EVIDENCE ON GROWTH AND FINANCE CONSTRAINT FROM INDIAN MANUFACTURING FIRMS

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Abstract

In this paper we investigate the impact of finance constraints on the growth of Indian manufacturing firms. Since finance constraints are not directly observable, empirical characterisation of this relationship is fraught with difficulties. We overcome this difficulty by using the predicted probabilities from an endogenous regime switching model to indicate the presence of finance constraints. This method, by exploiting information from multiple variables, posits finance constraints as a multi-facet firm characteristic. Employing a battery of estimation techniques (LAD, OLS, 2SLAD and 2SLS) we show a negative and significant impact of finance constraints on the growth of firms. We also show that the growth of firms is persistent over time and it decreases with their size and age.

JEL Classification: D82, G31, L25

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1. Introduction

Traditional research on firm growth uses the Gibrat's law as the benchmark which, assuming lognormal growth distribution of firms, suggests that the growth rates are well described purely in terms of random shocks (Gibrat 1931).[1] In recent literature, however, several aspects of the firm growth process have been highlighted. Firstly, extreme growth events occur relatively frequently than a normal distribution posits making a disproportionately large contribution to the evolution of firms (Cabral and Mata 2003). Secondly, if firms experience economies of growth, persistence is more likely than a stagnation-growth or a decline-growth sequence (Garnsey et al. 2006). Thirdly, growth of firms may be a consequence of their size and age (Evans 1987). Finally, if financial variables have real effects, they may also explain the growth of firms (Levine 2005). In this paper, we attempt to empirically evaluate these aspects with a specific focus on the impact of finance constraints on the growth of firms.

The literature identifies at least three channels through which finance constraints may affect firm growth. Firstly, it can restrict capital expenditure (Fazzari et al. 1988). Secondly, it can hinder technological innovations (Bottazzi et al. 2010). Finally, it may restrict acquisition of information important for risk management, resource mobilization, amelioration of transaction costs, etc. and thus influence growth of firms (Rajan and Zingales 1998). Empirically, since finance constraints are not directly observable, characterisation of the relationship between finance constraints and firm growth is fraught with difficulties. The usual practice is to use a variable such as, dividend payout, size, group affiliation, age, etc., to proxy firm's finance constrains.[2] However, the reliance on single variable to indicate the presence of finance constraints is problematic as finance constraints is a multi-facet phenomenon (Hu and Schentiarelli 1998). Following Gautam and Vaidya (Fourthcoming) we use information from a wide array of variables to indicate the presence of finance constraints faced by firms. They use an endogenous regime switching investment model which besides using an investment function

1 See Sutton (1997) and Coad (2009) for a detailed discussion on firm growth.

[2] See Hubbard (1998) and Calcagnini and Saltari (2010) for a literature survey on financer constraints.

also uses a selection function to distinguish financially constrained firm-observations from the unconstrained ones. The selection function, in the course of estimation, produces an estimate (as probabilities) of finance constraints faced by firms each year which we use for our analysis.

We consider assets growth as the measure of firm growth which allows us to examine the use of the available finance for all elements on the asset side of the balance sheet.[3] For our analysis we use a sample of 2282 private Indian manufacturing in the period 1994 to 2009. The Indian context provides an interesting environment to study the interaction between firm growth and finance constraints in the wake of the financial sector reforms initiated in 1991.[4] Since the reforms the economy has been gradually opened up for freer trade and capital mobility creating a market driven environment. This has enabled firms to have greater flexibility with respect to their choice of capital structure. But, in spite of these reforms, it is suggested that the contribution of manufacturing sector to the economy has increased only moderately in the last two decades on account of low corporate investment and restrictive labour laws (Alfaro and Chari 2009). Moreover, the presence of finance constraints at the firm level is widely established in the Indian context.[5]

There are several studies which have exclusively focused on investigating the growth of firms in the Indian context (See Das 1995, Shanmugam and Bhaduri 2002, Coad and Tamvada 2011, Allen et al. 2012). Several aspects these studies are relevant. Firstly, all the studies implicitly assume a lognormal growth process for firms. If this assumption is not valid, as shown in the recent literature, their results may not be robust. Secondly, across the studies there is no clear cut association of size and age of firms with their growth rates. Finally, none of the studies, except Allen et al. (2012) have analysed the impact of finance on growth. They use firms' access to markets and banks as the measure of financing. But, this measure may not give a complete picture of firms' financing as the authors note that alternative finance (e.g., trade credit) constitutes the most important form of external finance to firms.

[3] It is argued that measuring growth in terms of change in employment reduces measurement problems compared to financial measures, as it is a real variable. But its use, in our case, is not possible because the data on employment is missing for a large proportion of firms.

[4] For a comprehensive review of the reforms, see Sen and Vaidya (1997) and Roland (2008).

[5] See Athey and Laumas (1994), Athey and Reeser (2000), Ganesh-Kumar et al. (2001), Lensink et al. (2003) and Bhaduri (2005, 2008).

Our empirical investigation shows that the underlying firm growth process cannot be approximated by a normal distribution. Therefore, we employ Least Absolute Deviations (LAD) as our preferred estimation technique, which is robust to extreme observations, to investigate the determinants of firm growth. For a comparative assessment we also present our results using Ordinary Least Squares (OLS). We also take care of the bi-directional influence between finance constraints and firm growth which may induce an endogeneity bias by using instruments for finance constraints. Our results show that the growth of firms is persistent over time and it decreases with their size and age. Finally, we show a negative and significant impact of finance constraints on firm growth. We establish the robustness of our results using alternative estimation methods and using a sub-sample of firms which are listed in the Bombay Stock Exchange.

