

The Effect of Currency Crises on Foreign Direct Investment Activity in Emerging Markets

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Despite the ample literature on currency crises, the effect of currency crises on foreign direct investment FDI activity has been largely unexamined. This paper tests the sensitivity of three measures of U.S. outbound non-bank FDI activity to currency crises in 21 emerging economies. The findings of this analysis suggest that contrary to the common perception, currency crises do not seem to have a negative effect on FDI activity in the crisis economy. Indeed, we find some evidence that currency crises may increase FDI activity in the affected country. These results underline the stable nature of FDI relative to other types of international capital flows and as a safer mode of financing for emerging economies.

JEL Classification: F21, F31.

Key Words: Foreign direct investment, currency crises, multinational corporations.

INTRODUCTION

The devastating effect of currency crises on the affected economies may have generated a common perception that the impact of currency crises on foreign direct investment (FDI) activity in the affected economy is negative. This paper argues that this is not necessarily the case. In fact, IMF data show that FDI continued to flow into many countries that were hard hit by currency crises. Moreover, United Nations (1998) documents several cases in which multinational corporations relocated some production facilities into countries like Thailand right after the Asian currency crisis. These observations suggest that FDI activity does not panic during currency crises and may work as a stabilizing factor when the affected country experiences more FDI inflows where other forms of capital flows are in the decline. This paper provides formal evidence that FDI activity increases following a currency crisis and further supports the literature that argues that FDI is a safer form of financing as in Fernandez- Arias and Hausmann (2001).

The existing literature has established some links between exchange rates and FDI as in Froot and Stein (1991) and Blonigen (1997). The main thrust is that currency devaluation may

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create a wealth effect that enables foreign firms to take over domestic firms who possess firm specific assets. Acknowledging the difference between currency crises and exchange rate movements, this paper extends the existing literature to formally examine the effect of currency crises on FDI activity in the affected economies. The examination of the impact of currency crises on FDI becomes more important if we realize that almost every country in the world was hit by at least one currency crisis over the last three decades (Glick and Hutchison, 1999). Table 1 shows the occurrence of currency crises in some developing countries.

Table 1
Occurrences of Currency Crises

	<i>Currency Crisis - Glick and Hutchison</i>
Argentina	1975-1976, 1982-1983, 1989-1991
Brazil	1982-1983, 1987, 1990-1991, 1995
Chile	1985
Columbia	1985
Costa Rica	1981
Dominican Republic	1985, 1987,1990
Ecuador	1982-1983, 1985-1985, 1988
Egypt	1979, 1989-1991
EL Salvador	1986, 1990
Guatemala	1986, 1989-1990
Honduras	1990
India	1976, 1991, 1993, 1995
Indonesia	1978, 1983, 1986, 1997
Kenya	1975, 1981-1982, 1985, 1993-1995, 1997
Korea	1980, 1997
Malaysia	1986, 1997
Mexico	1976, 1982, 1985, 1994-1995
Nigeria	1986-1987, 1989, 1992
Peru	1976, 1979, 1987-1988
Philippines	1983-1984, 1986, 1997
Singapore	1975
South Africa	1975, 1978, 1984-1986, 1996
Thailand	1981, 1984, 1997
Turkey	1978-1980, 1994
Venezuela	1984, 1986, 1994-1996
Zimbabwe	1982, 1991, 1993-1994, 1997

Source: Glick and Hutchison (1999)

Despite the ample literature on currency crises, their effect on FDI has hardly been subject to formal investigation. This paper examines the behavior of three measures of FDI activity in 21 developing countries using bilateral US non-bank FDI data covering the period from 1983 through 2000 and two different model specifications. The paper proceeds as follows: Section 2 gives the definition of currency crisis, and section 3 explores possible channels through which currency crises may affect FDI. Section 4 formally investigates the effect of currency crises on FDI using two model specifications and three alternative measures of FDI activity. Section 5 sums up our findings and points to some policy implications and potential research areas.

DEFINITION OF CURRENCY CRISIS

Krugman (2000, pp.1) acknowledges that “there is no generally accepted formal definition of currency crises, but we know them when we see them”. Different definitions of currency crises may actually fall into three classes. An example of the first class of definitions appears in the work of Frankel and Rose (1996) who define a currency crisis as a nominal depreciation of a currency of at least 25 per cent and at least a 10 per cent increase in the rate of depreciation.

The second class of definitions is based on changes in the real exchange rate and foreign reserves. For example, Eichengreen *et al.* (1995) define a currency crisis to include both the large depreciation and also speculative attacks that are successfully warded off by the authorities. They construct a currency pressure index that includes real exchange rate, reserve loss and interest rates hikes and define currency crises when readings of the index exceed an arbitrary level. A similar definition is introduced by Glick and Hutchison (1999).

The third class, like in Kaminsky and Reinhart (1996), identifies currency crises when the affected country itself and /or international financial institution, and reputable financial agencies report that there is indeed a currency crisis. This definition spares the effort of arbitrarily setting a limit or for devaluation or currency pressure index.

