Direction of Outward FDI of Indian Manufacturing Firms: Influence of Technology and Firm Productivity

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Abstract: The paper is concerned with the direction of OFDI flows from India. The main issue investigated econometrically is whether the direction of OFDI of Indian manufacturing firms is related to their technical competence and the level of productivity. The theoretical model of Aw and Lee (2008) is taken as the basic framework for the econometric analysis. Data for about 2400 Indian manufacturing firms are used for the analysis. The data for the firms covered in the study relate to the year 2007-08 or thereabout. The econometric results obtained in the study indicate that a firm with relatively high level of productivity is more likely to invest abroad than a firm with relatively low productivity, which is consistent with the Helpman, Melitz and Yeaple (2004) hypothesis. However, the type of relationship between firm productivity and direction of FDI that is expected on the basis of the Aw-Lee model and their empirical findings for Taiwanese electronics firms is not found from the analysis of data on Indian manufacturing firms. The econometric evidence presented in the paper does not show that Indian firms investing in industrialized countries have significantly higher productivity than the firms that have invested in developing countries, which is the prediction of the Aw-Lee model. The results for the technology related variables, on the other hand, do provide some support to the Aw-Lee model. There are indications from the econometric results that a relatively greater engagement with technology acquisition activities among Indian firms is associated with investment in industrialized countries. One interpretation of this empirical finding is that the technical competence of a firm is an important factor determining whether it will invest in an industrialized country. The higher the level of technical competence, the greater is the likelihood of the firm investing in an industrialized country. An alternate interpretation of the finding is that a firm which is more keen to acquire advanced technology is relatively more likely to invest in industrialized countries than in developing countries.

[1] I thank Ms.Isha Chawla and Ms.Meera Bhalla for the contributions they have made to this study. Ms. Chawala has prepared the tables of Section 4 of the paper. She has processed the month-wise RBI (Reserve Bank of India) data on foreign investments made by India companies to prepare a database on cumulative investments made by different companies during July 2007 to January 2012 segregated by destination countries, which has been used for the econometric analysis presented in Section 6 of the paper. Ms Bhalla has worked with company-level data of *Capitaline* database and helped in making estimates of firm-level productivity. An earlier version of the paper was presented at a conference held in 2012, organized by the Center for International Trade and Development, School of International Studies, Jawaharlal Nehru University, New Delhi.

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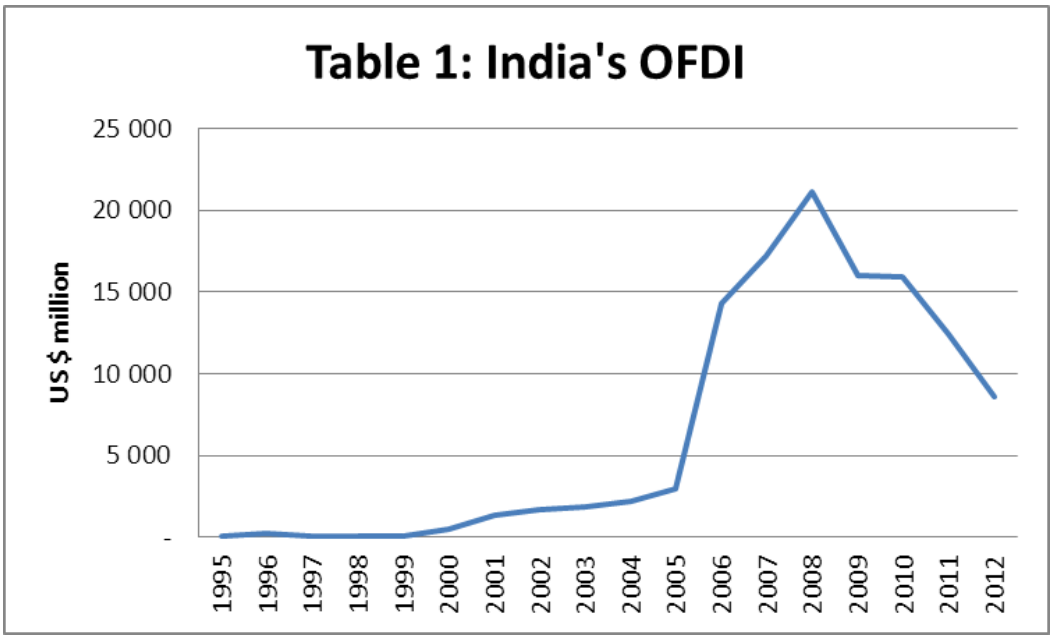
1. Introduction

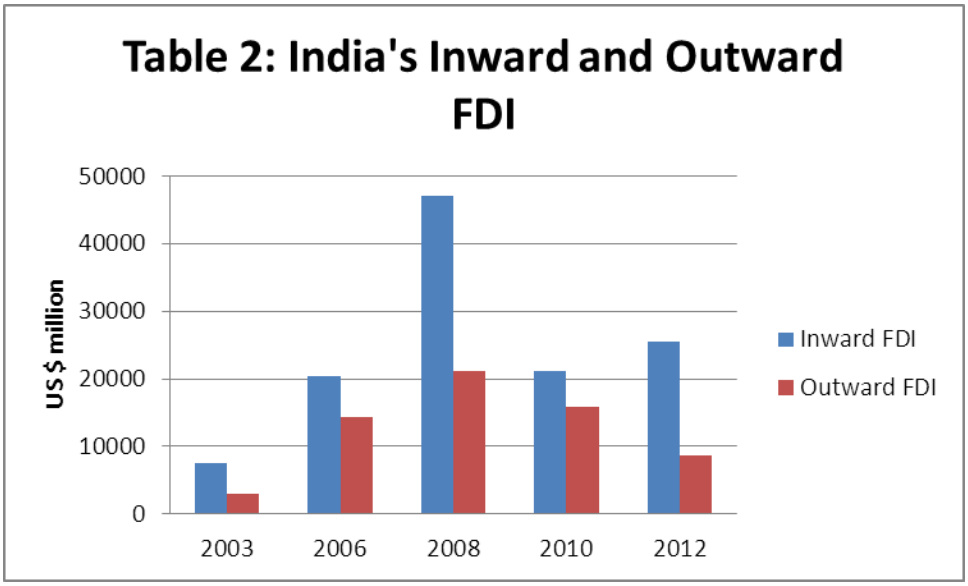
In the 2000s, there was a substantial increase in outward FDI (foreign direct investment) from India (see Figure 1). In 2000, outward FDI (or OFDI) flow from India was small, at about US$ 0.5 billion, which increased to US$ 21.1 billion in 2008 (*World Investment Report*, UNCTAD, 2013). After reaching a peak in 2008, the outward FDI flow from India came down between 2008 and 2010; it fell from US$ 21.1 billion in 2008 to US$ 15.9 billion in 2010.[2]There was further fall between 2010 and 2012. In 2012, India's OFDI flow was about US$ 8.6 billion.



