

# Multinational corporations and crisis transmission (Draft paper)

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## **Abstract**

In the global crisis of 2008, one of the most important shocks was the rise in the cost of borrowing for firms. In this paper, we apply a quasi-experimental strategy of comparing the exposure of Indian MNCs to the Moody's Baa spread against the exposure of matched domestic firms. The results show that MNCs had significantly larger exposure to the Moody's Baa spread. If large shocks were experienced by financially constrained firms, these could result in a decline in fixed corporate investment. Our empirical analysis shows that while smaller MNCs – which could face financing constraints – did cut back on investment when compared with matched domestic firms, the largest MNCs actually accelerated investment in 2008-09. In the aggregate, Indian MNCs helped counteract the downturn by enlarging investment in the crisis.

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# 1 Introduction

In recent years, a considerable literature has paid attention to ‘open economy Bernanke-Gertler-Gilchrist effects’, where financially constrained firms faced with adverse external shocks tend to cut back on investment. This is a mechanism through which external shocks can impact upon business cycle fluctuations. As an example, when a large exchange rate depreciation takes place, it can adversely affect the balance sheets of unhedged firms, and once the balance sheet is adversely affected, the firm could become financially constrained and pull back from investment even if it sees good projects.

In the global crisis of 2008, while significant exchange rate fluctuations did take place, a more important shock was the credit market shock. In this paper, we focus on the credit shock as portrayed by the Moody’s Baa spread, which rose from 160 basis points in July 2007 to 600 basis points in December 2008: an increase of 440 basis points. This suggests an examination of the class of firms with a large exposure to this shock, and the consequences for their investment.

One group of firms of particular interest is multinational corporations, which have come to play a prominent role in the functioning of the global economy. MNCs are likely to have higher exposure to the Moody’s Baa spread, both because their corporate financial arrangements are likely to be optimised on a global scale with borrowing costs linked to the Moody’s Baa spread, and because the Baa spread is correlated with global business cycle conditions.

In this paper, we setup a quasi-experimental design where a dataset of 115 Indian MNCs are matched against domestic firms with similar characteristics but no overseas assets. Using this matched sample, we ask two questions: Did MNCs carry a bigger exposure to the Baa spread, and did MNCs cut back on investment to a bigger extent?

We apply augmented market model estimation to measure the exposure of firms to the Moody’s Baa spread, thus harnessing information from the stock market for this purpose. Our results suggest that MNCs had substantially bigger exposure to the Baa spread. The point estimate for the MNC dummy is -4.3, which suggests that for each 100 bps rise in the Baa spread, the stock price of an MNC drops by 4.3 percentage points more when compared with a matched domestic firm.

We then turn to the question of balance sheet effects. On one hand, the MNCs in this dataset suffered adverse shocks. On the other hand, MNCs are also likely to be firms which do not have financing constraints, through

global treasury management which avoids the infirmities of the local financial system. Our results suggest that smaller MNCs did experience reduced growth of investment, when compared with that of matched partners. But the largest MNCs actually accelerated investment in the crisis year, when compared with the matched domestic firm. In the aggregate, the investment rate in the overall dataset went *up* in 2008-09 when compared with 2007-08. We may conjecture that this reflects the superior access to finance of large MNCs when compared either with their domestic peers or when compared with smaller firms.

This paper thus offers new insights into the role of MNCs in crisis transmission. On one hand, it suggests that MNCs were exposed to the Baa spread, and were thus a mechanism through which the credit crisis of 2008 was propagated into India. Yet, large MNCs did not respond by cutting back on investment: on the contrary they expanded investment in the crisis year. India's internationalisation through the rise of domestic MNCs generated a new channel for crisis transmission, but the overall investment of MNCs expanded in 2008-09 thus stabilising the domestic business cycle.

## **2 The international exposure of multinationals**

In recent decades, a considerable literature has emphasised the role of multinational corporations in international economics. Our focus in this paper is the international risk exposure of multinational corporations.

