case, however, through the sample period. Second, as hypothesized in Blonigen (1997), the depreciations could be accompanied by an increased incentive for foreign multinationals to purchase emerging market corporations and exploit their intangible assets abroad. This explanation of investment dynamics during depreciations, hypothesized in the context of U.S.-Japan mergers and acquisition activity, is less likely relevant in the emerging market setting where firms are less likely to have intangible assets worth exploiting in developed markets. Moreover, the evidence presented above is on capital expenditures and therefore is less likely to be driven by acquisitions, as hypothesized in this theory.

Finally, reduced investment by local firms could reflect the corporate governance deficiencies of local firms. Johnson et al. (2000) model this possibility and, in their model, stealing increases as investment becomes less profitable through the crisis due to the weak governance environment. The results in Table 5 suggest that the profitability of local firms in the tradeable sector does not decrease around the time of a crises, so the Johnson et al. framework does not predict an increase in stealing. However, it is possible that differences in the strength of corporate governance drive the observed results. To examine this possibility, we investigate if the distinct reactions of multinational affiliates and local firms is a function of the governance environment. To do so, we employ the country-level governance variables used in Johnson et al. (2000), split the sample at

median levels of these governance variables, and look for continued differential performance in the subsamples. Splitting the sample at the median level of judicial efficiency, rule of law, or enforceable minority shareholder rights indicates that multinationals outperform local firms in all subsamples. Only if the sample is split at the median level of accounting standards is there a subsample, the subsample of countries with poor accounting standards, where multinationals do not outperform local firms.[33] While these results do not completely reject this alternative hypothesis, our robustness tests and the links between changes in leverage and investment in the instrumental variables analysis suggest that it is primarily the impact of financial constraints that explain the differential investment responses documented above.[34]

8. Conclusion

Affiliates of multinational firms expand sales, assets and investment subsequent to depreciations, while local firms show little change (or a decrease) in each of these measures of operating activity. Results on the investment response of locally-focused multinational affiliates and results from matching estimation techniques indicate that these patterns are not driven by differential investment opportunities arising from product market exposures. There is strong evidence that the differential ability to overcome financing constraints contributes significantly to the differential performance of multinational affiliates. Local firms, but not multinational affiliates, tend to experience increases in leverage following depreciations, and those local firms with the greatest financial exposure experience the largest investment reductions. Investment specifications that employ depreciation dummies as instruments demonstrate that changes in local firm financial constraints induced by depreciations lead to differential investment performance of local firms relative to multinational affiliates. A more detailed analysis of multinational affiliates also illustrates that multinationals receive equity infusions from their parent companies after depreciations. This evidence further confirms the importance of internal capital markets to multinationals in overcoming the financing constraints that hinder local firms in the aftermath of currency crises.

[33] This analysis is unreported but available from the authors.

[34] More generally, we find that investment opportunities improve for the firms in our sample during the currency crises, however, so governance problems as modeled by Johnson et al. (2000) are unlikely to be driving our results.

These findings point to an underappreciated effect of foreign direct investment in emerging markets. The internal capital markets of multinational firms allow their affiliates to expand output after severe depreciations, precisely when economies are fragile and prone to severe economic contractions. As a consequence, multinational affiliates can mitigate some of the aggregate effects of currency crises. This analysis, however, does not explore the long-run distributional consequences of this differential impact of currency crises on multinational affiliates. Does increased economic activity due to multinationals during crises help support local firms through spillover effects such as increased demand for local inputs, improved access to trade credit, or higher levels of employment? Or does increased multinational investment crowd out activity by local firms, with potentially persistent effects? While multinational firms appear to mitigate the contractionary output effects of severe depreciations, the longer term effects on local firms remain an open question.