Source: Based on OFDI flow data given in *World Investment Report*, UNCTAD, 2013

[2] According to RBI data (Address delivered by Shri. Harun R Khan, Deputy Governor, Reserve Bank of India at the Bombay Chamber of Commerce & Industry, Mumbai on March 2, 2012, available at the RBI website, http://rbi.org.in/scripts/BS_SpeechesView.aspx?Id=674, accessed March 25, 2012), India's outward FDI was US$ 18.8 billion in 2008-09, US$ 13.7 billion in 2009-10, US$ 16.8 billion in 2010-11 and US$ 8.9 billion in 2011-12 (April to February). This does not include 'Guarantee Issued', which was about US$ 27 billion in 2010-11. Thus, after including 'Guarantee issued', the total outward FDI flow of India in 2010-11 was about US$ 44 billion. This is much higher than the amount of OFDI reported by UNCTAD.

In the three-year period 2008 to 2010, the average annual inflow of FDI in India was about US$ 35 billion whereas the average annual outward FDI flow from India in this period was about US$ 18 billion. Thus, outward FDI flow was about half of the FDI inflow (see Figure 2). All these show that in the course of the last ten years or so outward FDI has become an important phenomenon in India.[3]



Source: Based on OFDI flow data given in *World Investment Report*, UNCTAD, 2013

The annual average amount of OFDI flow from India during the three-year period 2008 to 2010 (at about US$ 18 billion) exceeded the corresponding figures for Argentina (about US$ one billion), Brazil (US$ 7.1 billion), Chile (US$ 9.1 billion), Columbia (US$ 4.2 billion), Indonesia (US$ 3.6 billion), Malaysia (US$ 12 billion), Taiwan (US$ 9.2 billion) and Thailand (US$ 4.2 billion)(*World Investment Report*, 2013, UNCTAD, Annex tables). Indeed, in terms of OFDI flow, India has in recent years been ahead of the developing countries in almost all cases.

[3] According to a report of Pricewaterhouse Coopers (*Emerging Multinationals: The rise of new multinational companies from emerging economies*, April, 2010), India is likely to become the largest source of emerging market multinational enterprises (overshadowing China) by 2024. Over 2200 Indian firms are expected to invest overseas in the next fifteen years. The Report also expects that there will be further shift away from intra-regional investment in other emerging nations and towards a greater share of new multinationals going directly to the advanced countries.

However, there are three exceptions, Singapore, South Korea and China. The average annual OFDI flows from Singapore, South Korea and China during 2008-10 were about US$ 18.7 billion, US$ 22.0 billion and US$ 60.4 billion respectively. The Chinese OFDI flow was a little over three times the OFDI flow from India.

Although the available statistics on FDI flows from the UNCTAD indicate that the OFDI flows from China in recent years were much higher than that from India, the gap is probably not as large as these statistics seem to suggest. This is so because a large part of the Chinese OFDI is to overseas financial centers and tax heavens and thus involve round-tripping. Chinese FDI flows to Hong Kong, Cayman Islands, and British virgin islands (which are overseas financial centers) accounted for about 77 percent of China's OFDI in 2003-07 (Pradhan, 2011). In the case of India too, OFDI to overseas financial centers forms a large part. Investments to Singapore, Mauritius, Channel Island and Cyprus accounted for 42 percent of OFDI in the 2000s (Pradhan, 2011). Evidently, the OFDI flows from both China and India need to be adjusted downward to correct for round-tripping. Yet, even with such adjustments, India's OFDI flows would probably remain substantial and it would not be wrong to say that India is one of the leaders among developing countries in terms of outward FDI flows.

While, in terms of overall magnitude, India's OFDI flow is less, probably substantially less, than that of China, India has been performing well in terms of investment in industrialized countries. About 36 percent of India's OFDI stock is in Europe (in 2006), and the corresponding figure for China is only about 3 percent (Milelli and Hay, 2008). Also, the share of North America in India's OFDI stock (20 percent) is far higher than that in the OFDI stock of China (2 percent) (Milelli and Hay, 2008). Overall, the share of industrialized countries in India's OFDI significantly exceeds the share of industrialized countries in the OFDI of China. If investments in industrialized countries are regarded as of superior quality[4] than investments in developing countries, then India's OFDI appears to be the qualitatively superior to that of China even though in terms of the total value of outward investments made, China is currently well ahead of India.

[4] Investment in industrialized countries may be regarded as superior in quality since it requires higher technological capabilities of the investor and there are higher technological gains from the investment.

2. Some Earlier Studies on India's OFDI

India's rapidly growing OFDI has received increasing attention of the researchers. There have been several econometric studies on this aspect, and these are of interest to the present study. A brief review of some of the studies undertaken earlier is presented below.

Chen (2011) asks the following question: why India has so large OFDI flows when the per capita income level is relatively low, which in certain ways is not consistent with the Investment Development Path (IDP) theory? Chen notes that according to the traditional IDP theory, outward FDI is expected to rise only after a country reaches a per capita income level of US$10,000. Obviously, going by this prediction of the theory, India's outward FDI is out of line with the theory.

To explain the above noted discrepancy, Chen draws attention to the existence of under-developed and developed sub-national markets within India (which is also true of other emerging economies). He goes on to argue that India has certain developed pockets in which institutional environment is as liberal and business friendly as developed countries, and the firms in those regions are sophisticated in terms of technology, operations and management. Accordingly, it is these developed regions within India that produce global investors.

Another question taken up by Chen (2011) is why India multinational enterprises (MNEs) act like established MNEs from the West. He notes that Indian outward FDI is directed at developed, rich countries and knowledge-intensive industries, and mostly via wholly ownership acquisitions. He refers to the study by Sauvant and Pradhan (2010) who observed that during 1990-2007 almost 62 percent of Indian outward FDI went to developed countries, a pattern much different from its comparator economy China, of which the figure is only eight percent. He also refers to a study undertaken by Satyanand and Raghavendran (2010) and draws attention to the fact that 17 out of 20 largest Indian M&A (merger and acquisition) deals abroad during 2007-2009 were through 100% equity acquisition, and all happened in knowledge-intensive sectors such as IT and pharmaceuticals and developed countries except only one in Indonesia.

In some studies, an answer to the above question has been given by drawing on the strategic-asset seeking perspective, including the view that Indian firms have greater entrepreneurial orientation or strategic agility to venture into developed countries, particularly through high-risk

mode such as full acquisition, in search of technologies, ideas, brands, and markets. But, one needs to explain where such entrepreneurial orientation comes from. Chen (2011) is of the view that that there are two sources of the entrepreneurial orientation: (a) private ownership because of which they have greater acceptance to the Western policy makers and the public (as compared to the Chinese firms), and (b) existence of relevant firm capacity that can be leveraged and exploited in a host market. Going by Chen's argument, the second source is connected with firm-specific advantages of Indian firms which enable them to invest in the industrialized countries and be successful at that.

