Why India Choked when Lehman broke

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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. We propose an explanation centering on the behaviour of Indian multinationals: 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 significant empirical support for it. This suggests an important role for Indian multinationals in India's evolution towards *de facto* convertibility, and raises questions about the effectiveness of the existing array of *de jure* capital controls.

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. 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.900 billion 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. 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. Another interesting element of the story is the evidence provided by the rupee dollar forward market. Instead of the forward premium going up when there was pressure on the rupee to depreciate, or remaining the same, it crashed sharply. How can this be explained? Our hypothesis is that some Indian MNCs, who were taking dollars out of India, planned to bring the money back to India. 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.

Data from the balance of payment showing that outbound FDI was the largest element of outflows in the sudden stop of capital flows to India of the last quarter of 2008, supports this hypothesis. This was not a time when there was any 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 operations of Indian MNCs.

Finally, we present evidence from stock market data which shows that Indian MNCs were more exposed to conditions in international money markets as compared with non-MNCs. In this testing, we control for size, leverage, trade exposure and exposure to global business cycles.

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 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 & Ito . 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 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]

[1]The measurement of intensity of capital controls is itself a field where standard

Figure 1 *De Jure* capital controls

The Chinn-Ito measure of *de jure* capital controls for India stood at -1.1 in every year from 1970 to 2007. This is superposed against the world mean and the emerging markets mean.

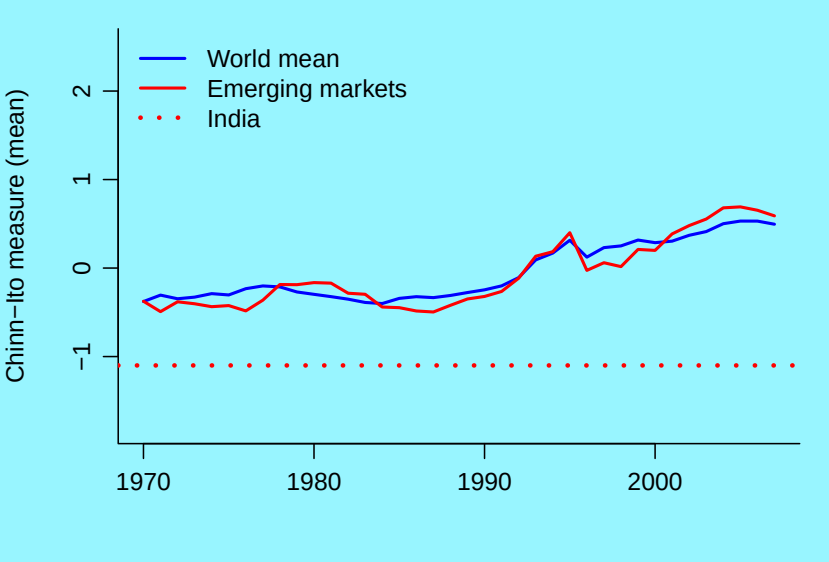
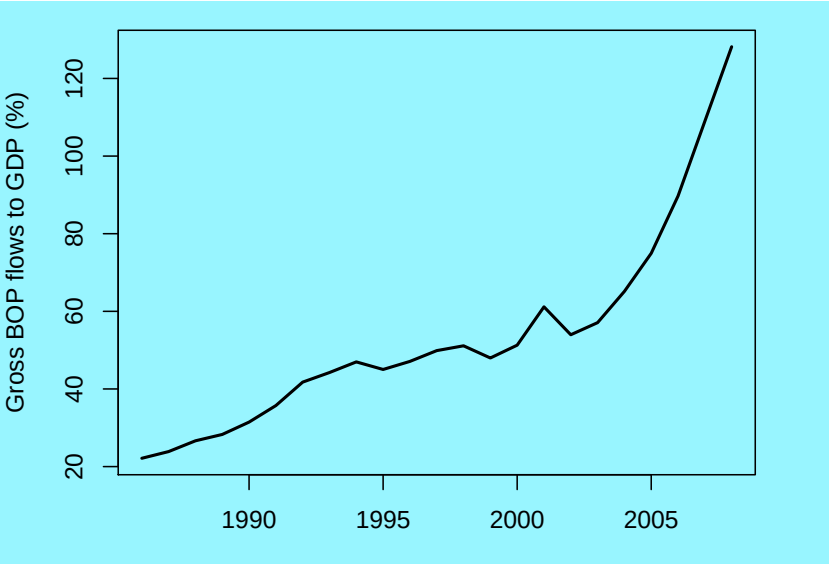


Figure 2 Gross flows to GDP

One measure of the extent of integration into the world economy is to extend the intuition of the trade/GDP ratio, and sum up the gross flows coming into the country and leaving the country (on both the current account and the capital account), and expressing this as percent of GDP. This graph shows a dramatic increase, in recent years, in the pace of India's long-term reintegration into the world economy.