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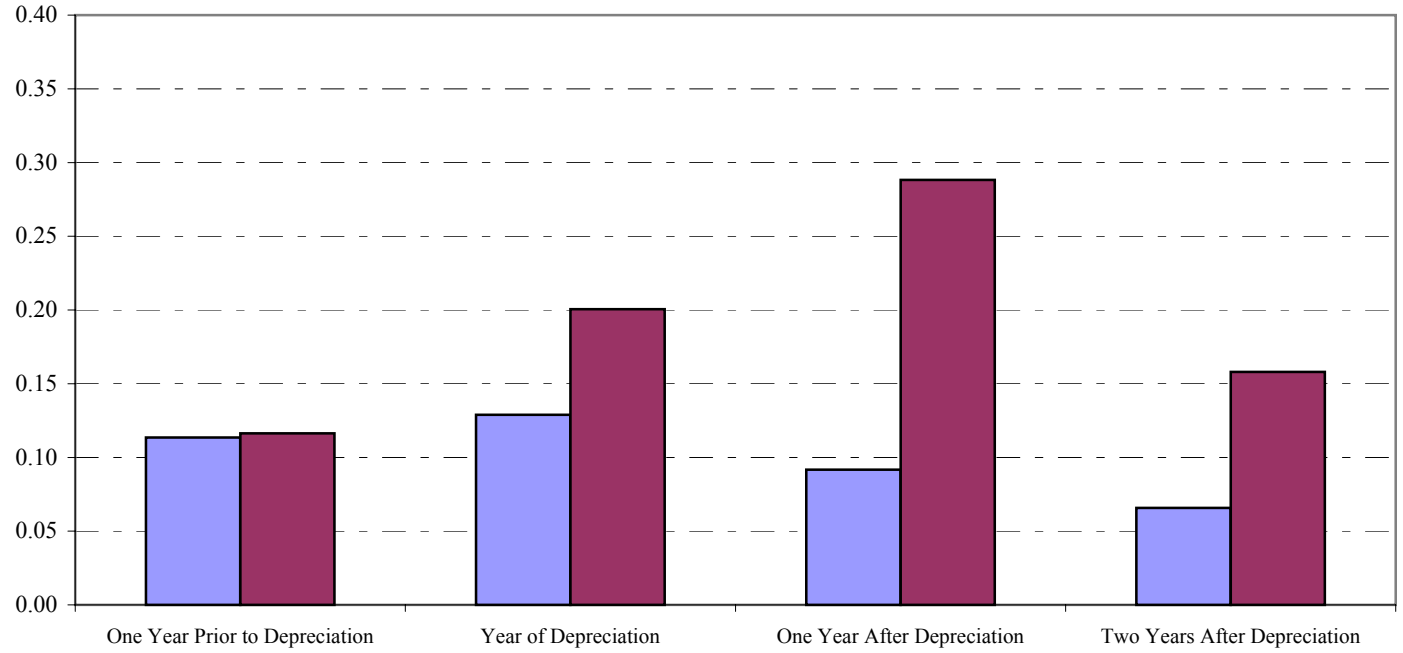
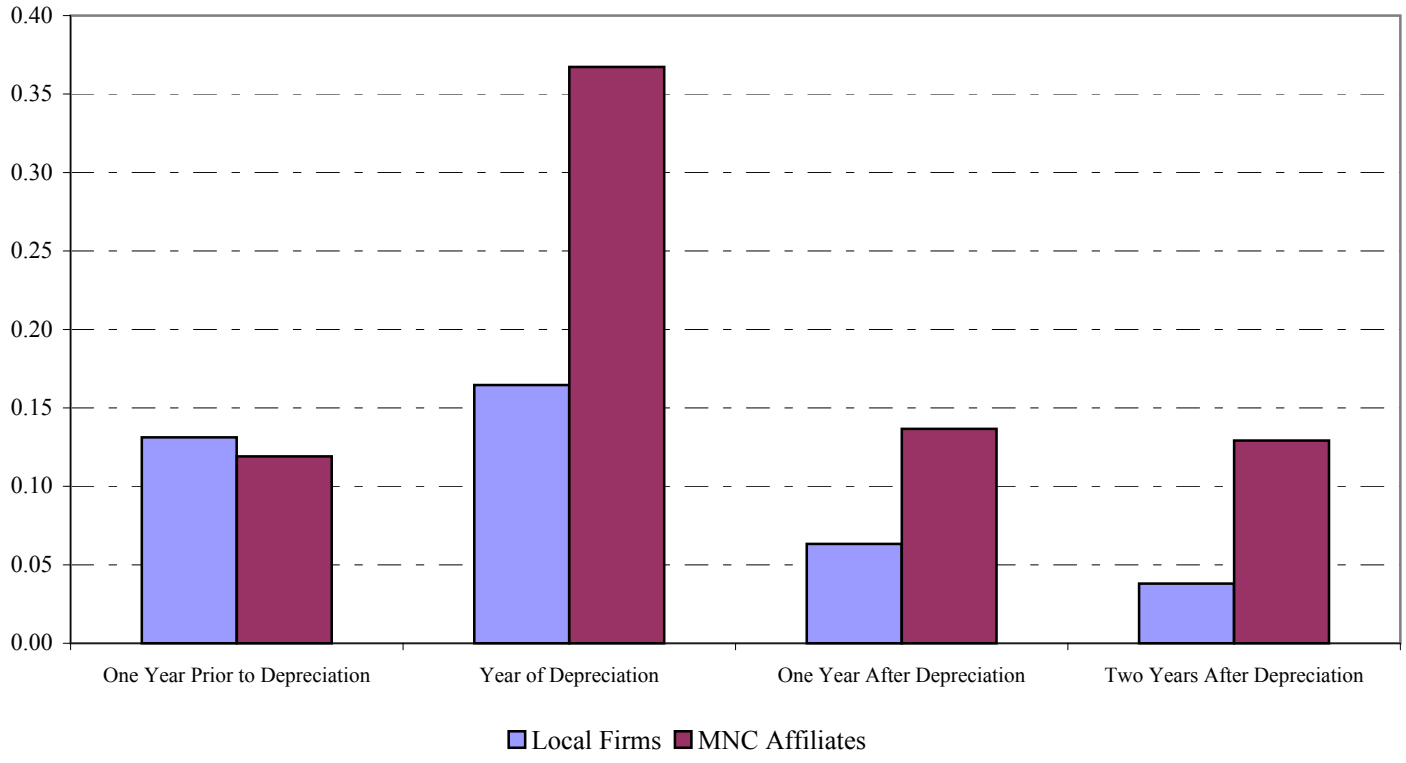
Figure 1: The Differential Response of U.S. Multinational Affiliates and Local Firms During Currency Crises