Several studies have used a model similar to the 'gravity model' to explain the geographic spread of India's outward FDI. To give one example, Pradhan (2011) takes GDP (gross domestic product), population and distance between the investor and host country among the explanatory variables in his model explaining outward investments made by firms in India and China. These variables are commonly used in the gravity model of trade. A number of other explanatory variables have been used in the econometric analysis. These include variable reflecting natural resource endowment, policy towards FDI inflow, imports made by the host countries from India and China, and exchange rate, inflation rate, and political stability in the host countries. Data for the period 2000 to 2008 have been used for the analysis, covering the investments made by Indian and Chinese firms. Pradhan finds that the emerging MNEs from India and China are more interested in a host country if imports from India/China are relatively high and the host country has the following characteristics: has a strong local currently, has the character of an overseas financial center, follows a liberal inward FDI policy and has a relatively higher inflation rate. Two other findings are: (a) Chinese outward investments are attracted to large countries by GDP and population, whereas Indian outward investments do not show such a tendency, and (b) Chinese outward investments get attracted by natural resource endowments of the host country, but Indian outward investments are not strongly influenced by natural resource endowments of the host countries.

Pradhan and Singh (2010) have used a model very similar to that of Pradhan (2011). The Pradhan-Singh study is confined to India's overseas acquisitions in the period 2000 to 2008. A distinction is made between stand-alone firms and business group affiliated firms. Pradhan and Singh find that group affiliated firms have wider geographical distribution of their acquisition

than the stand-alone firms. Both stand-alone and group affiliated firms while locating their international acquisitions are attracted by the size of host countries and the existence of preferential tax regime with India, but get discouraged by weak currency of the host country. However, there are differences in the behavior of stand-alone and group affiliated firms. The group affiliated firms are attracted, among other factors, by the economic growth rate of host country and the presence of bilateral investment treaty with India, whereas the stand alone firms are attracted by the imports made by the host country from India and by cultural proximity.

De Beule (2010) has carried out an analysis similar to that Pradhan and Singh (2010). He examines the locational determinants of acquisitions made by firms from India and China. The period covered in the study is 2000 to 2008. Some of the explanatory variables used in the model are the same as or similar to those used in by Pradhan (2011) and Pradhan and Singh (2010). These include GDP and distance. A positive effect of GDP and a negative effect of distance are found from the econometric analysis, corroborating the findings of Pradhan (2011) and Pradhan and Singh (2010). But, on some points, the findings of De Beule are different. De Beule finds that natural resource seeking motive is as important for the Indian multinationals as for the Chinese multinationals. This finding is at variance with the findings of Pradhan. Another conclusion of the study is that strategic asset seeking investments are apparently more important to Chinese than to Indian multinationals. This finding needs verification, since other studies give the opposite impression.

The three papers mentioned above mainly focus of the influence of host country characteristics on a firm's decision on overseas investment. There is another strand of literature that focuses on the characteristics of the investing firm. This literature links firm heterogeneity to firms' decision to invest abroad. An important contribution to this area is the paper of Helpman, Melitz and Yeaple (2004). Based on their theoretical analysis, Helpman and associates predict that the relatively more productive firms export and the most productive firms do outbound FDI. This hypothesis has been put to empirical testing in several studies. Demirbas, Patanayak and Shah (2010) have tested the abovementioned hypothesis for Indian firms using company level data for the period 2001 to 2007. They find some evidence in support of the hypothesis. They conclude that there are strong differences between the Indian firms that serve the domestic market, the

firms that export and the firms that invest abroad. The differences are rooted in the investments made in knowledge. This suggests that it is the relatively high level of technical knowledge and competence that makes Indian industrial firms invest abroad.

3. Object, Scope and Organization of the Paper

This paper is concerned with the direction of OFDI flows from India. It is particularly concerned with the impact of firm productivity on the direction of investments made by manufacturing firms in India. Thus, the analysis is similar to that undertaken by Demirbas, Patanayak and Shah (2010) mentioned above. But, there is an important difference. While Demirbas, Pattanayak and Shah are concerned with the decision of a firm to invest abroad, this paper also goes into the question, where such investments are being made. Besides productivity, the paper investigates whether the level of technology acquisition activities in a firm has an influence on the direction of its overseas investments.

As mentioned in Section 2 above, the determinants of location of the overseas investment of Indian firms have been analyzed by Pradhan (2011), Pradhan and Singh (2010) and De Beule (2010). The main determinants considered in these three studies do not find a place in the econometric analysis presented here because the nature of the model is different. The aim of the analysis presented here is to explain a firm's decision regarding the location of its overseas investment by linking it to the characteristics of the firm, particularly the firm level variables reflecting technological capabilities and productivity.

A distinguishing feature of the analysis presented in the paper is that it makes use of a database of investments made by Indian firms abroad which has recently been put up by the Reserve Bank of India on its website. At the time the analysis was done, the period covered by the RBI data on outward investment was July 2007 to January 2012. Hence, OFDI data for this period (July 2007 to January 2012) disaggregated by the investing firms and the destination of the investment is utilized in this study. By contrast, the period covered in the studies mentioned in Section 2 above is mostly 2000 to 2008. Thus, the analysis presented in this paper relates to a more recent period than that considered in the studies reviewed in Section 2.

The rest of the paper is organized as follows. The next section provides a preliminary analysis of the OFDI data of the RBI (for the period July 2007 to January 2012). The model utilized for the empirical analysis is briefly described in Section 5 of the paper. The results of the econometric analysis (based on data for about 2400 manufacturing companies) are presented and discussed in Section 6. Finally, some concluding remarks are made in Section 7 of the paper.

4. Pattern of India's OFDI Flows in Recent Years – A Preliminary Analysis

The RBI dataset on outward investments in the period July 2007 to January 2012 covers investments made by about 3600 Indian firms. In a majority of cases, the amount of cumulative investment made by a firm in the period July 2007 to January 2012 is small. Out of 3600 odd cases in the database, a cumulative investment of US$ 10 million or more in the period 2007-12 has been made by only 612 firms. These 612 firms account for about 97 percent of the total investment made by the 3600 odd firms covered in the dataset. Thus, for the analysis presented in this section of the paper, the investment data for only these 612 firms have been used.

The econometric analysis presented in Section 5 of the paper is confined to the manufacturing firms. This involves matching of names of companies in the RBI OFDI database and the company database used for the study, containing information from their balance sheet and profit and loss accounts. Out of the 612 firms mentioned above, only a minor proportion could be matched with the list of manufacturing companies obtained from the database on Indian companies (*Capitaline*) used for this study. Hence, for the econometric analysis, a larger number of firms from the RBI OFDI database have been taken; firms that have invested between US$ 5 million to US$ 10 million have also been included. Thus, the total number of OFDI firms considered for the econometric analysis comes to 798 firms. It should be noted, however, that only a subset of these 798 OFDI firms is actually covered in the econometric analysis, because the analysis is confined to manufacturing firms.

The industry-wise distribution of investment in respect of the abovementioned 612 cases is shown in Table 1. The cross-classification of investments by industry and host county groups (with breakup of the investment into developed and developing countries as hosts) is presented in

Table 2. In this case too, the data for only those firms are covered which invested abroad US$ 10 million or more during the period July 2007 to January 2012.

Table 1 shows that, in the period July 2007to January 2012, 275 firms made overseas investments of US$ 100 million and above. These account for nearly 90 percent of the total foreign investments made in this period. On the other hand, 478 firms invested between US$ 10 and US$ 50 million in the period July 2007- January 2012, and these investments accounted for only about seven percent of the total outward foreign investments made by Indian firms.

