
Why India choked when Lehman broke

Ila Patnaik and Ajay Shah

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Abstract

India has an elaborate system of capital controls which impede capital mobility and particularly short-term debt. Yet, when the global money market fell into turmoil after the bankruptcy of Lehman Brothers on 13/14 September 2008, the Indian money market immediately experienced considerable stress, and the operating procedures of monetary policy broke down. We suggest that Indian multinationals were using the global money market and were short of dollars on 15 September. They borrowed in India and took capital out of the country. We make three predictions that follow from this hypothesis, and find that the evidence matches these predictions. This suggests an important role for Indian multinationals in India's evolution towards *de facto* convertibility.

Keywords: capital controls, global financial crisis, Indian multinationals, effectiveness of capital controls, *de facto* convertibility.

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1 Introduction

De jure measures of capital account liberalisation suggest that India's capital account is quite closed. *De facto* integration has risen sharply in recent years, but India still remains fairly closed. The rapid transmission of the impact of the Lehman bankruptcy into Indian financial markets was consequently unexpected. In this paper, we propose an explanation involving the treasury operations of Indian multinationals (MNCs). These MNCs are less subject to the capital controls imposed on Indian companies.

The developments in Indian financial markets in September and October following the death of Lehman Brothers in New York on September 14, 2008 were quite unprecedented. First, there was the sudden change in conditions in the money market. Call money rates shot up immediately after September 15th. Despite swift action by the Reserve Bank of India (RBI), the tightness persisted through the month of October. The operating procedure of monetary policy broke down in unprecedented fashion. Rates were persistently above RBI's policy rate corridor. The call rate consistently breached the ceiling of the repo rate, of 9 percent, and attained values beyond 15 percent. There was a huge amount of borrowing from RBI. On some days, RBI lent an unprecedented Rs.90,000 crore through repos.

These events are surprising given the apparent scale of India's *de jure* capital controls. Our understanding of crisis transmission, the effectiveness of capital controls, and India's *de facto* openness would be enhanced by carefully investigating this episode and identifying explanations.

The main hypothesis of this paper is that many Indian firms (financial and non-financial) had been using the global money market before the crisis, avoiding India's capital controls by locating global money market operations in offshore subsidiaries. When the global money market collapsed after the failure of Lehman, these firms were suddenly short of dollar liquidity. They borrowed in the rupee money market, converted rupees to USD, to meet obligations abroad.

This led to pressure on the currency market. The rupee depreciated sharply. RBI attempted to reduce rupee depreciation by selling dollars. It sold \$18.6 billion in the foreign exchange market in October alone. Ordinarily, we may have expected depreciation of the exchange rate on both the spot and the forward markets. However, instead of the forward premium going up when there was pressure on the rupee to depreciate, or remaining the same, it crashed sharply. Our hypothesis is that some Indian MNCs, who were taking

dollars out of India, planned to bring the money back to India in a few weeks. To lock in the price at which they would bring money back after a month, they sold dollars forward. The one month forward premium fell sharply into negative territory.

Balance of payments data shows outbound FDI was the largest element of outflows in the ‘sudden stop’ of capital flows to India of the last quarter of 2008. This supports this hypothesis. This was not a time when there was significant merger and acquisitions activity going on owing to the banking and money market crisis around the world. The explanation for the large FDI outflow when money market conditions in India and the world were among the worst in many decades could lie in the offshore money market operations of Indian MNCs.

Finally, we analyse stock market data, and find that Indian MNCs were more exposed to conditions in international money markets as compared with non-MNCs.

The contribution of this paper lies in showing that Indian MNCs are now an important channel through which India is financially integrated into the world economy. This raises questions about the effectiveness of India’s capital controls which inhibit short-dated borrowing by firms. This restriction appears to be sidestepped to a substantial extent by Indian MNCs. This evidence fits into the larger understanding about the gap between India’s highly restrictive *de jure* capital controls but yet substantial *de facto* openness.

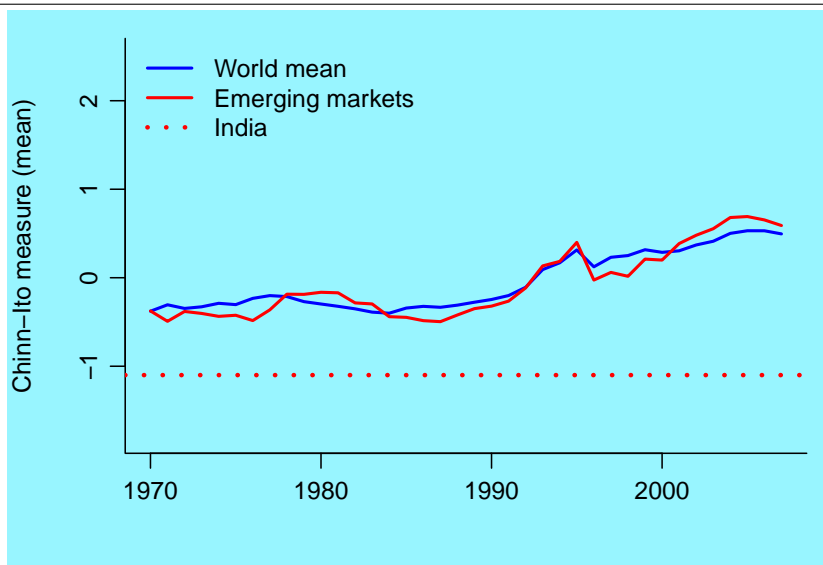
2 What happened in India when Lehman broke

2.1 India’s capital account liberalisation

The extent of capital account integration is usefully examined in terms of the apparent rules in place (*de jure* integration) as opposed to the effective ground reality (*de facto* integration).

One important database with cross-country evidence about *de jure* capital controls has been created by Chinn and Ito (2008). Figure 1 shows the time-series of the Chinn-Ito measure from 1970 till 2007 for India, for the world average and the emerging markets average. The Indian value of the score has been at -1.1 all through, which highlights the limited progress that India has made in terms of removing capital controls. The world mean went up from -0.38 in 1970 to 0.495 in 2007. The average for emerging markets went

Figure 1 *De Jure* capital controls



Source: Chinn and Ito (2008)

