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ABSTRACT

Using a unique panel data set on Indian firms we analyse some basic but important and often neglected aspects of technology licensing agreements and their effect on the licensees. The study shows that the stock of scientific and technical knowledge abroad has a positive influence on the firms' decision to license foreign technology indicating the existence of strong technological spillovers. While the firm specific factors like firm size, imports, profit and foreign control are found to be having a positive influence on the decision to collaborate, market concentration has a negative effect. The choice of partners is influenced positively by the stock of patents in the partners' country and negatively by its competitors' patents. This tend to suggest that, as regards Indian firms, the stock of knowledge in one country is a substitute to those available in other countries. Estimates of the Multinomial logit model on the terms of technology licensing as manifested in the different combinations of royalty rates and lumpsum payments have shown that the highest probability is to have a technology deal with only lumpsum payments indicating the terms in which firms obtain technology. This could be a combined effect of the bargaining power of the Indian firms and the increasing competition in the international technology market. Our selection-corrected estimates of technology payments have shown that foreign control and exports have a positive effect on royalty rates. Profit is found to have a negative effect. Similarly, while the market share, exports and imports have a positive effect on lumpsum payments foreign control and firm size is found to have a negative effect. Our analysis of the effect of foreign technology licensing on profits and net export earnings produced mixed results. While technology licensing is found to enhance firms' profitability, it is associated with a dampening effect on net export earnings.

Introduction

There has been an increasing recognition of the catalytic role of international technology spillovers in augmenting productivity and growth in the Less Developed Countries (LDCs). Such spillovers are facilitated predominantly by foreign technology transfer (in India it is called foreign collaboration) from firms in the Developed Countries (DCs) through different modes ranging from setting up of fully owned subsidiaries to outright purchase of technology in arms-length transactions. Notwithstanding the earlier disenchantment with foreign technology and Transnational corporations (TNCs)[1], recent research has shown that there appears to be real opportunities for LDCs to obtain high yields to their investments in technology licensing agreements (Basant and Fikkert 1996). In fact, one of the new research issues in this area relates to the "incentive competition" among LDCs to attract more foreign direct investment and its implications (UNCTAD 1994, Srinivasan 1995). Any research into this area, however, is handicapped by the poor theoretical base and non availability of reliable data at a disaggregated level because of the strategic nature of the information involved. Hence, Vernon (1990, p 255) notes that few of the available studies on the acquisition of technology in LDCs have applied rigorous methodology, and that scarcely any has produced incontrovertible results.

Using a unique data set on all foreign technology licensing agreements entered into by India's largest 485 private sector firms, this paper analyses some basic but important and often neglected questions on licensing agreements and their effect on the licensees. The paper presents estimates on: a) the probability that a firm involves in foreign collaboration and the factors that influence the decision to collaborate, b) the probability of choosing their partners from a particular country and the factors and forces influencing the observed choice, c) the

1 For a survey of literature see Helleiner (1992)

probability of obtaining technology on certain terms and conditions and the factors that govern the terms of licensing, d) the determinants of the levels of royalty rate and lumpsum payment to be made for the technology transferred and e) the effect of foreign collaboration on the licensees' performance in terms of profit and net export earning[2].

Given the fact that only a select sample was found to be engaged in foreign collaboration, we use the Heckman selection model to correct for sample selectivity. While a probit model is used to estimate the probability of collaboration, multinomial logit models are employed to determine choice of the collaborating country and the terms of collaboration. The effect of foreign collaboration on licensees' performance is analyzed using OLS.

The estimates made in this study show that the growth in the stock of scientific and technical knowledge abroad has a positive influence on the firms' decision to license foreign technology. This tend to suggest the existence of strong technological spillovers. While the firm specific factors like the size, imports, exports, profit and foreign control have a positive influence, the market concentration seems to have a negative effect on the decision to collaborate. The choice of a partner is influenced positively by the stock of patents in the partner's country and negatively by its competitor's patents suggesting that the stock of knowledge in one country is a substitute to those available in other countries. Estimates of the Multinomial logit model on the terms of foreign collaborations as manifested in the different combinations of royalty rates and lumpsum has shown that the highest probability is to have a technology deal with only lumpsum payments indicating the terms in which firms obtain technology. This could be a combined effect of the bargaining power of the Indian firms and the increasing competition in the international technology market. Our selection-corrected estimates of royalty rates and lumpsum payments show that foreign control and exports have a positive effect on royalty rates. Profit is found to have a negative effect.

2 We do not intend to present the details of policy changes regarding technology licensing in the Indian industry which has been subjected to substantial change in the recent years. Interested readers are referred to a recent study by Subramanian et al (1996)

Similarly while the market share, exports and imports have a positive effect on lumpsum payments, foreign control and firm size is found to have a negative effect. Our analysis of the effect of foreign technology licensing using the estimates of the profit and export functions produced mixed results. While technology licensing is found to enhance firms' profitability, it is found to be associated with a dampening effect on net export earnings.

This paper is presented in five sections including this introduction. In the next section we describe the different data sets used and procedure involved in the measurement of variables. The third section presents the specific issues and the econometric models used in their analysis. Results of the estimates are presented and discussed in section four. Some concluding observations are made in the last section.

Data Sources and Measurement of Variables

This study is based on the data on all foreign collaboration approvals obtained by the 485 largest firms in the Indian industrial sector for the year 1985, 1988, 1989, 1990, and 1991. To begin with, we have collected the financial statistics (investment, sales export, import, profit etc) of the largest 500 private corporate firms from the publication - Key Financial Data on Larger Business Units - by the Center for Monitoring the Indian Economy. We confined our analysis to a sample of 485 private sector firms. In addition to financial statistics, the publication also provides data on the production and installed capacity of different product(s) and the ownership of the firm. It need to be stated at the outset that most of the firms were multi-product firms which made our analysis more difficult. For most part of study, we focus on the major product defined as the product which accounts for the largest proportion of the sales by the firm. Going by their major product it was found that these firms produce 119 products. These data are available for the five year period from 1989 to 1993. Though the data refers to the largest firms, there is substantial variation in the data in terms of any commonly used measures of size like sales or investment. A summary of the variables used in the analysis is provided in table 1.