Table 1: Major-activity wise Outward Foreign Direct Investment from India, by size class, July 2007 to January 2012

Major-Activity Wise Outward Foreign Direct Investment From India – By Size Class Cumulative Investment from July 2007 to January 2012 (in USD Million)												
Major-Activity	**USD 10 - 50 Million**			**USD 50 - 100 Million**			**USD 100 - above Million**			**Total**		
	Number of Firms	**Amount**	**%**	**Number of Firms**	**Amount**	**%**	**Number of Firms**	**Amount**	**%**	**Number of Firms**	**Amount**	**%**
Agriculture, Hunting, Forestry and Fishing	30	378.5	5.7	7	81.1	1.2	23	6136.1	93.0	60	6595.7	100
Agriculture and Mining	14	59.3	15.7	4	65.3	17.3	12	244	66.2	30	368.7	100
Manufacturing	**153**	**2722.1**	**6.5**	**42**	**2150.4**	**5.2**	**83**	**36853.6**	**88.3**	**278**	**41726.1**	**100**
Electricity, Gas and Water	6	53.9	3.9	3	146.9	10.7	5	1172.3	85.4	14	1373.1	100
Construction	35	616.2	10.4	10	448.0	7.6	16	4854.5	82.0	61	5918.6	100
Wholesale, Retail Trade, Restaurants and Hotels	61	892.6	8.6	15	672.2	6.5	42	8815.5	84.9	118	10380.4	100
Transport, Storage and Communication Services	17	250.5	1.1	8	323.7	1.4	16	22027.3	97.5	41	22601.6	100
Financial, Insurance, Real Estate and Business Services	127	2435.7	11.9	33	1909.7	9.3	61	16152.3	78.8	221	20497.8	100
Community, Social and Personal Services	19	331.7	16.0	7	404.0	19.4	8	1342.9	64.6	34	2078.7	100
Miscellaneous	16	232.4	16.3	2	41.2	2.9	9	1156.6	80.9	27	1430.3	100
Grand Total	**478**	**7972.9**	**7.1**	**131**	**6242.6**	**5.5**	**275**	**98755.5**	**87.4**	**884***	**112971.0**	**100**

Source: Database on Outward FDI from India, released by the Foreign Exchange Department, Central Office, Overseas Investment Division, Reserve Bank of India.

Available at http://www.rbi.org.in/scripts/Data_Overses_Investment.aspx

* The number of firms with cumulative investment 10 USD Million and above is 612. As some firms invest in multiple major-activity groups, the number of firms as in the above table is more than 612.

Table 2: Major-activity wise Outward Foreign Direct Investment from India, by destination, July 2007 to January 2012

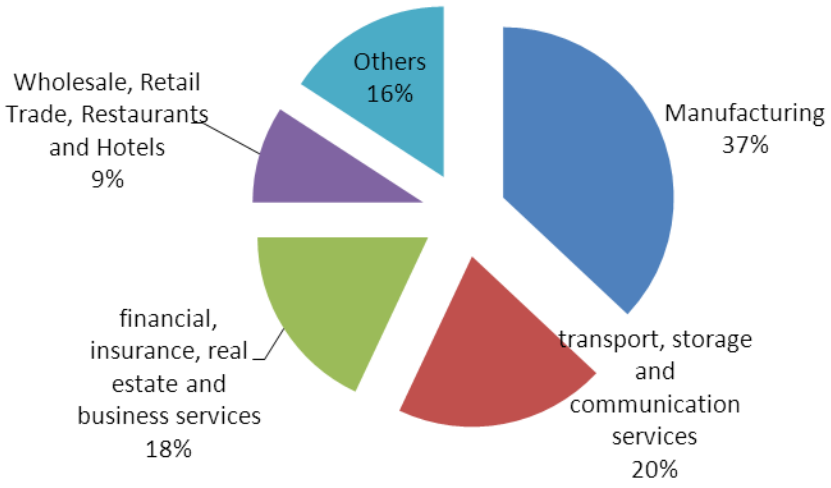
Major-Activity Wise Outward Foreign Direct Investment From India – By Destination
Cumulative Investment from July 2007 to January 2012 (in USD Million)

Major-Activity	Developed Countries									Developing Countries												Total	
	Europe			USA			Other Developed Countries			Asia and Oceania			Africa			Latin America and the Caribbean			CIS				
	No. of Firms	Amount	%	No. of Firms	Amount	%	No. of Firms	Amount	%	No. of Firms	Amount	%	No. of Firms	Amount	%	No. of Firms	Amount	%	No. of Firms	Amount	%	Amount	%
Agriculture, Hunting, Forestry and Fishing	13	225.6	3.4	-	-	-	6	114.6	1.7	34	2870.1	43.5	18	983.5	14.9	7	2401.8	36.4	-	-	-	**6595.7**	**100**
Agriculture and Mining	5	25.7	7.0	1	63.7	17.3	3	0.7	0.2	15	222.2	60.3	5	30.8	8.3	3	25.7	7.0	-	-	-	**368.7**	**100**
Manufacturing	**108**	**10468.8**	**25.1**	**59**	**2583.9**	**6.2**	**25**	**264.8**	**0.6**	**171**	**11583.9**	**27.8**	**79**	**13640.6**	**32.7**	**38**	**1855.2**	**4.4**	**3**	**1328.9**	**3**	**41726.1**	**100**
Electricity, Gas and Water	5	824.4	60.0	-	-	-	1	70.3	5.1	10	478.3	34.8	-	-	-	1	0.1	0.0	-	-	-	**1373.1**	**100**
Construction	9	398.7	6.7	7	200.6	3.4	3	2309.5	39	42	1169.1	19.8	21	1222.8	20.7	7	615.4	10.4	1	2.5	0	**5918.6**	**100**
Wholesale, Retail Trade, Restaurants and Hotels	41	3226.1	31.1	18	580.0	5.6	3	43.1	0.4	72	2515.8	24.2	23	2518.4	24.3	4	1492.3	14.4	2	4.7	0	**10380.4**	**100**
Transport, Storage and Communication Services	16	7826.5	34.6	3	1.9	0.0	1	3.6	0.0	27	13795.8	61.0	8	771.8	3.4	4	201.9	0.9	-	-	-	**22601.6**	**100**
Financial, Insurance, Real Estate and Business Services	93	4071.9	19.9	80	2641.2	12.9	19	912.3	4.4	120	6201.7	30.3	56	6302.2	30.7	28	348.3	1.7	1	20	0	**20497.8**	**100**
Community, Social and Personal Services	12	601.1	28.9	10	543.6	26.2	-	-	-	14	209.4	10.1	9	678.9	32.7	2	45.7	2.2	-	-	-	**2078.7**	**100**
Miscellaneous	5	475.2	33.2	6	74.7	5.2	1	20.4	1.4	12	255.2	17.8	3	88.6	6.2	2	516.2	36.1	-	-	-	**1430.3**	**100**
Grand Total	**307**	**28144.0**	**24.9**	**184**	**6689.5**	**5.9**	**62**	**3739.4**	**3.3**	**517**	**39301.6**	**34.8**	**222**	**26237.6**	**23.2**	**96**	**7502.7**	**6.6**	**7**	**1356**	1	**112970.9**	**100**

Source: Database on Outward FDI from India, released by the Foreign Exchange Department, Central Office, Overseas Investment Division, Reserve Bank of India.

