DOES THE STRUCTURE OF DEBT AFFECT THE OUTPUT AND INVESTMENT STRATEGIES OF THE FIRM?

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Abstract: The paper examines the impact of total debts, short-term debts and long-term debts on the output, gross investments and technology-upgrading strategies of the firms in certain oligopolistic industries in India. We first develop a simple theoretical model to motivate the analysis. The empirical analysis shows that debt as a whole may have a negative impact on the choice of output and investment levels of the firms. However, the short-term debts make firms behave in a conservative fashion while the long-term debts make firms behave more aggressively in this respect. Debt, irrespective of its structure, forces the firms to upgrade their technology. Total debt has a negative impact on profitability, however, firms with higher long-term debts have higher profitability.

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1. INTRODUCTION

An important question in financial economics is whether the capital structure of a firm affects its product market strategies. Modigliani and Miller (1958) first showed that debt and equity are identical forms of financing in a "frictionless" environment. After that a large theoretical literature has focused on the relevance of capital structure choice when some of Modigliani and Miller's (1958) stringent assumptions are dropped. These studies have made it clear that there are benefits and costs of using debt as opposed to equity and as a result an optimal capital structure may exist. However, more recently a few papers have discussed the links through which the capital structure of a firm can affect the product market strategies and whether the capital structure can be strategically designed in order to take advantage in the product market.

In a seminal contribution, Brander and Lewis (1986) argued that when the debt contract is subject to limited liability, Cournot firms use debt to commit to large output stances in an attempt to gain strategic advantage. Brander and Lewis (1986) introduced a two stage duopoly model linking debt choice with output decisions and demonstrated that because of limited liability, equity holders (or owner-managers) of the firm optimise only over non-bankrupt states of demand leading to higher output decision. Showalter (1995) modified this result to show that if firms compete a la Bertrand (price), the use of debt is advantageous if there is uncertainty in demand and disadvantageous if the costs are uncertain. The literature has discussed different aspects of strategic use of debt. In one class of models, it is shown that the leverage tends to make the firms aggressive in the product market (among others, Brander and Lewis (1986),Titman (1984), Gertner et al. (1988); and Maksimovic (1988) and Rotemberg and Scharfstein (1990)). In another class of models, the increase in leverage tends to soften the product market competition. This literature includes the work of Fudenberg and Tirole (1986), Bolton and Scherfstein (1990) and Phillips (1991) etc. Glazer (1994), on the other hand, introduced the dynamic aspects of debt repayment and concluded that longer is the horizon of debt repayment the more collusive is the firms' output strategies and shorter is the period of debt repayment the more aggressive is the firms' behaviour.

However, a very limited empirical literature exists to link the debt and the product market strategies. Opler and Titman (1994) have considered a large sample of US firms in industries, which are experiencing a recession. They showed that the highly leveraged firms suffer from a competitive disadvantage. However, they did not focus on Oligopolistic industries in particular and therefore, this disadvantage cannot be attributed to strategic components. Kovenock and Phillips (1997) analysed plant closing and investment decisions following sharp debt increases in relatively concentrated industries. Their findings demonstrate that industry concentration is a crucial variable for explaining

the relationship between financial and product market strategies. This points towards the existence of a strategic effect of debt[1]. It is found that increased debt makes the firms behave more passively, thus debt puts the firm at a disadvantage. These results are consistent with the conclusions of Phillips (1995) where four concentrated industries are studied. In three industries the firms, which increased their debt, generally ended up with lower sales. The studies by Chevalier (1995 a, b) also corroborate these results. Her study investigates the consequences of leverage in the super market industry in the US, where many companies in her sample went through leveraged buy out and it is found that the product market competition becomes "softer" when leverage increases (Chevalier, 1995a). Debt is shown to weaken the competitive position of firms.

Despite the fact that very few empirical studies exist on the topic, it is generally true in these studies that the debt financed firms are at a competitive disadvantage. However, this literature has mainly focussed on the impact of debt as a whole on some real variables to conclude this. In the light of the different conclusions in the theoretical literature it is imperative to analyse the impact of debt on a larger set of real variables, which are important factors in affecting the product market related strategies such as price and quantity. The effects may also differ with respect to the structure of the debt. In other words, short-term debts and long-term debts may have different impacts on the choice of real variables by the firms.

The theoretical literature (already cited) on the issue of debt influencing the product market strategies are divided and the debate is inconclusive. The purpose of this paper to empirically examine how the structure of the debt affects different real variables choice by the firms and as a result what happens to the performance of the firms measured in terms of profitability. More specifically, we are interested to examine the impact of total debts, short-term debts and long-term debts on the output, gross investments and technology upgrading strategies of the firms. The study is undertaken for certain oligopolistic industries in India. The empirical analysis shows that debt as a whole may have a negative impact on the choice of sales and investment levels of the firms. However, this impact differs with respect to short-term and long-term nature of debts. Short-term debts make firms behave in a conservative fashion while the long-term debts make firms behave more aggressively in those respects. It is found that higher debts irrespective of their structure force the firms to upgrade their technology. Debt as a whole has a negative impact on profitability; however, long-term debts have a positive impact on profitability.

[1] More recently, Showalter (1999) shows that manufacturing firms increase debt as demand uncertainty grows and reduce debt as cost uncertainly increases, thereby supporting the strategic use of debt.

The rest of the paper is organized as follows. Section 2 lays out the basic framework of our paper with the help of a simple theoretical model. In section 3 we discuss the data and the variables chosen for our empirical analysis. Section 4 describes the methodology adopted for the empirical analysis. The results of the univariate analysis, the discriminant analysis and the regressions are presented in sections 5, 6 and 7 respectively. Section 8 concludes the discussion.