The data on the market share of each firm in its major product was collected from another publication by the CMIE viz. markets and market shares. The same data base was used to estimate the market concentration ratio. (estimated in terms of the 4-firm concentration ratio)

Data on foreign collaboration approvals was obtained from the publication _ foreign collaboration: A compilation- a document with restricted circulation- by the Department of Scientific and Industrial Research[3]. These data are available to us for the following years, viz. 1985, 1988, 1989, 1990 and 1991. This data set covers all the foreign collaborations approved by the government of India and it provides following information; name and address of the Indian firms, and the collaborating firms, name of the product or process technology which is transferred, foreign equity amount and the share of foreign equity, royalty rate on domestic sale and its duration, Lumpsum amount (also called technical fee) and the duration of collaboration. If the royalty rate on export is different from the domestic sale, it is provided along with duration of payment. It is found that out of the total 485 firms only 228 have had any foreign collaboration during the period under consideration. These 228 firms have entered into 660 collaborations during 1985, 1988, 1989, 1990 and 1991. Since the financial data was available only from 1989, we have made use of only 400 collaborations which were approved during the three years, viz. 1989, 1990 and 1991. Nevertheless the information for the period prior to 1989 was used in determining whether the firm has had any collaboration before 1989. The country-wise distribution of the sample collaborations tend to suggest that the broad pattern is similar to that observed at the aggregate level (see table 2)

The fourth set of data made use of in this study is the micro patent data from the US patent office which provides information on the details of the patents registered in the United States. This has been supplemented by the Basic Science and Technology Statistics published by the OECD.

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[3] Given the confidentiality of the data this publication is restricted only for official use. We have used this data in such a way as to maintain the confidentiality by not revealing the identification of either the local or foreign firm.

The micro patent data covers the period 1975 to 1994, grouped into five time periods viz. 1975-78 (four years) 1979-82 (four years) 1983-86 (four years) 1987-89 (three years) 1990-92 (three years) and 1993-94 (two years).

The collaboration dummy in the probit model is arrived at in the following way. We have scanned through all the foreign collaboration approvals for the five years (1985, 1988, 1989, 1990 and 1991) for which information is available. The dummy takes the value 1 if the firm has had collaboration in any of these years and zero if not. Indeed, there is room for some concern because we do not have the data for the years 1986 and 1987. However, a close examination of the data reveals that the additional information for the missing two years would have added only a few new firms.

In this study, the size of the firm is measured in terms of the gross fixed asset at constant (1980==100) prices, the deflator used being the whole sale price index of machinery and machine tools. Exports and imports are estimated in dollar terms to take care of the possible effect on account of rupee devaluation. Profitability is measured in terms of the ratio of net profit (after tax) to net sales. The dummy variable, foreign control, indicates whether a firm is foreign controlled or not. It takes the value of one if the foreign equity is more than 51 per cent and zero otherwise.

There are different ways of estimating the extent of spillovers and most studies employ either the R&D or the patents as the proxy for the aggregate stock of scientific and technical knowledge[4]. In the present study we make use of the data on patents registered in USA by both US and foreign firms. The estimation procedure of the total patent which represent the spillover is as follows. To begin with, we have collected the total number of patents registered by India's major collaborating countries like, United States, England, Germany, and Japan in the 119 major product of Indian firms in USA during 1975-1986. The patents of

4 See Griliches (1992) for a survey.

other countries is estimated as a residual. Then we have made a stock of patents by each country in the 119 products for the period 1975-1986. It need to be noted that the micro patent data is very much US centered in the sense that while it covers all the patents by all the US firms, there is an under estimation of the patents by other countries, *albeit* with a decline in the extent of under estimation overtime. For example, estimates based on the data from Basic Science and Technology Statistics published by the OECD shows that during 1975-78 out of the total German patents (ie. total number of patents registered by the Germans in Germany) only 1.4 per cent were registered in the USA and this increased to 19.8 per cent during 1982-86. Similar trend was observed in the case of other countries as well. We, there fore, collected the total number of patents registered in each of the countries during the period of analysis. The estimated ratio of the number of patents registered by each of these countries in the US to their total number of patents was used to adjust for propensity to patent abroad.

It need to be noted that not all the patents made by these countries are of relevance to India. Hence we need to estimate the total number of patents relevant to India. This is obtained by weighing the total number of patents with relevance index[5] due to Evenson & Putnam (1989) and Basant & Fikkert (1996). Since the relevance index was available only at a more aggregated level (45 product groups) we collapsed our 119 products to 45 for estimating the relevant patent.

There are two variables used in the estimated equations to represent the spillover. The first variable - Own Relevant Patent - takes the value of total relevant patent of the technology exporting country. Another estimated variable - Others Relevant Patent - essentially captures the influence of patents by other countries on the decision to collaborate and/or the choice of partners. For example, if the technology exporting country is the US it takes the average number of patents by countries

5 The Relevance Index (REL_{ijc}) is the ratio of the number of patents granted by India to inventors in industry j from country c to the number of patents granted by country c to inventors in country j from country c during the period 1972-89 (Basant and Fikkert 1996).

other than US. Similarly for all the countries.

In terms of the period of analysis our focus is on 1989, 1990 and 1991, for all the above mentioned data are simultaneously available only for these three years. In terms of the policy stance of the government towards foreign technology licensing, above period may be considered as more liberal compared to the seventies and less liberal as compared to the new economic policies announced since the middle of 1991. Indeed, six months in the second half of 1991 represented a liberalized policy environment.

Methods: Hypotheses

We begin with the collaboration decision. Given that only 47 per cent of the firms in the sample had any foreign collaboration, (during 1985-1991) the dependent variable is binary. Hence we approached the problem using a probit model. We hypothesize that the decision to collaborate is governed, *interalia*, by exogenous factors such as the available stock of scientific and technical knowledge abroad, firm specific factors like market power, size, ownership and profit and industry specific factors measuring the competitive environment in which the firms operate and other industry specificities.

The dependent variable in the model takes the value of one if the firms had any foreign collaboration since 1985 and zero otherwise. There are three sets of independent variables. The first set, **Own Relevant Patents** and **Others' Relevant Patents**, captures the influence of the stock of scientific and technological knowledge abroad measured by the cumulative stock of relevant patents registered by the major technology exporting countries during 1975-86[6]. While this variable measures the

6 This, in a sense, represents the potential supply of scientific knowledge. The knowledge stock actually available may be less because of reasons including the following: some of the technologies may not be sold to the LDCs on account of reasons including strategic ones. It is also possible that some of the patents may not actually result in viable technologies or some of the viable technologies are actually patented at all. While we recognize such a gap the available data may not allow us to take into account this aspect.

stock of own inventions, **Others' Relevant Patents** measures the stock of inventions by countries other than the collaborating country. The former is expected to have a positive influence on the decision to collaborate and the latter is expected to be a major choice variable in the selection of partners. The second set of variables includes a) **market share** b) **profit**, c) **exports**, d) **imports**, e) **size** and e) **ownership** (foreign or local) measures firms' characteristics. The third set of variables, **market structure** and the **industry dummies** are intended to capture the competitive environment in which the firms operate and other industry specificities.