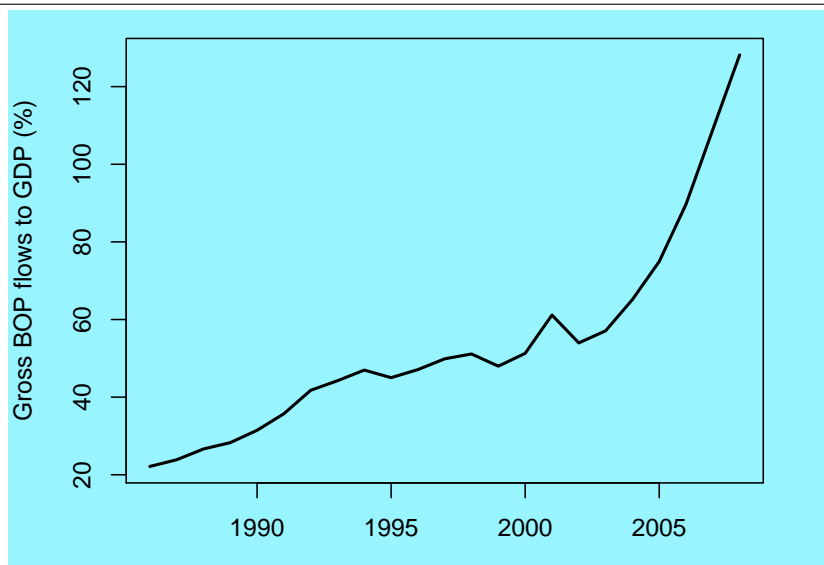
up from -0.375 in 1970 to 0.59 in 2007. Thus, regardless of whether India is compared against the world average or emerging markets, in both 1970 and 2007, its capital account has been significantly more closed, *de jure*.¹

In terms of *de facto* measures, there are two important approaches to measurement. The first involves a simple examination of the gross flows on the balance of payments, expressed as percent of GDP. This extends the intuition of the trade/GDP ratio. Figure 2 shows that gross flows have risen dramatically in recent decades, growing from roughly 20 per cent to roughly 125 per cent. Of particular interest is the doubling which took place in the period after 2002, which suggests an accelerated pace of capital account integration in these years.

The second strategy for measuring *de facto* integration lies in arriving at estimates of the *stock* of external assets and liabilities, as has been done by Lane and Milesi-Ferretti (2007). Their database shows that India has been rapidly opening up. At the same time, as Prasad (2009) notes, on a cross-country comparison and relative to its size, India appears to have been one

¹The measurement of intensity of capital controls is itself a field where standard methodologies have not yet been fully established. Another measurement effort, Edwards (2007), finds that Indian *de jure* capital controls have eased significantly in the recent decade.

Figure 2 Gross flows to GDP



Source: Business Beacon, CMIE

of the least financially open economies in the world.

2.2 The events of September 2008

When the global financial crisis erupted, at first it was believed that India would be experience little turbulence, given a relatively closed economy and domestic financial system. The events went against these expectations (Aziz *et al.*, 2008). Table 1 juxtaposes three time-series, observed at a daily frequency. The ‘TED Spread’ measures financial distress in London.² This is compared against two measures of money market tightness in India: the call money interest rate and the quantity borrowed from RBI by the banking system.

The last pre-crisis day was 12 September 2008, which was a Friday. On this day, the call money rate was 6.15 per cent and the banking system had borrowed Rs.144 billion from RBI. Over the weekend, Lehman Brothers filed for bankruptcy. On Monday, the money market in Bombay opened in turmoil, even though this opens 5.5 hours before the money market in

²This is the spread between the three-month USD LIBOR and the 90 day US treasury bill (UST). This measures the extent to which financial firms mistrust each other. Under normal circumstances, this is near zero.

Table 1 Turmoil in the money market: from London to India

Date	TED Spread	Call money rate	RBI repo (Bln. Rs.)
(Monday) 8 Sep	1.13	8.83	10.25
9 Sep	1.19	8.30	30.25
10 Sep	1.20	8.94	129.85
11 Sep	1.24	8.88	151.95
12 Sep	1.36	6.15	144.00
(Monday) 15 Sep	1.79	9.84	518.15
16 Sep	2.04	10.59	575.65
17 Sep	3.03	13.07	594.80

Source: Author's calculations based on data in Datastream, Business Beacon, CMIE

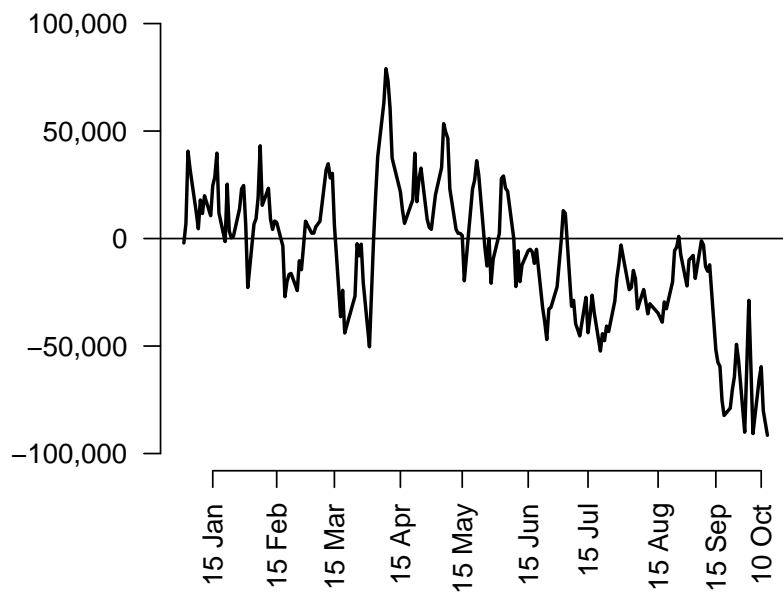
London. By 17 September (Wednesday), the quantity borrowed by banks from RBI had jumped to Rs.594 billion. The call money rate had risen to 13.07 per cent.

Some of the Indian money market tightening was caused by the advance tax payment of 15 September and the unfortunate timing of a government bond auction. However, tightness in liquidity owing to such events typically subsides rapidly. In this episode, money market tightness did not subside rapidly. On 7 October, the call rate closed at over 16 percent. In a similar vein, the RBI repo operations surged from Rs.100 billion on 8 September to Rs.575.65 billion on 16 September and then to Rs.900 billion on 29 September.

Figure 3 shows the status of RBI's 'liquidity adjustment facility' (LAF) operations. The numerical values seen here are an inadequate depiction of the liquidity squeeze, since access to borrowing from RBI is restricted to a few financial firms and requires certain kinds of collateral. A lot more borrowing would have taken place if the rules would have permitted it. A better picture of liquidity conditions is obtained from observing interest rates.