Panel A: Sales Growth



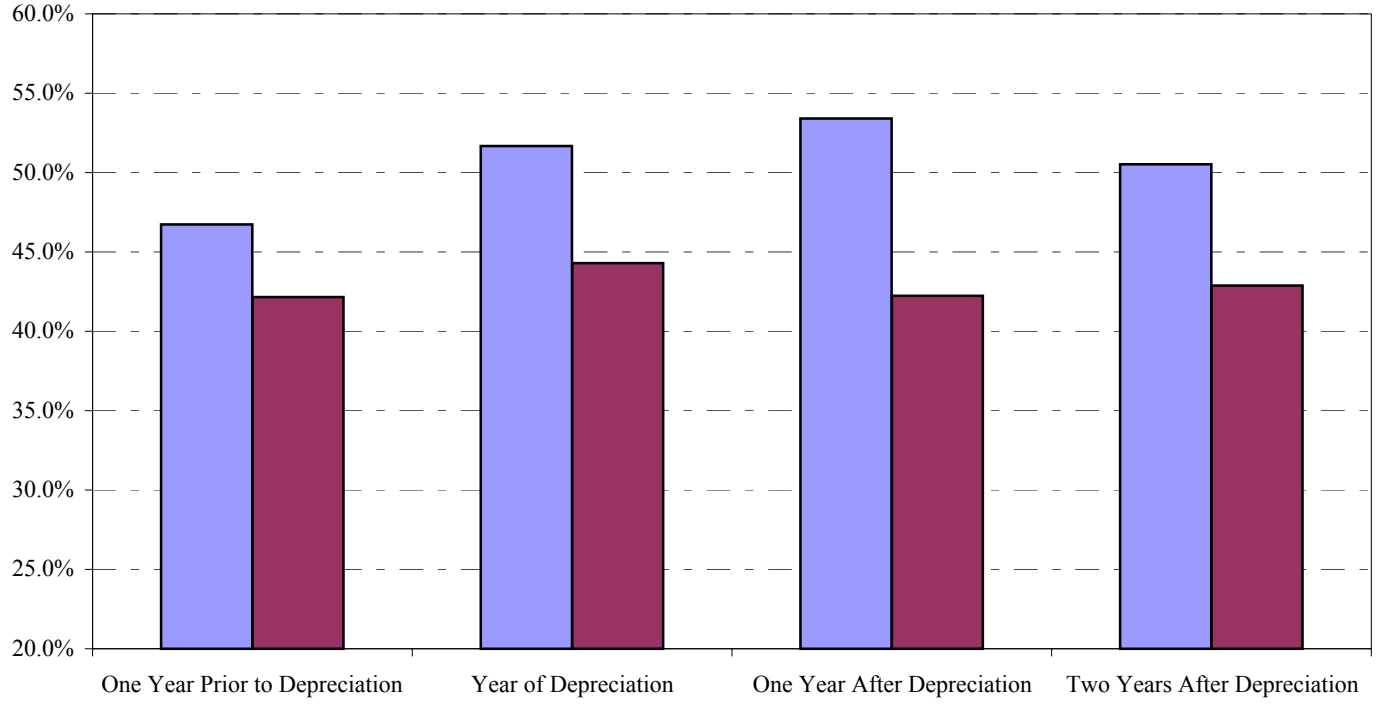
Panel B: Asset Growth



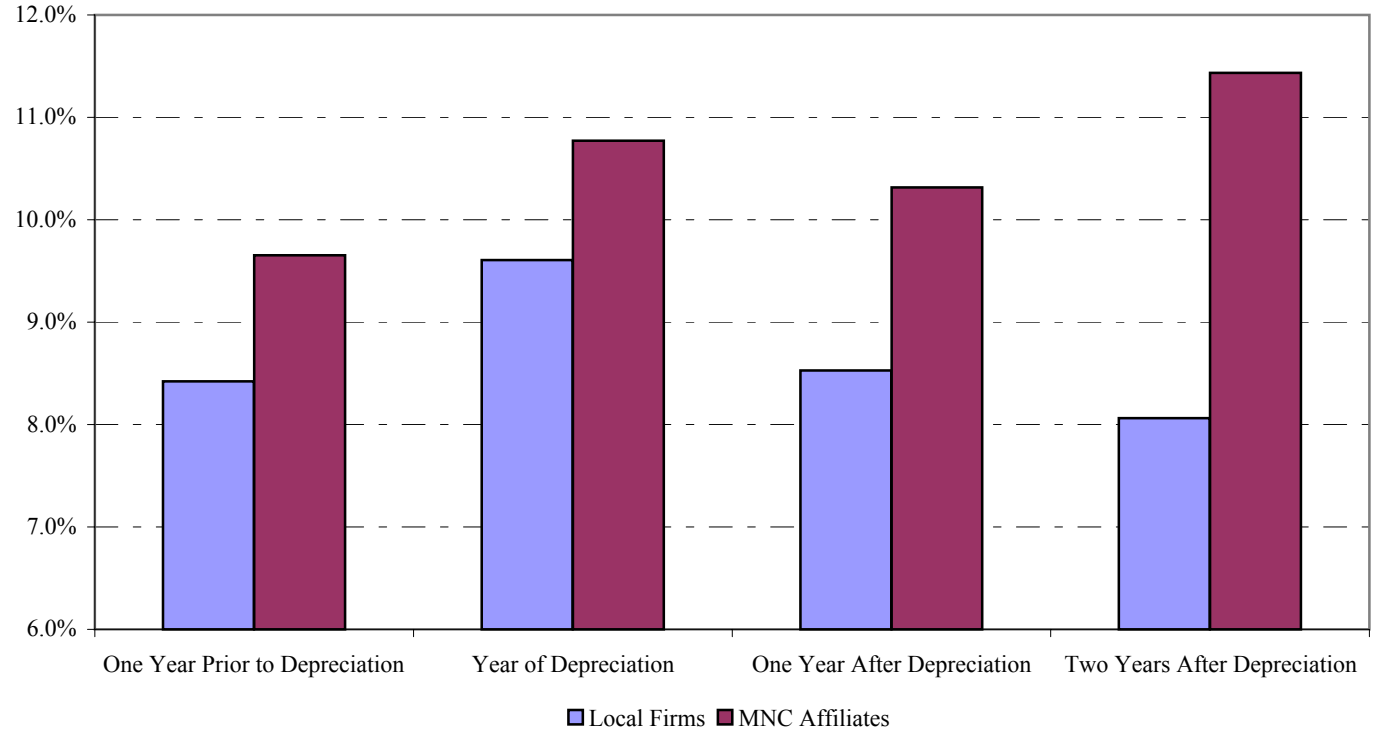
Note: The panels compare the median growth rates of sales and assets of local firms and U.S. multinational affiliates. In each panel, the pairs of bars correspond to years relative to a currency crisis. Within each pair, the first bar represents the median growth rate for local firms and the second bar represents the median growth rate for the multinational affiliates.

Figure 2: Changes in Leverage and Operating Profitability for U.S. Multinational Affiliates and Local Firms During Currency Crises

Panel A: Leverage



Panel B: Operating Profitability



Note: The panels compare the median leverage and the median operating profitability of local firms and U.S. multinational affiliates. In each panel the pairs of bars correspond to years relative to a currency crisis. Within each pair, the first bar represents the median value for local firms and the second bar represents the median value for the multinational affiliates.

Table 1
Sample Composition by Year and by Type of Firm for Emerging Markets with Currency Crises and Control Countries

	Number of Observations										% of Sample	
	1991	1992	1993	1994	1995	1996	1997	1998	1999	*All Years*	Worldscope	BEA
Depreciation Countries	1,224	1,555	1,740	2,674	2,342	2,466	2,569	2,935	4,085	21,590	49%	51%
Brazil (1999)	0	0	0	0	284	276	292	341	489	1,682	35%	65%
China (1994)	32	42	57	176	150	191	243	281	413	1,585	26%	74%
India (1991)	41	191	227	261	302	325	312	319	353	2,331	81%	19%
Indonesia (1997)	109	121	121	193	132	143	145	148	189	1,301	54%	46%
Malaysia (1997)	119	152	159	214	229	252	255	253	284	1,917	67%	33%
Mexico (1994)	277	284	289	578	275	290	297	343	585	3,218	14%	86%
Peru (1993)	0	23	33	49	30	37	38	47	70	327	56%	44%
Philippines (1997)	53	63	65	108	83	86	84	84	118	744	41%	59%
Russia (1998)	0	0	0	0	0	7	13	47	63	130	29%	71%
Singapore (1997)	110	121	127	215	163	180	186	189	242	1,533	38%	62%
South Africa (1998)	123	130	143	171	147	126	112	195	226	1,373	63%	37%
South Korea (1997)	143	154	202	281	236	229	241	301	568	2,355	70%	30%
Thailand (1997)	93	140	165	219	175	177	178	185	230	1,562	64%	36%
Turkey (1994)	54	63	77	89	67	77	96	109	139	771	58%	42%
Venezuela (1996)	70	71	75	120	69	70	77	93	116	761	13%	87%
Control Group	283	419	508	847	792	900	955	992	1,247	6,943	45%	55%
Argentina	72	79	89	139	105	109	123	133	174	1,023	22%	78%
Chile	50	59	64	103	78	82	88	100	151	775	48%	52%
Colombia	52	60	64	104	66	67	72	71	87	643	20%	80%
Czech Republic	0	0	0	0	29	56	60	61	81	287	40%	60%
Hong Kong	0	89	92	153	159	214	196	201	244	1,348	57%	43%
Hungary	0	0	21	40	31	41	44	48	66	291	28%	72%
Israel	16	35	41	61	37	34	48	50	74	396	44%	56%
Poland	0	0	26	42	58	65	73	83	106	453	39%	61%
Slovak Republic	0	0	0	5	2	7	17	17	22	70	54%	46%
Taiwan	93	97	111	200	227	225	234	228	242	1,657	64%	36%