About 37 percent of the foreign investment in the period July 2007- January 2012 was made by firms engaged in manufacturing (See Figure 3). Next in importance are firms engaged in transport, storage and communication services accounting for 20 percent of the investment, and firms engaged in financial, insurance, real estate and business services accounting for about 18 percent of the total foreign investment made by Indian firms.

Table 3: Industry wise distribution of India's OFDI, July 2007-January 2012

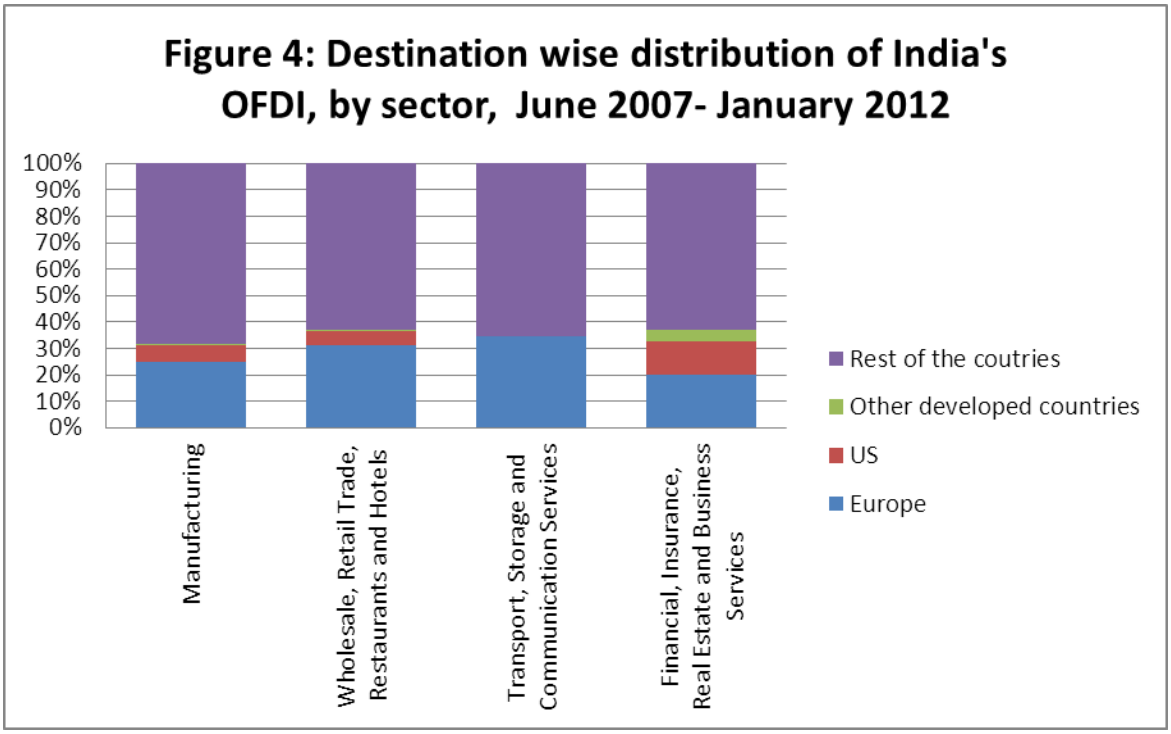


Source: Author's computations based on data drawn from the Database on Outward FDI from India, released by the Foreign Exchange Department, Central Office, Overseas Investment Division, Reserve Bank of India

Distribution by host country shown in Table 2 brings out that Europe and USA accounted for about 25 percent and 6 percent of total investment abroad (see Figure 4). The other developed countries accounted for another 3 percent. Thus, the developed countries accounted for about one third of the overseas investments made by Indian firms in the period July 2007-Januray 2012.[5]

[5] As mentioned earlier, Sauvant and Pradhan (2010) observe that during 1990-2007 almost 62 percent of Indian outward FDI went to developed countries. Similarly, Milelli and Hay (2008) observe that about 36 percent of India's OFDI stock is in Europe (in 2006), and 20 percent of the stock is in North America. The pattern of investment

The investment pattern of manufacturing firms is similar to the overall pattern observed for all firms (see Figure 4). The shares of Europe and USA in the investments made by manufacturing firms are 25 and 6 percent respectively. Bulk of the investments made by manufacturing firms is in Asia and Oceania (about 28 percent) and Africa (about 33 percent).



Source: Author's computations based on data drawn from the Database on Outward FDI from India, released by the Foreign Exchange Department, Central Office, Overseas Investment Division, Reserve Bank of India

An interesting point that emerges from Table 2 is that that while about one third of the investments made by manufacturing firms are directed at industrialized countries, about 60 percent of the investment is directed at Asian and African countries. It should be noted here that a proportion of the firms have invested in both industrialized countries and developing countries of Asia and Africa.

observed for the period since 2007 is quite different. Does this mean that in the more recent period 2007-2012, Indian OFDI has shifted away from developed to developing countries? This issue needs further investigation (not attempted in this paper).

5. Firm Productivity and Direction of OFDI – Aw-Lee Model

The econometric analysis presented in the paper follows the model proposed by Aw and Lee (2008) and empirically applied by them to Taiwanese multinationals. In the Aw-Lee model, a firm in Taiwan serves three markets: the home market, a developing country or a south country market (hereafter South) and an industrialized country or a north country market (hereafter North). The firm has the choice of serving these markets either from its home country plant or from a plant set up in the North or in the South. The firm, if it so chooses, may set up plants in both the North and the South. Three important factors that influence the firm's decision regarding setting up plants in a foreign country are: (a) the investment cost for new plants, (b) the wage gap between countries, and (c) the cost of transportation that the firm will have to bear if it decides to serve the North or the South country markets from its home country plant. It is assumed further that the firms are heterogeneous in their productivity level, which is firm specific such that each subsidiary belonging to the firm is endowed with the same productivity level in different production locations.

Using the theoretical model described above, Aw and Lee show that the profits associated with different strategies vary with the endowed productivity level of the firm. Given the same fixed investment cost, more productive firms will choose FDI over no FDI. With small wage differential and sufficiently high transportation cost, the more productive firms will invest in both North and South. The relatively smaller fixed investment cost and market size of the South relative to the North implies the firms that invest the North are endowed with relatively higher level of productivity than those that invest in the South. Accordingly, Aw and Lee predict that the Taiwanese firms that invest in both China (representing South) and USA (representing North) are more productive than those that invest in USA only which in turn are more productive than those that invest in China. Compared to these three types of firms, the firms that invest neither in China or USA are least productive.

Aw and Lee apply the above model to data on Taiwanese electronics firms. A multinomial logit model is estimated from firm-wise cross-section data. The econometric results indicate that the choice of production site is influenced by the underlying productivity level of the firm in accordance with the prediction of the model.