A small literature has developed on the issue of currency risk exposure of MNCs. When compared with domestic firms, MNCs are expected to carry greater currency risk owing to a bigger scale of international operations. At the same time, their financial hedging and operational hedging can yield reduced currency risk exposure (Crabb, 2002; Pantzalis, Simkins, and Laux, 2001; Choi and Jiang, 2009). Chowdhry and Howe (1999) model the decision of MNCs to undertake operational hedging. One dimension of interest here is the distinction between large and small multinational firms: small multinational firms may be less able to incur the fixed costs of establishing currency hedging programs, and may hence carry larger exposure. One example of such a result is Shin and Soenen (1999). While the bulk of this literature has focused on US MNCs, research in settings such as Japan (He and Ng, 1998) and Eastern Europe (Muller and Verschoor, 2007) has also appeared.

In the global crisis of 2007 and 2008, while currency fluctuations took place to a significant extent, the dominant financial risk of this period was the dramatic increase in the cost of borrowing. The Moody's Baa credit spread rose from 160 basis points in July 2007 to 600 basis points in December 2008: an increase of 440 basis points.

While the Moody's Baa spread directly measures the cost of borrowing for a Baa rated corporation, it also incorporates some information about US business cycle conditions (Jagannathan and Wang, 1996). To the extent that MNCs have a greater exposure to the US business cycle, and to the extent that MNCs are likely to engage in foreign borrowing, they would have a larger exposure to fluctuations of the Moody's Baa spread. If such exposure is present, it would generate a channel for transmission of the global credit crisis. In this paper, we undertake an empirical examination of the extent to which Indian MNCs had a larger exposure to the Moody's Baa spread when compared with a matched sample of domestic firms.

### **3 Crisis propagation through balance sheet effects**

Once the question of exposure of MNCs to the global credit market is established, we turn to the consequences of this exposure. The overall rise of the Moody's Baa spread was 4.4 percentage points. If a firm had an exposure of  $\beta_3 = 10$  this would roughly translate into a 44% drop in the stock price.

Krugman (1999) emphasised the 'open economy Bernanke-Gertler-Gilchrist effects' when large currency depreciations interact with financial frictions: the firms adversely affected by these large depreciations could reduce investment, which would be contractionary. In a recent example of this literature, Aguiar (2005) finds that Mexican firms with larger currency exposure in 1994 had bigger declines in investment after the peso crisis.

The Krugman model links currency depreciation to the macroeconomy through corporate balance sheets. In this paper, we explore the analogous question: *If MNCs had large exposures to the Moody's Baa spread, did they reduce fixed investment by more than non-MNCs?* There is a direct analogy between the shock to a balance sheet caused by a large depreciation and the shock to a balance sheet caused by a sharp rise in the Moody's Baa spread for a firm with considerable exposure to it. Our work here links up Desai and Foley (2004) who suggest that cross-border investments of multinationals can play

**Table 1** Summations across categories of firms (2009)

Variable	Units	Domestic	Lo-MNC	Hi-MNC	All
Sales	Rs. Bln.	11948.13	12662.70	3417.77	28028.61
Total assets	Rs. Bln.	14710.03	12598.82	6571.99	33880.83
Market capn.	Rs. Bln.	10734.73	10753.57	4249.49	25737.80
Exports	Rs.Bln.	1318.05	2425.23	1234.98	4978.25
Number of Obs.	Number	1702	379	233	2314

a role in synchronisation of business cycles. In a related paper focusing on balance sheet effects in the 2008 crisis, Almedia, Campello, Laranjeira, and Weisbenner (2009) examine US firms which faced difficulties in rolling over debt in 2008, and find that these firms reduced investment by more when compared with similar firms where debt was scheduled to mature well after 2008.