2. THE BASIC FRAMEWORK

Firms can finance their capital requirements from two sources: debt and equity. In the beginning of a period they choose how much total capital to be employed and determine on the optimal mix of debt and equity depending on their relative costs. Once the debt-equity mix of the total capital is chosen, the firms choose different real variables to produce and sell their products to realize profits at the end of the period. The list of such variables is quite large. However, we would consider a set of variables, which we believe to be important decision variables for the firms for realizing profit. These variables are sales, gross investments, proportion of fixed asset to total assets and technology upgradation variables like imports of capital goods and imports of disembodied technology normally accounted in terms of royalty, technical fees payment and R&D expenditure. These choice variables are expected to be affected by the firms' debt equity mix and the structure of the debt. Now we present a simple theoretical illustration before putting forward the hypotheses of our paper.

2.1 THEORETICAL MODEL

We provide a simple theoretical analysis to show how the structure of debt, i.e., short term and long term debts, affects the output strategies of the firms. Suppose there are two firms in the market. Each firm has the same amount of capital requirements for undertaking production. We assume that the levels of borrowed funds are D^1 and D^2 for firms 1 and 2 respectively. These total debts can have two parts: secured loans and unsecured loans. For the unsecured loans the firms do not need to put their assets on mortgage. These unsecured loans are usually for short period of time. We call it short-term debt of the firms. The liability of this kind of debt is that it has to be repaid within the period. On the other hand the secured loans are taken for a long period of time and these loans are made against the assets of the firms. In case the firms cannot pay up these long-term loans the debt holders can claim the assets of the firms and thus the firms go bankrupt. The short term and long term debts are denoted by S^i and L^i for the firm i = 1, 2.

We assume that the market demand is uncertain and there are only two states of demand: high (h) and low (l) and the associated probabilities are p and (1-p). The net revenue function of firm i is $R^i(q_i, q_j, \theta)$, where outputs of firms are q_i, q_j for firms i and j; and θ denotes the state of demand, h or l. The net revenue functions are concave and satisfy all the usual properties for the existence and uniqueness of Cournot equilibrium. Apart from this net revenue function of the current period, each firm has some discounted expected future profit function V^i starting from the next period. We assume that a firm first chooses output before the realization of the state of demand in the current period.

Thus, the firm i's total profit is

$$p\, R^i(q_i, q_j, h) + (1-p)\, R^i(q_i, q_j, l) + V^i. \qquad (1)$$

Each firm i would choose the level of output q_i to maximize its profit. The Nash equilibrium is achieved for the output combinations q_i^*, q_j^* when each firm maximizes its profit given the output of the other firm.

Now suppose that the firm i has no debt (short term or long term). Then, q_i^*, q_j^* are the output choices of the two firms in equilibrium. The first order condition for this profit maximization for firm i is

$$p\, R^i_i(q_i, q_j, h) + (1-p)\, R^i_i(q_i, q_j, l) = 0. \qquad (2)$$

An intuitive thing to note is that both the net revenue functions (for high and low states of demand) are concave. So the optimal choice q_i^* (satisfying Eq. 2) implies that $R^i_i(q_i^*, q_j, h) > 0$ and $R^i_i(q_i^*, q_j, l) < 0$. That is, given the concavity of net revenue functions in both states of demand, for any q_j the optimal choice q_i^* is at the right side of the maximum of $R^i(q_i, q_j, l)$ function and to the left of the maximum point of $R^i(q_i, q_j, h)$ function.

The current period profit would be $R^i(q_i^*, q_j^*, h)$ when the market demand is high and $R^i(q_i^*, q_j^*, l)$ when the market demand is low. Now we introduce that firms have only short term debt. If the short term debt of firm i, S^i is less than the current profit in the low state of demand then there will be no problem of paying that up. However, if $R^i(q_i^*, q_j^*, h) > S^i > R^i(q_i^*, q_j^*, l)$ then the firm would not be able to pay up its short term debt in low state of demand but would be able to pay up if the realized demand is high. There are two effects of this kind of default on repayment of loans. First, the amount of shortfall of the debt has to be rolled over and has to be paid from the future profit and second, this kind of default would increase the cost of raising short term debt in future as the lender may charge higher interest rate on the subsequent borrowed funds or may not like to lend the requisite amount. Thus, this default would decrease the value of V^i. We assume that V^i is a decreasing concave function of the amount of shortfall on debt repayment. Note that the possibility of default under $R^i(q_i^*, q_j^*, h) > S^i > R^i(q_i^*, q_j^*, l)$ is there, when the low state of demand is realized. Therefore, the shortfall of

payment would increase if the firm i chooses output greater than q_i^* and it would decrease if the output choice is marginally less than q_i^*.

Thus, the profit function of firm i can be rewritten as

$p R^i (q_i, q_j, h) + (1-p) R^i (q_i, q_j, l) + pV^i + (1-p) V^i$.