Note: The sample includes data on U.S. multinational affiliates and local firms from all of the listed countries over the 1991-1999 period. The top panel provides sample information on the number of entities operating in emerging markets that undergo depreciations and the share of these entities that are drawn from Worldscope and BEA data. The bottom panel provides similar information on entities operating in emerging markets that do not undergo depreciations. Years in which countries experience "hyperinflation" of over 100% and country/year observations for which inflation or exchange rate data is unavailable are excluded. Country/years that are removed from the sample due to either of these criteria are: Brazil (1991-94), Czech Republic (1991-94), Hong Kong (1991), Hungary (1991-92), Peru (1991), Poland (1991-92), Russia (1991-95), Slovak Republic (1991-93). Depreciation episodes are defined as any real depreciation of the U.S. dollar exchange rate over 25% during any one-year period from January 1991 through December 1999. Nominal exchange rates are adjusted for inflation differentials using producer prices (whenever possible). If a country experiences a depreciation episode in the current year, the next year is excluded as a possible episode.

Table 2
Descriptive Statistics for Local Firms and Multinational Affiliates

	Local Firms			Multinational Affiliates		
	Mean	Standard Deviation	Median	Mean	Standard Deviation	Median
Log of Sales	15.0488	3.0231	14.5613	13.3198	2.9091	12.8418
Sales Growth	0.1266	0.3144	0.1096	0.1969	0.3759	0.1494
Log of Assets	15.4664	2.9699	14.9050	13.5045	2.7861	12.8514
Asset Growth	0.1460	0.2448	0.1128	0.1689	0.2958	0.1405
Log of Capital Expenditures	12.4075	3.1360	12.0052	10.2501	3.0486	9.7854
Capital Expenditures/ Net PPE	0.1967	0.1697	0.1522	0.2303	0.2259	0.1696
Foreign Sales Share				0.2841	0.3714	0.0000
Net Foreign Sales Share				0.1641	0.3790	0.0000
Short Term Share of Debt	0.3267	0.2116	0.3225			
Log of Operating Profits	13.0989	3.1087	12.4497	12.0271	2.9005	11.4914
Operating Profitability	0.0939	0.1629	0.0877	0.1201	0.1699	0.1083
Leverage	0.4730	0.2307	0.4617	0.4559	0.2672	0.4168
Price Index	115.3496	75.1014	103.2000	115.8554	67.7326	100.0000
Inflation	0.0796	0.1272	0.0459	0.1082	0.1434	0.0656
Growth in Local Debt				0.1401	0.6110	0.1291
Growth in Foreign Debt				0.1228	0.7418	0.0690
Growth in Related Party Debt				0.0852	0.8119	0.0000
Growth in Paid in Capital				0.0624	0.3446	0.0000

Note: Values of sales, assets, capital expenditures, net PPE, operating revenues, local sales, foreign sales, related party sales, local debt, foreign debt, and related party debt are measured in thousands of local currency units. The growth rates are calculated as differences in log values. Operating profits are the difference between sales and operating expenses. Foreign Sales Share is the avreage share of affiliate sales outside of the affiliate host country in the three pre-crisis years. Net Foreign Sales Share is the average affiliate's share of sales outside of the affiliate host country less the average affiliate sales share of imports from the US; averages are taken over the three pre-crisis years. Short Term Share of Debt is the local firms' share of short term debt and the current portion of long term debt in total current liabilities and long term debt. Operating Profitability is the ratio of the difference between sales and operating expenses to sales. Leverage is the ratio of debt to assets. The price index and inflation are taken from Datastream and measure prices and changes in prices in the host country. Local debt is borrowing by an affiliate from persons in the affiliate's host country. Foreign debt is borrowing by an affiliate from person's outside the affiliate's host country. Related party debt is borrowing by an affiliate from the affiliate's parent. Paid in capital includes equity capital investments in an affiliate, and this item is measured in U.S. dollars.

Table 3
Responses of Multinationals and Local Firms to Currency Crises

Dependent Variable:	Log of Sales		Sales Growth		Log of Assets		Asset Growth	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	12.8621	12.8581	1.3997	1.4149	12.8046	12.8235	2.8180	2.9006
	(0.6518)	(0.6531)	(0.4276)	(0.4269)	(0.7287)	(0.7511)	(0.3849)	(0.4061)
Price index	0.0048	0.0049			0.0044	0.0043		
	(0.0003)	(0.0003)			(0.0002)	(0.0002)		
Inflation			0.7361	0.7236			0.2050	0.1456
			(0.0534)	(0.0528)			(0.0375)	(0.0374)
Lag of Sales			-0.1419	-0.1424				
			(0.0200)	(0.0200)				
Lag of Assets							-0.2181	-0.2275
							(0.0112)	(0.0114)
$Depreciation_{t-1}$	-0.0712	-0.0782	-0.0185	-0.0147	-0.0286	-0.0265	-0.0223	-0.0217
	(0.0265)	(0.0262)	(0.0146)	(0.0145)	(0.0188)	(0.0186)	(0.0111)	(0.0111)
$Depreciation_{t}$	-0.0437		-0.0284		0.0376		0.0199	
	(0.0283)		(0.0154)		(0.0209)		(0.0127)	
$Depreciation_{t+1}$	-0.0787		-0.0845		-0.0219		-0.0624	
	(0.0316)		(0.0179)		(0.0228)		(0.0136)	
$Depreciation_{t+2}$	-0.1270		-0.0247		-0.0579		-0.0499	
	(0.0327)		(0.0144)		(0.0242)		(0.0114)	
Post Depreciation		-0.0852		-0.0414		-0.0143		-0.0266
		(0.0272)		(0.0114)		(0.0207)		(0.0098)
Multinational* $Depreciation_{t-1}$	0.0073	0.0174	-0.0580	-0.0593	-0.0147	-0.0168	-0.0147	-0.0218
	(0.0404)	(0.0397)	(0.0193)	(0.0192)	(0.0243)	(0.0240)	(0.0162)	(0.0163)
Multinational* $Depreciation_{t}$	-0.0447		0.0248		0.1256		0.1488	
	(0.0528)		(0.0210)		(0.0285)		(0.0183)	
Multinational* $Depreciation_{t+1}$	0.1466		0.1415		0.1019		0.0104	
	(0.0546)		(0.0251)		(0.0327)		(0.0197)	
Multinational* $Depreciation_{t+2}$	0.1898		0.0088		0.0779		0.0250	
	(0.0580)		(0.0242)		(0.0362)		(0.0176)	
Multinational* Post Depreciation		0.0841		0.0544		0.1130		0.0753
		(0.0456)		(0.0158)		(0.0278)		(0.0136)
Industry/Year Fixed Effects?	Y	Y	Y	Y	Y	Y	Y	Y
Firm Fixed Effects?	Y	Y	Y	Y	Y	Y	Y	Y
No. of Obs.	27,969	27,969	19,627	19,627	27,767	27,767	19,476	19,476
R-Squared	0.9684	0.9683	0.5250	0.5235	0.9898	0.9898	0.5345	0.5221