However, the critical element of the story is financial frictions. To the extent that MNCs are *less* financially constrained, they may be able to absorb shocks without reducing investment. A series of papers (Cheong, 2006; Hercourt and Poncet, 2009; Desai, Foley, and Forbes, 2008) find that MNCs face reduced financial constraints and thus cut back on investment, when faced with adverse shocks, to a smaller extent. There are, thus, good economic arguments for suggesting that even though MNCs may have suffered substantial shocks in the 2008 crisis, the extent to which this would have generated a reduction of investment might have been small.

## 4 The Indian setting

In recent years, many Indian firms have become multinationals (Demirbas, Patnaik, and Shah, 2009; Pradhan, 2004). This gives us an ideal quasi-experimental setting, with MNCs being exposed to international shocks while domestic firms are available as controls. We focus on the firms who were MNCs in the accounting year 2008-09, which runs from 1 April 2008 till 31 March 2009, where the bulk of the impact of the global crisis was felt.

Table 1 shows summations of firm characteristics from the Prowess database maintained by the Centre for Monitoring Indian Economy (CMIE)<sup>1</sup> subject

<sup>1</sup>India has a long tradition of sound accounting standards. Publicly traded corporations face pressures from public shareholders and the securities regulator. Owing to these factors, Indian firm level data is of a high quality by the standards of emerging mar-

**Table 2** Median and mean values for firms in the dataset

Variable	Units	Domestic	Lo-MNC	Hi-MNC	All
Sales	Rs. Bln.	1.13	5.25	3.01	1.52
Mean		7.02	33.41	14.67	12.11
Total assets	Rs. Bln	1.28	6.65	5.51	1.89
Mean		8.64	33.24	28.21	14.64
Market capn.	Rs. Bln.	0.22	1.37	1.67	0.36
Mean		6.46	28.83	18.40	11.35
Leverage	Times	2.16	2.56	1.91	2.18
Mean		1.84	4.75	2.28	2.36
Exports to sales	Per cent	1.22	13.08	37.91	4.04
Mean		41.28	24.74	45.75	39.02
Number of Obs.	Number	1702	379	233	2314

to two exclusions: Non-financial firms are excluded given the unique complexities of their financial data, and firms which are not members of the CMIE Cospi stock market index are excluded in order to focus on firms with the highest quality data.

This dataset captures a substantial slice of the Indian economy: The combined sales of these firms work out to 51% of GDP. We categorise firms into three categories: Domestic firms (with no overseas assets), Lo-MNC firms (with below 5% of their total assets outside the country) and Hi-MNC firms (with over 5% of their total assets outside the country). In the case of sales, these three groups account for 43 per cent, 45 per cent and 12 per cent of the overall sales respectively. This suggests that multinationals occupy a substantial role in the economy, and at the same time a substantial mass of firms (1702 in number) which have no overseas assets are also observed in the dataset.

In our empirical analysis, we will focus purely on a comparison between the Hi-MNC and the Domestic firms, so as to isolate the consequences of multinationalisation of a firm. The Lo-MNC firms, where overseas assets range from 0 to 5 per cent are excluded from the analysis.

Table 2 shows the median and the mean values of a few parameters which describe these firms. Hi-MNC firms are bigger: they have a mean total assets of Rs.28 billion and median total assets of Rs.5.5 billion, as opposed

kets. CMIE has a well developed ‘normalisation’ methodology which ensures inter-year and inter-firm comparability of accounting data. This database has encouraged an emerging empirical literature, including papers such as Khanna and Palepu (2000); Bertrand, Mehta, and Mullainathan (2002); Ghemawat and Khanna (1998).

to domestic firms where the mean is Rs.8.6 billion and the median is Rs.1.3 billion.

While the mean value of the exports to sales ratio is similar between Hi-MNC and Domestic firms, the median value is much lower for Domestic firms. At the same time, the financial statements used in this analysis focus on the standalone firm, and ignore the overseas subsidiaries of the MNCs. Hence, the true extent of the trade exposure of an MNC is not measured by the apparent export to sales ratio. We conclude that MNCs have more trade exposure than domestic firms, but we abstain from using the exports to sales ratio in the empirical analysis.