The first firm-specific factor, the market power of the collaborating firm, as represented by its market share, in general, is postulated to have a negative influence on the decision to collaborate. Assuming that the primary objective of the firm is to maximize profit, a price setting firm (monopolist), operating in a closed economy has hardly any incentive to go for foreign collaboration. On the other hand, if the firm is a price taker, it may resort to foreign collaboration either to bring down the cost of production or to find new export market or both. Viewed thus, it could be argued that there is an inverse relation between the market share and the decision to collaborate.

Another firm specific factor that is expected to influence the decision collaborate is the size of the firm. We expect a positive scale effect for the following reasons; First, similar to the resource cost of technology Transfer incurred by the technology exporting firms (Teece 1977), there is substantial search cost to be incurred by the technology importing firms which the larger ones would be more readily willing to undertake. Secondly the technology exporting firms are likely to prefer larger firms because of their higher risk taking capability and higher expected return by way of royalty and lumpsum payments. Viewed in a similar vein, we expect a positive relation ship between the firm's profit and the decision to collaborate.

While the role of technology in trade has attracted considerable attention by researchers, the possible "reverse causation" remains almost

neglected and deserves empirical verification. Therefore, another factor considered influencing the decision to collaborate is the external orientation of the firm. It has been argued that technology imports, imports of capital goods and intermediates and that of foreign equity are inter-linked. Also very often technology transfer takes place through trade, by importing capital goods and intermediates (Stewart 1990). It could also be argued that the more outward oriented firms with larger exports and imports are likely to be more aware of the technological changes abroad, and hence are more likely to collaborate as compared to their inward oriented counterparts. Moreover, the need to be competitive in the world market will induce such firms to resort to foreign collaborations to keep up with the advancements in technology. However, the likely impact of exports and imports could be different. It could be argued that firms consider the import of embodied technology (ie. import of capital goods and intermediates) a substitute for the import of disembodied technology (technology licensing) and hence those with high imports are less likely to collaborate.

Finally, among the firm specific variables we consider the influence of ownership (foreign or local) structure on the decision to collaborate. There is a strong presumption that the multinational enterprises would transmit their technologies more readily and efficiently to their subsidiaries not only to recoup a part of the investment in R&D but because the risk of leakage would be less. Hence it is hypothesized that those firms with foreign majority equity participation are more likely to collaborate than their local counter parts. In addition to these firm specific variables, we have also taken into account the industry specific factors like the market structure in which the firms operate. The hypothesis is that firms operating in the more concentrated market (more competitive) are less likely (more likely) to collaborate. Other industry specificities are taken into account by incorporating industry dummies. The industries so considered are chemicals, electrical and electronics, engineering, steel and basic goods, food, textiles and miscellaneous.

The estimated probit equation is

$$\begin{aligned}\text{Prob (Collaborate} = \alpha_0 &+ \alpha_1 \text{ own Relevant Patent} \\ &+ \alpha_2 \text{ size } \alpha_3 \text{ market shares} \\ &+ \alpha_4 \text{ market concentration} + \alpha_5 \text{ profit} + \alpha_6 \text{ Foreign Control} \\ &\alpha_7 \text{ export} + \alpha_8 \text{ import} + \alpha_9 \text{ d chemical} \\ &+ \alpha_{10} \text{ delectronics} + \alpha_{11} \text{ d engineering} + \alpha_{12} \text{ d steel \& basic} \\ &+ \alpha_{13} \text{ d textiles} + \alpha_{14} \text{ d others}\end{aligned}$$

where

$$\text{Prob (collaborate)} = \frac{e^{x\beta}}{1 + e^{x\beta}}$$

Having taken the decision to collaborate, the next issue that a firm faces is to decide on which country to collaborate with? Our objective is to estimate the probability that a collaboration is agreed upon with USA, England, Germany, Japan, or Other countries. Also, we are concerned with identifying the factors having a bearing on the choice made. These issues have been analyzed using a multinomial logit model.

In the multinomial logit model[7] we estimate a set of coefficients say $\beta^{(1)}$, $\beta^{(2)}$, and $\beta^{(3)}$ corresponding to each outcome category such that

$$P(y=1) = \frac{e^{x\beta(1)}}{e^{x\beta(1)} + e^{x\beta(2)} + e^{x\beta(3)}}$$

$$P(y=2) = \frac{e^{x\beta(1)}}{e^{x\beta(1)} + e^{x\beta(2)} + e^{x\beta(3)}}$$

$$P(y=3) = \frac{e^{x\beta(1)}}{e^{x\beta(1)} + e^{x\beta(2)} + e^{x\beta(3)}}$$

The model, however, is unidentified in the sense that there is more than one solution to $\beta^{(1)}$, $\beta^{(2)}$, and $\beta^{(3)}$ that leads to the same probabilities for y=1, y=2 and y=3. To identify the model, one of $\beta^{(1)}$, $\beta^{(2)}$, or $\beta^{(3)}$ is arbitrarily set to zero. If we set $\beta^{(1)}=0$ then the remaining coefficients $\beta^{(2)}$ and $\beta^{(3)}$ would measure the change relative to y=1 group. Setting $\beta^{(1)}=0$, the equations for estimating the probabilities become

7 See Greene (1993). For an intuitive introduction to the topic see Kennedy (1992)

$$P(y=1) = \frac{1}{1 + e^{x\beta(2)} + e^{x\beta(3)}}$$

$$P(y=2) = \frac{e^{x\beta(2)}}{1 + e^{x\beta(2)} + e^{x\beta(3)}}$$

$$P(y=3) = \frac{e^{x\beta(3)}}{1 + e^{x\beta(2)} + e^{x\beta(3)}}$$

The selected comparison group is the fifth category (Other countries).

The first hypothesis being tested is that the choice of a country depends on its stock of scientific and technical knowledge vis-a-vis that of the competing countries. The other independent variables in the model are the same as those in the probit model.