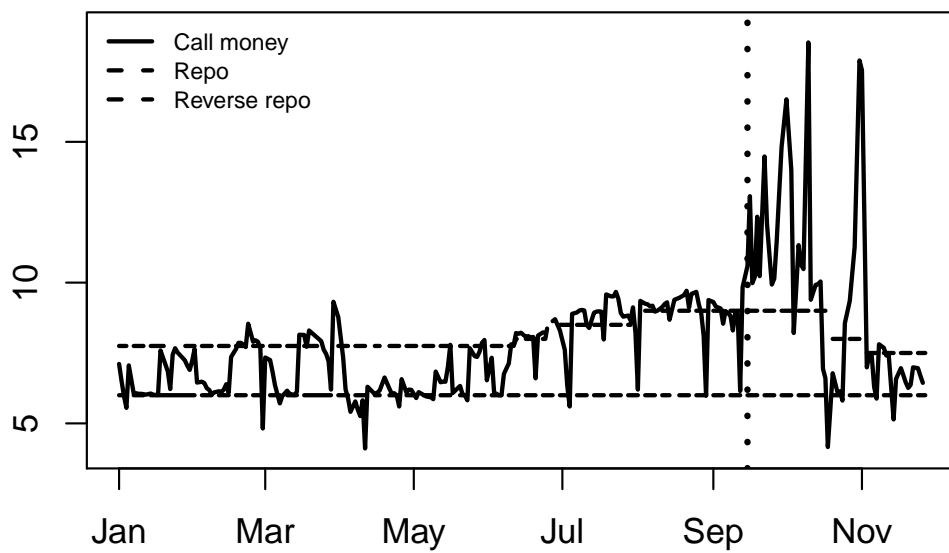
Figure 4 shows the time-series of the call money rate juxtaposed against the "corridor" defined by RBI's repo and reverse repo rates. For a while, the call money rate was closer to the top of the corridor. In the weeks following the Lehman bankruptcy, the call money rate consistently breached the ceiling of 9 per cent, often attaining values of above 15 per cent. The operating procedure of monetary policy broke down in unprecedented fashion.

Figure 3 Outstanding position of RBI LAF operations (Rs. crore)



Source: Business Beacon, CMIE

Figure 4 The call money rate vs. RBI's "corridor"



Source: Business Beacon, CMIE

2.3 The question

Indian capital controls are a maze of rules, restrictions, quantitative controls and outright bans. For instance, restrictions on external commercial borrowing prevent firms from borrowing short term (less than 3 years) in international money markets or to utilise the money borrowed for uses other than those specified such as capital goods imports and infrastructure. The total borrowing by India has a cap and every firm needs approval from RBI for such borrowing. India is one of the more closed economies in the world in terms of *de jure* controls. On the weekend of 13/14 September 2008, there was a near-universal consensus in India that the turmoil in global markets caused by the failure of Lehman Brothers was not going to affect India. Yet, in the week starting 15 September, the Indian money market fell into turmoil. These events merit an exploration.

These events clearly suggest a gap between *de jure* controls and the extent to which they bind. The international evidence suggests that over time, and particularly when given a sophisticated financial system, capital controls lose effectiveness as economic agents learn ways to get around these controls. This motivates the question: What were the aspects of the capital account which enabled substantial *de facto* integration despite the burden of *de jure* controls? In this paper, we argue that the new phenomenon of Indian MNCs is important to understanding these events.

3 A proposed explanation: offshore operations of Indian MNCs

Our main argument involves the global treasuries of Indian MNCs.

The domestic operations of all Indian firms – MNCs and others – are subject to the same regime of capital controls concerning offshore borrowing. It is reasonable to expect MNCs to be no more effective at obtaining foreign borrowing, when compared with non-MNCs. However, MNCs are able to borrow in their overseas subsidiaries in a way that domestic firms cannot. In an environment where RBI enforced quantitative restrictions upon overseas access to debt capital for firms operating in India, it is reasonable to think that MNCs would have done borrowing in their offshore subsidiaries.

When the global money market became illiquid on 13/14 September, these firms were faced with dollar shortages associated with liabilities which could

not be rolled over. It would be efficient for these firms to respond to this situation by borrowing in rupees in India, moving this money abroad, and thus discharging their dollar liabilities.

If this explanation is on track, then it has significant implications for the extent to which India will be able to maintain meaningful capital controls in the face of the rise of Indian MNCs. It is hence interesting to investigate this hypothesis further.

Information from within Indian MNCs which would directly resolve this question is not available. Hence, in this paper, we focus on three predictions that follow from this proposed explanation:

Prediction about the currency market Some of the MNCs taking capital out of the country in the week of 15 September would be anticipating the return of this money into India in the future. They could choose to hedge their currency risk by locking in the INR/USD exchange rate at which the capital would come back at a future date. The Indian currency derivatives market is fairly illiquid and inefficient; shocks to the order flow influence prices. Hence, if significant capital left the country in meeting short-term money market obligations, and if many firms chose to hedge the return of this capital into India at a future date, then an unusual decline in the INR/USD forward premium would be observed.

Prediction about quarterly BOP data Late 2008 was a difficult period in the Indian economy and the world economy. Ordinarily, outward FDI flows would be muted in this period. However, if Indian MNCs wanted to take money out of the country in order to meet obligations on the money market abroad, one path which they could use is RBI rules about outbound FDI. Hence, we would expect to see an unusual upsurge in outbound FDI in that quarter.

Prediction about stock market price fluctuations Offshore borrowing by Indian firms is constrained by capital controls. If Indian MNCs were evading these controls by borrowing through offshore subsidiaries, then their stock prices should be significantly exposed to fluctuations of the offshore credit spread relevant for emerging market corporations.

3.1 The rise of Indian MNCs

In recent years, there has been an upsurge of outward FDI from India (Pradhan, 2004; Demirbas *et al.*, 2009). Hundreds of large Indian firms are now

Table 2 Exporters and MNCs in the CMIE Cospi firms

	Not MNC	MNC	Sum
Not Exporter	827	44	871
Exporter	1003	288	1291
Sum	1830	332	2162

Source: Author's calculations based on data in Prowess, CMIE

MNCs, and the most outwardly oriented of these increasingly have over 50 per cent of their assets outside the country.

The literature on capital account openness or cross-border flows has focussed on portfolio, debt or FDI flows rather than on the internal flows and treasury operations of MNCs. However, there is a literature on how MNCs organise themselves, which suggests that MNCs make decisions about utilising financial markets in different countries based on costs of financing. As an example, Desai *et al.* (2004) examine the ways in which firms use internal capital markets opportunistically to complement external financing opportunities when external finance is costly and when there are tax arbitrage opportunities.

In a world where MNCs run global treasuries, maximise the tax efficiency of their operations, and source capital at the cheapest price across multiple locations, it is reasonable to think that MNCs would also optimally exploit opportunities for engaging in cross-border finance, based on a sophisticated understanding of a given set of capital controls.

Another dimension is the explicit evasion of capital controls. MNCs engage in substantial intra-firm trade. These transactions can be used for transfer pricing, so as to recognise profits at low-tax locations, and to move capital across the world in ways that are not permitted by capital controls. There is thus a link between the rise of MNCs and the long-understood issues of misinvoicing as a mechanism for obtaining *de facto* capital account openness (Patnaik and Vasudevan, 2000; Patnaik *et al.*, 2009).

3.2 Data description

We draw firm level data from the CMIE Prowess data base, using data for firms in the CMIE COSPI index, which is a set of 2500 companies with high stock market liquidity and good disclosure. This includes both financial and non-financial firms. Of these, the 2162 companies which had full data availability for 2007-08 were included in the data set for our analysis.