In the further empirical analysis, we apply the following additional exclusions:

1. We create a balanced panel for the 2007, 2008 and 2009 years, and use this to compute  $I_{2008}/K_{2007}$ ,  $I_{2009}/K_{2008}$  and  $\Delta I_{2009} = I_{2009}/K_{2008} - I_{2008}/K_{2007}$ , where  $I_t = K_t - K_{t-1}$  and  $K_t$  is the gross fixed assets in year  $t$ .
2. We require stock market data from June 2007 till January 2009.
3. We drop firms with below \$10 million of fixed assets.
4. Some firms have very large positive or negative values for  $\Delta I_{2009}$ : the range of this variable runs from -850 to +2330. Hence, the most extreme three per cent of observations at both ends of the distribution are deleted.

These exclusions yield a dataset of 146 Hi-MNC companies and 861 Domestic companies.

The analysis of this paper is about asking: *Do these Hi-MNC firms have a bigger exposure to the Moody's Baa spread? Do these Hi-MNC firms have bigger or smaller values for  $\Delta I_{2009}$ ?* In order to answer these questions, we create a matched sample using propensity score matching. A logit model is estimated using log fixed assets of 2008 (the pre-crisis year) and its squared value, log size and its squared value,<sup>2</sup>, return on assets and the cashflow margin. A control firm is identified for each MNC within its major industry group with a caliper of 0.25.

Table 3 shows the improvement in sample characteristics achieved through the propensity score matching. However, for 38 firms, matches are not found. Thus the final dataset has 115 Hi-MNC firms and 115 matched Domestic firms.

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<sup>2</sup>Size is defined as  $0.5(\text{assets} + \text{sales})$ .

**Table 3** Quality of matching

Variable	Before matching		After matching	
	Treatment	Controls	Treatment	Controls
Log Fixed Assets	5.96	5.27	6.03	6.01
Log size	7.03	6.01	7.10	6.97
Cashflow margin	11.34	-0.73	7.33	14.66
Return on assets	7.68	1.88	3.33	5.23

## 5 Did Indian multinationals have more exposure to the global credit market?

We first address the question: *In the global crisis of 2007 and 2008, did MNCs have a bigger exposure to the Moody's Baa spread?* In order to address this question, a methodology for measurement of this exposure is required. A considerable literature has used 'augmented market models' to measure firm exposure to exchange rates. In this paper, we extend this strategy to measure firm exposure to the Moody's Baa spread. The model:

$$r_{jt} = \alpha + \beta_1 r_{M1,t} + \beta_2 r_{M2,t} + \beta_3(1 - L)S_t + \epsilon_t \quad (1)$$

relates the stock market returns on the firm in time  $t$ ,  $r_{jt}$ , to market index movements  $r_{M1,t}$ , currency fluctuations  $r_{M2,t}$  and the first differences of the Moody's Baa spread  $S_t$ . The coefficient  $\beta_3$  measures the sensitivity of the firm valuation to changes in global credit market conditions.<sup>3</sup>

In an efficient market, this has the advantage of reflecting the efforts of speculative markets at putting together all aspects of the credit exposure of the firm. Stock market speculators have an incentive to unearth information about the overseas credit market exposure of the firm, the currency derivatives position of the firm, the invoicing currency of international trade of the firm, etc., which would give a full picture of the risk exposures of the firm. In particular, if borrowing has been done through offshore affiliates or subsidiaries, and is managed out of a global treasury, this approach is likely to show the full exposure while accounting data might not.

<sup>3</sup>Our empirical work builds on the measurement of currency exposure in a similar dataset done in Patnaik and Shah (2010 (forthcoming)), where a more detailed description is found.