In this paper we mainly use the definition of currency crises that is introduced by Glick and Hutchison (1999; 2005). They construct a comprehensive currency crisis indicator based on changes in an index of weighted average of monthly real exchange rate changes and monthly per cent reserve losses. The weights are inversely related to the variance of changes of each component over the sample for each country. This measure presumes that any nominal currency changes associated with exchange rate pressure should affect the purchasing power of the domestic currency, i.e. result in a change in the real exchange rate at least in the short run. This condition excludes some large depreciations that occur during high inflation episodes, but it avoids screening out sizable depreciation events in more moderate inflation periods for countries that have occasionally experienced periods of hyperinflation and extreme devaluation. Large changes in exchange pressure are defined as changes in the pressure index that exceed the mean plus 2 times the country specific standard deviation. (Glick and Hutchison, 1999). While this definition is adopted in this paper, previous definitions by Frankel and Rose (1996) and Kaminsky and Reinhart (1996) are used to conduct a sensitivity test.

HOW DO CURRENCY CRISES AFFECT FDI

A simple view of currency crises is that they are large exchange rate devaluations. A simple conceptual framework may start with a foreign firm operating in some host country and serves both home and host countries markets. The firm uses host country’s inputs and some fixed home country’s inputs and maximizes its profits in its home country’s currency. This resembles the model introduced in Brander (1981). In this setting currency devaluation affects foreign firms in many different ways. First it reduces the cost of production as domestic input prices become lower if measured in home country’s currency. This effect may seem to have a positive effect on FDI activity as foreign firms find it cheaper to acquire domestic assets and to hire more factors of production. Nevertheless, devaluation also implies that, all else equal, revenues in host country’s currency translate into smaller amounts of foreign or home country’s currency.

We can still argue, however, that this decline only applies to revenues from local sales but not to revenues from exports. Moreover, as devaluation increases volatility and therefore uncertainty about future revenues it may negatively affect FDI activity. Accordingly one may conclude that the overall effect of devaluation on FDI activity may work in any direction.

Indeed, the literature on FDI and the exchange rate yields mixed results. Froot and Stein (1991) suggest that local currency devaluation generates a positive “wealth effect” that allows potential direct investors to take over domestic firms for lower foreign currency value. Klein and Rosengren (1994) confirm the previous findings on the wealth effect. Blonigen (1997) suggests that exchange rate movements may affect acquisition FDI when acquisitions involve firm specific assets. Campa (1993), however, finds exchange rate volatility to be negatively correlated with the number of new FDI entries.

Nevertheless, the effect of currency crises may largely differ from that of regular exchange rate movements. Currency crises may have large impact on the overall performance of the economy, domestic asset prices, banking and financial sectors and may as well induce major regulatory changes (United Nations, 1998). These effects do not necessarily follow currency devaluation.

Currency crises often have a negative effect on GDP and per capita GDP. This is highly documented in many reports by the IMF and many other international economic organizations. Barro (2001) finds that a currency crisis causes some 3% loss in GDP growth in Asian countries and suggests that the effect lasts for 4 years before recovery. Nevertheless, the fall in domestic demand may not have a symmetric effect on all forms of FDI activity. Export oriented FDI activity seems to be less vulnerable to domestic demand shocks if compared to import substitution or tariff jumping FDI activity¹. Furthermore, the latter may escape the above negative effect by switching from local sales to exports. Indeed, United Nations (1998) documents several cases in which large multinational corporations (MNCs) shifted their production facilities to some of the affected countries following currency crises. Lipsey (2001) finds switching to exports to be common for US affiliates in Mexico and Asia following three currency crises.² This may explain how could some foreign firms survive currency crises and perhaps increase their production in the affected economy to serve exports markets.

Currency crises often result in unusually large declines in asset prices and prices of nontradable goods (Mendoza, 2000). Indeed, Asian stock market indexes plunged by as much as 48.4 per cent in Thailand to 81.7 per cent in Indonesia in the period from July 1997 to February 1998 (United Nations, 1998). In Mexico, by the end of January 1995 and nearly a month after the devaluation of the peso, Mexico’s stock market index fell by more than 50% (Mendoza, 2000). This may provide existing and potential foreign firms with a unique opportunity for expansion and entry. This trend can also gain momentum as currency crises often induce some regulatory changes that offer more incentives to FDI activities which by and large has been the case following the recent crisis in Asia even in countries that had a history of hostility towards FDI like South Korea (United Nations, 1998).

The above analysis shows that currency crises while represent a challenge they also create an opportunity for FDI activity. The question now is how fast can FDI activity react to these challenges and opportunities? The literature on FDI may provide some answers as it compares

FDI to portfolio investment. A large body of literature as in Frankel and Rose (1996), Kaminsky et al. (1998) and Lipsey (1999) emphasizes the stability of FDI as opposed to portfolio investment. FDI is seen as less subject to capital reversals and it involves large volumes of illiquid assets that make it very difficult for FDI to fly away with the early signs of trouble. The volatility of portfolio investment is often equated with its short-term nature while the long-term nature of FDI is taken as a sign of stability.³ This may suggest that since FDI is sticky and “bolted down” then its reaction to currency crises may be very limited if it reacts at all. Nevertheless, it is argued that it is not the stickiness of FDI activity that shapes its behavior following the crisis. It is rather the very reason for FDI to locate its activity in a particular country and the firm’s long-term objectives it seeks from the choice of a particular location. Indeed, the ownership – location - internalization synthesis as introduced by Dunning (1997) emphasizes that location advantages are crucial to firms’ decision to go multinational. Similarly, Aizenmann (1992) argues that as FDI locates its facilities to the cheapest location, it becomes less costly to adjust to shocks to the host economy. The literature on FDI has long ago drawn the lines between portfolio investment and FDI. The seminal work of Hymer (1960) argues that FDI flows are not the subject of the international capital theory. Instead, MNCs are a product of imperfect competition and should be analyzed in an industrial organization context. This path-breaking thesis triggered a large body of literature on FDI that stresses the monopolistic nature of MNCs and the importance of firm specific assets and internalization as in Rugman (1982), Hennart (1991), and Dunning (1997) in his eclectic paradigm. It is not implausible therefore to argue that the reaction of FDI to currency crises is different from that of portfolio flows. Specifically, Froot and Stein (1991) and Blonigen (1997) argue that exchange rate movements (devaluation) create an opportunity for FDI but not for portfolio investment. This difference arises from the ability of FDI to generate income in a variety of markets and currencies without involving any currency transactions.