The outline of the remainder of this paper is as follows: section 2 discusses the identification of finance constraints. Section 3 presents the data and the variables. Section 4 outlines the distribution of the growth variable and the descriptive statistics. Section 5 presents the estimates of finance constraints. Section 6 discusses the determinants of firm growth with a focus on the relevance of finance constraints. This is followed by robustness checks in section 7. Finally, section 8 concludes.

2. Identification of finance constraints faced by firms

Three matrices are commonly used to indicate the presence of financially constrained firms-investment-cash flow sensitivity (ICFS), cash-cash flow sensitivity (CCFS) and investment-asset sale sensitivity (IASS).[6] The rational for the use of ICFS (CCFS/IASS) is as follows: if a firm is financially constrained, its ability to invest (save cash/invest) is limited by its ability to generate internal liquidity, represented by cash flows (cash flows/proceeds from asset sales). Therefore, ICFS (CCFS/IASS) should be higher for constrained firms. In contrast, financially unconstrained firms should not display a systematic propensity to invest (save cash/invest) out of cash flows (cash flows/proceeds from asset sales) as the cost of external funds, relative to their opportunity

[6] The use of ICFS, CCFS and IASS to indicate the presence of financially constrained firms were first suggested by Fazzari et al. (1988), Almeida et al. (2004) and Hovakimian and Titman (2006), respectively.

cost, is negligible for them. Empirically, the usual practice is to sort the sample of firms into groups based on their likelihood of being financially constrained using variables such as dividend payout, size, age, etc. The group having significantly higher ICFS (CCFS/IASS) in the investment regression is interpreted as financially constrained in comparison to the other group.

Although there is no consensus on the relative superiority of any of these measures (ICFS, IASS and CCFS) over the other, there are certain issues which are well accepted and which must be taken into account while examining finance constraints. Firstly, to test for the presence of finance constraints, the growth opportunities of firms, represented by Tobin's *q* and/or the accelerator, must be controlled for (Hubbard 1998).[7] Secondly, finance constraints are a multi-facet firm characteristic (Hu and Schentiarelli 1998). Thirdly, the variable which is taken as the proxy for internal liquidity must not contain information on the growth opportunities of firms unless they are financially constrained (Hovakimian and Titman 2006). Fourthly, *a priori* sorting of firms into constrained and unconstrained groups, based on some variable imposes an implicit assumption of monotonicity of the finance constraint with the sorting variable which may be restrictive (Hovakimian and Titman 2006). Fifthly, firms must be allowed to change regime from constrained to unconstrained and vice-versa in the sample period as conditions leading to finance constraints may change over time (Hu and Schentiarelli 1998). Finally, distressed firm-observations must be excluded from the analysis of finance constraints. This is because a marginal rupee (Indian currency) is more likely to be paid back to the creditors than invested, if a firm is in financial distress (Fazzari et al. 2000). Ignoring any of these issues may yield biased estimates.

To identify financially constrained firm-observations we rely on the IASS metric. Its use is appropriate as proceeds from asset sales is a cleaner proxy than cash flows for measuring internal liquidity of firms because they are unlikely to be related to the firms' growth opportunities unless they are financially constrained (Hovakimian and Titman 2006). In the Indian context, Gautam and Vaidya (Fourthcoming) employ an endogenous regime switching

[7] Tobin's *q* is forward looking measure of firms' growth opportunities, but its use restricts the sample to only those firms which are listed in the stock exchanges. The accelerator, unlike Tobin's *q*, is backward looking, but it is less susceptible to omission of firms which are not listed.

model to estimate IASS to identify financially constrained firm-observations.[8] The endogenous regime switching model besides estimating an investment function also estimates a selection function which produces the likelihood of firms to be financially constrained in any year. It has the following advantages: firstly, using a set of variables it produces the probabilities of finance constraints associated with each firm-observation. Secondly, does not require IASS to increase monotonically with the variables used in the selection function. Finally, it allows firms to change regimes endogenously in the sample period.

Gautam and Vaidya (Fourthcoming) show that firms with lower operating income, maturity, dividend payout, tangibility, growth opportunities, short term debt and export sensitivity are more likely to be financially constrained.[9] Also, firms with higher long term debt and firms in industries with negative operating income shock are more likely to be financially constrained. From their estimates of the selection equation, we use the probabilities of firm-observations to be in the financially constrained regime as the measure of finance constraints (constraint probabilities, henceforth).

Following the discussion of the identification of finance constraints faced by firms, we outline a description of the data and variables used for analysing the growth of firms in the next section.

3. Data and variables

We use data from the PROWESS, corporate data directory of the Center for Monitoring of Indian Economy (CMIE), Mumbai. It contains detailed information on over 20,000 Indian firms covering around 1,500 data items and ratios per company. We also use Reserve Bank of India (RBI) monthly bulletins to get data on price deflators for constructing replacement value of capital stock (capital, henceforth). Our study refers to the period from 1994 to 2009.

We choose firms based on the following criteria: firstly, we consider only private firms. Public sector enterprises and foreign firms are excluded as investments by such firms are

[8] For an outline of the endogenous regime switching model, see Hovakimian and Titman (2006), Gautam and Vaidya (Fourthcoming).

[9] Variables are defined in the Appendix

controlled by the Ministry of Industry and a foreign parent company, respectively. Secondly, to ensure that the firms are mainly into manufacturing business, we require sales of manufactured goods to contribute at least 75 per cent of the total sales for at least two-third of the sample period. Thirdly, we drop firms undergoing major restructuring. We identify such firms as those that report unreasonable jump in manufactured sales and the ratio of asset sales to net fixed assets in excess of 75%.[10] Fourthly, we exclude financially distressed firm-observations from the sample. A firm is defined as distressed in a year if its profit before depreciation, interest, taxes and amortisation (PBDITA) is less than 80 percent of interest accrued in that year or PBDITA is less than interest accrued in the year and the year before. Fifthly, we consider only those firms that have sold assets at least once in the sample period as we intend to examine the relationship between asset sales and investment expenditure. Sixthly, we require firms to have at least four years of continuous data. Finally, for variables which portray extreme values, we winsorise one percent observations at both the extremes. Meeting these conditions, we get an unbalanced panel of 2282 firms with 20958 observations.