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 of the least financially open economies in the world.

3 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 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

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.

[2]This 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

The TED Spread is the difference between the inter-bank rate for 90-day borrowing and the interest rate on the 90-day US treasury. The former contains the credit risk perception of banks while the latter does not. Hence, the TED Spread is a good measure of global financial system distress, of the extent to which big global banks mistrust each other.
The Indian call money rate is the price of overnight borrowing by Indian banks from each other. There is no collateral, hence this price includes a credit risk premium.
The third column shows the aggregate resources borrowed by banks from the RBI through the 'RBI repo' where securities are placed as collateral with RBI in exchange for credit.

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

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.

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

This graph shows the time-series of the aggregate resources borrowed by the banking system from RBI as part of the operations of the 'liquidity adjustment facility' (LAF).

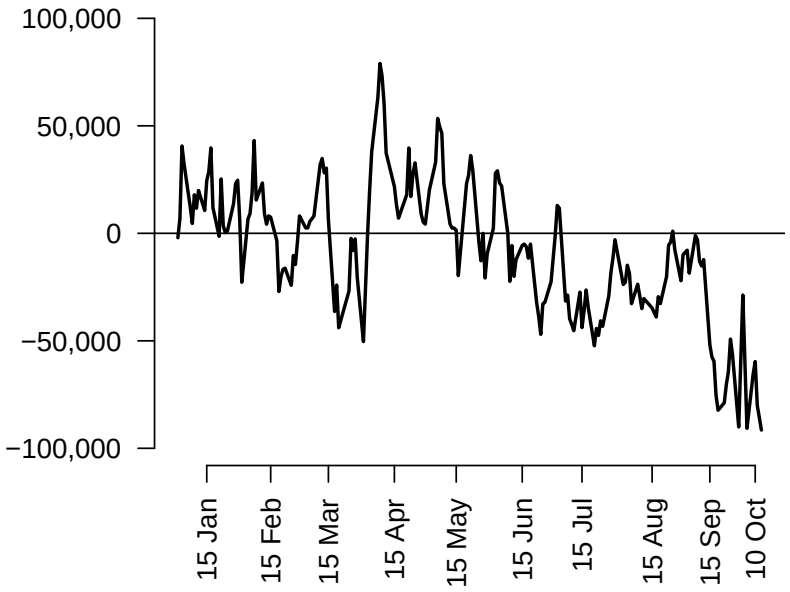
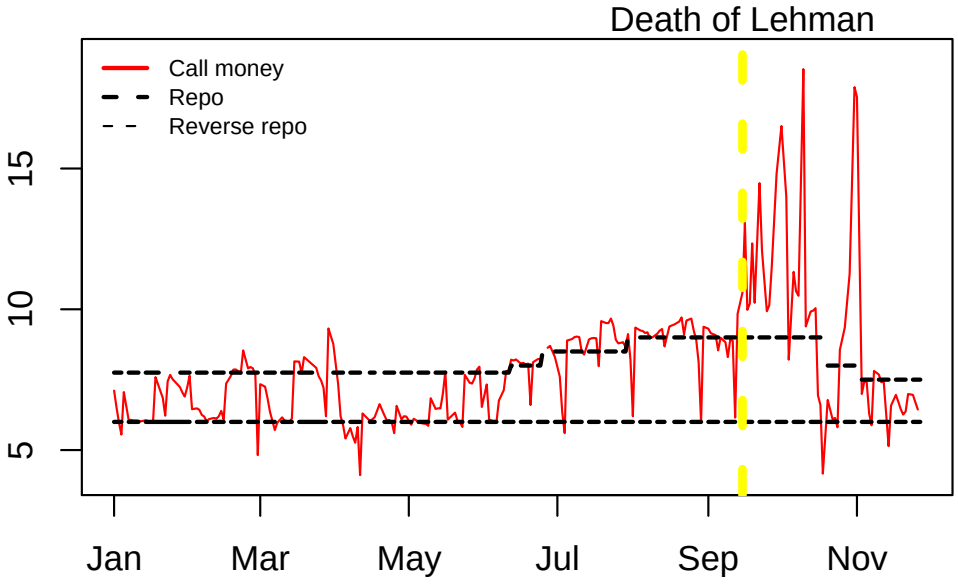