The next question deals with the terms of collaborations, more specifically the choice of the different modes of payment for technology. Studies have shown that the market for technology licenses, like other markets for intangible knowledge, is susceptible to market imperfections (Caves et.al 1983, Vernon 1990) arising from small numbers bargaining, appropriability problems, uncertainty, transaction cost, and so on. These market failures imply several sets of predictions about the prevalence and provisions of technology transactions, some of which have been tested by Caves et al (1983). Our focus here will be on the terms as reflected in the payments involved[8]. Payments for technology are generally made in terms of royalty (a certain per cent of the sales)[9] and/ or lumpsum payment which is generally paid at the time of collaboration or in installments. As has been argued in the literature, under competitive conditions, while royalty payments may adversely affect profitability

8 There are other terms involved in the collaboration agreements like restrictions on export, cross licensing of technology, import of capital goods and spares an so on. However, with the available data we are not able to look into these aspects.

9 In the case of technical collaborations the maximum royalty rate payable is 5 per cent of the sales and the ceiling for the overall payment (lumpsum + royalty) is 8 per cent of the value of production during the collaboration period, less standard deductions. Higher royalty rate up to 8 per cent is allowed for exports. As per the overall guidelines of the government, in overall technology payments, more weighage is to be given to royalty rather than lumpsum payments.

(because it raises the variable cost, and therefore the marginal cost) the lumpsum payments may not have an effect on profit because it affects only fixed cost (Katrak 1988). What we estimate is the probability that a foreign collaboration involves a) only royalty, b) only lumpsum c) both royalty and lumpsum and d) neither royalty nor lumpsum using a multinomial logit model.

In the model that we estimate, only lumpsum category is the comparison group. We hypothesize that there are differences in the terms of collaborations offered by different countries. For this purpose we have incorporated country dummies in the estimated multinomial model. The other independent variables considered in the model are the ones included in the probit model, with the exception of total relevant patent.

The next issue relates to the factors that determine the amount of lumpsum and royalty rate. We have estimated separate OLS equations for the royalty rate and the lumpsum payments using data from those collaborating firms.

The estimated equations are

$$\text{Royalty} = \beta_0 + \beta_1 \text{colldum} + \beta_2 \text{marketshare}\ \beta_3 \text{export} + \beta_4 \text{import} + \beta_5 \text{size} + \beta_6 \text{mnedum} + \beta_7 \text{dchemical} + \beta_8 \text{delectronics} + \beta_9 \text{d engineering} + \beta_{10} \text{d steel} + \beta_{11} \text{d food} + \beta_{12} \text{d others}$$

and

$$\text{Lumpsum} = \delta_0 + \delta_1 \text{colldum} + \delta_2 \text{marketshare}\ \delta_3 \text{export} + \delta_4 \text{import} + \delta_5 \text{size} + \delta_6 \text{mnedum} + \delta_7 \text{dchemical} + \delta_8 \text{delectronics} + \delta_9 \text{d engineering} + \delta_{10} \text{d steel} + \delta_{11} \text{d food} + \delta_{12} \text{d others}$$

However, the above procedure is affected by sample selection bias (also called Heckman selection bias). This bias arise out of the fact that firms decide whether to collaborate or not and we select only those collaborating firms and observe only their royalty rates and lumpsum payments. If firms made these decisions randomly, we could have ignored that all royalty rates and lumpsum payments are observed and an OLS

estimation method could have been used. The assumption of such random collaboration behavior is unlikely to be true; firms which confronted with higher lumpsum and royalty rates may have chosen not to collaborate. To put it differently, the firms did not collaborate because their reservation price - the maximum price which they were ready to pay in terms of royalty and lumpsum - were lower than demanded by the foreign firm.[10] Under such conditions the observed royalty and lumpsum are biased and it is possible that the firms who chose not to collaborate could have even lower offer of royalty and lumpsum but their ceiling would have been still lower. Heckman selection model (Heckman 1979) provides the methodology for the consistent and asymptotically efficient estimate of the royalty and lumpsum by correcting for sample selectivity. The heckman selection model assumes that a potential observation is observed if

$$x_1\beta_1 + u_1 > 0$$

where u_1 has a standard normal distribution. Simultaneously there is another regression equation

$$y = x_2\beta_2 + \alpha u_2$$

where u_2 also has a standard normal distribution but u_2 is potentially correlated with u_1 with correlation r. When r # 0 standard regression techniques applied to the second equation yield biased results. The heckman selection model there fore involves the estimation of two equations and it uses the Mills ratio estimates (Heckman 1979) for starting values.

In estimating the Heckman model we need to locate certain identifying variables; the variables that strongly affect the decision to collaborate but not the terms of collaboration. The two identifying variables in the estimated model are the market concentration (4-firm

10 It could also be possible that the governmental approval was not given because of the higher royalty and lumpsum payment involved or for any other reasons like the nature of technology involved. We assume for that the collaboration was not agreed up because of higher payment.

concentration ratio) in the product concerned and the total number of relevant patents in the collaborating countries. It is hypothesized that a firm which operates in a highly competitive market has a higher probability to collaborate while it doesn't influence directly the terms of contract. Similarly, while an increase in the stock of patents increases the probability of collaborating it may not directly influence the terms of collaboration.

The last issue relates to the effect of foreign collaboration on performance. It has been argued that substantial gains are to be made by the LDC firms by increased levels of technology licensing (Basant and Fikkert 1996) Hence, it is legitimate to raise a question regarding the effect of technology licensing on the importing firms. In this study we selected two indicators of performance, profits and net export earnings. The basic hypothesis is that the foreign collaboration and the inflow of foreign technology enables the firms to bring down cost of production and increase international competitiveness and profitability. In the initial equations that we have estimated, following the common practice, collaborating firms are distinguished from others by a dummy variable. We tested for significant differences in coefficients between collaborators and non collaborators. Having observed a statistically significant difference in all the variables, including the endogenous,we have estimated separate OLS for collaborators and non collaborators.