Among the drivers of firm growth, growth opportunities represented by the accelerator and Tobin's *q*, are of prime importance as they potentially capture most of the information on firm performance. Firms with high growth opportunities are well recognised by the market, it is less likely that they would face problems in raising funds. However, their inability to signal scope for profitable investments may cause a bottleneck in raising funds (Hovakimian and Titman 2006). Firm size and maturity are observed to have a negative effect on growth of firms in a large number of studies (e.g., Evans 1987, Geroski and Gugler 2004). However, some studies find that growth of firms increases with maturity (Barron et al. 1994, Das 1995).

Table 1 presents the descriptive statistics of the variables. The mean (median) asset growth is 12.40 (9.00) percent, indicating that, on average, growth in Indian firms is much higher than firms in the advanced countries.[11] The estimated probabilities of firms being financially

[10] We allow up to a ten-fold jump if the manufactured sales is up to Rs. 10 million; five-fold if the manufactured sales is between Rs. 10 million to Rs. 50 million; four-fold if the manufactured sales is between Rs. 50 million to Rs. 100 million; three-fold if the manufactured sales is between Rs. 100 million to Rs. 250 million; and two-fold if the manufactured sales is above Rs. 250 million. We tried various other cutoffs but these cutoffs are chosen in such a way as to include maximum possible number of observations in the sample on one hand and putting a restriction on the restructuring of firms on the other.

[11] see Arellano et al. (2012) for a comparison.

constrained in any year have the mean (median) value of 0.39 (0.37). Overall, the Table suggests significant heterogeneity in the sample.

[Insert Table 1]

4. Growth distribution and the choice of estimation method

4.1. Growth distribution

We use kernel density plots to examine the distribution of asset growth. To begin with, we produce four sets of estimates for the years 1994, 2002, 2009 and for the complete sample (Figure 1).[12] The plots show a more gradual decay on the upper tail compared to the lower tail. The skewness and kurtosis measures are in excess of 0.7780 and 3.6623, respectively, for all the plots across the years.[13] These patterns suggest that normal distribution is not a good description of firm growth process. The plotted growth process, however, implicitly assumes that the basic conditions facing firms are invariant over time. An alternative possibility is that some firms may exit from the sample over time and this could be leading to the shape in Figure 1. To account for this, we also examined the growth distribution of only those firms which remain in the sample throughout the sample period (Figure 2). A similar pattern emerges.

[Insert Figure 1 and 2]

4.2 Estimation method

Since the firm growth process does not follow a normal distribution, LAD is our preferred estimation method of estimation. LAD is the generalization of the sample median to the linear regression context. Thus, it is robust to extreme observations. For a comparative assessment of our results we also carry out the OLS estimation.[14] In examining the influence of finance constraints on the growth of firms it can be argued that though availability of finance is a

[12] We checked the plots of all the years. They show almost similar pattern.

[13] For a standard normal distribution the skewness and kurtosis measures should be zero and 3, respectively. We also conducted the test suggested by D'Agostino et al. (1990) after incorporating the correction for sample size by Royston (1991), DBD henceforth, which rejects normality at all level of significance.

[14] OLS would not be efficient, though it would be consistent.

necessary pre-condition for firm growth but, availability of finance is also contingent on the growth of firms. This bi-directional influence between finance constraints and firm growth may induce an endogeneity bias as finance constraints may be correlated with the error term in the firm growth equation. We take care of this possibility by using a two-stage instrumental variable regression method. In the first stage constraint probabilities are estimated using the instruments and the exogenous variables in the growth equation. In the second stage we use the predicted constraint probabilities from the previous step to estimate the firm growth equation.

Amemiya (1982) shows that in the two-stage LAD instrumental variable regression (2SLAD) even though the LAD estimation is used in the second stage, OLS may be used in the first stage if the underlying process is normal. We checked the distribution of the constraint probabilities in the similar way as done for firm growth in the previous section and we found normality as a suitable representation of the variable's distribution. We, therefore, as suggested by Amemiya (1982), use OLS for the first stage regression in 2SLAD. We also perform the two-stage least squares regression (2SLS) which, besides a comparative assessment, provides a platform to check the validity of the instruments.[15] We rely on three tests- Hansen test, Kleibergen-Paap Wald test and Kleibergen-Paap LM test. The null hypothesis for the Hansen test is that the instruments are uncorrelated with the error term and they are correctly excluded from the estimated equation. The null hypothesis for Kleibergen-Paap Wald test is that the instruments are only weakly correlated with the endogenous regressor. The null hypothesis for the Kleibergen-Paap LM test is that the equation is under-identified.

Finally, all the regressions are bootstrapped with 100 replications. This procedure is especially important for the specifications which include constraint probabilities as one of the variables as these probabilities are point estimates from another regression.

In the next section we discuss the determinants of firm growth.

[15] For applied researchers, these tests are available only for the 2SLS.

5. Determinants of firm growth

In discussing the determinants of firm growth we use three alternative set-ups. Firstly, we sequentially introduce all the potential variables which can determine firm growth without introducing finance constraints. Secondly, we introduce finance constraints into the analysis. Finally, we examine the determinants of firm growth after correcting for the endogeneity bias.