**Table 4** Summary statistics about estimated exposures to the exchange rate and to the Baa spread

	MNC	Domestic
$\beta_2$		
Mean	-1.99	-2.05
Median	-1.79	-1.83
$\beta_3$		
Mean	-17.50	-16.10
Median	-15.90	-15.60

The market index  $r_{M1}$  might be affected by  $(1 - L)S$  and  $r_{M2}$ . We draw on Griffin and Stulz (2001) and orthogonalise the market index time-series by first estimating a regression model explaining  $r_{M1}$  as a function of past and present values of  $r_{M2}$  and  $(1 - L)S$ , and extracting the residual from this regression. These residuals represent pure domestic equity index returns, uncontaminated by the impact (if any) of exchange rate and credit spread fluctuations.

Using this procedure, we have an estimate  $\hat{\beta}_{3,j}$  of the exposure of firm  $j$  to the Moody's Baa spread, along with the standard error of this estimate,  $\sigma_{\beta,j}$ . Summary statistics about the estimated currency risk  $\beta_2$  and Baa exposure  $\beta_3$  are shown in Table 4. These location estimators suggest that stock prices decline when the rupee-dollar rate depreciates (i.e. positive returns are experienced) and when the Moody's Baa spread goes up.

A natural strategy for exploring this data involves regressions of the form:

$$\hat{\beta}_{3,j} = aMNC_j + bX_j + e_j$$

where  $MNC_j$  is 1 for firms with outbound FDI,  $X_j$  is a vector of characteristics about firm  $j$  and  $e_j$  is a residual. The OLS estimator of the model above fails to utilise the fact that we have an estimate of the imprecision of each exposure. Since the  $\sigma_{\beta,j}$  of  $\hat{\beta}_{3,j}$  is observed, this is a measurement error model with known measurement error.

Financial data is known to have important deviations from normality. However, estimates from the augmented market model are likely to be normally distributed owing to the central limit theorem. This suggests a parametric model of measurement error, which would give greater efficiency:

$$\beta_{3,j} \sim N(aMNC_j + bX_j, \sigma_{\beta,j}^2 + \sigma_e^2)$$

**Table 5** Model explaining the cross-section of  $\beta_3$ 

	Coef	't'
Intercept	-10.089	-0.967
Log size	-0.307	-0.111
(Log size) <sup>2</sup>	-0.025	-0.138
Leverage	0.291	1.181
Leverage <sup>2</sup>	-0.006	-0.745
MNC dummy	-4.338	-3.728
$\sigma_e$	18.753	3.613

where the observed  $\beta_{3,j}$  for each company is viewed as a linear model with a two-part error: a generic  $\sigma_e^2$  which reflects deviations from the linear model and a firm-specific  $\sigma_{\beta,j}^2$  which reflects the measurement error specific to firm  $j$ . The model is estimated by maximum likelihood.

Table 5 shows ML estimates of a linear model explaining the cross-sectional variation of  $\beta_3$ . The MNC dummy has a large value of -4.338 with a  $t$  statistic of -3.728. For a 100 bps rise in the Moody's Baa spread, the stock price of an MNC (on average) fell by 4.3 percentage points more, when compared with a similar domestic firm. This demonstrates that MNCs carried bigger exposure to the Moody's Baa credit spread with both economic and statistical significance.

A similar analysis for the currency exposure of the two groups of firms showed that there was no significant difference in the currency exposure of MNCs. This is consistent with the recent literature (e.g. Choi and Jiang (2009)) which emphasises the extent to which MNCs are able to use operational hedging in order to contain currency exposure.

## 6 Did Indian multinationals lower investment?

We now turn to the question of fixed investment by the firms. The question we ask is: *Did MNCs report smaller values for  $\Delta I_{2009}$  when compared with comparable domestic firms?*

One area of concern lies in the distribution of  $\Delta I_{2009}$  which, even after winsorisation, potentially contains extreme values. Hence, Table 6 first approaches the data through summations of fixed assets and investment, so as to avoid the extreme values.