Figure 4 The call money rate vs. RBI's "corridor"

RBI's operating procedure of monetary policy does not pin down a single policy rate: it involves two rates: a price for borrowing and a price for lending. These are the black lines in the graph. The red line is the price of borrowing on the inter-bank call money market. Under normal circumstances, the call rate should be within the 'LAF corridor', i.e. the range of interest rates between the repo and the reverse repo rate. After the failure of Lehman, the call money rate was found to attain values far from the LAF corridor, which suggests that the events overwhelmed the ordinary operating procedures of monetary policy; the central bank was not able to pin down the short rate through its conventional operating procedures.



4 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. As Section 2 suggests, 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.

5 A proposed explanation: offshore operations of Indian MNCs

Our main argument involves the global treasuries of Indian MNCs. Prior to the crisis, these firms would have been users of the global money market. 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 borrow in rupees in India, move this money abroad, and discharge 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.

5.1 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 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 openess 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].

5.2 Evidence from the foreign exchange market

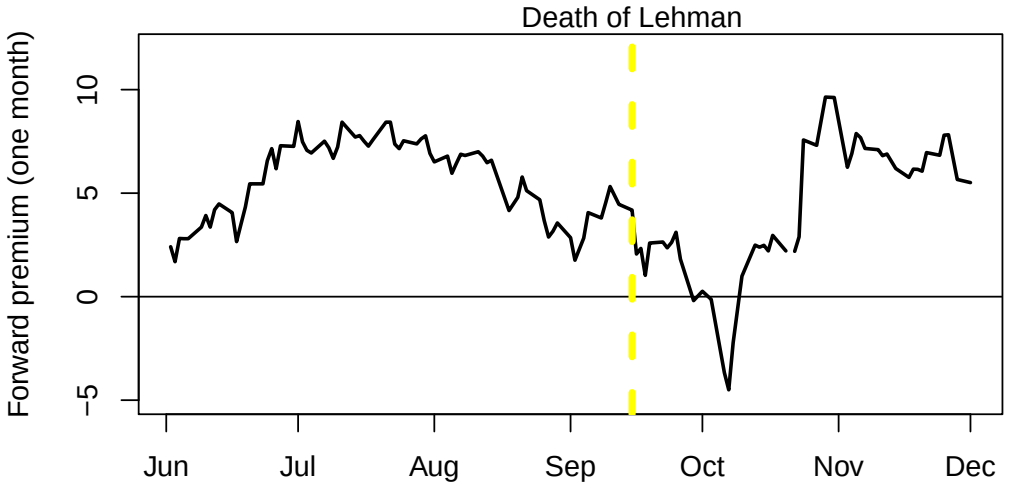
A sudden stop of capital flows or an outflow from the capital account would put downward pressure on the exchange rate. Evidence of this is seen in partly in the depreciation of the rupee, and partly in the sudden and large sale of dollars by RBI. The normal reaction to a sudden jump in the exchange 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]. 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.

Figure 5 The one-month forward premium

This shows the time-series of the premium seen for a maturity of one month on the rupee-dollar forward market. Under ordinary circumstances, this shows positive values. If there are expectations of rupee depreciation, the forward premium tends to become larger. However, after the failure of Lehman, something unusual happened: the forward premium became *negative*. This is consistent with the idea that what was going on was not just capital flight: it was capital being taken out by *Indian* firms with the intention of bringing it back (at a locked in exchange rate) in the near future.



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 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 withdrawl of foreign capital, these dramatic changes in forward premia would not have

Table 2 What happened in the sudden stop?

This table shows quarterly data about the structure of capital flows, from the Balance of Payments. In all cases, the values are in the units of million USD per quarter. The three major components of net capital flows are loans, banking capital and investment flows. The biggest net capital inflow into India was $33.155 billion, in the quarter of Jul/Aug/Sep 2007. India's 'sudden stop' involved this dropping to a net outflow of $3.7 billion in the quarter of Oct/Nov/Dec 2008.

(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

taken place.

5.3 Evidence from the balance of payments

The balance of payment data, shown in Table 2, 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.

[3]The phrase 'sudden stop' was brought to prominence by Calvo [1998].

Collateral requirements for outstanding CDS positions went up. When Indian 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.