5.1. Basic specifications

We use four basic specifications to investigate the growth of firms. Firstly, we regress firm growth on its own lag to control for persistence in the dependent variable. Secondly, we introduce the accelerator to the list of regressors. Thirdly, we add size and age to the set of regressors. Finally, financial variables are added to the list of regressors. The first lags of regressors are also used as controls.[16] The specifications are outlined below:

$$g_{i,t} = f_i + \tau_t + \alpha_1(g_{i,t-1}) + \xi_{i,t} \quad (1)$$

$$g_{i,t} = f_i + \tau_t + \alpha_1(g_{i,t-1}) + \alpha_2(accelerator_{i,t}) + \xi_{i,t} \quad (2)$$

$$g_{i,t} = f_i + \tau_t + \alpha_1\left(g_{i,t-1}\right) + \alpha_2\left(accelerator_{i,t}\right) + \alpha_3\left(log\,assets_{i,t}\right) + \alpha_4\left(log\,age_{i,t}\right) + \xi_{i,t} \quad (3)$$

$$g_{i,t} = f_i + \tau_t + \alpha_1\left(g_{i,t-1}\right) + \alpha_2\left(accelerator_{i,t}\right) + \alpha_3\left(log\,assets_{i,t}\right) + \alpha_4(log\,age_{i,t}) + \beta\left(financial\,variables_{i,t}\right) + \xi_{i,t} \quad (4)$$

here $g_{i,t}$ is firm growth, α_i's and β are parameters with the regressors; ; f_i and τ_t are unobserved firm and year effects and $\xi_{i,t}$ is error term.

Table 2 and 3 report the estimates of the LAD and the OLS regression for the equation (1)-(4), respectively. Estimates of variables across both the methods, except the lagged accelerator, are consistent in sign and significance. The Lagged asset growth is positive and significant implying persistence in growth of firms. Negative and significant coefficient of log

[16] Size and age show strong correlation with their lagged values. We, therefore, dropped the current size and current age from the regression.

assets and log age suggest that smaller and younger firms grow faster. The coefficient associated with accelerator is positive and significant for only specification (3) in Table 2 and for all specifications in Table 3. It suggests that growth opportunities influence firm growth positively. The estimates also suggest that some of the financial variables (current slack in both the tables whereas current interest coverage in only Table 1 and current asset sales only in Table 2) influence the growth of firms.

[Insert Table 2 and 3]

5.2. Impact of finance constraints on firm growth

To analyse the impact of finance constraints on the growth of firms, we use two specifications- firstly, we regress assets growth on its own lag, growth opportunities and constraint probabilities $(constraints_{i,t})$. In an alternative specification, we also include size and age to the list of regressors. The specifications are outlined below:

$$g_{i,t} = f_i + \tau_t + \alpha_1(g_{i,t-1}) + \alpha_2(accelerator_{i,t}) + \beta(constraints_{i,t}) + \xi_{i,t} \quad (5)$$

$$g_{i,t} = f_i + \tau_t + \alpha_1(g_{i,t-1}) + \alpha_2(accelerator_{i,t}) + \alpha_3(log\, assets_{i,t}) + \alpha_4(log\, age_{i,t}) + \beta(constraints_{i,t}) + \xi_{i,t} \quad (6)$$

Estimation is done in the similar way as done above.

Table 4 reports the estimates of specifications (5) and (6) using LAD and OLS methods. Our main variable of interest, constraint probabilities, has a negative and significant coefficient in both the estimation methods. Given the magnitude of the coefficient, it can be inferred that finance constraints severely hinder firm growth. Interestingly, the coefficients of constraint probabilities for the specification 6 are significantly greater than the coefficients in specification 5.[17] The coefficients associated with lagged asset growth, log assets and log age remain consistent with the estimates in Table 2 and 3.

[Insert Table 4]

[17] We tested for equality of coefficients associated with constraint probabilities in both the tables. The tests reject equality of coefficients at 0.1% significance level.

5.3. Impact of finance constraints on firm growth after correcting for endogeneity bias

To correct for the endogenous bias, as discussed above, we use 2SLAD and 2SLS estimation methods for the specifications (5) and (6). We use two variables as the instruments for constraint probabilities- lagged constraint probabilities and relative industry sales growth. Lagged constraint probabilities, by construction, are not likely to be related to the shocks to firm growth in the current period. Relative industry sales growth is the difference between the average sales of the industry to which the firm under investigation belongs to and the average sales of all the remaining industries after excluding the firm under investigation. Since the firm under investigation is excluded, relative industry sales growth is unlikely to be related to the shocks to the individual firm's growth in the same period.[18] Its use as an instrument for firm's finance constraints can be justified as a large number of empirical findings suggest that firms in industries which are doing well, compared to other industries, are likely to have better performance (For example, Gupta 1969, Kruse 2002, Delmar et al. 2003). Thus, they are less likely to face problems in accessing external sources of funds.

Table 5 reports the estimates of the 2SLAD and 2SLS methods. Our main variable of interest, constraint probabilities, has a negative and significant coefficient in both the estimation methods. The coefficients associated with lagged asset growth, log assets and log age remain consistent with the estimates in Table 2 and 3. The accelerator appears with a negative sign only for the specification (6). All tests for the validity of this exercise (Sargan test, Kleibergen-Paap Wald test and Kleibergen-Paap LM test), as discussed before, go through.

[Insert Table 5]

In the following section, we discuss the robustness of our estimates.