The estimated equations are

$$\text{Profit} = \gamma_0 + \gamma_1 \text{ marketshare} + \gamma_2 \text{ exports } \gamma_3 \text{ imports} + \gamma_4 \text{ size} + \gamma_5 \text{ mnedum} + \gamma_6 \text{ dchemical} + \gamma_7 \text{ delectronics} + \gamma_8 \text{ d engineering} + \gamma_9 \text{ d steel} + \gamma_{10} \text{d food} + \delta_{11} \text{ d others}$$

and

$$\text{Net Exports} = \epsilon_0 + \epsilon_1 \text{ marketshare} + \epsilon_2 \text{ profit} + \epsilon_3 \text{ size} + \epsilon_4 \text{ mnedum} + \epsilon_5 \text{ dchemical} + \epsilon_6 \text{ delectronics} + \gamma_7 \epsilon \text{ engineering} + \epsilon_8 \text{ d steel} + \epsilon_9 \text{d food} + \epsilon_{10} \text{ d others}$$

Estimation Results

a. *The Collaboration Decision*

We begin with results of the probit model (see table 3). We find strong evidence for international technology spillovers in the Indian industrial sector. That is, Indian firms respond positively to the advancements in the scientific knowledge abroad by developing collaborations. This is evident from the positive and statistically significant value of the estimated coefficient representing the stock of total relevant patents in the major collaborating countries. We also find that the market concentration has a negative effect on the decision to collaborate. This tend to suggest that the firms operating the competitive market consider foreign collaboration as one of the strategies to increase their competitiveness. It is possible that foreign collaboration enables them to bring down the cost of production and provide other pecuniary benefits like the use of foreign brand names which help increasing the acceptability of their product[11]. The coefficients of the profit and size variables are statistically significant and positive. Larger firms and those with higher profit not only have the resources to invest in the search process and to take the risk, but the foreign firms also seem to have greater preference for those with larger resource base. Coming to the influence of trade on technology import it is found that import and export of goods has a catalytic effect of technology licensing. The dummy variable representing the foreign equity participation is also positive and significant suggesting that the subsidiaries of foreign firms are more likely to collaborate than local firms.

We now turn to the results of inter-industry variation as reflected from the coefficients of industry dummies. The coefficient of the omitted industry (textiles) is found negative and significant. It is worth noting that the behavior of food, steel and miscellaneous industries are not significantly different from textiles. Other industries like electronics,

11 If one considers foreign collaboration as a competitive strategy, then the behavior could be modelled in a game theoretic framework. See Singh (1992)

chemical and engineering industries show a significantly different pattern as compared to textiles.

b. *Choice of Partners*

The results of the estimated multinomial logit model (see table 3) indicate the factors influencing the choice of country by the firms. The model enables us to estimate the probability that a collaboration is agreed up on with US, England, Germany, Japan or Other countries. Estimates of probability of having a collaboration with each of the countries have shown that the highest probability is for the Other Countries (60.33) followed by Germany (17.40), Japan (9.57) USA (6.97) and UK (5.72). The variable representing the own total relevant patents is positive and significant with respect to the choice regarding all the countries. The variable representing the relevant patents of other countries, on the other hand, shows a statistically significant negative sign. This implies that the overall stock of scientific knowledge relevant to India that exists in any one country is more or less similar to those in others and hence they are substitutes. This means not only that the LDCs have a much wider choice, but also that the technology market shows some signs of becoming competitive. This offers, as has been argued by Bhardhan and Singh (1987), a possibility for the technology buyers to turn the table in their favor if proper strategies are used. The role of market share is found to be different in the choice of country. While it is found not significant in the choice of Japan and the US it exerted a positive and significant influence in the collaborations with UK and negative and significant influence in collaborations with Germany as compared to the other countries. The preference of the firms with monopoly power to go for foreign collaboration with UK could be attributed to historical factors. It is interesting to note that the positive role of size and profit that we have observed in the probit model do not hold in the case of none of the major collaborating partners except the other countries. Similarly, the foreign control is found to be negative in the case of Germany where as, it is not significant in the case of USA, UK or Japan, implying that it is positive and significant in other countries. The role of trade is also found to differ

with respect to the major technology exporting countries. While exports are positive and imports are negative in the case of USA and UK neither exports nor imports are found to have any influence in the firms' decision to collaborate with Japan or Germany.

c. *Terms of Collaborations*

Estimates of the multinomial logit model on the terms of collaboration as revealed from the different combinations of royalty and lumpsum is presented in Table 4. The estimated probability for different terms of collaboration is as follows; probability of having only lumpsum is found to be the highest (78.58) followed by both royalty and lumpsum (14.06), no royalty and no lumpsum (4.25) and only royalty (3.10). The preference order of a typical profit maximizing firm operating in a competitive market, everything else remaining the same, it could be argued, would be the following; the highest preference would be for a deal involving neither royalty nor lumpsum followed by only lumpsum, only royalty, and finally for those with lumpsum and royalty. Viewed thus, the observed highest probability for the cases with only lumpsum tend to indicate that the Indian firms have been able to obtain technology at favorable terms. However, given the fact that most of the firms operate in concentrated market, the revealed preference of the large Indian firms would have been different from the competitive firms. This is evident when we piece together the probability of the choice of country and the probabilities of different terms across different countries. It is evident from table 5 that the most preferable term (for a firm operating in the competitive market) is offered by UK where the probability of neither lumpsum nor royalty, or only lumpsum payment is the highest and that of both royalty and lumpsum is the lowest. But, as we have already noted, in terms of the revealed preference, the highest probability is to collaborate with other countries, where the probability of a collaboration involving both royalty and lumpsum is the highest.

From the technology sellers' point of view a deal involving both royalty and lumpsum is most preferred because it enables them to spread

the risk. By setting such a term the firm is better insulated against ordinary commercial and the so called political risk (Contractor 1985 p.5). From the buyers' side, a deal involving both royalty and lumpsum ensures continued support of the seller, if needed, so that the risk is minimized. This will particularly be the case if the buyers' technological capability is rather poor and need the continued support of the seller. Though it would raise the cost of production, given the high market power, increased cost could easily be transferred to the consumers. Viewed thus the observed preference could be an indication of the risk aversion behavior of large Indian firms with low technological capability and high market power.

It is also interesting to note that the subsidiaries of the foreign companies have a much higher probability of obtaining technology at the most favorable term viz. with neither royalty nor lumpsum (58.43%) with the respective probability of only lumpsum, only royalty and both royalty and lumpsum being 24.48%, 2.01% and 15.08 per cent. This is a plausible explanation for the strong positive association between foreign control and technology licensing. However, a firm conclusion is not warranted in the absence of any information on other transfers made by the subsidiaries to the parent firm.

d. *Levels of Payments*

Table 6 presents the Heckman two stage selection corrected estimates for lumpsum and royalty equation. The selection coefficient (lambda) is found significant for both of the equations estimating lumpsum and royalty rate. Therefore, in analyzing the factors that determine the levels of lumpsum and royalty rate we focus on the two-step estimates rather than the OLS estimates. It may also be noted that both of the variables used to identify sample selection correction, in the probit equations are found statistically significant in all the estimated equations. In both lumpsum and royalty equations, the selection corrected estimates are found lower than the OLS estimates for almost all the independent variables.