Note: The dependent variable is the logarithm of sales in columns (1) and (2), growth in sales in columns (3) and (4), the logarithm of assets in columns (5) and (6), and growth in assets in columns (7) and (8). The sample used in all specifications includes U.S. multinational and local firms operating in emerging markets. Each specification includes industry/year and firm fixed effects. "Price index" is an index of producer prices (or consumer prices if producer prices are unavailable) in the host country; the base year of 1995 has a price index of 100. "Inflation" is the change in the producer price index over the period. Changes in consumer price indices are used if changes in producer price indices are not available. "Lag of Sales" is the log of sales in the previous period, and "Lag of Assets" is the log of beginning of period assets. The time sub-scripted "Depreciation" variables are a set of dummies equal to one in the year prior to, the year of, and the two years following a depreciation. "Post Depreciation" is a dummy equal to one in the year of and the two years following a depreciation. "Multinational" is a dummy set equal to one for affiliates of U.S. multinationals. Heteroskedasticity-consistent standard errors that correct for clustering of errors by firm appear in parentheses.

Table 4
Investment Responses of Multinationals and Local Firms to Currency Crises

Dependent Variable:	Log of Capital Expenditures	Log of Capital Expenditures	Capital Expenditures/ Net PPE	Capital Expenditures/ Net PPE
	(1)	(2)	(3)	(4)
Constant	7.5609	7.6623	0.2267	0.2228
	(0.9240)	(0.9401)	(0.2081)	(0.2162)
Price Index	0.0048	0.0047	0.0001	0.0001
	(0.0004)	(0.0004)	(0.0000)	(0.0000)
$Depreciation_{t-1}$	0.0362	0.0253	0.0122	0.0103
	(0.0522)	(0.0518)	(0.0074)	(0.0073)
$Depreciation_{t}$	0.0650		0.0070	
	(0.0570)		(0.0072)	
$Depreciation_{t+1}$	-0.2820		-0.0326	
	(0.0604)		(0.0073)	
$Depreciation_{t+2}$	-0.3942		-0.0373	
	(0.0625)		(0.0071)	
Post Depreciation		-0.2101		-0.0220
		(0.0506)		(0.0058)
Multinational*$Depreciation_{t-1}$	-0.0173	-0.0011	-0.0031	-0.0003
	(0.0719)	(0.0711)	(0.0111)	(0.0110)
Multinational*$Depreciation_{t}$	0.0790		-0.0215	
	(0.0797)		(0.0116)	
Multinational*$Depreciation_{t+1}$	0.5311		0.0619	
	(0.0887)		(0.0136)	
Multinational*$Depreciation_{t+2}$	0.4133		0.0460	
	(0.0934)		(0.0122)	
Multinational*Post Depreciation		0.3448		0.0257
		(0.0700)		(0.0095)
Industry/Year Fixed Effects?	Y	Y	Y	Y
Firm Fixed Effects?	Y	Y	Y	Y
No. of Obs.	23,950	23,950	25,524	25,524
R-Squared	0.9382	0.9379	0.5817	0.5801

Note: The dependent variable in columns (1) and (2) is the log of capital expenditures, and the dependent variable in columns (3) and (4) is capital expenditures scaled by net property, plant, and equipment. The sample used in all specifications includes U.S. multinational and local firms operating in emerging markets. Each specification includes industry/year and firm fixed effects. "Price index" is an index of producer prices (or consumer prices if producer prices are unavailable) in the host country; the base year of 1995 has a price index of 100. The time sub-scripted "Depreciation" variables are a set of dummies equal to one in the year prior to, the year of, and the two years following a depreciation. "Post Depreciation" is a dummy equal to one in the year of and the two years following a depreciation. "Multinational" is a dummy set equal to one for affiliates of U.S. multinationals. Heteroskedasticity-consistent standard errors that correct for clustering of errors by firm appear in parentheses.

Table 5

Foreign Sales Exposures and Investment Responses of Multinationals and Local Firms

Dependent Variable:	Log of Capital Expenditures	Log of Capital Expenditures	Capital Expenditures/ Net PPE	Capital Expenditures/ Net PPE
	(1)	(2)	(3)	(4)
Constant	11.3694	11.4021	0.2597	0.2611
	(0.1382)	(0.1389)	(0.0299)	(0.0304)
Multinational Depreciation$_{t-1}$	0.0411	0.0126	-0.0051	-0.0034
	(0.0893)	(0.0803)	(0.0142)	(0.0129)
Multinational Depreciation$_{t}$	0.0435	0.0679	-0.0431	-0.0342
	(0.0992)	(0.0908)	(0.0146)	(0.0130)
Multinational Depreciation$_{t+1}$	0.3917	0.4195	0.0473	0.0542
	(0.1207)	(0.1072)	(0.0189)	(0.0169)
Multinational Depreciation$_{t+2}$	0.3520	0.3877	0.0449	0.0500
	(0.1382)	(0.1227)	(0.0173)	(0.0154)
Foreign Sales Share * Multinational Depreciation$_{t-1}$	-0.4308		-0.0132	
	(0.1758)		(0.0268)	
Foreign Sales Share * Multinational Depreciation$_{t}$	-0.0125		0.0600	
	(0.1973)		(0.0305)	
Foreign Sales Share * Multinational Depreciation$_{t+1}$	0.0793		0.0520	
	(0.2054)		(0.0354)	
Foreign Sales Share * Multinational Depreciation$_{t+2}$	0.0886		0.0351	
	(0.2349)		(0.0320)	
Net Foreign Sales Share * Multinational Depreciation$_{t-1}$		-0.5281		-0.0290
		(0.1760)		(0.0259)
Net Foreign Sales Share * Multinational Depreciation$_{t}$		-0.1707		0.0417
		(0.1935)		(0.0289)
Net Foreign Sales Share * Multinational Depreciation$_{t+1}$		-0.0255		0.0433
		(0.1971)		(0.0340)
Net Foreign Sales Share * Multinational Depreciation$_{t+2}$		-0.0533		0.0247
		(0.2157)		(0.0284)
Country/Industry Group/Year Fixed Effects?	Y	Y	Y	Y
Firm Fixed Effects?	Y	Y	Y	Y
No. of Obs.	14,984	14,984	15,872	15,872
R-Squared	0.9438	0.9438	0.5533	0.5533