Now by assuming that an interior solution exists and second order condition is satisfied, the maximization of the profit for the firm i would entail a choice of q_{is}^* such that

$p R^i_i (q_i, q_j, h) + (1-p) R^i_i (q_i, q_j, l) + (1-p) V^i_i = 0$.[2] (3)

Since V^i_i is negative around the optimal q_{is}^*, so by comparing Eqs. (2) and (3) we find that the optimal output choice would go below q_i^* in equilibrium. Note that given any equilibrium combination of outputs, increase in S^i would increase the shortfall of payment leading to more negativity of the term V^i_i (because of the concavity of the V^i term) leading to even lower output. Thus, we establish that more is the short term debt more conservative would be the firm's output choice, because the firm would try to guard more against the default in the lower states of demand. Similarly, one can analyse the impact of short-term debt on output when the short-term debt is so large that the firm would default even in the high state of demand. Thus,

Proposition 1. *The presence of short-term debt makes the firm conservative in its output strategy.*

Now suppose that a firm finances its capital requirement only through long-term debt, where the long-term debts are generally secured loans, i.e., the firms borrow against their assets. If the firms default on the payment of this kind of debt then the bankruptcy would occur. The firms' assets would be turned to the debt holders and the equity holders of the firms do not receive anything in the bankruptcy states. Suppose the firm i has long term debt L^i. In case the profit of the firm even in the lower state of demand is greater than L_i then there would be no default. However, if Max. $R^i (q_i^*, q_j^*, l) < L_i <$ Max. $R^i (q_i^*, q_j^*, h)$, i.e., if the long term debt is greater than the maximum profit available to the firm i in lower state but less than that of the higher state then the firm would default on loan repayment in the lower state only.[3] Then the firm i's objective is to maximize profit for the non-bankrupt states of demand (see Brander and Lewis (1986)). Thus, the profit function would be

$p R^i (q_i, q_j, h) + pV^i$.

The first order condition for maximisation implies

$R^i_i (q_i, q_j, h) = 0$. (4)

[2] Note that in case of realization of high state of demand, output q_i would not affect V_i.

[3] In case the longterm debt obligation is greater than the the net revenue in higher state of the demand then the firm would halt its operation immediately without going for any further production.

Now by comparing Eqs.(2) and (4) we find that the choice of output would be greater as compared to the situation when the long-term debt is not a binding constraint on firms. This implies that the firms behave aggressively with respect to long-term debt. Hence, we have

Proposition 2. *The presence of long- term debt makes the firm aggressive in its output strategy.*[4]

A caveat needs to be sounded regarding the long-term debt on the output strategy of the firms. This aggressive behaviour is theoretically appealing in the face of bankruptcy. However, in reality sometimes the long-term debts are also rescheduled in case of default. And also the debt holders take over the assets of the firms only if there is no chance of repayment in future and also it depends on the amount of shortfall of returns from the debt obligation. Thus, the explanation of the results based on bankruptcy is not so robust for the ongoing business establishments. This can only be valid for the firms, which are on the verge of bankruptcy for a sustained period of time. It should also be noted that we have only looked into the impact of different types of debt financing (short term or long term) on the output strategies of the firms. The above theory does not analyse how the debt equity is optimally chosen given its implications for the firms product market behaviour.

2.2. HYPOTHESES

In the empirical context, the structure of debt would have impact on more variables than just output, which is used in the above theoretical illustration. Given the structure of the debt-equity in the beginning of the period, different variables would be chosen by the firms within the period. We study the impact of the structure of debt, i.e., total debt, short-term debt and long-term debt obligations of the firms on two sets of strategies: (a) output and (b) investment. In case of output strategy, we would be concerned with the choice of sales turnover of the firms. In case of the investment strategies we consider the asset structure of the firms i.e., the proportion of fixed assets to total asset, gross investments and technology upgradation variables like import of embodied and disembodied technology and research and development expenditures of the firms. Given the theoretical setup of our analysis we expect the following behavior of the firms depending on their debt orientation.

1. Two important components of product market strategy are the price and output of a firm. Since products are not homogeneous in any industry, comparing prices and quantities sold by different firms does not make much sense. We take sales turn over of the firms as the most

[4] Note the difference between our propositions and that of Glazer (1994). In Glazer's model there is certain amount of debt and the firms are concerned about the timing of repayment. On the other hand, in our model we consider the different kinds of debt depending on the differences in liabilities. As a result, our conclusions with respect to short term and long term debts are opposite to those of Glazer.

important indicator of product market strategy and analyse the impact of the debt obligations on this variable. We propose that there will be in general a negative relationship between the total debt obligations and sales of the firms. We, however, expect that the sales of the firms would be affected differentially depending on the short term and long term nature of the debt of a firm. Since short-term debt of a firm is a liability of a firm that needs to be repaid within a short period of time, the firms' behaviour would be conservative (see Proposition 1). Thus, we expect that short-term debts of a firm will have a negative impact on the sales of the firms, i.e., larger the short-term debts lower will be the sales of the firms and vice-versa. On the other hand, the firms would behave aggressively with respect to long-term debt (see Proposition 2). That is to say that the larger the long-term debts higher will be the sales of the firm.

2. The level of the debt of the firms would also affect the investment strategy of the firms. Since debt has a fixed commitment for repayment we propose that the level of total debt and short-term debt would have a negative impact on the gross investment decision of the firms. However, with respect to the long-term debt obligations of the firms, given the choice of aggressive output strategies of the firms, we expect a positive relationship between the long-term debts and gross investments undertaken by the firms.

3. The important determinant of the debt holding of a firm is the proportion of fixed assets to total assets in the possession of the firm. This is because of the bankruptcy norms practiced in the corporate business. In case of bankruptcy, the fixed assets of the firms are turned to the debt holders. This is the return the creditors can expect to get in the state of bankruptcy. Apart from the bankruptcy effect, the creditors feel more confident about their repayments when the firms have greater fixed assets even for the unsecured components of the debt. Thus, the level of fixed assets determines the capacity of the firms to borrow from the market. Given the importance of the fixed assets in raising debt, it is expected that firms with higher debts will also have higher proportion of fixed assets to total assets so as to maintain their credit worthiness in the market.