6. Robustness Checks

To check the robustness of our estimates, we conduct three independent exercises. Firstly, Chernozhukov and Hansen (2006) suggest that the estimates from the 2SLAD method

[18] For firms *i* and *j* in industry *I* and other industries *K*, we assume that the sales growth of firm *j* relative to firms in industry *K* does not affect the assets growth of firm *i* where $i \neq j$.

may not give a true picture if the estimates at different percentiles vary significantly. Therefore, we estimate 10th, 25th, 75th and 90th percentile for the specifications S5 and S6. Secondly, to check the stability of growth-finance constraint sensitivities we depict their evolution of by using firm-observations from the year 1994 to 2000 as the base and then adding one year in subsequent steps. Finally, the literature commonly uses Tobin's *q* as the proxy for growth opportunities. To impart comparability to our estimates with such studies, we consider a sub-sample of firms which are listed in the Bombay Stock Exchange (BSE).

6.1. 10th, 25th, 75th and 90th percentile estimates

The estimates for the 10th, 25th, 75th and the 90th percentile for the growth equation specifications (5) and (6) are presented in Tables 6 and 7, respectively. The significant coefficients in both the tables, except for the accelerator, are consistent with previous estimates. The accelerator is significant with positive sign only for the 90th percentile for specification (5) whereas it assumes negative sign for the 75th and the 90th percentile for specification (5). Our main result that finance constraints affect growth of firms negatively remains robust. Two important points are especially important to note. Firstly, the impact of constraints is greater in the upper percentiles. It implies that finance constraints are more binding for the high growth firms than for the low growth firms. Secondly, the influence of size and age on the growth of firms is more regressive for the upper percentiles. It implies that there is a secular trend in the negative impact of size and age on the growth of firms.

[Insert Table 6 and 7]

7.2. Evolution of the growth-finance constraint sensitivities

In Figure 3 and 4, we depict the evolution of growth-finance constraint sensitivities by using firm-observations from the year 1994 to 2000 as the base and then adding one year in subsequent steps for the Specifications in (5.5) and (5.6), respectively. Our main results that finance constraints negatively influence the growth of firms remains stable. Moreover, it is also evident that the impact of finance constraints on firm growth, in general, is increasing over time.

[Insert Figure 3 and 4]

7.3. Estimates for listed firms

For the results presented so far we have used the accelerator to represent the growth opportunities of firms as we have many unlisted firms in the sample. For a sub-sample of firms that are listed, we present the LAD and OLS estimates for the specifications in (5) and (6) in Table 8 by introducing Tobin's *q* to the basic specification. We also present the estimates using 2SLAD and 2SLS for these specifications in Table 9. The results clearly indicate a consistency in sign and significance of the estimates of constraint probabilities. The coefficients associated with lagged asset growth and size remain consistent with the previous tables. The maturity variable, which was significant earlier, however, turns insignificant. The additional variable, Tobin's *q*, assumes significance with a positive sign in the lagged period and; with a negative sign in the current period in both the tables.

[Insert Table 8 and 9]

Our overall results suggest that finance constraints significantly hurt firm growth. Additionally, we show that growth of firms show persistence and smaller firms grow faster. The impact of maturity is negative on firm growth when we consider both listed and unlisted firms in the sample. But the maturity variables turns insignificant if we consider only listed firms. We also show that finance constraints are more binding for the high growth firms.

6. Conclusion

In this chapter, using a sample of 2282 Indian manufacturing firms over the period 1994-2009, we show that finance constraints are an important factor influencing firm growth. We also show that the growth of firms is persistent and smaller firms grow faster. The impact of maturity is negative on firm growth when we consider both listed and unlisted firms in the sample. But this effect turns insignificant if we consider only listed firms. Two aspects of the influence of finance constraints on the growth of firms, which emerged in the course of our analysis, are of particular interest. Firstly, finance constraints are more binding for the high growth firms than for the low growth firms. Secondly, the influence of finance constraints on firm growth seems to be increasing over time.

Our discussion largely supports Penrose (1955) and the subsequent literature in arguing for finance constraints as an important factor limiting the growth of firms. Moreover, our results also reaffirm the implications drawn by Alfaro and Chari (2009) and Allen et al. (2012) that financial liberalization to facilitate the growth of firms in India is yet to deliver the expected results.

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Tables and Figures

Table 1: Descriptive statistics

Variable	Mean	Median	Std. Dev.
Assets growth	0.124	0.090	0.187
Log assets	3.860	3.716	1.474
Log age	3.370	3.295	0.505
Accelerator/K	0.570	0.252	1.370
Short term debt/K	0.524	0.353	0.598
Long term debt/K	0.511	0.394	0.530
Cash flow/K	0.210	0.135	0.275
Slack/K	5.718	5.677	0.147
Interest coverage	0.043	0.000	0.126
Export Sensitivity	0.128	0.012	0.221
Constraint probability	0.391	0.374	0.092

Notes: Number of observations for all variables is 20958 from 2282 firms.

Table 2: LAD estimates of equation 1-4

Dependent variable: assets growth	Equation 1	Equation 2	Equation 3	Equation 4
L. assets growth	0.1895***	0.2326***	0.2126***	0.2468***
	(26.88)	(21.51)	(17.90)	(21.64)
L. accelerator/K		-0.0000	-0.0000	0.0000
		(0.28)	(0.24)	(0.66)
Accelerator/K		0.0003	0.0003**	0.0002
		(1.73)	(2.84)	(1.87)
L. Log assets			-0.0070***	-0.0056***
			(7.60)	(11.14)
L. Log age			-0.0196***	-0.0142***
			(12.65)	(8.09)
L. cash flows/K				0.0000
				(0.59)
Cash flows/K				0.0018
				(1.92)
L. asset sales/K				-0.0002
				(0.70)
Asset sales/K				0.0088
				(1.62)
L. slack/K				0.0000
				(0.11)
Slack/K				0.0026***
				(3.35)
L. interest coverage/K				-0.0000
				(0.00)
Interest coverage/K				0.0113*
				(2.46)
Observations	20360	17229	17229	17229
R-squared	0.0784	0.0833	0.0872	0.0577

Notes: The standard errors for the regressions are bootstrapped with 100 replications after controlling for firm-specific and time-specific effects. Absolute t-statistics are in parentheses. *, ** and *** represent level of significance at 5%, 1% and 0.1%, respectively.