**Table 6** Fixed asset growth from 2007 to 2009

Group	Sum fixed assets (Rs. Bln.)			$I_{2008}/K_{2007}$	$I_{2009}/K_{2008}$	$\Delta I_{2009}$
	2007	2008	2008			
Small quartile						
Domestic	20	26	32	28.08	22.74	-5.34
MNC	22	27	30	21.02	13.15	-7.87
Difference				-7.06	-9.59	-2.53
Q2 by fixed assets						
Domestic	61	71	87	17.17	21.89	4.72
MNC	52	62	72	18.21	16.31	-1.90
Difference				1.04	-5.59	-6.62
Q3 by fixed assets						
Domestic	148	169	198	14.12	17.13	3.02
MNC	129	152	179	17.89	18.43	0.54
Difference				3.78	1.30	-2.48
Big quartile						
Domestic	1138	1252	1381	10.02	10.29	0.27
MNC	1073	1207	1523	12.48	26.23	13.75
Difference				2.46	15.94	13.48
Overall						
Domestic	1367	1518	1697	11.04	11.81	0.76
MNC	1276	1447	1805	13.41	24.75	11.34
Difference				2.36	12.94	10.58

The bottom panel shows the overall results. In 2008, the investment ratio of MNCs was 13.4% while that of the domestic controls was 11.04%. In the crisis year, the investment of domestic firms was essentially stagnant at 11.81%. But investment by MNCs went up sharply to 24.75%. This yields a higher  $\Delta I_{2009}$  for MNCs of 10.58 percentage points.

When we break this overall result down by quartiles by fixed assets, a sharp pattern is seen. The phenomenon of MNCs who stepped up investment is limited to the top quartile. In the remaining three quartiles, MNCs expanded investment by less than the control firms. However, the Big quartile dominates overall fixed assets. As an example, in 2008, of total MNC assets of Rs.1447 billion, a full Rs.1207 billion were in the Big quartile. Hence, the overall summary statistics are dominated by the behaviour seen in the Big quartile.

We now turn to the cross-sectional analysis of  $I_{2009}/K_{2008}$ . This draws upon the microeconomic analysis of firm investment (Forbes, 2007; Aguiar, 2005). The standard Euler equation for the solution to the firms optimisation problem, under quadratic adjustment costs, is:

$$E_{t-1} \left\{ \frac{I_t}{K_t} - \frac{1}{(1-\delta)\beta} \frac{I_{t-1}}{K_{t-1}} + \left( \frac{1}{(1-\delta)\beta} - 1 \right) c + \frac{1}{b(1-\delta)\beta} \frac{\partial \pi_{t-1}}{\partial K_{t-1}} \right\} = 0$$

where  $\beta$  is the discount rate,  $\delta$  is the rate of depreciation,  $E_t$  is the expectation based on information available at time  $t$ , and the cost of adjustment of the stock of capital is

$$\chi(I_t, K_t) = \frac{b}{2} \left( \frac{I_t}{K_t} - c \right)^2 K_t$$

and  $b$  and  $c$  are parameters describing the process of stock adjustment. If we write  $\eta_t$  as the expectational error, the Euler equation can be written as:

$$\frac{I_t}{K_t} = \frac{1}{b(1-\delta)\beta} \frac{I_{t-1}}{K_{t-1}} + \left( \frac{1}{(1-\delta)\beta} - 1 \right) c + \frac{1}{(1-\delta)\beta} \frac{\partial \pi_{t-1}}{\partial K_{t-1}} + \eta_t$$

where

$$\eta_t = \frac{1}{b} (E_t - E_{t-1}) \sum_{s=0}^{\infty} (1-\delta)^s \beta^s \frac{\partial \pi_{t+s}}{\partial K_{t+s}}$$

**Table 7** Linear models of the cross-sectional variation of investment

	OLS	Robust regression
Intercept	10.256 (4.59)	6.653 (7.94)
$I_{2008}/K_{2007}$	0.118 (1.90)	0.277 (11.94)
MNC dummy	12.382 (4.14)	2.663 (2.37)
$R^2$	0.0902	

Here  $E_t - E_{t-1}$  reflects changes in expectations owing to new information of time  $t$ , which in our case is the crisis year 2008-09. This could include changes in the profitability of capital (where MNCs may be expected to fare worse owing to greater exposure to the world economy), changes in financing costs (where MNCs may be expected to fare worse owing to greater borrowing from the overseas credit market) and changes in uncertainty (where MNCs might fare worse owing to the cloudy outlook for the world economy).