The selection corrected estimates of lumpsum and royalty have some interesting results to offer. Given the fact that both are choice variables, in the sense that lower royalty rates are often counter-balanced by higher lumpsum (Alam 1985), let us consider the results of both equations together. To begin with, the coefficient of foreign control is positive and significant in the royalty equation, whereas the sign of the coefficient is negative in the lumpsum equation. That is, with equity participation the collaborator could fix a higher royalty rate to compensate properly for the technology and possibility of shirking is minimized. This explains the negative coefficient of lumpsum. Similar finding was made by Subrahmanian (1986) by analyzing the industry level data on foreign collaborations published by the Reserve Bank of India. The amount of lumpsum is found to be positively associated with the market share, where as the sign of the coefficient is negative (not statistically significant) in the royalty equation. The coefficient of exports is positive and imports is negative in the royalty equation, whereas both exports and imports are positive in the lumpsum equation. That is, the firms with larger exports are expected to pay high royalty and lumpsum, where as, the royalty rates could be lower if the firm has high imports[12]. It is interesting to note that firms with higher profits could obtain technology at a lower royalty.(A firm conclusion is not warranted in absence of an analysis of causality). Similarly while the size has a negative effect on lumpsum it is not significant in determining royalty rate. Regarding the inter-country variation, while there is hardly any difference across countries regarding lumpsum, collaborations with USA and Germany has a positive effect on royalty. Finally the coefficients of the industry dummy tend to suggest certain inter-industry variation. In electronics and engineering the observed trend is similar, positive in lumpsum but negative in royalty where as steel and miscellaneous industries, the coefficient was found negative in lumpsum compared to the textile industry.

12 This is in tune with the findings of Reserve Bank of India (1985) which stated "the tendency to impose export restrictions has increased over time" (p.41)

Effect of Technology Licensing on Profit and Net Exports

Results of the estimated profits and net exports equations for collaborators and non collaborators is presented in table.7[13]. To begin with, the predicted mean profit of the collaborating firms (4.88) is found to be higher than that of non collaborating firms (3.33). On the other hand, the predicted mean net export earning of the collaborating firms (-0.96) are found to be lower than the non collaborating firms (-0.18)[14]. On the whole, the effect of foreign technology licensing on the domestic firms presents a mixed picture, while it enhances the firms' profitability, it is found to be having a dampening effect on net export earning. The latter aspect indeed has to be seen *interalia* in the overall context of a trade policy regime in which firms' preferred protected local market to the competitive export markets.

Another interesting result relates to the scale effect in the net export earning. We find an inverse relationship between size and exports for both collaborating and non-collaborating firms. This finding is similar to the results of earlier studies that the larger firms tend to have a smaller propensity to export (Lall and Kumar 1981, and Sidharthan 1986). This is to be expected in an economy with large domestic market characterized by a concentrated market structure on the one hand and higher levels of protection from international competition on the other. The effect of foreign control on exports still continues to be a point of controversy in the development economics literature[15]. Our results show that net export earnings are higher in those foreign controlled firms with technology licensing agreements. The sign of the coefficient for the non collaborating foreign subsidiaries is negative but not statistically significant. Turning to the inter-industry variation in net export earning, compared to the textiles reference group, all the industries with foreign collaboration have

13 We have also made OLS estimates of total exports and export intensity (export as a proportion of sales) and the results were the same as the net export earnings equation, hence not presented here.

14 t-test in both cases have shown that the difference is significant at 1 per cent level.

15 See Jenkins (1990) for a recent survey.

a positive effect on net export. However, it need to be noted that textiles have a very high negative coefficient. Only the miscellaneous industries in the collaborating group has a positive effect on export earning where as electronics has a negative impact. In the non collaborating group also, the only industry where there is a positive net export earning is food, while chemicals, electronics and engineering have a negative effect on the net export earning. To be more precise, firms in the food processing industry, whether collaborating or non-collaborating, have a positive effect and firms in electronics, both collaborating and non-collaborating, have a negative effect on net exports[16].

Results of the profit function for collaborators and non collaborators have shown that, while market share plays a positive and significant role in the case of collaborators, the coefficient is positive but do not have the required level of statistical significance in the case of non collaborators. This finding is broadly in tune with industrial organization theory which predicts a positive association between market structure and profitability. Secondly, exports are found to have positive effect on profit only in the case of non-collaborators. Similarly, the positive association between foreign control and profitability is found only in the case of non collaborators. Turning to the inter-industry differences, compared to the textiles reference group, all the other industries have negative sign in the case of collaborators, and positive in the case of non-collaborators except electronics and steel. Since the textile coefficient is positive and significant in both cases, the estimated absolute coefficients has shown the following. In the case of chemical and food both collaborators and non collaborators have positive profits. In the case of steel collaborators have positive profit and non collaborators have negative profit. In the case of electronics, engineering and miscellaneous industries only non collaborators have positive profit. On the whole, the collaborators have higher profit than the non collaborators.

16 The high import intensity of electronics industry under liberalization has been noted by Joseph (1992)

Concluding Observations

In the light of the findings by the recent research that there appears to be real opportunities for LDCs to obtain high yields from technology licensing agreements, we have looked into some of the basic but important and often neglected issues on foreign technology licensing in Indian industry. They included; a) what is the probability that a firm resorts to foreign collaboration and what are the factors that influence the decision to collaborate, b) what is the probability of choosing their partners from a particular country and what are the factors and forces influencing the observed choice, c) what is the probability of obtaining technology on certain terms and conditions and what are the factors that govern the observed terms of licensing, d) the determinants of the levels of royalty rate and lumpsum payment to be made for the technology transferred and e) the effect of foreign collaboration on recipient firms' performance in terms of profit and net export earning.