Table 3: OLS estimates of equation 1-4

Dependent variable: assets growth	Equation 1	Equation 2	Equation 3	Equation 4
L. assets growth	0.1377***	0.1851***	0.1688***	0.1682***
	(9.80)	(21.04)	(22.83)	(18.78)
L. accelerator/K		-0.0000	-0.0000	0.0000
		(0.19)	(0.27)	(0.99)
Accelerator/K		0.0003*	0.0003**	0.0002*
		(2.23)	(3.01)	(2.10)
L. Log assets			-0.0074***	-0.0074***
			(9.40)	(10.58)
L. Log age			-0.0290***	-0.0294***
			(13.17)	(13.30)
L. cash flows/K				0.0000
				(0.67)
Cash flows/K				0.0007
				(0.87)
L. asset sales/K				-0.0002
				(0.94)
Asset sales/K				0.0119*
				(2.28)
L. slack/K				0.0000
				(0.23)
Slack/K				0.0035***
				(4.85)
L. interest coverage/K				-0.0000
				(0.08)
Interest coverage/K				0.0037
				(0.69)
Observations	20360	17229	17229	17229
R-squared	0.124	0.137	0.146	0.149

Notes: The standard errors for the regressions are bootstrapped with 100 replications after controlling for firm-specific and time-specific effects. Absolute t-statistics are in parentheses. *, ** and *** represent level of significance at 5%, 1% and 0.1%, respectively.

Table 4: Estimates of equation 5 and 6

Dependent variable:	Equation 5		Equation 6	
Assets growth	LAD	OLS	LAD	OLS
L. assets growth	0.2036***	0.1693***	0.1932***	0.1609***
	(22.64)	(19.59)	(19.48)	(19.36)
L. accelerator/K	-0.0000	-0.0000	-0.0000	-0.0000
	(0.20)	(0.25)	(0.30)	(0.19)
Accelerator/K	0.0001	0.0001	0.0000	-0.0001
	(1.07)	(0.66)	(0.06)	(0.95)
L. Log assets			-0.0114***	-0.0113***
			(9.75)	(8.96)
L. Log age			-0.0298***	-0.0380***
			(8.82)	(15.93)
Constraint probability	-0.3385***	-0.3644***	-0.5933***	-0.6262***
	(19.13)	(18.49)	(26.38)	(18.13)
Observations	17137	17137	17137	17137
R-squared	0.0949	0.1550	0.1039	0.1720

Notes: The standard errors for the regressions are bootstrapped with 100 replications after controlling for firm-specific and time-specific effects. Absolute t-statistics are in parentheses. *, ** and *** represent level of significance at 5%, 1% and 0.1%, respectively.

Table 5: IV estimates of equation 5 and 6

Dependent variable:	Equation 5		Equation 6	
Assets growth	2SLAD	2SLS	2SLAD	2SLS
L. assets growth	0.2733***	0.2566***	0.2532***	0.2371***
	(32.19)	(29.85)	(29.64)	(24.91)
L. accelerator/K	-0.0000	-0.0000	-0.0000	-0.0000
	(0.24)	(0.21)	(0.24)	(0.14)
Accelerator/K	0.0001	0.0001	-0.0003**	-0.0003*
	(0.63)	(0.82)	(2.72)	(2.31)
L. Log assets			-0.0213***	-0.0212***
			(10.01)	(8.70)
L. Log age			-0.0319***	-0.0388***
			(12.30)	(11.77)
Constraint probability	-0.3221***	-0.3325***	-0.9104***	-0.9267***
	(16.29)	(14.94)	(14.64)	(11.81)
Sargan statistic		0.5130		0.0080
Prob. >Chi2		0.4734		0.9278
Kleibergen-Paap Wald statistic		9694.7460		1961.4280
Critical value at 5%		19.93		19.93
Kleibergen-Paap LM statistic		8945.9710		3176.1320
Prob. >Chi2		0.0000		0.0000
Observations	16,593	16,593	16,592	16,592
R-squared	0.0973	0.1018	0.1700	0.1760

Notes: The standard errors for the regressions are bootstrapped with 100 replications after controlling for firm-specific and time-specific effects. Absolute t-statistics are in parentheses. *, ** and *** represent level of significance at 5%, 1% and 0.1%, respectively. The null hypothesis for the Hansen test is that the instruments are valid. The null hypothesis for Kleibergen-Paap Wald test is that the instruments are only weakly correlated with the endogenous regressor. The null hypothesis for the Kleibergen-Paap LM test is that the equation is under-identified.

Table 6: 10^{th}, 25^{th}, 75^{th} and 90^{th} percentile IV estimates of equation 5

Dependent variable: Assets growth	10^{th} percentile	25^{th} percentile	75^{th} percentile	90^{th} percentile
L. assets growth	0.1249***	0.2000***	0.3507***	0.3836***
	(11.21)	(19.56)	(24.07)	(21.90)
L. accelerator/K	-0.0000	-0.0000	-0.0000	0.0000
	(-0.09)	(-0.30)	(-0.22)	(0.29)
Accelerator/K	0.0000	0.0001	0.0001	0.0005*
	(0.23)	(0.53)	(0.92)	(2.12)
Constraint probability	-0.2914***	-0.2369***	-0.3464***	-0.3930***
	(9.86)	(9.10)	(9.27)	(5.82)
R2	0.0418	0.0665	0.1174	0.1183
Observations	16,593	16,593	16,593	16,593

Notes: The standard errors for the regressions are bootstrapped with 100 replications after controlling for firm-specific and time-specific effects. Absolute t-statistics are in parentheses. *, ** and *** represent level of significance at 5%, 1% and 0.1%, respectively.