A firm is defined as a multinational if it holds more than 1 per cent of total

Table 3 Summary statistics about four kinds of firms

Variable	Units	D	DI	DX	DXI	All
Age	Years	21.00	19.50	23.00	21.00	22.00
iqr		15.00	45.50	21.00	13.00	18.00
Total assets	Rs. crore	131.48	577.78	226.82	615.20	214.07
iqr		490.51	1765.42	501.70	1678.96	631.35
Sales	Rs. crore	92.25	257.94	202.76	352.59	174.55
iqr		354.88	1517.58	472.51	1075.80	523.26
Employees	Number	131.16	509.72	382.71	912.50	296.00
iqr		516.69	3384.52	1058.28	2318.45	1060.00
Mkt. Capn.	Rs. crore	68.18	686.83	98.93	551.80	111.79
iqr		368.27	3889.40	387.28	2128.44	591.54
Turnover ratio	Per cent	80.80	97.88	77.27	92.77	80.51
iqr		139.07	127.05	111.26	151.65	126.31
Exports/Sales	Per cent	0.00	0.00	15.18	40.17	3.53
iqr		0.00	0.15	33.36	69.88	25.18
OFDI/Assets	Per cent	0.00	3.19	0.00	8.34	0.00
iqr		0.00	7.00	0.00	17.26	0.01
Size	Log Rs. crore	4.80	5.95	5.41	6.22	5.34
iqr		2.67	2.65	1.88	2.31	2.30
Leverage	Times	2.10	2.20	2.48	1.91	2.26
iqr		1.99	2.48	1.71	1.32	1.78
Number of observations	Number	827.00	44.00	1003.00	288.00	2162.00

Source: Author's calculations based on Prowess, CMIE

assets outside India. This emphasises the abrupt transition which takes place when a firm becomes an MNC. When a firm is not an MNC, it is fully subject to RBI's capital controls. Once a firm establishes overseas operations, a new set of techniques for doing corporate finance become available. This transition is about becoming an MNC, and not about the magnitude of foreign assets.

Symmetrically, we also define a firm as an exporting firm if it derives more than 1 per cent of sales from exports. Table 2 shows the breakdown of firms based on their exporting status and their MNC status. Of the 2,162 firms in the database, there are 332 MNCs, of which 288 are exporters and 44 are not.

We use the terminology 'D' for firms which only produce for domestic customers, 'DX' for firms that export, 'DXI' for firms that export and have FDI outside India, and 'DI' for firms which are multinationals but do not export. Table 3 shows summary statistics about the four groups for the accounting year 2007-08. For each group of firms, for each variable of interest, the median and the inter-quartile range (IQR) is shown. Here, we define 'size' as $\log((\text{sales} + \text{assets})/2)$.

Table 4 Industry distribution of the multinationals

Industry	Number of firms
Chemicals	69
Diversified	2
Electricity	2
Food	14
Machinery	26
Metals	16
Mining	3
Misc. manufacturing	4
Non-metallic minerals	18
Textiles	13
Transport Equipment	16
Services (Construction)	7
Services (Finance)	14
Services (IT)	96
Services (Other)	32
Total	332

Source: Author's calculations based on data in Prowess, CMIE

This table shows sharp differences between the firm characteristics of these four groups. In particular, multinationals who are also exporters (the DXI group) have a median value for total assets and number of employees which is almost three times larger than that computed for the full dataset. They have a median value for market capitalisation that is more than four times bigger than that seen for the full dataset. They are also much more export oriented – with an export/sales ratio of 40.17% – when compared even with exporting firms which are not multinationals who have an export/sales ratio of just 15.18%. In terms of financing, multinationals have somewhat *less* leverage when compared with others.

Table 4 shows the industry distribution of the MNCs. The biggest single industry is information technology. At the same time, some multinationals are found in all the top-level industries. While financial firms are represented in this data, only 14 of the 332 multinationals are financial firms.

In this paper, we suggest that the *microeconomic* phenomenon of some firms becoming multinationals helps us understand a *macroeconomic* phenomenon - the crisis on the money market and the collapse of the operating procedures of monetary policy in India after Lehman Brothers failed. For this claim to be tenable, the size of multinationals (in the aggregate) has to be large enough to matter to macroeconomics.

In order to assess these issues, Table 5 sums up financial data for the 332

Table 5 How big are the multinationals?

Variable	Units	Not MNC	MNC	All	Share of MNCs (Per cent)
Sales	Rs. crore	21,12,181	5,86,082	26,98,263	21.72
Total assets	Rs. crore	49,48,705	17,60,003	67,08,709	26.23
Mkt. Capn.	Rs. crore	34,08,303	15,17,651	49,25,955	30.81
Exports	Rs. crore	2,64,906	1,59,761	4,24,668	37.62
Number of observations	Number	1830	332	2162	15.36

Source: Author's calculations based on data in Prowess, CMIE

multinationals in our dataset, and compares them against the total for the full dataset of 2,162 firms. While the MNCs only account for 15.36% of the firms by number, they make up between 22% and 38% of the dataset when viewed through certain variables of interest. The sales of these 332 MNCs works out to 11.7% of GDP, and their total assets works out to 35.2% of GDP.

If, hypothetically, these 332 MNCs were financing 5% of their balance sheet through the money market in London, this translates to a sum of Rs.88,000 crore, which is of the same order of magnitude as the sudden increase in borrowing from RBI's lending window depicted in Figure 3.

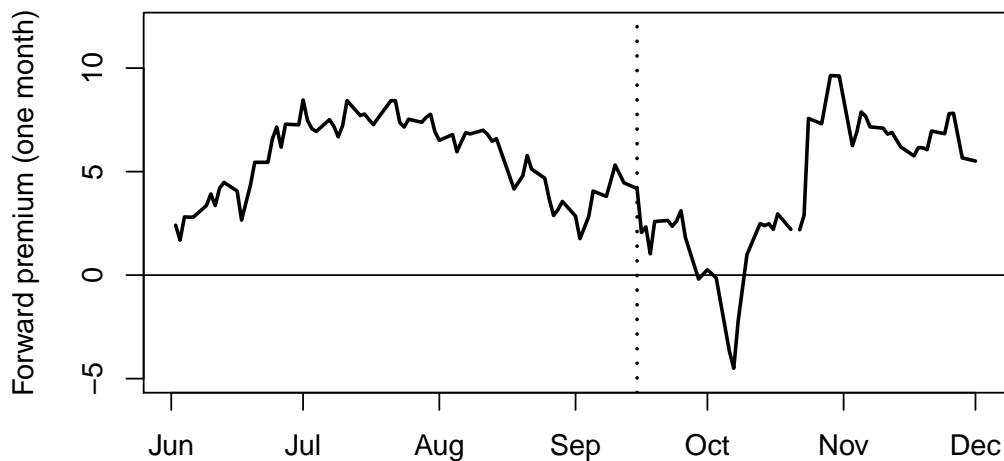
This suggests that this set of 332 multinationals is large enough to matter to macroeconomics. To the extent that our dataset is incomplete, i.e. to the extent that some MNCs exist which are not captured in our dataset, the influence of MNCs upon macroeconomic outcomes would be correspondingly larger.