The speed with which FDI can react to threats and opportunities remains to be unresolved. There is some evidence, however, that suggests that FDI is not as sticky as it is conventionally viewed. For instance, Hausmann and Fernandez- Arias (2000) argue that since FDI is one of the firm’s liabilities rather than one of its illiquid assets, then it is not really “bolted down” and an FDI exit may be easier and faster than the previous literature suggests. Moreover, Kogut and Chang (1996) show that movements in the real exchange rate may trigger new FDI entry to which previous entry may serve as a platform. Blonigen (1997) shows that exchange rate depreciation triggers acquisition FDI but the effect on new plant FDI is absent since the former involves firm specific assets while the latter does not. The speed of FDI reaction to currency crises, therefore, differs from one FDI type to another. New entry may require more time than the expansion of an existing firm. Also establishing a new plant may require more time than acquiring an existing one. Similarly, the ability to smoothly withdraw from a market differs across firms and across locations. Therefore, for some FDI activity and for some locations we may expect some sluggishness in the reaction of FDI to currency crises.

The behavior of FDI following currency crises has hardly been examined. The literature on early signs of crises establishes that FDI is not “crisis prone” as suggested by Fernandez-Arias and Hausmann (2001) who examine the effect of the composition of capital flows on the likelihood of crises in 170 countries, including a subsample of emerging markets. The main

finding of their analysis suggests that non-FDI flows are crisis prone while FDI is neutral. The policy implications of this result require an equally important question on how do foreign firms react to crises. The examination of the effect of currency crises on FDI activity in this paper, therefore, comes as a plausible extension of the existing literature.

EMPIRICAL ANALYSIS

Methodology

The goal of this paper is to examine the effect of currency crises on FDI activity in the crisis economy. We begin with a gravity specification as a generally accepted empirical model of FDI. The gravity model is widely used in explaining trade flows as well as multinational corporation sales as in Brainard (1997). In this specification the determinants of FDI are assumed to be the involved countries' RGDP, RGDP per capita, distance, trade frictions and investment frictions. The specification we use is:

$$FDI_{ij} = f(RGDP_i, RGDP_j, RGDP_{CAP_i}, RGDP_{CAP_j}, DIST_{ij}, T_COST_j, F_ENV_j, SKILL_j, CCRISIS_j, LCRISIS_j, LCRISIS_{j2}, LCRISIS_{j3}) \dots(1)$$

Where FDI is a measurement of FDI activity from country *i* to country *j*, RGDP is real gross domestic product, RGDP_{CAP} is per capita RGDP, DIST is the distance between country *i* and country *j*. T_COST_{*j*} is a measure of trade costs while F_ENV_{*j*} captures host country's investment environment. T_COST is constructed as in Blonigen et al. (2003) as one minus the ratio of trade to real GDP and is used as a proxy for trade frictions. Carr et al. (2001) suggest that the effect of higher trade costs on investment reflects the relationship between trade and FDI. When trade and FDI are complements, as in vertical FDI, higher trade costs suppress FDI activity. In the Horizontal model, as discussed below, where trade and FDI are substitutes, higher trade costs may induce more FDI activity. For F_ENV we use a composite measure of operation risk index. This index captures both political and economic risks and runs from 0 to 100 with higher values indicating lower levels of operation risks in the host country. It is plausible therefore to expect more FDI activity in countries that have a better investment environment or less political and economic risks. Therefore, the expected sign on F_ENV is positive (see table 2). SKILL_{*j*} is a measure of skilled labor abundance in the host country as a proxy of human capital. The importance of skilled labor abundance to inwards FDI is highlighted in Markusen and Maskus (1999) and Carr et al. (2001). We use for skilled labor abundance the average years of education attained by adult population. CCRISIS_{*j*} is a binary variable that takes the value 1 when currency crises hit country *j* and takes the value 0 otherwise. LCRISIS_{*j*}, LCRISIS_{*j2*} and LCRISIS_{*j3*} are the one, two and three year lagged currency crisis dummies. The inclusion of lagged currency crisis dummies seems reasonable as FDI activity may need some time to adjust to currency crises. Moreover, it overcomes endogeneity concerns as some third factor may be simultaneously affecting FDI related dependent variable and causing a currency crisis at the same time. We include three lags of CRISIS_{*j*} based on the findings of Barro (2001) and Park and Lee (2001) who examined the crisis and recovery in South East Asian countries and suggest that the crisis did not have a long-term effect on growth. They observed a pattern of a V shape drop and recovery in which recovery to pre crisis performance starts after three years from the crisis.⁴

Despite the popularity of the gravity model it lacks a formal theoretical foundation. Recent literature as in Carr et al. (2001) and Blonigen et al. (2003) introduces a new model that nests a number of alternative theories of FDI, such as the vertical, horizontal and the knowledge capital types of FDI.