4. The choice of the debt structure can also affect the technology up-gradation decisions of the firms. Since the firms which take more debt, will have greater obligation to pay up, they will have an added pressure to upgrade their technology so as to reduce their per-unit costs and raise their returns. This would imply that firms with higher debts, whether short-term or long-term, will also spend more on upgrading their technology, either by importing capital good or disembodied technology or by spending more on research & development.

5. Given the above output and investment strategies of the firms, it is expected that the profitability of firms would be affected depending on the level and structure of the debt. Since the holding of debt, essentially short-term debts, restricts the firms' behaviour away from the unconstrained optimal decisions with respect to output and investment strategies, it is expected that firms' profitability would go down with more of short-term or total debts. However, since long-term debts make the firms behave more aggressively in their choice of output and investment strategies this may lead to a positive relationship between long-term debt obligations and performance of the firms.

3. DATA & VARIABLES

The empirical analysis is based on the data for the Indian firms. The data have been collected from the *Capitaline package*, provided by Capital Markets Ltd. This database provides panel data for around 7000 Indian firms. In order to focus on strategic effects of debt, we restrict ourselves only to the oligopolistic industries. Since advertisement is an important feature of oligopolistic competition we have chosen our data set by fixing the advertisement intensity (advertisement as a proportion of sales turnover) on or above 0.05 %. Table 1 presents the descriptive statistics of the study. We have selected total 32 industries with 146 firms; out of which 29 industries are concentrated industries with two to six numbers of firms each and 114 firms altogether. It is expected that the hypotheses will be more strongly supported in case of concentrated industries.

An average of two years i.e., 1997-98 and 1998-99 has been taken to construct the debt variables, while an average of 1998-99 and 1999-2000 has been taken to construct the real variables. Thus, the debt variables are taken with one period lag as compared to real variables since it is expected that the debt in the beginning of the period will affect the real variable choice of the firms in that period.

Most empirical studies with firm level data have utilized the sales of the firms to adjust for the scale factors. Thus, the usual approach to study the firms' behaviour is to study the variables as a ratio of sales turnover (STO). Since our focus is to study the impact of debt on different variables including sales, so using STO to adjust for the scale factors would introduce bias. We need to look for an alternative variable to account for the scale effect of the firms, which should be unaffected by the firms behaviour or should be least affected. One such variable can be total capital employed by the firms. Given the theoretical structure of the analysis, we believe that firms first decide on the total capital to be employed and then decide on the structure of the financing of that capital (i.e., debt and equity).

VARIABLES:

To assess the impact of debt on the choice of real variables by the firms, short-term debts, long-term debts and total debts as a ratio of total capital employed have been considered. The debt to total capital employed has been used by, among others, Ferri and Jones (1979) and Friend and Lang (1988). The variables considered in our analysis to represent output strategies of the firms are

1. Sales / Total capital employed ≡ STO

The investment strategies of the firms' are represented by the following variables

1. Gross investments / Total capital employed ≡ GROSSINV
2. Fixed Assests / Total Assets ≡ FX

The technology upgradation variables considered are e.g.,

3. Import of capital goods / total capital employed ≡ TECHIMP
4. Import of disembodied technology, i.e., payment of royalty and technical fees / total capital employed ≡ ROY
5. Expenditure on research and development / total capital employed ≡ R&D
6. An index of technology up gradation in a firm is constructed using Principal Component Analysis ≡ UPGRADATION

To compare the profitability of the high debt and low debt firms both Profits after Tax (PAT) as a ratio of total capital employed, i.e., net profits (NP) and also Earnings before Interest and Tax (EBIT) as a ratio of total capital employed i.e., gross profits (GP) are compared.

The other control variables, which are used in the course of the analysis are:
a. The size of the firm is measured by log of sales ≡ SIZE,
b. The age of the firm is measured as the number of years since inception to the date of observation ≡ AGE
c. The capital intensity in the firm is measured by the ratio of gross block to total employee cost in the firm ≡ K/L

d.The extent of vertical integration is measured by the ratio of value-added by the firm to the total sales of the firms ≡ VI.

4. METHODOLOGY

The impact of the structure of debt on the choice of real variables of the firms has been analysed by using both non-parametric and parametric approaches. Under the non-parametric approach both univariate and multivariate analyses have been undertaken. Independent Samples t-test has been used to identify the significant differences in the choice of real variables between high-debt and low-debt firms in all oligopolistic industries as well as in concentrated industries. However, Discriminant Analysis and Ordinary Least Square regressions have been undertaken for only concentrated industries.

It is important to note that the structure of financing the capital requirements may have certain industry specific characteristics. Some industries may have inherently higher level of debt financing than other industries. Our focus is to study the differences in behavior of high debt firms from the low debt firms within the same industry. In the univariate analysis, one way to account for the industry specific characteristics of debt financing is to redefine the high debt firms and the low debt firms with respect to the average debt intensity of the concerned industry. Thus, we first determine the debt as a ratio of total capital employed of all firms in all industries in our sample. Then we calculate the average (simple) debt/ total capital employed in each industry and take the deviation of each firm's ratio of debt to total capital employed from its industry average. If the deviations are positive we call them high debt firms as compared to their industry average and the firms with negative deviations are called low debt firms as compared to their industry average.

To study the behaviour of these high debt and low debt firms with respect to choice of output and investment strategies, we take the deviations in the same way for all the variables. Now the hypothesis of conservative output strategies with respect to debt in the present context would imply that the high debt firms would have lower sales as compared to the industry average (negative deviation). A similar interpretation would hold true for other variables also.

Along with the univariate analysis, which helps us to see whether high-debt firms and low-debt firms differ with respect to their real variables choice, amongst the multivariate tests, discriminant analysis is chosen to takes into account the inter-relationships between the financial and real variables. The discriminant analysis involves fitting of linear discriminating score function on the basis of observed data on a number of discriminating variables of individuals whose group membership is known.