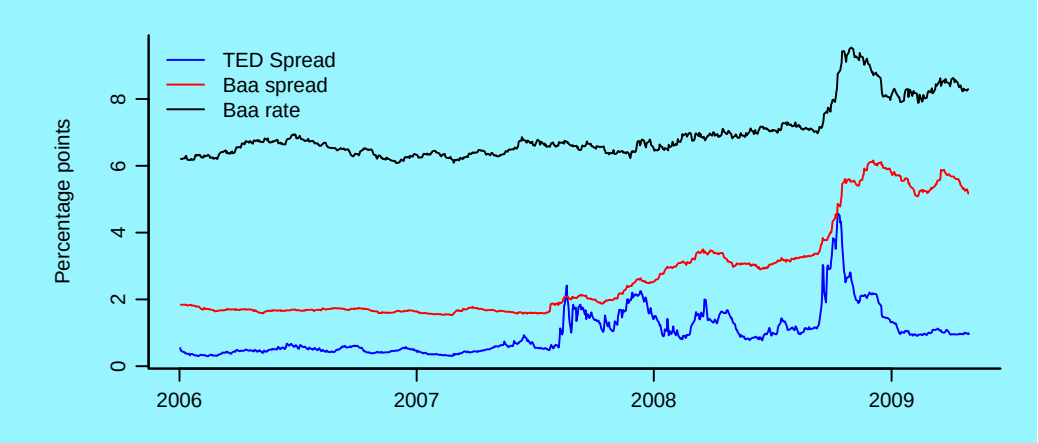
5.4 Evidence from the stock market

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

Figure 6 The Moody's Baa spread

This graph superposes daily data for the three interesting time-series about global financial conditions. The TED Spread is the best measure of the global financial crisis. However, from the viewpoint of an Indian borrower, what is more important is the price of borrowing faced by a Moody's Baa rated borrower, which is roughly the rating of the best Indian companies. The Moody's Baa Spread is the difference between the rate and the US 10-year government bond.



the credit risk of bonds that are roughly comparable to those issued by the 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 relevent question is: did the share prices of Indian MNCs get adversely affected with a change in the Baa spread?

5.4.1 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]

[4]There 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

2. It could be argued that MNCs are firms with significant international 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. Details of the matching procedure are in Appendix A.

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 companies which had full data availability for 2007-08, 2162 firms were included in the data set for our analysis. 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.

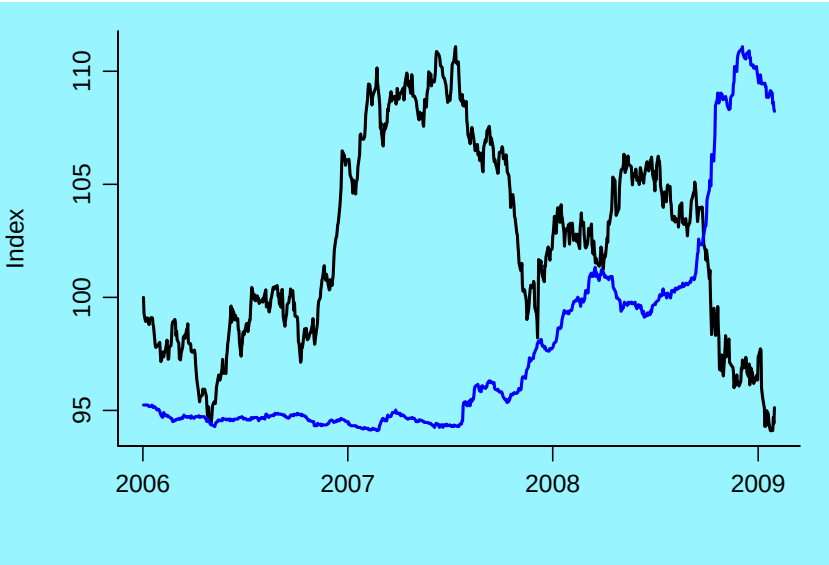
2. *Exposure to the world economy*: MNCs and exporting firms would both be exposed to the world economy. Hence, mere business cycle considerations would affect both the exporters portfolio and the MNC portfolio.

3. *MNCs tend to be large leveraged firms*: The matching procedure iden-

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.

Figure 7 Long MNC + short exporter portfolio, against the Moody's Baa spread

The black line shows the time-series of the portfolio value of a portfolio, initialised to Rs.100, which is long MNCs and simultaneously short a matched set of non-MNC exporters. The blue line (right scale) is the time-series of the Moody's Baa spread. Visually, it appears that the two periods where the hedged portfolio did badly were periods where the Moody's Baa spread rose.



tifies 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.