6. Results of Empirical Analysis

For this study, a model similar to that of Aw and Lee (2008) has been applied. The choices considered are: (a) investment only or predominantly in industrialized countries (cut off level used is 80% of the investment made), (b) investment only or predominantly in developing countries (again, cut off level used is 80% of the investment made), (c) investment in both industrialized and developing countries (industrialized countries account for at least 20% of the investment and developing countries too account for at least 20% of the investment) , and (d) no foreign investment. Going by the prediction of the Aw-Lee model, the productivity level of the firms that make choice (c) should be the highest. Firms with relatively lower productivity will opt for choices (a) and (b), in that order. The productivity level is expected to be relatively low for the firm that opts for choice (d) than the firm opting for other choices.

Cross-section data for Indian manufacturing firms are used for the analysis. The data on firm characteristics mostly relate to 2007-08 or thereabout. The foreign investment data are for the period July 2007 to January 2012, cumulated over this period.[6] The data on foreign investment are drawn from the RBI database. The data on firm characteristics and firm productivity are drawn from *Capitaline*. As mentioned earlier, there is a problem of matching of firms between the two data sources. In a fairly large number of cases, the names of firms could not be matched. For about 150 cases,[7] the foreign investment data could be matched with the list of manufacturing firms prepared on the basis of *Capitaline*. From Capitaline, data on firm characteristics could be obtained for about 2400 manufacturing firms.[8]

For the empirical analysis, a multinomial logit model (see Annex) has been estimated, as done by Aw and Lee (2008). The dependent variable of the model is the four choices listed above. 'No

[6] This has the advantage that the investment data relate to a period later than that for productivity. The possibility of productivity getting influenced by OFDI and the two variables becoming inter-dependent in the model is therefore avoided.

[7] The 150 cases are distributed as follows. Investment only or predominantly in industrialized countries, 53 cases; investment only or predominantly in developing countries, 79 cases, and investment in both industrialized and developing countries, 18 cases. In the process of data cleaning, 24 of these cases get dropped from the dataset because the reported values of some explanatory variables are beyond plausible range.

[8] Although the dataset prepared for the study contains about 2400 manufacturing firms, the econometric analysis is based on a smaller number of observations. A number of firms had to be dropped from the analysis because the reported values of certain variables are too high compared to the average or because the reported values of the variables are beyond the plausible range.

investment abroad' is taken as the base category. The following explanatory variables have been used for estimating the model:

Firm Size = measured by the logarithm of capital stock;

R&D intensity = Ratio of R&D expenditure to sales;

Export intensity = Ratio of exports to sales;

Capital goods import intensity = Expenditure on capital goods imports divided by sales;

Foreign equity in the firm= foreign equity as percentage of total equity of the firm;

Productivity (measured by technical efficiency of a firm) = A stochastic frontier production function (of Cobb-Douglas functional form) is estimated from cross-section data, taking three inputs, namely labour (number of persons employed), capital (book-value figure deflated, taking into consideration the year of incorporation) and energy (measured in physical units), with output defined accordingly. The efficiency term is assumed to follow a half-normal distribution. From the estimated stochastic frontier production function, firm specific estimate of technical efficiency estimate is derived.[9] The distribution of firms according to their level of technical efficiency is shown in Figure 5.

One problem is applying the multinomial model described above to cross-section data on manufacturing firms belonging to diverse industries is that there is considerable heterogeneity among firms, and therefore the effect of productivity and other firm characteristics on the firms' decision regarding foreign investment may not come out clearly in the econometric analysis. To address this problem, at least partly, the firms have been divided into eleven broad industrial groups based on the three-digit industries (according to the National Industrial Classification) to which they belong, and the industry group dummy variables have been introduced in the model.

[9] There is substantial literature on the estimation of technical efficiency using a stochastic frontier production function. Hence, the details of the methodology are not provided here. Interested reader may see Forsund et al. (1980) and Greene (1997), among others. Given the estimate of the frontier production function, it is possible to derive firm specific estimates of efficiency under certain assumptions. This study used the STATA software for estimating the frontier production function. The software package has the option of getting observation specific estimates of technical efficiency.

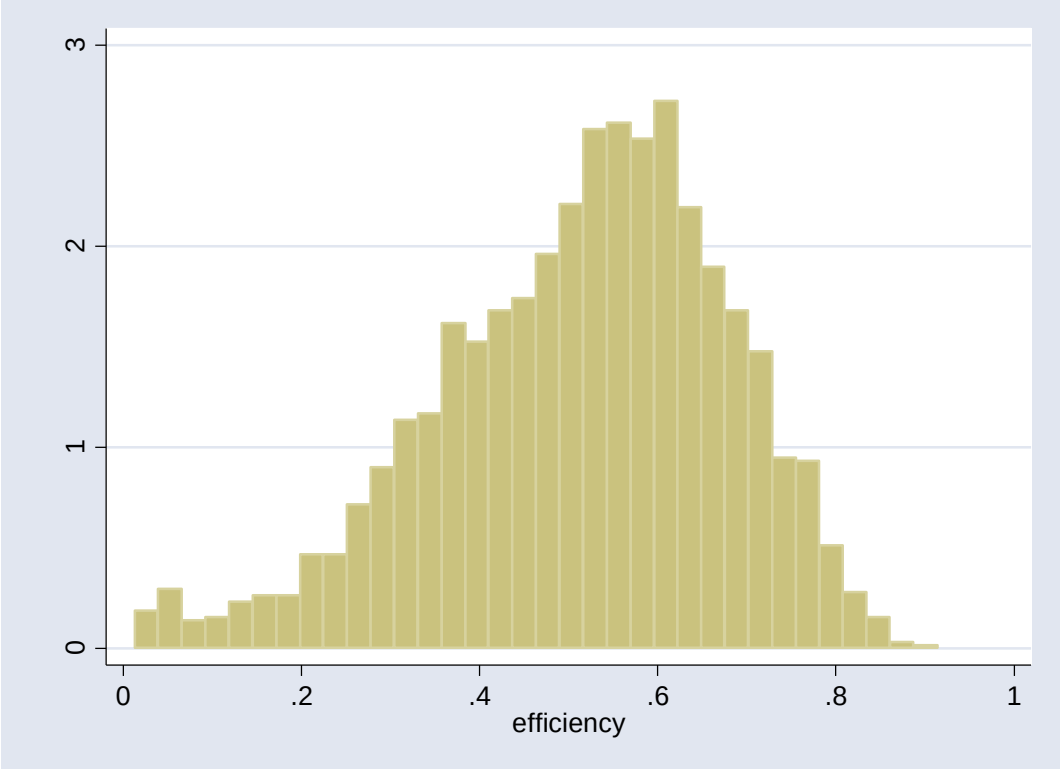


Figure 5: Distribution of manufacturing firms in the sample according to their level of technical efficiency

Source: Author's computation based primarily on data for manufacturing companies drawn from the *Capitaline* database

The model estimates are presented in Tables 3 and 4. The two set of results presented respectively in Tables 3 and 4 differ with regard to the inclusion or otherwise of the firm size variable. In the results reported in Table 4, the firm size variable is not included. The firm size variable has a significant positive correlation with R&D intensity. It becomes important therefore to get a set of results in which the firm size variable is dropped, so that the effect of R&D intensity of firms' decision regarding in foreign investment is properly assessed.