Table 2
Expected Sign of Independent Variables

<i>Independent Variable</i>	<i>Expected Sign</i>
Gravity Model	
RGDP _i	+
RGDP _j	+
RGDPCAP _i	+
RGDPCAP _j	+
DISTANCE _{ij}	-
GDP _j /GDP _i	+
GDP _j CA _j /GDP _i CA _i	+
Carr et al. (2001) model	
SUMRGDP _{ij}	+
GDPDIFSQ _{ij}	-
SKDIFF _{ij}	-
	If Horizontal Model
	+
	If Vertical or Knowledge Capital Model
SKDIFF _{ij} *GDPDIFF _{ij}	-
	If Knowledge Capital MNE model
	0
	If Horizontal or Vertical MNE model
T_Cost _j *SKDIFFSQ	-
	If knowledge capital model Horizontal model
	+
	If vertical model
Other Variables	
T_Cost _j	+
	If horizontal model (trade and FDI are substitutes)
	-
	If vertical model (trade and FDI are complements)
F_ENV _j	+
SKILL _j	+
CCRISIS	+/-

The horizontal multinational firm produces the same goods and services in multiple plants in different countries. The model as presented in Markusen (1984) arises when both home and host countries are similar in size and factor endowments. The multinational firm has the advantage of utilizing its headquartering services in many production locations including overseas plants at no additional costs. In this model trade and FDI are substitutes as the firm serves the foreign market via FDI and avoids trade costs. The horizontal FDI activity is therefore increasing in similarities in factor endowments and in trade costs and decreasing in differences in factor endowments.

In the vertical model as in Helpman (1984) the firm can geographically fragment production by stages where skilled labor used in headquartering services can be separated from the production activity. The skilled labor abundant country (home) specializes in headquartering services and the skill deficient country (host) specializes in the production of the multinational good. Vertical FDI, therefore, is increasing in skilled labor abundance differences and is decreasing in trade costs. Markusen (1997) and Carr et al. (2001) introduce the knowledge capital model to nest both the horizontal and the vertical FDI models. We use this specification to investigate the

effect of currency crises on FDI activity. FDI is explained in terms of home and host countries' GDP sum, GDP difference and skill differences along with trade frictions and investment frictions. Following Carr et al. (2001) our alternative specification is:

$$FDI_{ij} = f(SUMGDP_{ij}, GDPDIFSQ_{ij}, SKDIFF_{ij}, SKDIFF_{ij} * GDPDIFF_{ij}, F_ENV_{ij}, T_COST_{ij}, SKDIFF2 * T_COST_{ij}, DISTANCE_{ij}, CCRISIS_{ij}, LCCRISIS_{ij}, LCRISIS_{j2}, LCRISIS_{j3}) \quad (2)$$

Where SUMGDP is the sum of real GDP in the parent and host country, GDPDIFSQ is the squared difference of real GDP in both countries. SKDIFF is the difference in skilled labor abundance measured by the average years of education as before, and SKDIFF2 is the square of the skilled labor difference measure. The remaining explanatory variables are the same as in the augmented gravity specification. Carr et al. (2001) argue that different types of FDI are better explained in terms of the above specification and particularly in terms of differences in skilled labor abundance in the parent and the host country. The horizontal model is expected to prevail when the home and the parent countries have similar endowment of skilled labor. As the parent country becomes more skilled labor abundant, i.e. as the skill difference increases, the host country becomes less attractive to horizontal FDI. Nevertheless, this positive skill difference is conducive to vertical FDI activity. The knowledge capital model combines both models as it is motivated by minimizing trade and investment costs just like the horizontal model and by factor price differences as in the vertical model. Blonigen et al. (2003) modify the specification of Carr et al. (2001) to account for positive and negative skill difference effects. As this paper examines the effect of currency crises on FDI activity using data on outbound US FDI in emerging markets, the difference in skilled labor abundance is always in favor of the US, which automatically fits with the modification introduced by Blonigen et al. (2003). Table 2 shows the expected sign of the above independent variables.

Data

As always the case with FDI research, data availability is a major concern. We obtained an unbalanced panel of 48 developing countries spanning up to 35 years (from 1966 through 2000). Three measures of US outbound non-bank FDI are used: FDI stock, affiliate sales, and the number of affiliates. Data on FDI stock is available since 1966 for most countries in the sample while data on sales and the number of affiliates is available since 1983. The first two measures are converted into real US dollars using US GDP deflator as reported in the Economic Report of the President. The ending date of 2000 was primarily due to the final reported year of Penn-World Tables, which is the source of many independent variables. FDI data are collected from the official Bureau of Economic Analysis (BEA) web site. Countries that have small amounts of US FDI (less than \$500m of annual sales) are excluded from the sample. This reduces the number of countries in the sample to 26 countries. It is argued that output by foreign affiliates measured by affiliate sales is the best measure of FDI activity. Various studies that examine FDI activity use affiliate sales as the sole measure of FDI activity as in Carr et al. (2001) and Blonigen et al. (2003). In this paper we follow a more comprehensive approach and employ three different measures of FDI. Particularly we use the number of affiliates as it does not suffer distortions caused by re-evaluation and currency translation as in the case of FDI stock or sales. The depreciation of the host country's currency tends to decrease the estimates of sales and the stock FDI because affiliates generally keep their financial statements in the currency

of the foreign host country and translate their revenue, expenses, assets, sales and position data to U.S. dollars using average market exchange rates when reporting the data to BEA. The number of affiliates is a measure of FDI activity that is not subject to this type of distortion.⁵ Changes in the number of affiliates also sum up exit and entry FDI activity.