Discriminant Analysis in this study helps us to identify those variables which, given the inter-relationships amongst the variables, discriminate the most between the high-debt firms and low-debt firms, with respect to total-debts, short-term-debt and long-term debts.

Along with the non parametric analyses, least square regressions have been undertaken to assess the impact of the debt-structure on the output, investments and performance of the firms. Short-term debts, long-term debts and total-debts as a ratio of total capital employed are used as the principal explanatory variables in the models where the dependent variables are sales, gross-investment, technology-upgradation and profitability. Technology upgradation (UPGRADATION) variable is constructed by using the principal component analysis. The factor loadings used as weights for the variables R&D expenditure, import of capital goods and royalty payments are reported in Table 4 along with the percentage of cumulative variances explained by the variables.

In regression analysis, we also control for firm-specific effects like the size of the firm (SIZE), age of the firm (AGE), the capital intensity of the firm (K/L) and the extent of vertical integration (VI) in the firm. The industry specific effects are controlled for by using an industry dummy which takes the value one for high debt industries and zero for low debt industries.

5. RESULTS OF UNIVARIATE ANALYSIS

The results of univariate analysis using Independent Samples t-test for differentiating the means of real variables of high-debt and low-debt firms with respect to their output and investment strategies are presented in Table 2. Column 1, 2 and 3 presents the results for all oligopolistic industries chosen, with 2 to 12 number of firms, and column 4, 5 and 6 presents results for only concentrated industries with 2 to 6 number of firms (satisfying four firms concentration ratio). The firms are separated into high-debt and low-debt firms with respect to their total-debt, short-term debts and long-term debts. The results show that for all oligopolistic industries, high-debt and low-debt firms (with respect to total debt) differ significantly with respect to their gross investments, asset-structure and profitability. High-debt firms have lower gross investments, higher fixed assets and are less profitable as compared to low-debt firms.[5] Output strategies do not differ significantly although the signs of the coefficients are as expected. With respect to their short-term debts the results are similar. However, with respect to their long-term debts the results change for sales, gross-investments and profitability. High-debt firms have higher sales, gross-investments and profitability, though these differences are not significant.

[5] Harris and Raviv (1991) mentioned that the main empirical result is that firm profitability and the debt equity ratio are positively related (page 312). Here we get the opposite result.

This indicates that firms with higher long-term debts behave differently as compared to the firms with higher short-term debts.

The results become more focused with respect to the concentrated industries. The sales ratios now differ significantly in terms of short-term debts. Firms with high short-term debts have lower sales as compared to firms with lower short-term debts. This implies that high-debt (short term) firms are more conservative in nature as compared to the low-debt firms. This supports our hypothesis regarding the output strategies of the firms. Gross investments and profitability are negatively related to the short-term debts of the firms. The technology up gradation variables do not differ significantly between the two types of firms, however the expenditure on R&D is significantly higher for firms that have high short-term debts. With respect to the long-term debts of the firms, we find that the proportion of fixed assets to total asset is significantly higher for the high-debt firms though net profits are lower for high debt firms. The gross profitability, however, does not differ significantly. The technology upgradation variables also do not differ significantly. We, therefore, find little support for our hypothesis regarding the technology upgradation investments and performance of the debt-oriented firms using univariate analysis.

The univariate analysis however gives a partial picture not taking into account the interaction between the variables. The inter-relationship between the variables is taken into account by the discriminant analysis.

6. RESULTS OF DISCRIMINANT ANALYSIS

The Discriminant analysis is undertaken to identify the significant discriminators within the two sets of firms taking into account the inter-relationships of all factors under study, i.e., output strategies, investment strategies and profitability of the firms. The results are presented in Table 3. The analysis is undertaken only for the concentrated industries as it is observed that the differences in the behaviour of high debt and low debt firms are more prominent in the concentrated industries.

With respect to total debt of the firms, we find that taking the inter-relationships of the variables into consideration the variables that differ significantly with respect to high-debt and low-debt firms are their asset-structure, gross investments and profitability. The classification success is 63.7% and the chi-square of Wilk's Lambda is significant. However, with respect to short-term debts it is the sales and the asset-structure that differ significantly between the high-debt and low-debt firms. This is similar to our univariate analysis results, which showed that firms with high short-term debts follow conservative output strategies and have lower sales as compared to the firms with low short-term

debts. With respect to long-term debts only gross profitability is significantly different. However, the classification success using the long-term debts is only 54.8%, therefore the probability of misclassification is high. The discriminant analysis results, on the whole, thus support our hypotheses regarding the output strategies and the asset structure of the firms with respect to the short-term debts and total debts though with respect to the long-term debts the results are not very robust.

7. RESULTS OF REGRESSION ANALYSIS

In order to see the extent to which the structure of debt of the firm affects its output and investment strategies, the ordinary least squares regressions are used. The sales as a ratio of total capital employed, gross-investments as a ratio of total capital employed, index of technology upgradation and profitability as a ratio of total capital employed are used as the dependent ratios and short-term debts, long-term debts and total debts are the principal explanatory variables. Since the correlation between total debts to short-term and long-term debts is very high separate regression are run using total debts in one equation and short-term and long-term debts in the second equation. The analysis is undertaken only for concentrated industries. The results of the analysis for sales, gross investment, technology upgradation and profitability are presented in Table 5, 6, 7 and 8 respectively.