3.3 Evidence from the foreign exchange market

A sudden stop of capital flows or an outflow from the capital account would put downward pressure on the exchange rate. Evidence of this is seen in partly in the depreciation of the rupee, and partly in the sudden and large sale of dollars by RBI. The normal reaction to a sudden jump in the exchange market pressure on the rupee would have been a rise in the forward premium as people would expect further depreciation. Even if the premium did not rise, it would remain the same. In fact, the reverse happened.

Under ordinary circumstances, currency forward pricing is done through covered interest parity (CIP). As a consequence, in most situations, the forward price is uninformative since it merely reflects CIP arbitrage. India is a rare situation in that CIP arbitrage is blocked by RBI (Shah and Patnaik, 2007).

Figure 5 The one-month forward premium



Source: Business Beacon, CMIE

As a consequence, the price of the forward is disconnected from the spot exchange rate. As a consequence, fluctuations of the order flow influence the forward price. This makes the forward price uniquely informative.

If MNCs were taking money out of the country in order to address a short-term exigency, they are likely to want to bring this money back at a future date. Some of them could choose to hedge this conversion of dollars to rupees at a future date by selling dollars forward. In particular, the rules for banks require that these short-term movements of capital be fully hedged.

Hence, the period where capital was leaving the country in response to the money market crisis worldwide would be a period where dollars were being sold forward. As a consequence, the forward premium would drop.

Figure 5 shows the time-series of the one-month rupee-dollar forward premium. The selling pressure on the forward market in the days after 15 September yielded an unprecedented crash in the forward premium. When the forward premium is negative, it means that a dollar at a future date is traded at a lower price than the spot price, which is an unusual configuration.

In the period from 29 September to 8 October, negative forward premia were repeatedly seen on the one month, three month and six month forward markets. The most extreme value seen was a premium of -4.5 per cent for the

Table 6 What happened in the sudden stop?

	(Million USD per quarter)					
	Sep 2007	Dec 2007	Mar 2008	Jun 2008	Sep 2008	Dec 2008
Loans	9,305	10,942	12,527	4,228	3,561	1,733
Banking capital	6,643	207	5,826	2,696	2,131	-4,956
Investment	13,027	16,892	4,760	4,778	4,254	-5,000
FDI in India	4,709	7,873	14,197	11,891	8,782	6,684
FDI by India	-2,581	-5,832	-5,701	-2,902	-3,218	-5,864
Portfolio investment	10,917	14,751	-3,764	-4,178	-1,301	-5,787
Others	4,180	2,976	2,916	-579	-2,094	4,540
Net capital inflows	33,155	31,017	26,029	11,123	7,852	-3,683

Source: Business Beacon, CMIE

one-month forward premium on 7 October. These events are consistent with our arguments about the global treasuries of Indian MNCs as the mechanism through which money market difficulties in London were transferred to India. If the problem on the domestic money market was merely one of a withdrawal of foreign capital, these dramatic changes in forward premia would not have taken place.

3.4 Evidence from the balance of payments

The balance of payment data, shown in Table 6, also provides important insights into what was happening in this period.³ In this period, India experienced a sudden stop in capital inflows, with net capital flows going from an inflow of \$33.155 billion in the Jul/Aug/Sep 2007 quarter to an outflow of \$3.7 billion in the Oct/Nov/Dec 2008 quarter.

A striking fact in the balance of payment data for October-December 2008 is not that foreign capital flowed out, as it did from many emerging economies. The dominant story of the outflow in this quarter is capital being taken out by Indian companies. Capital leaving India through banks ('banking capital') and through non-bank corporations ('FDI by India') added up to \$10.8 billion which was bigger than the overall net capital outflow of \$3.7 billion. In comparison, the net capital outflow through portfolio investors was only \$5.78 billion.

Indian banks with overseas operations were under stress much like banks worldwide were facing stress when the global money market was disrupted. Collateral requirements for outstanding CDS positions went up. When In-

³The phrase 'sudden stop' was brought to prominence by Calvo (1998).

dian non-financial firms faced shortages of dollar liquidity in the money market outside India, they often turned to Indian banks who lent them dollars outside India.

Turning to ‘FDI by India’, in the pre-crisis period, many large Indian firms were in the process of turning themselves into MNCs. This required sending capital out of the country for the purpose of acquiring companies, setting up global distribution systems, etc. This process was critically linked to (a) Optimism about the outlook for the world economy and (b) Benign conditions for access to equity and debt capital. In the quarter of Oct/Nov/Dec 2007, \$5.8 billion left the country in this fashion.

After December 2007, optimism about the world economy and financing conditions both turned relatively sombre. Outbound FDI flows declined to \$2.9 billion in the quarter of Apr/May/June 2008. Ordinarily, one might expect that from July to December 2008, conditions *worsened* in terms of optimism on the outlook for the world economy and in terms of access to equity or debt financing. However, FDI by India *rose* to \$3.2 billion in the Jul/Aug/Sep 2008 quarter and further to \$5.9 billion in the Oct/Nov/Dec 2008 quarter. We would conjecture that these large values were not about Indian companies buying assets or building a business overseas. They were perhaps about Indian companies transferring capital to overseas subsidiaries, which had been using the global money market, and were now short of dollar liquidity.

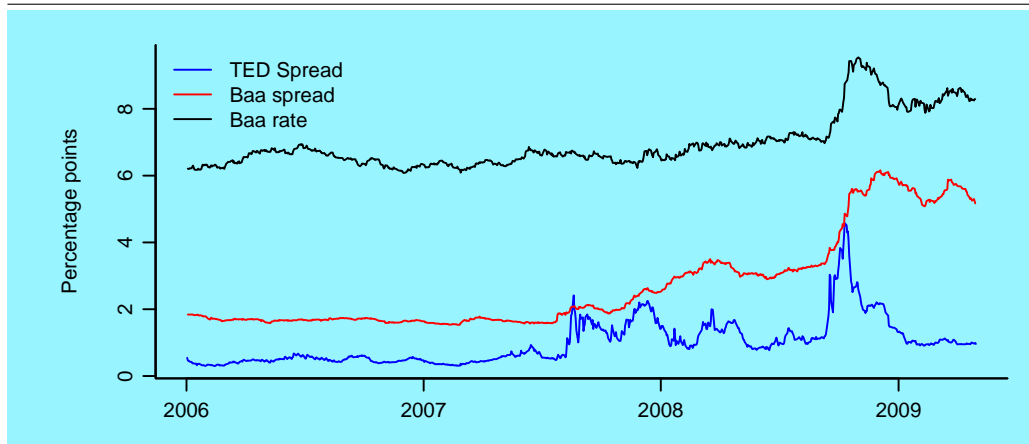
Apart from the official flows through the permitted mechanism of FDI by Indian companies, there is a possibility of Indian firms transferring capital out of the country through transfer pricing with their own subsidiaries. Prior research has shown that India has substantial capital flows in both directions through trade misinvoicing. However, it is not possible to identify these flows in the crisis period of late 2008 using the available data.