This reasoning suggests an empirical estimation equation of the form

$$\frac{I_{j,t}}{K_{j,t}} = \alpha_0 + \alpha_1 \frac{I_{j,t-1}}{K_{j,t-1}} + \alpha X_{j,t} + u_t$$

where  $X_{j,t}$  contains firm characteristics of interest. Specifically, we estimate the linear model:

$$\frac{I_{2009}}{K_{2008}} = a_0 + a_1 \frac{I_{2008}}{K_{2007}} + a_2 \text{MNC} + e$$

Given the extreme values that are present, we explore this data through OLS and robust regressions. We estimate these models with each observation weighted by  $K_{2008}$ , so as to give greater importance to firms with more fixed capital in 2008, and to link these results more directly with those seen in Table 6.

Table 7 shows linear models explaining  $I_{2009}/K_{2008}$ . The MNC dummy has a positive value with both economic and statistical significance. The OLS estimate of 12.38 percentage points is similar to the difference in investment of 10.58 percentage points seen in Table 6.

When  $\beta_3$  is also placed as an explanatory variable in these models, it is not significant. This suggests that the MNC dummy alone shapes the investment equation; once this has been taken into account,  $\beta_3$  does not matter.

## 7 Conclusions and areas for further research

In this paper, we embarked on an exploration of crisis propagation in the 2008 crisis. Given the prominent role of MNCs in international economic integration, it is reasonable to think that MNCs are likely to have had a bigger exposure to the credit crisis. This would reflect a combination of the direct impact upon borrowing firms – and MNCs are likely to have overseas subsidiaries with borrowing in New York and London – and the trade impact of a business cycle downturn upon MNCs given that the Moody’s Baa spread is correlated with world business cycle conditions.

Indian data offers a clean opportunity to construct a matched sample with MNCs and matched domestic firms with similar characteristics. Augmented market models were used to estimate  $\beta_3$ , the exposure to the Moody’s Baa spread, for all firms. Cross-sectional analysis of  $\beta_3$  revealed that MNCs carried much larger exposures to the Moody’s Baa spread. On average, MNCs had a bigger (more negative) value of  $\beta_3$  of 4.338. This meant that for each 100 bps rise in the Moody’s Baa spread, the stock price of MNCs dropped by 4.338 percentage points more than the comparable domestic firm.

This raises a question in open economy Bernanke-Gertler-Gilchrist effects. Did these shocks induce a decline in investment by MNCs? We expect reduced investment by financially constrained firms, but in the literature, MNCs are generally expected to be less constrained.

The analysis reveals a suggestive pattern where investment by MNCs declined, when compared with domestic control firms, in the first three quartiles by fixed assets. However, 83% of fixed assets are in the top quartile, and in this quartile, MNC investment grew by 10.58 percentage points when compared with domestic peers. Hence, the overall result is one where Indian MNCs absorbed large shocks to the Moody’s Baa spread, but did not exacerbate the business cycle downturn by cutting back on investment. On the contrary, MNCs helped stabilise the business cycle by *expanding* investment in 2008-09.

We may conjecture that the MNCs in the lower three quartiles were perhaps financially constrained, which explains their decline in investment in response to the shocks. However, we leave an exploration of this question to future research.