Equations 1 and 2 of Table 5 presents the results of the regression analysis with sales as the dependent variables and total debts, short-term debts and long-term debts as the principal explanatory variables. To assess the impact of debt structure on the output strategies of the firm it is necessary to control for certain firm-specific and industry-specific effects. The age, capital intensity and technology level of the firms and the extent of vertical integration in the firms are some of the firm specific effects that are controlled for. Older firms can get experienced based economies based on learning and can avoid the liabilities of newness. Studies have also shown that firms do not have equal access to credit i.e., small and young firms face greater binding debt constraints than more mature firms with well known prospects. This can also have an effect on the firms post entry performace. (Britto and Mello 1995).This results in “vintage effects”. Older firms can therefore have higher sales as compared to new firms. To control for the differences in the level of technology of the firms the variables used are the ratio of gross block to the total employee cost in the firm, (K/L), expenditures on R&D (R&D) and import of capital goods (TECHIMP). Since what is desired is the impact of debt on the output produced by the firms and the dependent variable is the sales of the firm, it becomes important to control for the extent of vertical integration in the firms. It is possible that a firm may have lower output but greater extent of vertical integration, as a result, it might have larger sales.

The industries differ with respect to their debt-equity ratios. It is possible that the effect of debt structure on sales may differ in high debt and low debt industries; therefore an industry dummy (INDDUMMY) is used which takes the value one for high debt industries and is zero otherwise.

The results show that after controlling for some of the important firm-specific and industry-specific effects long-term debts have a significant positive impact on the sales of the firms while short-term debts have a significant negative impact on the sales of the firms. This supports our hypothesis regarding the output strategy of the firms, i.e., long-term debts make firm follow aggressive output strategies while the short-term debts may have the opposite effect. Total debt does not have a significant impact on the sales though the sign is negative. In the presence of a significant White's test statistics, hetroscedasticity corrected standard errors have been reported.

Table 6 presents the results of the impact of debt structure of the firm on their investment strategy. The dependent variable is gross investment as a ratio of total capital employed. The size of the firm along with the age of the firm and the capital intensity of the firm may have an impact on the gross investments of the firm. An attempt is made to control for these firm specific effects. Industry dummy is used which takes the value one for high debt industries and zero otherwise. The results show that total debts and short-term debts have strong negative impact on the gross investments of the firm, however the impact of long-term debts on gross investment does not come out as significant though it enters with a positive sign. The dummy for the industries show that high debt industries have lower gross investments.

The results of the impact of debt-structure on the technology upgrading strategies are presented in Table 7, equations 1 and 2. The firm-specific effects that are controlled for are the size of the firm and the gross investments undertaken by the firm. An industry dummy is used which takes the value one for high debt industries and is zero otherwise. With respect to the impact of debt structure on the technology up-gradation of the firm we expect that debt as such, whether long-term or short-term is a liability for the firm and to repay the debts along with the interest payments the firms will try to upgrade their technology levels so as to decrease their per unit costs. However, there is evidence suggesting that a negative relationship exists between R&D intensity and long-term liability. (Baysinger and Hoskisson 1989, Smith and Warner 1979). Debt holders are assumed to be more risk averse than equity holders, consequently they force the managers to abandon risky projects and cut back on R&D expenditures. Leverage is therefore associated with decline in the firms' innovativeness. However, in India R&D expenditures are expected to be more adaptive than innovative in nature (Katrak 1989). To capture the firms' innovativeness we have constructed

technology upgrading variable using the principal component analysis. The results show that higher debts irrespective of their structure force the firms to upgrade their technology.

The literature on the impact of debt on the performance of the firm is still inconclusive. There are studies showing a positive impact of debt on the performance of the firm (Greenwald, Stiglitz and Weirs 1984, Myers and Majluf, 1984) and others that argue that the impact is negative. We however feel that debt makes the firms follow different output and investment strategies, which further differs with respect to the structure of the debt. Long term debts make the firm choose higher output and investment levels along with higher technology up gradation expenditures. It therefore should have a positive impact on the performance of the firm. However, the short-term debts, which make the firms conservative with respect to output and investments strategies, might have a negative impact on the performance of the firms. Table 8 presents the results with gross profitability as a ratio of total capital employed as the dependent variable. After controlling for the age, size, gross investments and the technology up gradation expenditures of the firm we find that total debt and short-term debts have a negative impact on the performance of the firm while long-term debts have significant positive impact on the performance of the firms. The empirical results therefore more or less support our hypotheses, based on the theoretical propositions, regarding the impact of debt on the output and investment strategies and the performance of the firms.

8. CONCLUSION

Theoretical literature puts forward two opposing views on how the leverage affects the product market behaviour of the firms. In other words, the issue is whether higher leverage makes the firms more aggressive or more conservative in their product market strategies. The empirical studies, although few in numbers, points to the fact the debt financed firms are at competitive disadvantage. In this context, the paper has tried to take a closer look at some of the related issues. In particular, we have studied the impact of total debts, short-term debts and long-term debts on the output, gross investments and technology-upgrading strategies of the firms in certain oligopolistic industries in India. The empirical analysis bears the evidence of theoretical propositions and the subsequent hypotheses developed in the paper. Thus, the empirical analysis sheds light on the importance of the structure of the debt i.e., the short term and long term nature of debts in influencing the choice of real variables by the firms.

The theoretical model establishes that more is the short term debt of the firm more conservative would be the firm's output choice. This is because the firms would try to guard more against the amount of default in the lower states of demand. On the other hand, with the logic of limited liability, we

propose that the long term debt makes the firms aggressive with respect to output strategy. Based on these theoretical propositions, the paper has developed some hypotheses and tested them empirically. The empirical results are more pronounced for the concentrated oligopoilstic industries.