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 7 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 concerns 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, there is a possibility that

MNCs are more exposed to international trade.[5] 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 $H_t^{Xhi/Xlo}$ 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; $H_t^{Xhi/Xlo}$ 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 model[6] is:

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

[5]The 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.

[6]When 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 to the stock market index should be zero. Further, the typical market-capitalisation weighted stock market index attaches considerable importance to MNCs, who tend to be big companies with a bigger weightage in the index. Hence, the typical market-capitalisation weighted stock market index is likely to contain some exposure to the MNCness that we are trying to identify.

This model suffers from the problem that MNCs might have a greater trade exposure to the world economy than non-MNC exporters, and that $(1 - L)S_t$ is likely to be correlated with global business cycle conditions. 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:

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

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:

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

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

5.4.2 Results

These results are shown in Table 3. 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 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

Table 3 Does the Moody's Baa spread matter in explaining stock market returns of Indian MNCs?

The table shows four alternative regression models, all of them aiming to explain $H_t^{I/DX}$, the daily returns on the hedged portfolio which is long MNCs and short a matched portfolio of non-MNC exporters.
Model M1 uses only the contemporaneous value of the change in the Moody's Baa spread. Model M2 additionally uses $H_t^{Xhi/Xlo}$, the returns on a portfolio which is long high-export companies and short low-export companies (all of which are not MNCs). This translates trade exposure to the world economy into Indian stock market returns.
The last two columns have models which augment M1 and M2 with lagged values of changes in the Moody's Baa spread.
In all cases, we find that the coefficient of the change in the Moody's Baa spread is statistically and economically significant. This suggests 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.

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

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.

6 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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Table 4 Exporters and MNCs in the CMIE Cospi firms

Our dataset is 2,162 firms who are members of the CMIE Cospi market index, and have annual report data for 2007-08. The table shows the joint distribution of these firms viewed in two dimensions: are firms exporters and have firms done outbound FDI.

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

A Details about matching procedure

In this appendix, we provide details of the matching procedure used for the empirical work in Section 5.4.

We focus on the firms which are members of the CMIE Cospi index, for reasons of the best information quality. A firm is defined as a MNC if it holds more than 1 per cent of total assets outside India. A firm is defined as an exporting firm if it derives more than 1 per cent of sales from exports. There are 2162 firms in this database with data for 2007-08.

Table 4 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.

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 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 8 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

Figure 8 Distribution of quality of match

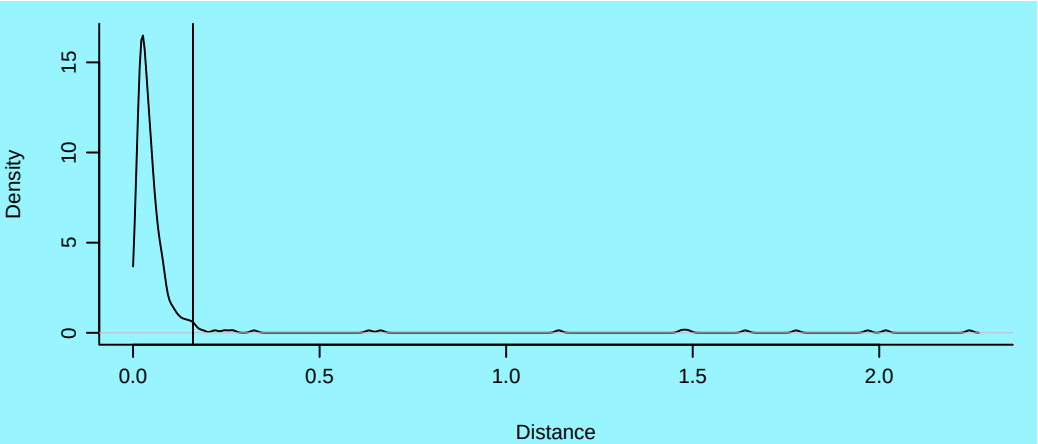

Table 5 Examples of matching procedure

The table shows some examples of the matching procedure in action. As an example, the firm 'Infosys', an MNC which has standardised (size, leverage) of $(9.71, 1.28)$, gets matched with a firm 'Sterlite', an exporting non-MNC which has standardised (size,leverage) of $(9.68, 1.41)$. This match implies a distance $||z_i - z_{i^*}|| = 0.0752$.

	Standardised			Standardised		
Firm	Size	Lev.	Best match	Size	Lev.	Distance
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

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 5. 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 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 8.