Note: The dependent variable in columns 1 and 2 is the log of capital expenditures. The dependent variable in columns 3 and 4 is capital expenditures scaled by net PPE. The sample used in all specifications includes U.S. multinational and local firms operating in emerging markets that experience depreciations. Each specification includes country/industry group/year and firm fixed effects. The time sub-scripted "Multinational Depreciation" variables are a set of dummies equal to one for multinationals in the year prior to, the year of, and the two years following a depreciation. Foreign Sales Share is the avreage share of affiliate sales outside of the affiliate host country in the three pre-crisis years. Net Foreign Sales Share is the average affiliate's share of sales outside of the affiliate host country less the average affiliate sales share of imports from the US; averages are taken over the three pre-crisis years. Heteroskedasticity-consistent standard errors that correct for clustering of errors by firm appear in parentheses.

Table 6

Matching Analysis of Multinational and Local Firm Investment Responses

Outcome Variable:			Capital Expenditures/Net PPE			Change in Log of Capital Expenditures		
Specification	Number of Matches	Exact Matching on Country and Industry?	Percent Exact Matches	N	Difference-in-means Treatment Effects	Percent Exact Matches	N	Difference-in-means Treatment Effects
1	4	Y	67.6	988	0.1086	65.6	908	0.6230
					(0.0205)			(0.1720)
1	4	N		988	0.1008		908	0.6345
					(0.0128)			(0.0920)
2	4	Y	72.3	1238	0.0708	71.5	1129	0.4442
					(0.0142)			(0.1100)
2	4	N		1238	0.0708		1129	0.3970
					(0.0111)			(0.1042)
3	4	Y	67.6	988	0.1113	65.6	908	0.6400
					(0.0201)			(0.1880)
3	4	N		988	0.0929		908	0.5917
					(0.0131)			(0.0896)
1	1	Y	84.6	988	0.1262	84.1	908	0.6844
					(0.0387)			(0.2810)
1	1	N		988	0.0911		908	0.5743
					(0.0131)			(0.1103)
2	1	Y	86.7	1238	0.0746	86.9	1129	0.4796
					(0.0163)			(0.1684)
2	1	N		1238	0.0658		1129	0.3847
					(0.0125)			(0.1298)
3	1	Y	84.6	988	0.1291	84.1	908	0.6830
					(0.0387)			(0.2793)
3	1	N		988	0.0876		908	0.5283
					(0.0132)			(0.1153)

Notes: This table presents results of tests using matching estimators to determine the differential effect of depreciations on multinational and local firm investment. The outcome variable considered is capital expenditure scaled by net ppe in the year subsequent to the depreciation and the change in log capital expenditures. As matching variables, specification 1 includes capital expenditures scaled by net ppe, the log of sales, GDP per capita, all measured in the year before the crisis as well as the correlation of real exchange rates and the ratio of operating profits to sales over the pre-crisis years in the sample. Specification 1 also includes squared terms of each of the these variables. Specification 2 no longer matches on the correlation of real exchange rates and the ratio of operating profits to sales over the pre-crisis years in the sample and the square of this variable. Sepcification 3 include all variables in Specification 1 except the squared terms.

Table 7

Leverage Characteristics and Investment Responses of Multinationals and Local Firms

Dependent Variable:	Log of Capital Expenditures	Log of Capital Expenditures	Log of Capital Expenditures	Capital Expenditures/ Net PPE	Capital Expenditures/ Net PPE	Capital Expenditures/ Net PPE
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	11.1462	11.0520	11.0249	0.1248	0.1324	0.1232
	(1.0176)	(1.0137)	(1.0045)	(0.1792)	(0.1801)	(0.1793)
$Depreciation_{t-1}$	0.0880	0.0143	0.0778	0.0030	0.0069	0.0042
	(0.0785)	(0.0759)	(0.0908)	(0.0113)	(0.0108)	(0.0132)
Post Depreciation	-0.3550	-0.3500	-0.4291	-0.0513	-0.0402	-0.0515
	(0.0902)	(0.0834)	(0.1097)	(0.0103)	(0.0095)	(0.0123)
Low Leverage * $Depreciation_{t-1}$	-0.0806			0.0125		
	(0.0977)			(0.0134)		
Low Leverage * Post Depreciation	0.3437			0.0410		
	(0.1116)			(0.0118)		
Low Short Term Share of Debt * $Depreciation_{t-1}$		0.0682			0.0053	
		(0.0979)			(0.0137)	
Low Short Term Share of Debt * Post Depreciation		0.3652			0.0218	
		(0.1111)			(0.0122)	
High Leverage and Low Short Term Share * $Depreciation_{t-1}$			0.0312			-0.0037
			(0.1466)			(0.0219)
High Leverage and Low Short Term Share * Post Depreciation			0.2161			0.0006
			(0.1742)			(0.0197)
Low Leverage and High Short Term Share * $Depreciation_{t-1}$			-0.1620			0.0066
			(0.1362)			(0.0188)
Low Leverage and High Short Term Share * Post Depreciation			0.1934			0.0271
			(0.1514)			(0.0153)
Low Leverage and Low Short Term Share * $Depreciation_{t-1}$			-0.0185			0.0138
			(0.1203)			(0.0165)
Low Leverage and Low Short Term Share * Post Depreciation			0.5676			0.0508
			(0.1409)			(0.0152)
Multinational * $Depreciation_{t-1}$	-0.0460	0.0284	-0.0342	0.0084	0.0047	0.0073
	(0.0901)	(0.0878)	(0.1001)	(0.0137)	(0.0133)	(0.0151)
Multinational*Post Depreciation	0.5121	0.5073	0.5869	0.0555	0.0444	0.0557
	(0.1012)	(0.0951)	(0.1184)	(0.0124)	(0.0117)	(0.0139)
Industry/Year Fixed Effects?	Y	Y	Y	Y	Y	Y
Firm Fixed Effects?	Y	Y	Y	Y	Y	Y
No. of Obs.	17,950	17,939	17,939	19,335	19,323	19,323
R-Squared	0.9419	0.9419	0.9420	0.5874	0.5871	0.5875