3.5 Evidence from the stock market

In the period of crisis, did the firms with treasury operations abroad do worse than those without? It would be useful to examine how the stock market sees the share price of Indian MNCs. If a firm got into trouble in its global money market operations, its share price would do badly.

The most important measure of financing conditions for Indian firms outside the country is the Moody’s Baa spread. This is the spread between the Moody’s Baa bond and the 10-year US government bond. This measures the credit risk of bonds that are roughly comparable to those issued by the

Figure 6 The Moody's Baa spread



Source: Author's calculations based on data from Datastream.

best Indian firms. Figure 6 juxtaposes recent values of the TED Spread, which measures the credit risk of large global financial firms, with the cost of borrowing for Baa firms and the Baa spread. The relevant question is: did the share prices of Indian MNCs get adversely affected with a change in the Baa spread?

3.5.1 Empirical strategy

The simplest empirical strategy would involve examining how the stock prices of MNCs fluctuated in relation to the changing values of the Moody's Baa spread. There are three difficulties with this approach:

1. Individual stock prices contain substantial idiosyncratic risk. The signal (of the extent to which Indian MNCs are influenced by the Moody's Baa spread) would be weak when compared with the noise (of idiosyncratic stock price fluctuations).⁴
2. It could be argued that MNCs are firms with significant international

⁴There is a small literature which argues that in many emerging markets, a substantial proportion of stock price volatility is explained by the overall market index. However, in the Indian case, the market model R^2 of the CMIE Cospi companies ranges from a median value of 0.273 in the top decile by size to 0.023 in the bottom decile (Table 4.14 of Shah *et al.* (2008)). The extent of idiosyncratic risk in India is hence broadly comparable with that seen in OECD countries.

exposure. When business cycle conditions in the world economy worsen, stock prices of Indian MNCs would do badly. Since the Moody's Baa spread is correlated with global business cycle conditions, there would be a bias in favour of finding that the Moody's Baa spread is linked to the stock price fluctuations of Indian MNCs.

3. It could be argued that MNCs tend to be large firms with more leverage. As a consequence, they are more exposed to credit market conditions. Indian firms do borrow abroad, though constrained by quantitative restrictions. All large leveraged Indian firms are likely to have some borrowing abroad, and would be adversely affected when the Moody's Baa spread rises. Interpreting this as a consequence of outbound FDI would be incorrect.

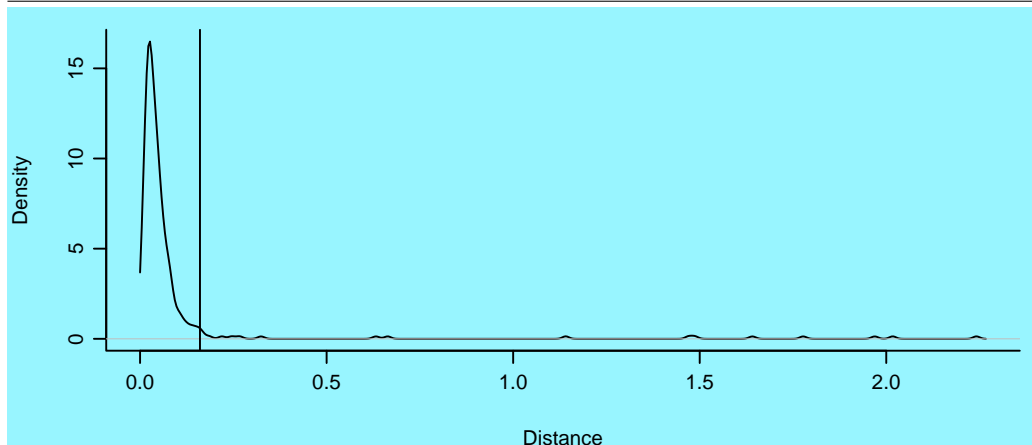
To address these problems, we resort to analysis of a special portfolio constructed through a matching procedure. We make two lists of firms: one of Indian MNCs, and another of exporting firms who are not MNCs. Each MNC is matched to a partner firm with similar size and leverage. We then form a portfolio which holds long positions in the MNCs along with holding short positions in their exporting partners. The performance of the portfolio shows the ways in which MNCs are different from companies in India which have not embarked on outbound FDI. This empirical strategy addresses the three problems described above:

1. *Idiosyncratic risk*: Idiosyncratic risk would be diversified away since the analysis only involves the returns on portfolios.
2. *Exposure to the world economy*: MNCs and exporting firms would both be exposed to the world economy. Hence, mere business cycle considerations would affect both the exporters portfolio and the MNC portfolio.
3. *MNCs tend to be large leveraged firms*: The matching procedure identifies exporting non-MNC firms which have similar size and leverage when compared with the MNCs. Credit market conditions onshore and offshore would influence both portfolios equally, since both kinds of firms operate under the identical capital controls onshore.

3.5.2 Matching procedure

For the matching procedure, size is defined as the $\log((\text{sales} + \text{assets})/2)$. Variables are standardised, but in the interest of robustness, the sample median is used instead of the sample mean and the inter-quartile range is

Figure 7 Distribution of quality of match



Source: Author's calculations

used instead of the sample standard deviation.

Each firm i is a point $z_i = (z_{1i}, z_{2i})$ where z_{1i} is the standardised size and z_{2i} is the standardised leverage. Let E be the set of exporting, non-MNC firms. For each MNC i , the matching procedure involves finding the firm i^* such that:

$$i^* = \arg \min_{j \in E} \|z_i - z_j\|$$

We define $Q_i = \|z_i - z_{i^*}\|$. In order to improve the quality of matching, the worst 5 per cent of firms in terms of the values of Q_i were deleted from the dataset. This corresponds to deleting the 17 firms with poor matching, leaving a dataset of 315 MNCs and their matched partners. This corresponded to deletion of firms where $Q_i > 0.16$. Figure 7 shows the kernel density plot of the best match seen across all the firms. The 25th and 75th percentile of Q_i prove to be 0.02 and 0.06, which suggests that for most firms, excellent matches were obtained. After deletion of the 5 per cent of firms with poor matching, the 25th and 75th percentile of Q_i works out to 0.021 and 0.056.