The estimates of the probit model show that the exogenous factors like the stock of scientific and technical knowledge abroad has a positive influence on the firms' decision to license foreign technology, suggesting the existence of strong technological spillovers. The firm specific factors like the size, imports, profit and foreign control are found to be inducing firms to develop foreign collaborations. On the other hand, the market concentration tend to have a negative effect suggesting that the Indian firms consider foreign collaborations as a means of increasing their competitive strategy. The choice of a partner is influenced positively by the stock of patents in that country and negatively by the competing countries' patents suggesting that the stock of knowledge in one country is a substitute to those available in other countries. This means not only that the LDCs have a much wider choice, but also that the technology market shows some signs of becoming competitive. This offers a possibility for the technology importers to turn the table in their favor if proper strategies are adopted. Estimates of the Multinomial logit model on the terms of technology licensing have shown that the highest probability is to have a technology deal with only lumpsum indicating

the terms in which firms obtain technology. This could be a combined effect of the good bargaining power of the Indian firms and the increasing competition in the international technology market. Our selection corrected estimates of royalty rates and lumpsum show that while the foreign control and exports have a positive effect on royalty rate, profit is found to have a negative effect. Similarly while the market share, exports and imports have a positive effect on lumpsum, foreign control and size is found to have a negative effect. The finding that the firms with larger exports are expected to pay high royalty and lumpsum tend to suggest that the foreign collaborations are yet to become export friendly. Evidently, the foreign firms are also interested in taking advantage of the protected domestic market. Our analysis of the effect of foreign technology licensing using the estimates of the profit and export functions has produced a mixed results. While technology licensing is found to enhance firms' profitability, it is found having a negative effect on the net export earnings.

Table. 1

Summary of Variables Used in the Analysis

Variable	Units	Mean	Std. Dev.	Min	Max
Size (Gross Fix. Inv)	Rs Crores	137.73	276.99	0.09	2703.29
Market Concentration	Per cent	56.90	28.72	1.90	100.00
Market share	Per cent	14.84	16.55	0.10	93.80
Profit	Rs Crores	3.72	8.57	-86.62	47.20
Exports	$ crores	0.64	1.23	0	13.43
Imports	$ crores	1.02	1.73	0	15.85
Net Exports	$ crores	-0.38	1.68	-13.81	12.74
lumpsum	$ lakhs	7.60	31.87	0	464.94
Royalty rate	Per cent	2.12	2.44	0	8.00
Own Relevant Patent	Number	101.41	144.09	0.04	714.60
Others' Relevant patent	- do-	169.22	221.62	0.05	1123.89

Table. 2

Country-wise Distribution of Licensing agreements by the Sample firms and Total agreements made by all the firms in India.

	Total Collaborations			Sample		
Country	1989	1990	1991	1989	1990	1991
USA	137 (21.4)	142 (20.2)	174 (17.8)	35 (29.2)	23 (18.4)	35 (22.6)
Germany	114 (17.8)	141 (20.0)	167 (17.1)	19 (15.8)	26 (20.8)	30 (19.4)
UK	142 (22.2)	78 (11.1)	107 (10.9)	9 (7.50)	20 (16.0)	19 (12.3)
Japan	63 (9.80)	55 (7.80)	74 (7.60)	10 (8.30)	12 (9.60)	14 (9.00)
Others	183 (28.6)	287 (40.8)	522 (53.4)	47 (39.1)	44 (35.2)	57 (36.8)
in which						
Italy	42	43	64	7	5	11
France	25	39	40	4	7	5
Switzerland	25	36	55	2	5	7
Total	**639**	**703**	**976**	**120**	**125**	**155**

Note: Figures in the parenthesis show share in total.

Table. 3

Probit estimate on the factors influencing the decision to collaborate and the Multinomial logit estimate on the choice of countries

Variables	Probit Model	Multinomial Logit model Collaborate with			
	collaborate with any country	USA	England	Germany	Japan
Intercept	-1.41997 *	-2.9710 *	-3.5675 *	-1.3023	-2.0653 *
	(-9.511)	(-2.048)	(-2.165)	(-1.591)	(-1.654)
Own Relevant Patent	0.01945 *	0.9322 *	0.9023 *	0.8034 *	0.9065 *
	(10.073)	(6.092)	(5.897)	(5.275)	(5.926)
Others Relevant Patent		-0.1084 *	-0.1002 *	-0.0819 *	-0.0998 *
		(-6.910)	(-6.413)	(-5.394)	(-6.392)
Size	0.0021 *	0.0129 *	0.0136 *	0.0095 *	0.0077 *
	(4.271)	(3.017)	(3.180)	(2.700)	(1.670)
Market Share	-0.00019	-0.0253	-0.0017	-0.0682 *	-0.0319
	(-0.060)	(-1.149)	(-0.084)	(-3.336)	(-1.212)
Market Concentration	-0.00517 *	-0.0104	-0.0222	0.0117	-0.0146
	(-2.361)	(-0.606)	(-1.319)	(0.810)	(0.796)
Profit	0.01162 *	-0.0284	0.0009	-0.0278	-0.0431
	(2.292)	(-0.921)	(0.028)	(-1.042)	(-1.358)
Export	0.03465 *	-1.0852 *	-0.8616 *	-0.2435	-0.3543
	(0.936)	(-3.090)	(-2.551)	(-0.980)	(-1.001)
Import	0.13249 *	-0.2698	-0.4717 *	-0.4189 *	-0.3191
	(3.719)	(-0.911)	(-1.619)	(-1.960)	(-1.030)
Foreign Control	0.44740 *	1.2475	-0.2224	1.1927 *	-0.6275
	(3.159)	(1.542)	(-0.230)	(1.811)	(-0.501)
Chemical Dummy	-0.43867 *	3.1462 *	3.7644 *	0.8858	1.9730
	(-2.390)	(1.946)	(2.104)	(0.835)	(1.263)
Electronics Dummy	0.61455 *	2.0016	3.6789 *	-0.0492	1.1947
	(3.337)	(1.181)	(2.104)	(-0.042)	(0.747)
Engineering Dummy	1.1650 *	2.9565 *	4.2391 *	1.0602	1.8917
	(6.119)	(.823)	(2.375)	(0.316)	(1.188)
Steel&basic Dummy	0.10562	4.8610 *	5.3432 *	4.0532 *	3.9935 *
	(0.586)	(2.889)	(2.893)	(3.514)	(2.390)
Food Processing Dummy	-0.1593	-3.4462	-1.9156	-42.97	-3.1142*
	(-0.796)	(-1.598)	(-0.901)	(0.00)	(-1.675)
Others Dummy	0.10562	3.6673 *	3.1633 *	1.7433	2.7776 *
	(0.586)	(2.223)	(1.686)	(1.551)	(1.771)
Number of Observations	1601	400			
Log Likelihood Ratio	-647.86	-322.86			
Chi-Squared	504.33	547.92			