Note: The dependent variable in columns 1-3 is the log of capital expenditures. The dependent variable in columns 4-6 is capital expenditures scaled by net PPE. The sample used in all specifications includes U.S. multinational and local firms operating in emerging markets that experience depreciations. Each specification includes country/industry group/year and firm fixed effects. Each specification includes industry/year and firm fixed effects. The time sub-scripted "Depreciation" variables are a set of dummies equal to one in the year prior to, the year of, and the two years following a depreciation. "Post Depreciation" is a dummy equal to one in the year of and the two years following a depreciation. "Multinational" is a dummy set equal to one for affiliates of U.S. multinationals. "Low Leverage," "High Leverage," "Low Short Term Share" and "High Short Term Share" are dummy variables set equal to one if the local firm is either below or above the relevant median of the sample. Coefficients on price indices are not presented. Heteroskedasticity-consistent standard errors that correct for clustering of errors by firm appear in parentheses.

Table 8
The Determinants of Investment Responses

Dependent Variable:	Log of Operating Profits		Leverage	
	(1)	(2)	(3)	(4)
Constant	14.2066	14.1739	-0.0616	-0.0575
	(0.5273)	(0.5251)	(0.2092)	(0.2132)
Price Index	0.0043	0.0043	0.0001	0.0001
	(0.0004)	(0.0004)	(0.0000)	(0.0000)
$Depreciation_{t-1}$	-0.0953	-0.1026	0.0240	0.0245
	(0.0453)	(0.0444)	(0.0056)	(0.0056)
$Depreciation_{t}$	0.0790		0.0753	
	(0.0452)		(0.0068)	
$Depreciation_{t+1}$	0.0035		0.0825	
	(0.0453)		(0.0082)	
$Depreciation_{t+2}$	0.0315		0.0521	
	(0.0434)		(0.0092)	
Post Depreciation		0.0366		0.0703
		(0.0348)		(0.0068)
Multinational* $Depreciation_{t-1}$	-0.0029	0.0056	-0.0311	-0.0312
	(0.0654)	(0.0643)	(0.0104)	(0.0102)
Multinational* $Depreciation_{t}$	-0.0256		-0.0750	
	(0.0713)		(0.0134)	
Multinational* $Depreciation_{t+1}$	0.0684		-0.1118	
	(0.0838)		(0.0154)	
Multinational* $Depreciation_{t+2}$	0.1292		-0.0812	
	(0.0840)		(0.0167)	
Multinational* Post Depreciation		0.0505		-0.0865
		(0.0602)		(0.0120)
Industry/Year Fixed Effects?	Y	Y	Y	Y
Firm Fixed Effects?	Y	Y	Y	Y
No. of Obs.	16,562	16,562	19,642	19,642
R-Squared	0.9648	0.9647	0.7926	0.7921

Note: The dependent variable is the log of operating revenues in columns (1) and (2), operating profitability in columns (3) and (4), and leverage in columns (5) and (6). Operating profits are equal to sales less operating expenses, and operating profitability is the ratio of operating profits to sales. Leverage is measured as the ratio of current liabilites and long term debt to assets. The sample used in all specifications includes U.S. multinational and local firms operating in emerging markets. Each specification includes industry/year and firm fixed effects. "Price index" is an index of producer prices (or consumer prices if producer prices are unavailable) in the host country; the base year of 1995 has a price index of 100. The time sub-scripted "Depreciation" variables are a set of dummies equal to one in the year prior to, the year of, and the two years following a depreciation. "Post Depreciation" is a dummy equal to one in the year of and the two years following a depreciation. "Multinational" is a dummy set equal to one for affiliates of U.S. multinationals. Heteroskedasticity-consistent standard errors that correct for clustering of errors by firm appear in parentheses.

Table 9
Instrumental Variables Analysis of the Determinants of Investment Responses

Dependent Variable:	Log Capital Expenditures					
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	12.1656	1.3634	-1.7350	11.9299	3.4188	-1.4944
	(1.3820)	(3.5442)	(4.6111)	(1.5090)	(3.5846)	(5.5624)
Leverage	-2.5728		-2.0398	-2.5126		-2.3131
	(0.3989)		(0.5254)	(0.4292)		(0.7461)
Multinational * Leverage				-1.0830		9.1130
				(2.5082)		(4.2359)
Log Operating Profits		0.7352	0.9847		0.4556	1.0366
		(0.2667)	(0.3139)		(0.2923)	(0.4492)
Multinational * Log Operating Profits					0.3670	0.1467
					(0.1770)	(0.3158)
Price Index	0.0049	0.0003	-0.0008	0.0049	0.0007	-0.0015
	(0.0003)	(0.0015)	(0.0018)	(0.0003)	(0.0015)	(0.0021)
IV using Depreciation Episodes?	Y	Y	Y	Y	Y	Y
Industry/Year Fixed Effects?	Y	Y	Y	Y	Y	Y
Firm Fixed Effects?	Y	Y	Y	Y	Y	Y
No. of Obs.	18,089	15,470	15,223	18,089	15,470	15,223

Note: The dependent variable in columns (1) through (6) is the log of capital expenditures, and the dependent variable in columns (7) through (12) is capital expenditures scaled by net property, plant, and equipment. The sample used in all specifications includes U.S. multinational and local firms operating in emerging markets. Each specification includes industry/year and firm fixed effects. Leverage is measured as the ratio of current liabilites and long term debt to assets. Operating profits are equal to sales less operating expenses, and operating profitability is the ratio of operating profits to sales. "Multinational" is a dummy set equal to one for affiliates of U.S. multinationals. All columns employ a set of dummies equal to one in the year prior to, the year of, and the two years following a depreciation, and the multinational dummy interacted with each of these time dummies as instruments for leverage, the log of operating profits, and operating profitability, and these variables interacted with the multinational dummy. "Price index" is an index of producer prices (or consumer prices if producer prices are unavailable) in the host country; the base year of 1995 has a price index of 100. Standard errors appear in parentheses.