The univariate analysis results indicate that firms with higher short-term debts have lower sales, lower gross investment ratios and lower profitability. The firms with higher short-term debts are also associated with higher technology-up gradation efforts like R&D expenditure. The multivariate approach suggests that the sales and the asset-structure of the firms with high short-term debt differ significantly from those of the firms with low short-term debts. The regression analysis results strongly supports the negative impact of short term debt on the sales and investment levels of the firms, after controlling for the firm and industry specific effects.

With respect to long-term debts the univariate analysis suggests that the firms with high long-term debts and low long-term debts differ significantly with respect to their gross investments, asset-structure and profitability. Higher long-term debts are associated with higher output and investment levels. However, only profitability comes out to be significantly different between firms with high long-term debts and low long-term debts in the multivariate analysis. The regression results show that long-term debts make the firms behave more aggressively with respect to their choice of output and investment levels. Thus, the paper demonstrates that the short term and long term nature of the debts have different impact on some of the real variable choice by the firms.

Debt, as a whole, has a significant negative impact on the gross profitability of the firms; however, the long-term debt is positively related with the firms' gross profitability. This can be explained by the aggressive output and investment strategies adopted by the firms with higher long-term debts, combined with their technology upgradation efforts. The structure of the debt of the firms is therefore found to have an important bearing on the firms' choice of product market related strategies and thereby influencing the performance of the firms as well.

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TABLE 1:	DESCRIPTIVE STATISTICS ALL OLIGOPOLISTIC INDUSTRIES	CONCENTRATED INDUSTRIES
1. NUMBER OF INDUSTRIES	**32**	**29**
2. NUMBER OF FIRMS	**146**	**114**
3. NUMBER OF HIGH DEBT FIRMS	**67**	**53**
4. NUMBER OF LOW DEBT FIRMS	**79**	**61**
5. AVERAGE OF TOTAL DEBT/TOTAL CAPITALEMPLOYED	**0.61**	**0.66**
6. AVERAGE OF SHORT-TERM DEBT/TOTAL CAPITALEMPLOYED	**0.12**	**0.23**
7. AVERAGE OF LONG-TERM DEBT/TOTAL CAPITALEMPLOYED	**0.49**	**0.43**

TABLE 2: UNIVARIATE ANALYSIS

Independent Samples t-Test for equality of means

VARIABLES	**ALL OLIGOPOLISTIC INDUSTRIES**			**CONCENTRATED INDUSTRIES**		
	1	**2**	**3**	**4**	**5**	**6**
	TOTAL DEBT	SHORT-TERM DEBT	LONG-TERM DEBT	TOTAL DEBT	SHORT-TERM DEBT	LONG-TERM DEBT
1.STO	-0.869	-1.32	1.33	-0.924	-1.662*	1.34
2. GROSSINV	-2.66***	-2.10***	0.33	-2.74***	-2.15***	0.53
3.FX	5.15***	2.03***	5.71***	4.54***	2.25***	4.39***
4.GP	-3.84***	-2.24***	0.35	-3.61***	-2.23***	1.30
5.NP	-2.66***	-1.26	0.45	-2.47***	-1.28	-2.18***
6.ROY	-0.113	-0.122	-0.584	0.352	0.36	-0.14
7.TECHIMP	0.494	0.346	0.488	0.516	0.649	0.44
8.R&D	1.22	0.557	1.52	1.30	1.73**	1.00

*** indicates 1% level of significance ** indicates 5% level of significance
* indicates 10% level of significance

Sales / Total capital employed ≡ STO
Gross investments / Total capital employed ≡ GROSSINV
Fixed Assests / Total Assets ≡ FX
Gross profits≡ (GP)
Net profits ≡ NP
Import of disembodied technology, i.e., payment of royalty and technical fees / total capital employed ≡ ROY
Import of capital goods / total capital employed ≡ TECHIMP
Expenditure on research and development / total capital employed ≡ R&D

TABLE 3: DISCRIMINANT ANALYSIS RESULTS FOR CONCENTRATED INDUSTRIES

VARIABLES	TOTAL DEBT STANDARD DISCRIMINANT FUNCTION COEFFICIENT	SHORT-TERM DEBT STANDARD DISCRIMINANT FUNCTION COEFFICIENT	LONG-TERM DEBT STANDARD DISCRIMINANT FUNCTION COEFFICIENT
1. STO	-	0.406	-
2. FX	0.724	0.989	-
3. GROSSINV	0.671	-	-
4. GP	0.444	-	1.00
WILK'S LAMBDA	0.856	0.884	0.982
CHI-SQUARE	22.18*	17.58*	2.562
EIGEN VALUE	1.168	1.131	0.018
CANNONICAL CORRELATION	0.380	0.340	0.133
CLASSIFICATION SUCCESS	63.7%	60.7%	54.8%

* indicates significant

Sales / Total capital employed ≡ STO
Fixed Assests / Total Assets ≡ FX
Gross investments / Total capital employed ≡ GROSSINV
Gross profits≡ (GP)

TABLE 4: UPGRADATION VARIABLE: FACTOR ANALYIS RESULTS

VARIABLE	FACTOR COEFFICIENT	EIGENVALUE	PERCENTAGE OF VARIANCE	PERCENTAGEOF CUMMULATIVE VARIANCE
1. R&D	0.529	1.28	42.739	42.739
2. ROY	0.462	0.931	31.032	73.770
3. TECHIMP	0.481	0.787	26.230	100.00

Expenditure on research and development / total capital employed ≡ R&D
Import of disembodied technology, i.e., payment of royalty and technical fees / total capital employed ≡ ROY
Import of capital goods / total capital employed ≡ TECHIMP