Table 7: 10^{th}, 25^{th}, 75^{th} and 90^{th} percentile IV estimates of equation 6

Dependent variable: Assets growth	10^{th} percentile	25^{th} percentile	75^{th} percentile	90^{th} percentile
L. assets growth	0.1225***	0.1937***	0.3199***	0.3418***
	(10.59)	(28.96)	(30.53)	(18.45)
L. accelerator/K	-0.0000	-0.0000	-0.0000	-0.0000
	(0.06)	(0.27)	(0.31)	(0.20)
Accelerator/K	0.0000	-0.0002	-0.0006***	-0.0007*
	(0.10)	(1.43)	(3.76)	(2.46)
L. Log assets	-0.0008	-0.0098***	-0.0372***	-0.0515***
	(0.24)	(4.36)	(12.66)	(11.63)
L. Log age	-0.0078*	-0.0189***	-0.0584***	-0.0800***
	(2.23)	(7.67)	(15.20)	(10.21)
Constraint probability	-0.3316***	-0.5269***	-1.4034***	-1.7271***
	(3.75)	(8.04)	(13.80)	(11.64)
R^2	0.0427	0.0680	0.1298	0.1358
Observations	16,593	16,593	16,593	16,593

Notes: The standard errors for the regressions are bootstrapped with 100 replications after controlling for firm-specific and time-specific effects. Absolute t-statistics are in parentheses. *, ** and *** represent level of significance at 5%, 1% and 0.1%, respectively.

Table 8: Estimates of equation 5 and 6 (listed firms)

Dependent variable:	Equation 5		Equation 6	
Assets growth	LAD	OLS	SLAD	OLS
L. assets growth	0.2801***	0.2608***	0.2751***	0.2558***
	(7.05)	(10.56)	(9.62)	(10.60)
L. accelerator/K	0.0000	0.0000	0.0000	0.0000
	(0.20)	(0.19)	(0.32)	(0.29)
Accelerator/K	0.0008	0.0004	0.0003	0.0001
	(1.59)	(0.78)	(0.57)	(0.11)
L. Tobin's *q*	0.0961***	0.0809***	0.0934***	0.0775***
	(6.02)	(10.09)	(20.61)	(8.12)
Tobin's *q*	-0.0391**	-0.0295*	-0.0378***	-0.0319*
	(2.69)	(2.32)	(4.18)	(2.35)
L. Log assets			-0.0130**	-0.0162***
			(2.98)	(4.40)
L. Log age			-0.0080	-0.0162
			(0.66)	(1.82)
Constraint probability	-0.2836***	-0.3109***	-0.5568***	-0.7000***
	(4.17)	(5.07)	(5.25)	(6.38)
Observations	1561	1561	1561	1561
R-squared	0.1573	0.249	0.1623	0.259

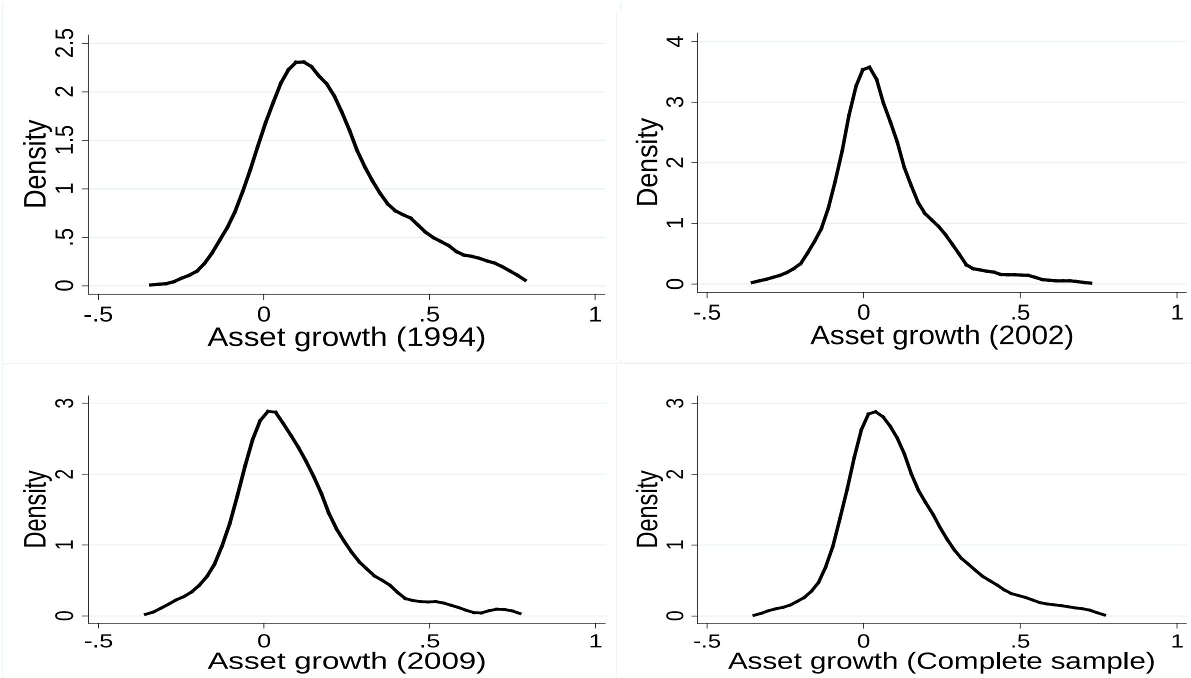
Notes: The standard errors for the regressions are bootstrapped with 100 replications after controlling for firm-specific and time-specific effects. Absolute t-statistics are in parentheses. *, ** and *** represent level of significance at 5%, 1% and 0.1%, respectively.