Table 3: Estimates of the Model Explaining the Direction of OFDI, including firm size

Explanatory variables	**Choice of the firm**		
	Investment in industrialized countries	**Investment in developing countries**	**Both**
Firm size	0.870 (8.51)***	0.787 (9.45)***	0.803 (3.86)***
Export intensity	0.606 (3.36)***	0.448 (2.82)***	0.135 (0.23)
R&D intensity	0.883 (2.33)**	0.189 (0.46)	2.388 (4.01)***
Capital goods import intensity	0.392 (0.47)	-1.651 (-0.91)	0.619 (0.30)
Foreign equity in the firm	-0.055 (-1.80)*	-0.017 (-1.30)	-0.046 (-1.20)
Technical efficiency (based on estimated stochastic frontier production function)	3.12 (2.14)**	3.22 (2.88)***	9.55 (2.57)***
Industry group dummy variables	included	included	included
Constant	-9.90	-8.50	-34.85
Observations by category	53	79	10
Total sample	2264		
Log likelihood	-441.1		
LR chi-square (degrees of freedom)	316.3 (48)		
Pseudo-R-squared	0.26		

Note: Figures in parentheses are t-values. 'No OFDI' is the base category which includes most firms.

*, ** and *** statistically significant at 10, 5 and 1 percent level, respectively.

Source: Author's computations

Table 4: Estimates of the Model Explaining the Direction of OFDI, excluding firm size

Explanatory variables	Choice of the firm		
	Investment in industrialized countries	**Investment in developing countries**	**Both**
Export intensity	0.512 (3.34)***	0.375 (2.75)***	0.204 (0.41)
R&D intensity	1.263 (3.90)***	0.668 (1.96)**	2.328 (4.39)***
Capital goods import intensity	0.756 (1.62)	0.457 (0.78)	0.954 (0.83)
Foreign equity in the firm	-0.037 (-1.32)	-0.006 (-0.54)	-0.020 (-0.59)
Technical efficiency (based on estimated stochastic frontier production function)	2.80 (2.26)**	3.02 (3.16)***	7.22 (2.17)**
Industry group dummy variables	included	included	included
Constant	-5.12	-4.45	-31.01
Observations by category	53	79	10
Total sample	2264		
Log likelihood	-542.6		
LR chi-square (degrees of freedom)	113.2(45)		
Pseudo-R-squared	0.09		

Note: Figures in parentheses are t-values. 'No OFDI' is the base category which includes most firms.

*, ** and *** statistically significant at 10, 5 and 1 percent level, respectively.

Source: Author's computations

From the results reported in Table 3, it is seen that firm size is an important explanatory variable. The results indicate that, other things remaining the same, a bigger firm is more likely to invest abroad than a small firm. The coefficient of the size variable does not differ much among the three choices, (a), (b) and (c). It appears from the results therefore that, after controlling for other factors, the firm-size is important for making overseas investment but does not have a major impact on the direction of OFDI. Firm size does not seem to affect in a major way the probability of investing in an industrialized country vis-à-vis the probability of investing in a developing country.

The results reported in Tables 3 and 4 indicate that an exporting firm is more likely to invest abroad than a firm that does not export. Also, there is some indication that as the export intensity of a firm goes up, the probability of investing in an industrialized country increases vis-à-vis the probability of investing in a developing country.[10] It is interesting to note that while the coefficient of export intensity is significantly positive for choice (a), i.e. investment in an industrialized country, as well as for choice (b), i.e. investment in a developing country, the coefficient is not statistically significant for choice (c), i.e. investing in both industrialized and developing countries. The number of cases in which choice (c) has been opted for is very small in relation to the size of the total sample of firms considered. Therefore, one need not place much importance to this finding in respect of choice (c).

The coefficient of R&D intensity is positive and statistically significant in the results reported in Table 4, i.e. when the firm size variable is dropped from the model. In the results reported in Table 3, when size variable is included, the R&D intensity variable has statically significant coefficient for choices (a) and (c), but not for (b). Considering the two sets of results, it appears that R&D intensity is positively related to the probability of making an investment abroad. In other words, a firm that undertakes significant R&D expenditure is more likely to invest abroad

[10] One may question the inclusion of export intensity as an explanatory variable in the model on the ground that the decision to export and the decision to set up plants abroad have to be taken jointly. Indeed, the Aw-Lee paper does not use export intensity as an explanatory variable. The inclusion of export intensity in the model estimated for this paper may not, however, face a problem of interdependence between the two variables because the data on export intensity relates to a period prior to the period in which foreign investments were made. It may be added here that exclusion of the export intensity variable from the estimated multinomial logit model does not cause any major change in the results for other variables.

than a similar firm that does not incur R&D expenditure. As regards the direction of the investment, the results seem to suggest that as the level of R&D intensity goes up, the probability of investment being made in industrialized country or both in industrialized and developing countries become increasing higher than the probability of investing in developing countries only.

The productivity variable has positive and statistically significant coefficients in model results shown in both tables. This may be interpreted as supportive of the Helpman, Melitz and Yeaple (2004) hypothesis according to which it is the most efficient firms that make investments abroad. Going by the Helpman-Melitz-Yeaple hypothesis, a firm that invests abroad should have higher productivity level than a firm that does not invest abroad. The model results in Tables 3 and 4 are consistent with this theoretical prediction. As regards the direction of investment, it will be noticed from Tables 3 and 4 that the coefficient of the productivity variable for the choice (c), i.e. invest in both developed and developing countries is bigger in numerical value than the coefficients for choices (a) and (b), i.e. invest in industrialized country or in a developing country. This is in line with the predictions of the theoretical model of Aw and Lee described above.

For all the theoretical predications of the Aw-Lee model to hold for Indian manufacturing firms, the coefficient of the productivity variable should be bigger for choice (a), i.e. investment in industrialized countries, than that for choice (b), i.e. investment in developing countries. This pattern is not visible in the results obtained. Rather the coefficient of productivity in the equation for investment in industrialized countries is found to be smaller than that in the equation for investment in developing countries. Hence this component of the theoretical prediction of the Aw-Lee model is not supported by the econometric results obtained.

It will be noticed from Tables 3 and 4 that the coefficient of foreign equity variable has a negative coefficient consistently and in one case the coefficient is statistically significant. In the equation for choice (a), i.e. investment in industrialized countries in Table 3, the coefficient of foreign equity is negative and statistically significant at 10 percent level. The results indicate that a firm with high proportion of foreign equity is not any more likely to make overseas investment than a comparable firm without foreign equity. Rather, a firm with foreign equity may be less inclined to invest in an industrialized country than a similar firm without foreign equity.