As far as the independent variables are concerned, data on real GDP, RGDP CAP and trade come from Penn-World Tables. Data on GDP is used to construct SUMGDP and GDPDIFF. Data on trade is used to construct T_COST as shown above. For F_ENV we use the composite measure of operation risk index obtained from Business Environment Risk Intelligent. This index is available since 1983, but it is not available for all countries in the sample. This reduces our sample size to 21 countries, see table 3, and limits it from 1983 through 2000. DISTANCE is miles between countries' capital cities and the data come from Bali Online (1999). Skilled labor abundance, SKILL, is measured by the average years of educations for populations of 25 years old and above and is also obtained from Barro and Lee (2000). For CCRISIS we follow the definition of currency crises introduced in Glick and Hutcheson (1999; 2005). With the exception of the currency crisis dummies this data set is an updated sub sample of the data used in Blonigen et al. (2003).

Table 3
List of Countries in the Sample

Argentina	Hong Kong	Philippines
Brazil	India	Singapore
Chile	Indonesia	South Africa
Colombia	Malaysia	Sri Lanka
Costa Rica	Mexico	Thailand
Ecuador	Nigeria	Turkey
Egypt	Panama	Venezuela

RESULTS

Table 4 shows estimates for determinants of US outbound FDI stock, affiliate sales and the log of the number of affiliates. In these regressions the subscript (i) refers to the parent country (i.e. the US) while the subscript (j) refers to the foreign host country. Although the R squared is relatively small but this is not uncommon as the case with other studies used the same data set and particularly as in Blonigen et al. (2003). The F-test rejects the null of zero slopes at the one per cent significance level for the three regressions. Coefficients are often significant with the expected sign. FDI seems to be positively correlated with RGDP and per capita RGDP in the host country, positively related to trade costs and negatively related to distance. Skilled labor abundance seems to have a negative effect on FDI suggesting that FDI is possibly attracted to cheap labor in host developing countries, a result that may lend support to a vertical FDI model.

The variable of interest, CCRISIS capturing the effect of currency crises is not significant in the FDI stock and affiliate sales regressions but positive and statistically significant for the log of the number of affiliates' regression. Similarly LCRISIS_j and LCRISIS_{j2} both have positive and statistically significant coefficients in the number of affiliates regression while insignificant in both FDI stock and sales regressions. The third lag of the currency crisis, LCRISIS_{j3} has a

positive and statistically significant coefficient in the sales regression while insignificant in the other two regressions. These findings suggest that currency crises may have a positive effect on the number of affiliates that lasts for two years before the effect of the crisis shows on affiliate sales which seems intuitive.

Table 4
Pooled OLS Estimates of the Effect of Currency Crises on US Outbound FDI Activity.

<i>Regressors</i>	<i>FDI Stock</i>	<i>Affiliate Sales</i>	<i>Log Number of Affiliates</i>
RGDP _i	.005 (.005)	.006 (.02)	-.0001 (.0001)
RGDP _j	.004 (.003)	-.01 (.01)	.0003** (.0001)
RGDPCAP _i	.0004 (.0003)	.006 (.008)	.0001* (.00006)
RGDPCAP _j	.004 (.004)	.04*** (.14)	-.0003*** (.0001)
T_COST _j	.14* (.08)	-.15 (.21)	.0001 (.001)
F_ENV _j	-.33 (.31)	.33 (.91)	.009 (.007)
SKILL _j	-11.10*** (2.30)	-25.44*** (5.44)	-.04 (.03)
Distance	-.002** (.01)	-.009** (.004)	-.0001** (.00002)
CCRISIS _j	5.59 (6.65)	29.83 (20.77)	.32*** (.11)
LCRISIS _j	4.35 (7.33)	25.10 (21.90)	.33*** (.11)
LCRISIS _j 2	5.44 (8.20)	33.30 (27.10)	.23* (.13)
LCRISIS _j 3	6.22 (6.67)	48.83* (27.54)	.18 (.12)
Adj. R-squared	0.26	0.34	0.29
F-test	11.76***	15.41***	22.22***
Sample Size	405	306	313

- Robust standard errors are in parentheses with ***, ** and * denote 1, 5 and 10 per cent significance levels.

- Constant suppressed.