Some examples of matching are shown in Table 7. The firms in the left column are MNCs; they are matched against non-MNC exporting firms in the right column. As an example, Infosys is matched against Sterlite. Infosys has a standardised size of 9.71, while Sterlite is at 9.68. Infosys has a standardised leverage of 1.28 and Sterlite is at 1.41. Thus, Sterlite is a company with size

Table 7 Examples of matching procedure

Firm	Standardised		Best match	Standardised		Distance
	Size	Lev.		Size	Lev.	
Info-drive Software	3.24	1.16	Intellvisions Software	3.21	1.16	0.0122
Infosys	9.71	1.28	Sterlite	9.68	1.41	0.0752
Infotech Ent.	6.38	1.19	Mahindra L. Devp.	6.37	1.16	0.0171
IPCA Labs	7.10	2.10	Kalyani Steels	7.06	2.20	0.0541
J B Chemicals	6.49	1.61	Jagatjit Inds	6.56	1.56	0.0402

Source: Prowess, CMIE

and leverage much like Infosys. In this case, Q_i works out to 0.0752. In the table, the numerical values seen for distance are small, which is consistent with the distribution of Q_i seen in Figure 7.

Table 8 shows a broad array of summary statistics about the 315 MNCs where matching was successful, and the partner firms identified.

Some rows merely constitute validation of the matching procedure. Partners were required to be exporting firms with no outbound FDI. Hence, the OFDI/Assets ratio for partners is 0. Partners were chosen to match the size and leverage of MNCs. Hence, the median size of the partners, at 6.12, is similar to the median size of MNCs, at 6.15. Similarly, the median leverage of the partners, at 1.95 times, is similar to the median leverage of the MNCs, at 1.91 times.

In other respects, the partners inevitably differ from the MNCs. There is surprising correspondence in some respects (e.g. number of employees) but not in others (e.g. sales or turnover ratio). A key fact, which influences the estimation strategy of the paper, concerns the export/sales ratio: this averages to 31.36% for MNCs but only 11.59% for the non-MNC exporters.

3.5.3 Alternative explanations, and estimation strategy

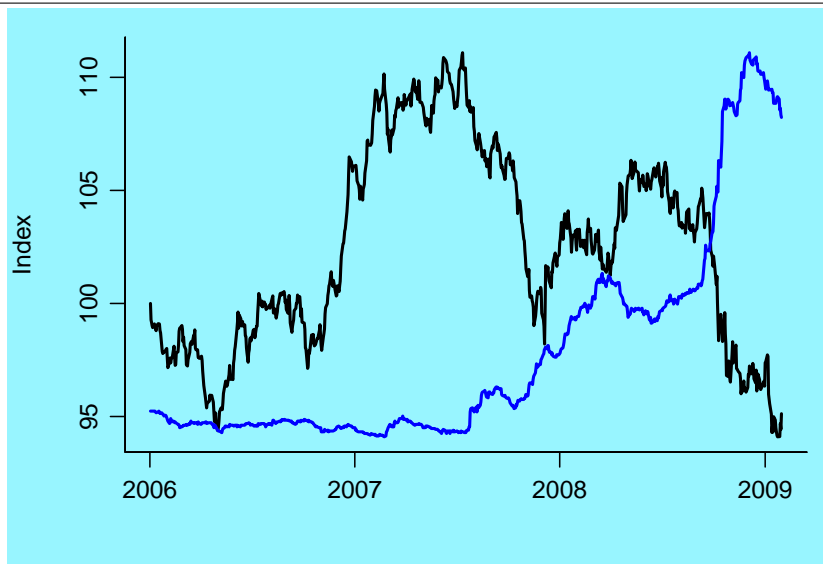
In this fashion, we compute the returns on this portfolio, which is long MNCs and short a matched portfolio of exporters who are not MNCs. Figure 8 shows the time-series of the value of this portfolio, which is indexed to start from 100. The time-series of the Moody's Baa spread, S_t is also shown on this graph. Both these series are in levels in the graph. The notation $H_t^{I/DX}$ denotes the daily *returns* of the hedged portfolio which is long MNCs and short non-MNC exporters.

An alternative explanation that limits the interpretation of these results con-

Table 8 Summary statistics about MNCs and matched partners

Variable	Units	MNC	Partner
Age	Years	21.00	25.00
IQR		14.00	29.00
Total assets	Rs. crore	581.82	458.45
IQR		1415.24	1272.55
Sales	Rs. crore	328.69	437.92
IQR		1004.61	1022.98
Employees	Number	790.33	726.00
IQR		2296.71	1862.82
Mkt. Capn.	Rs. crore	536.11	352.63
IQR		1850.24	1272.48
Turnover ratio	Per cent	92.77	71.35
IQR		151.44	106.73
Exports/Sales	Per cent	31.36	11.59
IQR		68.73	28.80
OFDI/Assets	Per cent	7.71	0.00
IQR		15.17	0.00
Size	Log Rs. crore	6.15	6.12
IQR		2.17	2.20
Leverage	Times	1.91	1.95
IQR		1.29	1.27
Number of observations	Number	315.00	315.00

Source: Author's calculations based on Prowess, CMIE

Figure 8 Long MNC + short exporter portfolio, against the Moody's Baa spread

Source: Author's calculations based on data from Prowess, CMIE and Datastream

cerns exposure to global business cycle conditions. While the portfolio that has been formed is long MNCs and short non-MNC exporters, both of which should have a trade exposure to the world economy, MNCs are more exposed to international trade.⁵ The 315 MNCs where good matches were found have an average value for the exports/sales ratio of 31.36%. On average, the exporting non-MNC partner had an export/sales ratio of 11.59%. Hence, the impact of the Moody's Baa spread upon the hedged portfolio could merely reflect the bigger trade exposure of MNCs.

In order to address this concern, we construct a daily time-series which represents the Indian stock market implications of international trade exposure. We break the non-MNC exporting firms into two groups: the firms with an above-median exports/sales ratio and the firms with a below-median export/sales ratio. The same matching procedure is used to match all above-median exporting firms with a below-median exporting firm while mimicking the size and leverage. This gives us the returns series on another hedged portfolio: long high exports + short low exports. We interpret the returns series on this portfolio as reflecting pure trade exposure to the world economy, mapped into the Indian stock market returns. We use the notation $H_t^{X^{hi}/X^{lo}}$ for the daily returns of the hedged portfolio which is long high-export non-MNCs and short low-export non-MNCs.

The natural estimation strategy is a regression explaining *returns* on these long/short portfolios using *changes* in the Moody's Baa spread. This is done using a daily time-series that runs from the start of the crisis (June 2007) till end-Jan 2009, which has 414 observations. To recapitulate notation, $H_t^{I/DX}$ is the daily returns of the hedged portfolio which is long MNCs and short non-MNC exporters; $H_t^{X^{hi}/X^{lo}}$ is the daily returns of the hedged portfolio which is long high-export non-MNCs and short low-export non-MNCs; S_t is the level of the Moody's Baa spread on date t . The simplest model⁶ is:

⁵The exports/sales ratio is observed for all firms, so in principle, matching could be done to find firms with similar size, leverage and the exports/sales ratio. The difficulty with this path is that for MNCs, sales outside India are tantamount to serving foreign customers by other means and induce trade exposure to global economic conditions. A fuller definition of sales to foreign customers (whether through exports or through outbound FDI) is not measured in the CMIE database.