TABLE 5: OLS REGRESSION RESULTS

DEPENDENT VARIABLE : STO/TOTAL CAPITAL EMPLOYED
(White Hetroscedasticity-Consistent Standard Errors & Covariance)

VARIABLES	1	2
CONSTANT	1.80***	0.81***
	(3.54)	(2.27)
DEBT	-0.14	-
	(-1.43)	
STDEBT	-	-0.62*
		(-1.86)
LTDEBT	-	-2.00***
		(2.41)
AGE	-0.02	0.02
	(-0.20)	(0.27)
R&D	12.24**	4.93
	(1.98)	(0.53)
TECHIMP	10.95***	13.53***
	(2.07)	(2.2)
K/L	1.10	0.53
	(1.22)	(0.66)
VI	0.04	0.02
	(0.25)	(0.36)
INDDUMMY	-0.02	-0.01
	(-0.44)	(-0.34)
NO. OF OBSERVATIONS	114	114
ADJ R^2	0.20	0.15
(for uncorrected OLS)		
White's Statistic	63.64***	108.39***
F statistics(White)	2.81*	30.34*

*** indicates 1% level of significance ** indicates 5% level of significance
*indicates 10% level of significance. figures in the paranthesis are the t-statistics.
The age of the firm is measured as the number of years since inception to the date of observation ≡ AGE
Expenditure on research and development / total capital employed ≡ R&D
Import of capital goods / total capital employed ≡ TECHIMP
The capital intensity in the firm is measured by the ratio of gross block to total employee cost in the firm ≡ K/L
The extent of vertical integration is measured by the ratio of value-added by the firm to the total sales of the firms ≡ VI.

TABLE 6: OLS REGRESSION RESULTS

DEPENDENT VARIABLE : GROSS-INVESTMENT/TOTAL CAPITAL EMPLOYED

VARIABLES	1	2
CONSTANT	1.28***	0.39
	(2.25)	(0.73)
DEBT	-0.92***	-
	(-6.41)	
STDEBT	-	-4.52***
		(-7.47)
LTDEBT	-	0.36
		(0.62)
AGE	-0.02	-0.06
	(-0.59)	(0.20)
SIZE	-0.34***	-0.27***
	(-2.53)	(-2.06)
R&D	-17.43***	-22.14***
	(-2.13)	(-2.90)
K/L	3.50	0.76*
	(4.79)	(1.61)
INDDUMMY	-0.08*	-0.13***
	(-1.55)	(-2.01)
NO. OF OBSERVATIONS	114	114
ADJ R^2	0.74	0.75
White's Statistic	15.19	9.80
F statistics(White)	0.489	0.437

*** indicates 1% level of significance ** indicates 5% level of significance

* indicates 10% level of significance

figures in the paranthesis are the t-statistics.

The age of the firm is measured as the number of years since inception to the date of observation ≡ AGE

The size of the firm is measured by log of sales ≡ SIZE

Expenditure on research and development / total capital employed ≡ R&D

The capital intensity in the firm is measured by the ratio of gross block to total employee cost in the firm ≡ K/L

TABLE7 : OLS REGRESSION RESULTS

DEPENDENT VARIABLE : TECHNOLOGY UPGRADATION /TOTAL CAPITAL EMPLOYED

VARIABLES	1	2
CONSTANT	0.007* (1.85)	0.002 (0.42)
DEBT	0.006* (5.27)	-
STDEBT	-	0.028*** (4.36)
LTDEBT	-	0.01*** (2.08)
SIZE	0.001 (1.01)	0.007 (0.57)
GROSSINV	0.003 (0.53)	0.58 (0.78)
INDDUMMY	-0.02 (-0.53)	-0.01 (-0.18)
NO. OF OBSERVATIONS	114	114
ADJ R^2	0.28	0.27
(for uncorrected OLS)		
White's Statistic	5.28	6.50
F statistics(White)	0.304	0.899

*** indicates 1% level of significance ** indicates 5% level of significance

* indicates 10% level of significance

figures in the paranthesis are the t-statistics.

The size of the firm is measured by log of sales ≡ SIZE

Gross investments / Total capital employed ≡ GROSSINV

TABLE 8: LINEAR REGRESSION RESULTS

DEPENDENT VARIABLE : GROSS PROFITABILITY / TOTAL CAPITAL EMPLOYED
(White Hetroscedasticity-Consistent Standard Errors & Covariance)

VARIABLES	1	2
CONSTANT	1.00 (1.22)	0.09 (1.40)
DEBT	-0.08*** (-4.38)	-
STDEBT	-	-0.10* (-1.70)
LTDEBT	-	0.32** (1.91)
AGE	0.024 (0.98)	0.001 (0.75)
SIZE	0.004 (0.23)	0.009 (1.40)
UPGRADATION	5.93*** (4.81)	6.76*** (3.08)
GROSSINV	0.07*** (7.47)	0.07* (1.67)
INDDUMMY	0.01*** (2.00)	0.01*** (2.46)
NO. OF OBSERVATIONS	114	114
ADJ R^2	0.59	0.57
(for uncorrected OLS)		
White's Statistic	111.01*	111.01*
F statistics(White)	58.319*	40.69*

*** indicates 1% level of significance ** indicates 5% level of significance
* indicates 10% level of significance
figures in the paranthesis are the t-statistics.
The age of the firm is measured as the number of years since inception to the date of observation ≡ AGE
The size of the firm is measured by log of sales ≡ SIZE
Gross investments / Total capital employed ≡ GROSSINV
An index of technology up gradation in a firm is constructed using Principal Component Analysis ≡ UPGRADATION