One major concern with the above results is that despite the many control variables that augment the gravity equation, the CCRISIS_j variable may just be picking up unobserved country pair specific characteristics that may shape US FDI activity in different countries. These may include bilateral trade, tax and investment arrangements and treaties. They may also include historical and cultural ties that influence bilateral FDI activity between the parent and the host. In the pooled estimates these unobserved country pair effects or individual effects are assumed to be uncorrelated with other regressors, which may not be the case and therefore OLS estimates are biased. The fixed effects formulation introduces country dummy variables that allow different intercepts for each country. In doing so it drops all time invariant effects, whether observed or unobserved, and yields unbiased estimates of the coefficients on other explanatory variables. The fixed effects estimates are therefore robust to the omission of any relevant time invariant regressor, like distance in this analysis.

Table 5 summarizes the results obtained after controlling for the unobserved country pair fixed effects. The fit has improved and both Hausman and Breusch Pagan Lagrange Multiplier tests favor the fixed effects over the random effects specification. In this specification we obtained qualitatively similar results as the currency crisis variables $CCRISIS_j$ and $LCRISIS_j$ continue to have a positive effect on the number of affiliates and a 3 period lagged effect affiliate sales. FDI activity seems to be positively correlated with skilled labor abundance and negatively with trade costs. One major concern with the above specification is the reversed signs we obtained for $RGDP_i$ and $RGDPCAP_i$ of both home and host countries. One possible explanation is that $RGDP_i$ and $RGDPCAP_i$ are both changing over time but they are invariant over the cross section, which might cause some country specific bias. One way of dealing with this is to take the ratios of $RGDP$ and $RGDPCAP$ in the host and home countries while continuing to control for the country pair fixed effects. Table 6 shows the results with $RGDP$ and $RGDPCAP$ ratios and we continue to see the same pattern. Currency crises have a positive and statistically significant effect on the number of affiliates that lasts for 2 periods and a 3 period lagged effect on the affiliate sales.

Table 5
Fixed Effects Estimates of the Effect of Currency Crises on US Outbound FDI Activity.

<i>Regressors</i>	<i>FDI Stock</i>	<i>Affiliate Sales</i>	<i>Log Number of Affiliates</i>
$RGDP_i$.009*** (.003)	.01 (.01)	-.00002 (.00003)
$RGDP_j$	-.01*** (.004)	-.05*** (.01)	.0005*** (.0001)
$RGDPCAP_i$	-.004* (.002)	-.009* (.005)	.0002** (.0001)
$RGDPCAP_j$.01*** (.003)	.06*** (.01)	-.0003*** (.00003)
T_COST_j	-.47*** (.13)	-1.47*** (.41)	-.003* (.002)
F_ENV_j	.80 (.53)	2.27 (1.62)	.04*** (.01)
$SKILL_j$	1.92 (4.13)	20.47* (11.75)	-.01 (.01)
$CCRISIS_j$	-3.29 (4.34)	8.75 (10.40)	.12*** (.04)
$LCRISIS_j$	-1.20 (4.30)	-1.86 (10.46)	.13*** (.04)
$LCRISIS_j2$	-.21 (4.15)	10.18 (10.71)	.06 (.04)
$LCRISIS_j3$	-1.60 (4.12)	17.54* (10.50)	-.001 (.04)
Adj. R-squared	0.78	0.82	0.90
F-test	23.17***	23.53***	33.02***
Sample Size	405	306	313
Breusch-Pagan LM Test (X^2)	1421.25***	912.48***	1323.75***
Hausman Test (X^2)	33.78***	35.77***	48.45***

- Robust standard errors are in parentheses with ***, ** and * denote 1, 5 and 10 per cent significance levels.

- Constant suppressed.

Table 6
Fixed Effects Estimates of the Effect of Currency Crises on US Outbound FDI Activity

<i>Regressors</i>	<i>FDI stock</i>	<i>Affiliate sales</i>	<i>Log Number of affiliates</i>
RGDP _j / RGDP _i	-1.25 (1.69)	5.36 (5.26)	-25.48* (14.74)
RGDPCAP _j / RGDPCAP _i	32.22 (181.75)	-530.75 (575.61)	28.84* (14.97)
T_COST _j	-.66*** (.13)	-1.90*** (.42)	-.004** (.002)
F_ENV _j	.30 (.53)	.96 (1.68)	.05*** (.01)
SKILL _j	15.58*** (2.84)	42.22*** (9.22)	.10*** (.01)
CCRISIS _j	-5.32 (4.50)	6.37 (10.85)	.11** (.05)
LCRISIS _j	-2.06 (4.47)	-4.62 (10.92)	.16*** (.05)
LCRISIS _j 2	.06 (4.31)	12.20 (11.19)	.06 (.05)
LCRISIS _j 3	.38 (4.28)	19.68* (11.02)	.02 (.05)
Adj. R-squared	0.76	0.80	0.88
F-test	25.57***	23.16***	30.52***
Sample Size	405	306	313
Breusch-Pagan LM Test (χ^2)	1165.07***	721.58***	1205.05***
Hausman Test (χ^2)	32.16***	111.94***	40.58***

- Robust standard errors are in parentheses with ***, ** and * denote 1, 5 and 10 per cent significance levels.

- Constant suppressed.