⁶When estimating models explaining stock market returns on a portfolio, the overall stock market index is often useful as an explanatory variable, to reflect overall market fluctuations. That is inappropriate here for two reasons. First, the hedged portfolio is long MNCs and short non-MNC exporters. Both groups of firms have similar leverage and are spread across all kinds of industries. Hence, the overall exposure of $H_t^{X^{hi}/X^{lo}}$ to the stock market index should be zero.

Further, the typical market-capitalisation weighted stock market index attaches con-

$$H_t^{I/DX} = a_0 + a_2(1 - L)S_t + e_{1t} \quad (1)$$

This model suffers from the problem that MNCs have a greater trade exposure to the world economy than non-MNC exporters. As a consequence, part of what is seen in a_2 is just the greater trade exposure of MNCs; \hat{a}_2 cannot be interpreted as being only about offshore borrowing by MNCs. This motivates:

$$H_t^{I/DX} = a_0 + a_1 H_t^{Xhi/Xlo} + a_2(1 - L)S_t + e_{2t} \quad (2)$$

The coefficient a_1 would pickup the extent to which $H_t^{I/DX}$ does well when global trade conditions improve. If it is the case that MNCs have greater trade exposure to the world economy when compared with non-MNC exporters with similar size and leverage, then we will observe $\hat{a}_1 > 0$.

A concern about these models lies in the extent to which shocks to $(1 - L)S_t$ influence Indian stock prices immediately. If there are weaknesses in information processing by the stock market, this information processing could take many days. To address this, we estimate models of the form:

$$H_t^{I/DX} = a_0 + a_1 H_t^{Xhi/Xlo} + \sum_{j=0}^{10} b_j(1 - L)S_{t-j} + e_{3t} \quad (3)$$

where lagged values of $(1 - L)S_t$ are allowed to influence $H_t^{I/DX}$ at time t .

3.5.4 Results

These results are shown in Table 9. Model 1, corresponding to equation 1, explains returns on the hedged portfolio (long MNC + short non-MNC exporters) using first differences of the Moody's Baa spread. This proves to

siderable importance to MNCs, who tend to be big companies with a bigger weightage in the index. E.g. a disproportionate number of the big components of the Nifty index are likely to be multinationals. Hence, the typical market-capitalisation weighted stock market index is likely to be contaminated with exposure to the very MNCness that we are trying to identify.

Table 9 Does the Moody's Baa spread matter in explaining stock market returns of Indian MNCs?

	M1	M2	M1 with lags	M2 with lags
(Intercept)	-0.02 (0.02)	-0.02 (0.02)	-0.01 (0.02)	-0.01 (0.02)
$H_t^{Xhi/Xlo}$		0.15* (0.06)		0.15* (0.06)
dBaa.spread	-1.50* (0.43)	-1.47* (0.43)	-1.32* (0.46)	-1.31* (0.46)
dBaa.spread lag 1			0.22 (0.45)	0.29 (0.45)
dBaa.spread lag 2			0.62 (0.45)	0.65 (0.45)
dBaa.spread lag 3			-0.11 (0.46)	-0.13 (0.45)
dBaa.spread lag 4			-0.15 (0.45)	-0.11 (0.45)
dBaa.spread lag 5			-0.60 (0.47)	-0.63 (0.47)
dBaa.spread lag 6			0.18 (0.46)	0.11 (0.46)
dBaa.spread lag 7			-0.32 (0.46)	-0.22 (0.45)
dBaa.spread lag 8			-0.38 (0.45)	-0.48 (0.45)
dBaa.spread lag 9			-0.17 (0.48)	-0.14 (0.48)
dBaa.spread lag 10			-0.62 (0.46)	-0.52 (0.46)
N	413	413	403	403
R^2	0.03	0.04	0.05	0.06
adj. R^2	0.03	0.04	0.02	0.03

Standard errors in parentheses

* indicates significance at $p < 0.05$

be statistically significant at a 95% level, and economically significant with a coefficient of -1.5. In other words, a 100 bps rise in the Moody's Baa spread induces a negative stock market return for Indian MNCs of -1.5 per cent. The time profile of information disclosure here involves data emanating from the US about the Baa spread in the Indian night, which is impounded into Indian stock prices in the day.

Model M2 reflects equation 2, augments Model M1 with an additional explanatory variable, $H_t^{Xhi/Xlo}$. This measures the Indian stock market impact of trade exposure to the world economy. This coefficient is statistically significant and has a value of 0.15. On average, when $H_t^{Xhi/Xlo}$ is +1 per cent, the portfolio $H_t^{I/DX}$ gains 0.15 per cent. This suggests that in the hedged portfolio $H_t^{I/DX}$, the MNCs have more trade exposure to the world economy than their matched partners with similar size and leverage. At the same time, after controlling for this, the Moody's Baa spread coefficient is essentially unchanged at -1.47. This shows that our main result is robust to the problem of MNCs having greater trade exposure than non-MNCs.

Two additional specifications are shown, which utilise lagged values of the Moody's Baa spread. These investigate the idea that the Indian stock market is not fast enough in understanding these things, that the process of domestic price discovery is not able to understand the implications of last night's value of the Moody's Baa spread for the valuation of hundreds of Indian MNCs. This conjecture is not substantiated. Ten days of lagged values are not significant, the adjusted R^2 actually declines, and the basic results stand. This suggests that stock market speculators are quite aware of the implications of fluctuations of credit conditions in the US for valuation of Indian MNCs.

The interpretation of these results is as follows. All firms – MNCs or otherwise – face the same capital controls that inhibit foreign borrowing and prohibit short-dated foreign borrowing. It is reasonable to think that MNCs and non-MNCs of similar size and leverage would have the identical incentives to engage in foreign borrowing (within the constraints of the capital controls). In both cases, capital controls that blocked short-dated borrowing should have implied that turmoil on the money market in London was not so important to Indian firms who were supposed to not have money market operations. Yet, we find that Indian MNCs had a credit exposure to the Moody's Baa spread over and beyond what non-MNC exporters with a similar size and leverage had. This suggests that there is something about MNCness which induces a bigger exposure to the Moody's Baa spread.

4 Conclusion

De jure capital controls have not made India as closed to global financial markets as expected. The expectation that a global financial market crisis would not hit India owing to these controls proved to be incorrect when the financial crisis was transmitted to India with unprecedented speed.

In this paper we have explored one element of India's capital account which answers some of the puzzles about the speed of transmission and behaviour of domestic financial markets. With a large presence outside India, Indian MNCs appear to have escaped the capital controls that are imposed on Indian companies. As a result, they are exposed to the global money market. Since they are the large firms, who are significant players in the Indian economy, their operations on money markets, foreign exchange markets and India's balance of payments are large and important. This dimension of India's integration with global capital markets gives a new insight into India's *de facto* capital account convertibility.

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