Table 10

Financing Responses of Multinationals to Currency Crises

Dependent Variable:	Growth in Local Debt	Growth in Foreign Debt	Growth in Related Party Debt	Growth in Paid in Capital
	(1)	(2)	(3)	(4)
Constant	1.1335	-0.6397	0.6131	0.3137
	(0.4222)	(0.4869)	(0.4159)	(0.3391)
Lagged Value	-0.0787	-0.0597	-0.0663	-0.0915
	(0.0282)	(0.0175)	(0.0164)	(0.0283)
Inflation	0.5428	0.1361	0.3679	0.0300
	(0.3385)	(0.4265)	(0.4013)	(0.1034)
$Depreciation_{t-1}$	-0.0165	-0.0427	-0.0774	-0.0077
	(0.0687)	(0.0895)	(0.0937)	(0.0288)
$Depreciation_{t}$	0.1798	0.3517	0.2480	0.0276
	(0.0792)	(0.1055)	(0.1160)	(0.0298)
$Depreciation_{t+1}$	-0.1092	-0.0472	-0.1568	0.1079
	(0.0952)	(0.1187)	(0.1223)	(0.0411)
$Depreciation_{t+2}$	0.0092	0.0135	-0.0504	0.0281
	(0.0971)	(0.1167)	(0.1370)	(0.0436)
Industry/Year Fixed Effects?	Y	Y	Y	Y
Firm Fixed Effects?	Y	Y	Y	Y
No. of Obs.	3,153	3,153	3,153	4,377
R-Squared	0.5127	0.4912	0.4644	0.4310

Note: The dependent variable is the growth in debt borrowed from local persons in column (1), the growth in debt borrowed from foreign persons in column (2), the growth in debt borrowed from related parties in column (3), and the growth in paid in capital in column (4). The sample used in all specifications is comprised of U.S. multinationals operating in emerging markets. Each specification includes industry/year and firm fixed effects. "Lagged Value" is the log of the value of the component of sales or financial capital in the previous period. "Inflation" is the change in the producer price index over the period. Changes in consumer price indices are used if changes in producer price indices are not available. The time sub-scripted "Depreciation" variables are a set of dummies equal to one in the year prior to, year of, and the two years following a depreciation. Heteroskedasticity-consistent standard errors that correct for clustering of errors by firm appear in parentheses.

Appendix Table 1
Sample Information By Industry and Data Source

Industry name	Total Obs	% in BEA sample	% in WS sample
Agricultural production-crops	206	53%	47%
Agricultural production--livestock and animal	122	25%	75%
Forestry	107	16%	84%
Fishing, hunting, and trapping	22	14%	86%
Iron ores mining	34	12%	88%
Copper, lead, zinc, gold, and silver ores mining	539	33%	67%
Other metallic ores mining	134	19%	81%
Coal mining	78	32%	68%
Crude petroleum (no refining) and natural gas	873	82%	18%
Nonmetallic minerals mining, except fuels	142	24%	76%
Meat products Mfg	139	35%	65%
Dairy products Mfg	179	51%	49%
Preserved fruits and vegetables Mfg	323	71%	29%
Grain mill products Mfg	723	58%	42%
Bakery products Mfg	71	56%	44%
Beverages Mfg	815	52%	48%
Other food and kindred products Mfg	1328	43%	57%
Tobacco products Mfg	282	55%	45%
Textile mill products Mfg	1022	10%	90%
Apparel and other textile products Mfg	474	37%	63%
Lumber and wood products Mfg	236	14%	86%
Furniture and fixtures Mfg	244	65%	35%
Pulp, paper, and board mills Mfg	330	22%	78%
Other paper and allied products Mfg	680	64%	36%
Newspapers Mfg	144	8%	92%
Miscellaneous publishing Mfg	164	70%	30%
Commercial printing and services Mfg	124	47%	53%
Industrial chemicals and synthetics Mfg	1964	59%	41%
Drugs Mfg	1308	67%	33%
Soap, cleaners, and toilet goods Mfg	909	91%	9%
Agricultural chemicals Mfg	467	41%	59%
Chemical products, nec Mfg	829	76%	24%
Integrated petroleum refining and extraction	189	9%	91%
Petroleum refining without extraction	100	100%	0%
Petroleum and coal products, nec	117	69%	31%
Rubber products Mfg	580	48%	52%
Miscellaneous plastics products Mfg	590	62%	38%
Leather and leather products Mfg	130	18%	82%
Glass products Mfg	362	52%	48%
Stone, clay, concrete, gypsum, etc. Mfg	973	9%	91%
Ferrous Metals Mfg	766	11%	89%
Nonferrous Metals Mfg	531	22%	78%
Metal cans, forgings, and stampings Mfg	378	56%	44%
Cutlery, hardware, and screw products Mfg	172	90%	10%
Heating equipment, plumbing fixtures, etc Mfg	201	45%	55%
Metal services, ordnance, & fabricated metal Mfg	213	68%	32%
Engines and turbines Mfg	113	59%	41%
Farm and garden machinery Mfg	62	50%	50%
Construction, mining, & materials handling Mfg	396	80%	20%
Metalworking machinery Mfg	104	36%	64%

Appendix Table 1
Sample Information By Industry and Data Source

Industry name	Total Obs	% in BEA sample	% in WS sample
Special industry machinery Mfg	179	59%	41%
General industrial machinery Mfg	197	55%	45%
Computer and office equipment Mfg	579	59%	41%
Refrigeration and service industry machinery Mfg	267	77%	23%
Industrial machinery and equipment, nec Mfg	111	76%	24%
Household appliances Mfg	296	52%	48%
Household audio & video, & communications Mfg	655	26%	74%
Electronic components and accessories Mfg	1737	68%	32%
Electronic and other electric equipment, nec Mfg	771	52%	48%
Motor vehicles and equipment Mfg	1451	68%	32%
Other transportation equipment, nec Mfg	283	29%	71%
Measuring, scientific, & optical instruments Mfg	232	49%	51%
Medical instruments & supplies & ophthalmic Mfg	310	89%	11%
Photographic equipment and supplies Mfg	80	73%	28%
Miscellaneous manufacturing industries	396	65%	35%

Note: The table provides the number of firm observations in each industry covered in the sample. The share in the BEA sample indicates the share of observations that are observations of multinational affiliates while the share in the WS sample refers to the share of observations of locally owned firms taken from Worldscope.