This specification brings our analysis closer to the specification introduced in Carr et al. (2001). The inclusion of the sum of RGDP and the squared difference of RGDP in the home and host countries looks like a logical extension to our analysis. Besides, the interaction between trade costs and skilled labor abundance differences accommodates different models of FDI as discussed above. Table 7 summarizes the results obtained from this regression. FDI activity now seems to be positively correlated with $SUMGDP_{ij}$, negatively correlated with the $GDPDISQ_{ij}$ and negatively correlated with trade costs. The coefficient on $SKDIFF_{ij}$ is positive and statistically significant in the affiliate sales regression. The variable of interest, $CCRISIS_j$ has a positive and statistically significant effect on the number of affiliates but not the FDI stock or the affiliate sales. Similarly the lagged effect is positive and statistically significant in the number of affiliates regression. The magnitude of the coefficients suggests that a currency crisis may lead to 11 per cent increase in the number of affiliates in the year of the crisis and a 14 per cent increase in the following year.

Interestingly these findings suggest that FDI is positively correlated with skilled labor difference and with a negative coefficient on the interaction between trade cost and skill difference squared. According to Carr et al. (2001), these signs support the vertical FDI model. This adds more insights to our findings, as vertical FDI is believed to be more export oriented and therefore less vulnerable to declines in domestic demand following a currency crisis.

Table 7
Fixed Effects Estimates of the Effect of Currency Crises on US Outbound FDI Activity

<i>Regressors</i>	<i>FDI stock</i>	<i>Affiliate sales</i>	<i>Log Number of Affiliates</i>
SUMRGDPij	.003*** (.001)	.01*** (.003)	.0001*** (.00001)
GDPDIFSQij	6.03e-9 (2.05e-8)	-4.96e-8 (6.80e-8)	-9.52e-10** (2.83e-10)
SKDIFFij	.17 (3.43)	24.01** (11.35)	.02 (.05)
SKDIFFij*GDPDIFFij	.0002* (.0001)	-.0002 (.0005)	1.49e-6 (1.88e-6)
T_COSTj	-.43*** (.15)	-1.16** (.50)	3.38e-6 (.002)
F_ENVj	-.38 (.51)	-.39 (1.65)	.05*** (.006)
T_COSTj*SKDIFFSQ	-.004** (.002)	.002 (.008)	-0001*** (.00002)
CCRISISj	-5.89 (4.29)	2.83 (10.54)	.11** (.04)
LCRISISj	-3.37 (4.24)	-8.22 (10.86)	.14*** (.04)
LCRISISj2	-1.27 (4.07)	8.23 (10.87)	.04 (.04)
LCRISISj3	-1.66 (4.07)	16.04 (10.78)	-.03 (.04)
Adj. R-squared	0.79	0.82	0.90
F-test	22.68***	20.62***	28.15***
Sample Size	405	306	313
Breusch-Pagan LM Test (χ^2)	1412.57***	901.63***	1114.48***
Hausman Test (χ^2)	31.65***	26.13***	263.75***

- Robust standard errors are in parentheses with ***, ** and * denote 1, 5 and 10 per cent significance levels.

- Constant suppressed.

The above positive effect of currency crises on FDI activity persists over three different specifications so far and is robust to many sensitivity tests as well. For instance, we introduce the log of the real exchange rate, LOGREX, as an additional explanatory variable. The inclusion of the LOGREX along with the currency crisis dummy helps distinguish between the effect of currency crises and that of exchange rate devaluation. As argued above the effect of currency crises is more complicated than that of the mere exchange rate depreciation. Table 8 shows the results which are similar to those obtained in table 7 as currency crises continued to have a positive and statistically significant effect on the number of affiliates. Interestingly, the coefficient on the LOGREX is negative and statistically significant on both affiliate sales and FDI stock. As the exchange rate is defined in US dollars per local currency units, an increase in the exchange rate represents local currency appreciation. The negative sign on the coefficient of LOGREX suggests that a real depreciation may have a positive and statistically significant effect on FDI stock and affiliate sales. This is consistent with findings of the literature on FDI and exchange rate as in Froot and Stein (1991) and Klein and Rosengren (1994). Similar results are obtained when the real exchange rate is used as the sole measure of currency crisis. The F

test on the inclusion on the LOGREX is conducted and the results are statistically significant. Moreover, we applied another definition of currency crisis as in Frankle and Rose (1996) and the results, which are not reported for space, are very close to what we have above obtained above. Interestingly, we found *a priori* that the currency crisis roster for the countries in our sample is almost identical for different definitions employed. We also run the above regressions with different number of lags and leads of currency crisis and the results remain qualitatively similar. We did not find any negative effect of currency crises on FDI activity. By contrary, a currency crisis may have some positive effect on FDI activity in the affected economy.

Table 8
Fixed Effects Estimates of the Effect of Currency Crises on US Outbound FDI Activity.