Role of Technological Competence

In the analysis above, the focus was on the role of firm productivity in influencing the direction of OFDI. Firm productivity is essentially an outcome of the technical competence of the firm, and it would be interesting therefore to analyze the effects of technology factors directly rather than through their effect on productivity. Accordingly a third set of estimates of the model have been made in which the productivity variable is not include, and instead certain technology related variables are included. The technology related variables considered are (1) R&D intensity (R&D expenditure to sales ratio), (2) capital goods import intensity (ratio of expenditure on capital goods imports to sales), and (3) technology import intensity (expenditure on royalty and technical fees paid in foreign exchange as a ratio to sales). The extent of foreign equity is also included in the model as an explanatory variable, as this may be connected with technology transfer from the parent firms to subsidiaries. Firm size variable is not included in the model as it is significantly correlated with R&D intensity. However, to incorporate this aspect into the estimates, the model has first been estimated for the entire sample (after data cleaning), and then for the relatively bigger firms (above median in terms of sales). The results are shown in Table 5.

One important change that has been made in the model is to merge investment choices (a) and (c) described above. Since the number of observations in which the firm opted for choice (c) is very small, merging choices (a) and (c) seems justified. Thus, altogether three options are considered: (a) invest in industrialized countries or invest in both industrialized and developing countries, (b) invest only or predominantly in developing countries, and (c) not make any investment abroad.

A dummy variable for firms that were set up prior to 1990 is included as an additional explanatory variable. The aim is to find out if the firms set up in the post-reform period differ from those set up earlier in terms of overseas investment and direction of such investment.

Table 5: Model Estimates, Explaining Direction of OFDI, Focusing on Technology Acquisition Variables

Explanatory variables	Sample: All firms		Sample: Relatively bigger firms (above median in terms of sales)	
	Choice of the firm		Choice of the firm	
	Investment in industrialized countries or in both industrialized and developing countries	Investment only or predominantly in developing countries	Investment in industrialized countries or in both industrialized and developing countries	Investment only or predominantly in developing countries
Ratio of technical fee and royalty payments to sales	0.434 (0.29)	1.231 (1.07)	0.252 (0.16)	1.837 (1.21)
R&D intensity	1.520 (5.58)***	0.658 (1.95)*	1.135 (3.68)***	0.420 (1.13)
Capital goods import intensity	1.597 (2.40)**	0.830 (0.98)	2.357 (2.37)**	1.420 (1.17)
Foreign equity in the firm	-0.033 (-1.54)	-0.007 (-0.56)	-0.039 (-1.77)*	-0.017 (-1.28)
Incorporated before 1990	0.483 (1.41)	-0.371 (-1.42)	0.395 (1.10)	-0.439 (-1.28)
Industry group dummy variables	included	included	included	included
Constant	-3.38	-2.50	-2.45	-1.71
Observations by category	56	70	54	67
Total sample	2292		1151	
Log likelihood	-536.0		-436.9	
LR chi-square (degrees of freedom)	77.01(30)		66.47(30)	
Pseudo-R-squared	0.07		0.07	

Note: Figures in parentheses are t-values. 'No OFDI' is the base category which includes most firms.

*, ** and *** statistically significant at 10, 5 and 1 percent level, respectively.

Source: Author's computations

The model results presented in Table 5 indicates that technology acquisition has a favourable effect on the probability of investing abroad. The coefficients of R&D intensity and capital goods import intensity are found to be positive and statistically significant. It is also seen from the results that the coefficients are bigger in magnitude in the equation for combined choices (a) and (c) than for the equation for choice (b). It may be inferred therefore that technical competence has a significant favourable influence on the decision to invest abroad. Also, the higher the level of technical competence, the greater is the probability that the investment will be made in industrializing countries or in both industrialized and developing countries rather than the investment being made only in developing countries.

Even though the results indicate that technology acquisition taking place through R&D activity and imports of capital goods tend to increase the probability of an Indian manufacturing firm making overseas investment, the same cannot be said about technology imports taking place against the payment of royalty and technical fees in foreign exchange. It is difficult to explain this unexpected results.

Foreign equity variable has a negative coefficient as in the results reported in Tables 3 and 4. It seems that a firm with foreign equity is less inclined to invest abroad – particularly less inclined to invest in industrialized countries.

7. Concluding Remarks

The basic purpose of the paper was to study the direction of OFDI flow from India and relate it to the productivity level of Indian manufacturing firms. The theoretical model of Aw and Lee was taken as the basic framework for the empirical analysis. The econometric results obtained provided support to some components of the theoretical predictions of the model, but not to others. It seems safe to infer from the results that a firm with highly productivity is more likely to invest abroad than a firm with low productivity. As regards the choice between industrialized countries and developing countries, it is difficult to say whether a relatively high level of

productivity of a firm will be induced it to invest in industrialized countries rather than investing in developing countries.

The effect of technological competence on direction of OFDI was also studied by including several technology related variables in the model. The results provide support to the Aw-Lee model. There are indications from the econometric results that a relatively greater engagement with technology acquisition activities is associated with investment in industrialized countries. One interpretation of this empirical finding is that the technical competence of a firm is an important factor determining whether it will invest in an industrialized country. The higher the level of technical competence, the greater is the likelihood of the firm investing in an industrialized country. An alternate interpretation of the finding is that a firm more keen to acquire advanced technology is relatively more likely to invest in industrialized countries than in developing countries

A major limitation of the database used for the econometric analysis is that the number of firms that have actually invested abroad is only a small fraction of the total number of firms in the sample. The sample in the sub-categories according to the type of the country in which investment has been made is still smaller. How can this problem be tackled so as to yield more reliable results is the empirical question to be addressed in future.

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Annex: Multinomial Logit Model

Consider a situation where a firm decides among J+1 choices. The choices available to the firm are 0,1,..J. The base choice is zero. The choice made by the firm (which is denoted by Y) depends on a set of explanatory variables, denoted by x. Under the multinomial logit model, the probability of making choice j is specified as:

$$\Pr ob(Y_i = j) = \frac{e^{\beta_j' x_i}}{\sum_{k=0}^{J} e^{\beta_k' x_i}}, \quad j = 0,1,..J \quad ...(1)$$

Note that there is one parameter vector associated with each choice. There is indeterminacy in the model above because if a vector q is added to each of the β vectors, then an identical set of probabilities emerge. To solve this problem, the convenient normalization done is to take the parameters for choice 0 as zero, i.e. $\beta_0=0$. With this normalization, the probabilities of the choices are obtained as:

$$\Pr ob(Y_i = j) = \frac{e^{\beta_j' x_i}}{1+\sum_{k=1}^{J} e^{\beta_k' x_i}}, \quad j = 1,..J \quad ..(2a)$$

$$\Pr ob(Y_i = 0) = \frac{1}{1+\sum_{k=1}^{J} e^{\beta_k' x_i}} ...(2b)$$

For each firm i, the J log-odds ratios vis-à-vis the base choice is given by:

$$\ln\left[\frac{P_{ij}}{P_{i0}}\right] = \beta_j' x_i \quad ...(3)$$

The log-odds ratio between choices j and k can be obtained as:

$$\ln\left[\frac{P_{ij}}{P_{ik}}\right] = x_i'[\beta_j - \beta_k] \quad ...(4)$$

The model described in equation (1) above is estimated by the maximum likelihood method given firm-wise observations on x and the choices actually made by them. Further details of the multinomial logit model and its limitations are available in standard econometrics textbooks.