## References

- AGUIAR, M. (2005): “Investment, devaluation, and foreign currency exposure: The case of Mexico,” *Journal of Development Economics*, 78(1), 95–113.
- ALMEDIA, H., M. CAMPELLO, B. LARANJEIRA, AND S. WEISBENNER (2009): “Corporate debt maturity and the real effects of the 2007 credit crisis,” Discussion Paper 14990, NBER.
- BERTRAND, M., P. MEHTA, AND S. MULLAINATHAN (2002): “Ferretting Out Tunneling: An Application to Indian Business Groups,” *Quarterly Journal of Economics*, 117(1), 121–148.
- CHEONG, D. (2006): “Surviving a currency crisis: How much did FDI and exports account for firm resilience in Asia?,” Discussion paper, Johns Hopkins University.
- CHOI, J. J., AND C. JIANG (2009): “Does multinationality matter? Implications of operational hedging for the exchange risk exposure,” *Journal of Banking and Finance*, 33, 1973–1982.
- CHOWDHRY, B., AND J. T. B. HOWE (1999): “Corporate Risk Management for Multinational Corporations: Financial and Operational Hedging Policies,” *European Finance Review*, 2(2), 229–246.
- CRABB, P. R. (2002): “Multinational corporations and hedging exchange rate exposure,” *International Review of Economics and Finance*, 11(3), 299–314.
- DEMIRBAS, D., I. PATNAIK, AND A. SHAH (2009): “Graduating to globalisation: A study of Southern multinationals,” Discussion paper, NIPFP DEA Research Program.
- DESAI, M. A., AND C. F. FOLEY (2004): “The comovement of returns and investment within the multinational firm,” in *NBER International Seminar on Macroeconomics*, pp. 197–237. University of Chicago Press.
- DESAI, M. A., C. F. FOLEY, AND K. J. FORBES (2008): “Financial Constraints and Growth: Multinational and Local Firm Responses to Currency Depreciations,” *Review of Financial Studies*, 21(6), 2857–2888.
- FORBES, K. (2007): “One cost of the Chilean capital controls: increased financial constraints for smaller traded firms,” *Journal of International Economics*, 71(2), 294–323.
- GHEMAWAT, P., AND T. KHANNA (1998): “The Nature of Diversified Business Groups: A Research Design and Two Case Studies,” *Journal of Industrial Economics*, 46(1), 35–61.

- GRIFFIN, J., AND R. STULZ (2001): “International competition and exchange rate shocks: a cross-country industry analysis of stock returns,” *Review of Financial Studies*, 14(1), 215–241.
- HE, J., AND L. K. NG (1998): “The foreign exchange exposure of Japanese multinational corporations,” *Journal of Finance*, 53(2), 733–753.
- HERICOURT, J., AND S. PONCET (2009): “FDI and credit constraints: Firm level evidence in China,” *Economic Systems*, 33(1), 1–21.
- JAGANNATHAN, R., AND Z. WANG (1996): “The conditional CAPM and the cross-section of expected returns,” *Journal of Finance*, 51(1), 3–53.
- KHANNA, T., AND K. PALEPU (2000): “Is Group Affiliation Profitable in Emerging Markets? An Analysis of Diversified Indian Business Groups,” *Journal of Finance*, 55(2), 867–891.
- KRUGMAN, P. (1999): “Balance sheets, the transfer problem, and financial crises,” *International Tax and Public Finance*, 6(4), 459–472.
- MULLER, A., AND W. F. C. VERSCHOOR (2007): “Trade and exposure of Eastern European multinationals,” *Emerging markets review*, 8, 218–229.
- PANTZALIS, C., B. J. SIMKINS, AND P. A. LAUX (2001): “Operational Hedges and the Foreign Exchange Exposure of U.S. Multinational Corporations,” *Journal of International Business Studies*, 32(4), 793–812.
- PATNAIK, I., AND A. SHAH (2010 (forthcoming)): “Does the currency regime shape unhedged currency exposure?,” *Journal of International Money and Finance*.
- PRADHAN, J. (2004): “The determinants of outward foreign direct investment: a firm-level analysis of Indian manufacturing,” *Oxford Development Studies*, 32(4), 619–639.
- SHIN, H.-H., AND L. SOENEN (1999): “Exposure to currency risk by US multinational corporations,” *Journal of Multinational Financial Management*, 9(2), 195–207.