<i>Regressors</i>	<i>FDI stock</i>	<i>Affiliate sales</i>	<i>Log Number of Affiliates</i>
SUMRGDP _{ij}	.003*** (.001)	.01*** (.003)	.0001*** (.00001)
GDPDIFSQ _{ij}	-2.61e-8 (1.92e-8)	-1.76e-7*** (6.81e-8)	-6.81e-10** (2.90e-10)
SKDIFF _{ij}	.51 (2.61)	7.10 (9.02)	.03 (.04)
SKDIFF _{ij} *GDPDIFF _{ij}	.0002** (.0001)	.0005 (.0003)	2.50e-6 (1.65e-6)
T_COST _j	-.69*** (.12)	-2.52*** (.37)	-.0001 (.002)
F_ENV _j	.52 (.44)	1.68 (1.51)	.05*** (.006)
T_COST _j *SKDIFFSQ	-.001 (.002)	.014*** (.005)	-.0001*** (.00002)
CCRISIS _j	-3.94 (3.92)	7.09 (10.08)	.11*** (.04)
LCRISIS _j	-1.62 (3.89)	-2.65 (10.08)	.13*** (.04)
LCRISIS _{j2}	-1.04 (3.74)	5.02 (10.32)	.04 (.04)
LCRISIS _{j3}	-2.96 (3.70)	6.87 (10.32)	-.02 (.04)
LOGREX _j	-4.46*** (.52)	-9.97*** (1.64)	.02*** (.006)
Adj. R-squared	0.82	0.83	0.90
F-test	33.02***	24.41***	28.15***
Sample Size	405	306	313
Breusch-Pagan LM Test (χ^2)	1077.04***	752.34***	1149.58***
Hausman Test (χ^2)	77.16***	68.24***	93.74***

- Robust standard errors are in parentheses with ***, ** and * denote 1, 5 and 10 per cent significance levels.

- Constant suppressed.

CONCLUSION

This paper estimates the effects of currency crises on three measures of FDI activity using two different models and data covering U.S. FDI activity in 21 countries spanning from 1983-2000. The findings of the above analysis suggest that contrary to the common perception, currency crises do not seem to have a negative effect on FDI activity. Indeed, our analysis

provides evidence that a currency crisis may actually increase FDI activity in the crisis economy as it leads to an increase in the number of affiliates and a lagged increase in the affiliate sales. Moreover, our results suggest that FDI activity most likely represent the vertical model of FDI, which adds more insights to our results.

The above results seem very intuitive if we try to search for possible channels through which currency crises affect FDI activity. Currency crises may generate a host of negative effects on the affected economy such as the decline in domestic demand, disruption of domestic credit channels, and the decline in domestic asset prices. The negative impact on domestic demand is likely to have an adverse effect FDI activity that serves local markets but not export oriented FDI who are not hostage to domestic demand shocks. This is particularly true for vertical FDI activity where intra firm exports and exports to home countries are very common. It could be argued then that foreign firms who are part of a global network and serve the domestic market can still somehow escape the decline in domestic demand by increasing their exports as noticed above. Moreover, foreign firms are less likely to suffer disruptions in domestic credit channels, the case of the twin crises when currency crises are accompanied by banking crises, as they may have access to international capital markets in addition to their home countries markets. Furthermore, when currency crisis have a negative effect on domestic assets and inputs prices then an exporting foreign firm who is not vulnerable to changes in domestic demand is in a good position to capitalize on these factors. Finally, when currency crises trigger more FDI friendly regulatory changes as in the case of Korea and are followed by major macroeconomic reforms that usually comes with an IMF rescue package as in recent crises, then the increase in FDI activity following the crisis becomes more plausible.

This paper advances the literature by examining the behavior of FDI activity following currency crises in developing countries. Our findings lend support to a growing literature that argues that FDI represents a safer form of financing as does Fernandez-Arias and Hausmann (2001) who conclude that FDI is not crisis prone. We find FDI activity to be stable if not increasing during and following currency crises, which suggests that FDI activity play a two fold stabilizing role. This provides host developing countries with one more reason to adopt a more FDI friendly policy and particularly points to the importance of vertical FDI activity, which is likely to be more export oriented.

Our results also point to possible research areas. Particularly, more research is needed to distinguish between different types of FDI, such as entry versus expansion FDI, greenfield investments versus acquisition, and equally important the behavior of FDI in the banking and services sectors. Moreover, the examination of the determinants of the size of foreign affiliates and how does it react to currency crises and other domestic shocks appears as a plausible extension to the above analysis. In all cases, disaggregated data may help explore firms' behavior during crises and how do they internalize it and specifically examine the channels through which currency crises affect FDI activity.

NOTES

1. Tariff jumping is one of the earliest explanations of FDI. When exports to a foreign market are harmed by high tariffs, firms may decide to serve that market by means of FDI. FDI therefore allows firms to bypass or "jump" trade barriers. For a formal treatment of FDI and protectionist threats see Blonigen and Feenstra (1997).

2. The three crises occurred in Latin America, including Mexico in 1982, Mexico in 1994, and East Asia in 1997.
3. Itay and Razin (2005) develop a model that explains the smaller volatility of FDI compared to portfolio investments. FDI has hands-on management style which enables the owner to obtain refined information about the productivity of the firm. This comes with a cost as firms owned by the relatively well-informed FDI investor has a low resale price because of asymmetric information between the owner and potential buyers.
4. Barro (2001) and Park and Lee (2001) show that growth rates returned to its pre crisis levels by 1999-2000. For instance, the annualized per capita growth rates were 8% in South Korea, 5% in Malaysia, 3% in Thailand, and 1% in the Philippines and Indonesia.
5. A foreign affiliate is a business enterprise in which there is U.S. direct investment, that is, in which a U.S. person owns or controls (directly or indirectly) 10 per cent or more of the voting securities or the equivalent. Foreign affiliates comprise the foreign operations of a U.S. MNC over which the parent is presumed to have a degree of managerial influence. This paper focuses on the operations of majority owned foreign affiliates; for these affiliates, the combined ownership of all U.S. parents exceeds 50 per cent.

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