* *Significant at least at 10 per cent level*

Table. 4

Estimates of the Multinomial logit model on terms of collaboration

Variables	Only royalty	Royalty and lumpsum	Neither royalty nor lumpsum
Intercept	-3.2328*	-1.7209*	-2.9164*
	(-2.723)	(-2.337)	(-2.550)
Market share	-0.0039	-0.0127	-0.0229
	(-0.302)	(-1.330)	(-1.240)
Profit	-0.0480*	-0.0043	-0.0252
	(-2.476)	(-0.221)	(-0.591)
Export	0.3583*	0.3442*	0.0033
	(1.831)	(2.148)	(0.008)
Import	0.0934	-0.1513	0.6109*
	(0.704)	(-1.439)	(3.048)
Size	-0.0006	-0.0004	-0.0060*
	(-0.398)	(-0.335)	(-2.502)
Foreign control	0.7296	1.2359*	3.7862*
	(1.372)	(3.462)	(5.456)
US collaborations	1.0915*	0.9433*	-0.1374
	(2.044)	(2.736)	(-0.197)
UK collaborations	0.8241	0.0073	0.9279
	(1.383)	(0.017)	(1.060)
German collaborations	1.0307*	0.7319*	-1.4049
	(1.929)	(2.074)	(-1.193)
Japanese collaborations	1.3618*	0.4951	-0.5412
	(2.336)	(1.052)	(-0.438)
Chemical dummy	-1.2253	-0.5491	-0.5411
	(-0.801)	(-0.654)	(-0.453)
Electronics dummy	0.7420	1.5766*	-1.3224
	(0.620)	(2.079)	(-1.067)
Engineering dummy	1.1646	1.4652*	-2.1245
	(1.012)	(1.967)	(-1.441)

Variables	Only royalty	Royalty and lumpsum	Neither royalty nor lumpsum
Steel&basic dummy	0.1377	0.4124	0.4669
	(0.129)	(0.551)	(0.440)
Food processing dummy	2.0485	-32.7	-0.6252
	(0.111)	(-0.000)	(-0.379)
Others dummy	1.1864	0.9086	-1.2363
	(0.986)	(1.161)	(-0.789)
number of observations	400		
Log likelihood ratio	-361.67		
Chi-squared	174.61		

Significant at least at 10 per cent level

Table. 5

Estimated probability of the different combination of royalty rate and lumpsum across different countries

Countries & Industries	Only Royalty	Only Lumpsum	Royalty & Lumpsum	Neither Royalty nor lumpsum
USA	0.0723	0.6157	0.2829	0.0291
UK	0.0639	0.7107	0.1281	0.0973
Germany	0.0737	0.6663	0.2478	0.0123
Japan	0.1041	0.6761	0.1985	0.0213
Others	0.0403	0.3488	0.5508	0.0599

Table. 6

Royalty and Lumpsum equations With Selectivity Correction (Heckman Two-step Estimates)

Variables	Royalty rate	Lumpsum
Intercept	0.0515*	25.2828*
	(0.095)	(2.474)
Market share	-0.0062	0.5656*
	(-0.787)	(5.077)
Profit	-0.0139*	-0.1975
	(-1.864)	(-1.008)
Export	0.2994*	4.1500*
	(2.214)	(2.177)
Import	-0.1312*	4.5595*
	(-1.540)	(3.823)
Size	-0.0013	-0.0432*
	(-0.398)	(-2.949
Foreign control	0.8976*	-8.4435*
	(2.806)	(-1.892
US collaborations	1.0074*	-0.9903
	(2.844)	(-0.208
UK collaborations	0.4372	2.8743
	(1.123)	(0.524)
German collaborations	0.8289*	1.3838
	(2.557)	(0.302)
Japanese collaborations	0.6265	-3.4102
	(1.461)	(-0.564
Chemical dummy	-0.5374	-10.0906
	(-0.875)	(-1.168)

Variables	Royalty rate	Lumpsum
Electronics dummy	1.4431*	-34.4857*
	(2.246)	(-3.905)
Engineering dummy	1.59978*	-30.87*
	(2.609)	(-3.637)
Steel&basic dummy	0.0946	-22.55*
	(0.162)	(-2.796)
Food processing dummy	-0.1762	-12.08
	(-0.222)	(-1.077)
Others dummy	0.3955	-29.5595*
	(0.623)	(-3.313
Selectivity term (Lambda)	0.5385*	-6.2903*
	(1.874)	(1.858)
Number of observations	1601	1601
Log likelihood ratio	-1514.44	-2576.80
Chi-squared	562.90	561.59

* Significant at least at 10 per cent level

Table. 7

OLS Estimates of Profit and Net Export Equations for Collaborators and Non-collaborators

Variables	Net Export		Profit	
	Collaborators	Non-collaborators	Collaborators	Non-collaborators
constant	-1.6133*	-0.0257	5.5703*	2.3186*
	(-4.336)	(-0.213)	(2.793)	(3.169)
Market share	0.0054	0.0037	0.0634*	0.2234
	(1.001)	(1.401)	(2.221)	(1.382)
profit	-0.0013	0.0031		
	(-0.452)	(0.660)		
size	-0.0057*	-0.0033*	-0.0005	0.0042
	(-14.78)	(-6.614)	(-0.128)	(1.133)
foreign control	0.3778*	-0.0668	0.9016	3.1499*
	(1.873)	(-0.430)	(0.836)	(3.349)
Export			0.3699	0.4186*
			(0.763)	(1.962)
Import			0.3064	0.3442
			(0.995)	(1.352)
Chemical dummy	1.4356*	-0.2583*	0.3677	0.7647
	(3.445)	(-1.738)	(0.164)	(0.846)
Electronics dummy	0.8079*	-0.3249*	-4.2409*	-0.5389
	(2.036)	(-1.905)	(-1.968)	(-0.519)
Engineering dummy	1.4506*	-0.2492	-3.7964*	0.0231
	(3.744)	(-1.477)	(-1.796)	(0.023)
Steel & basic dummy	1.5601*	-0.1016	-2.1366	-4.810*
	(3.744)	(-0.637)	(-1.052)	(-5.014)
Food dummy	1.6659*	0.5055*	1.2364	1.8543*
	(3.036)	(3.126)	(0.422)	(1.884)
Others	2.1132*	0.0599	-4.0459	0.8055
	(5.210)	(0.388)	(-1.772)	(0.855)
Number of Observations	400	1201	400	1201
R-Squared	0.5095	0.0717	0.0645	0.0811

* Significant at least at 10 per cent level

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