Table 9: IV Estimates of equation 5 and 6 (listed firms)

Dependent variable:	Equation 5		Equation 6	
Assets growth	2SLAD	2SLS	2SLAD	2SLS
L. assets growth	0.2795***	0.2642***	0.2919***	0.2474***
	(9.00)	(8.30)	(9.57)	(7.07)
L. accelerator/K	0.0000	0.0000	0.0000	0.0000
	(0.27)	(0.42)	(0.21)	(0.23)
Accelerator/K	0.0005	0.0005	0.0000	-0.0003
	(0.96)	(0.87)	(0.09)	(-0.45)
L. Tobin's *q*	0.0930***	0.0809***	0.0927***	0.0754***
	(8.42)	(7.96)	(9.85)	(6.94)
Tobin's *q*	-0.0373**	-0.0299*	-0.0327*	-0.0325*
	(2.71)	(2.42)	(2.37)	(2.34)
L. Log assets			-0.0214*	-0.0263*
			(2.37)	(2.53)
L. Log age			-0.0061	-0.0262
			(0.60)	(1.89)
Constraint probability	-0.2398**	-0.2458**	-0.7818**	-1.0743**
	(3.08)	(3.07)	(2.78)	(2.64)
Sargan statistic		0.256		0.146
Prob. >Chi2		0.6129		0.7020
Kleibergen-Paap Wald statistic		957.469		83.767
Critical value at 5%		19.93		19.93
Kleibergen-Paap LM statistic		862.401		152.435
Prob. >Chi2		0.0000		0.0000
Observations	1560	1560	1560	1560
R-squared	0.1533	0.249	0.1551	0.254

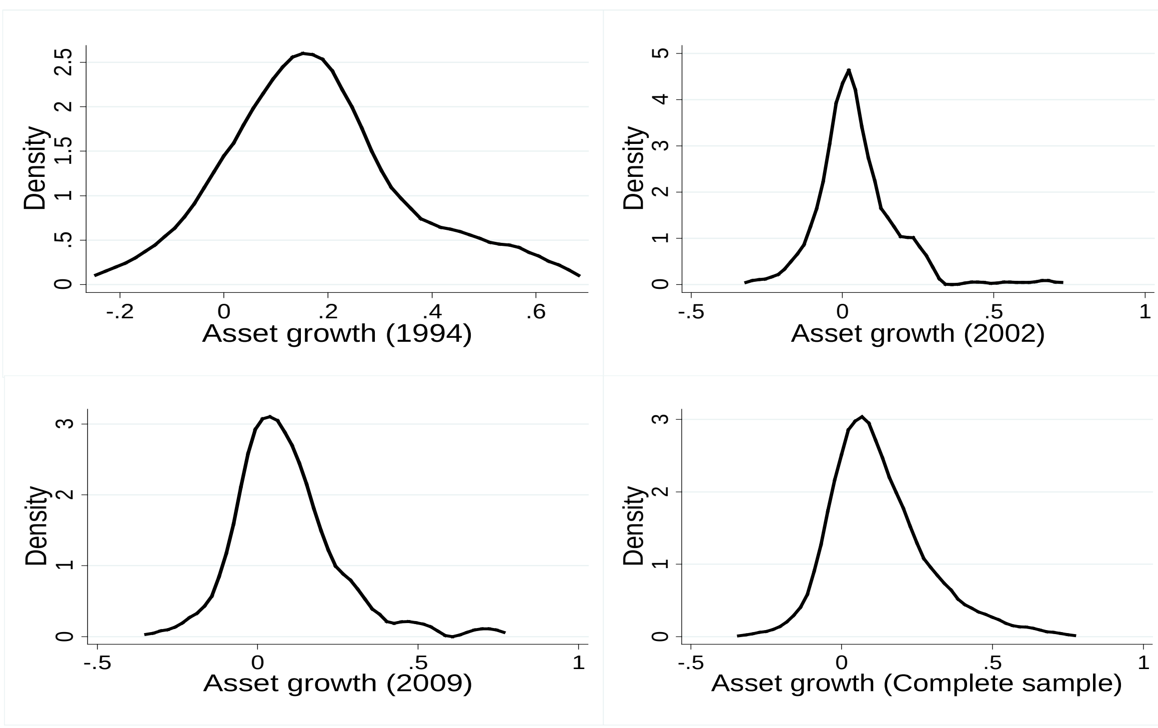
Notes: The standard errors for the regressions are bootstrapped with 100 replications after controlling for firm-specific and time-specific effects. Absolute t-statistics are in parentheses. *, ** and *** represent level of significance at 5%, 1% and 0.1%, respectively. The null hypothesis for the Hansen test is that the instruments are valid. The null hypothesis for Kleibergen-Paap Wald test is that the instruments are only weakly correlated with the endogenous regressor. The null hypothesis for the Kleibergen-Paap LM test is that the equation is under-identified.

Figure 1: Kernel density plots of assets growth (Complete Sample)



Notes: Epanechnikov Kernel density functions are used for the plots. The bandwidth is chosen to minimize the mean integrated squared error.

Figure 2: Kernel density plot of assets growth (Balanced sample)



Notes: Epanechnikov Kernel density functions are used for the plots. The bandwidth is chosen to minimize the mean integrated squared error.

Figure 3: Growth-finance constraints sensitivities for Specification 5

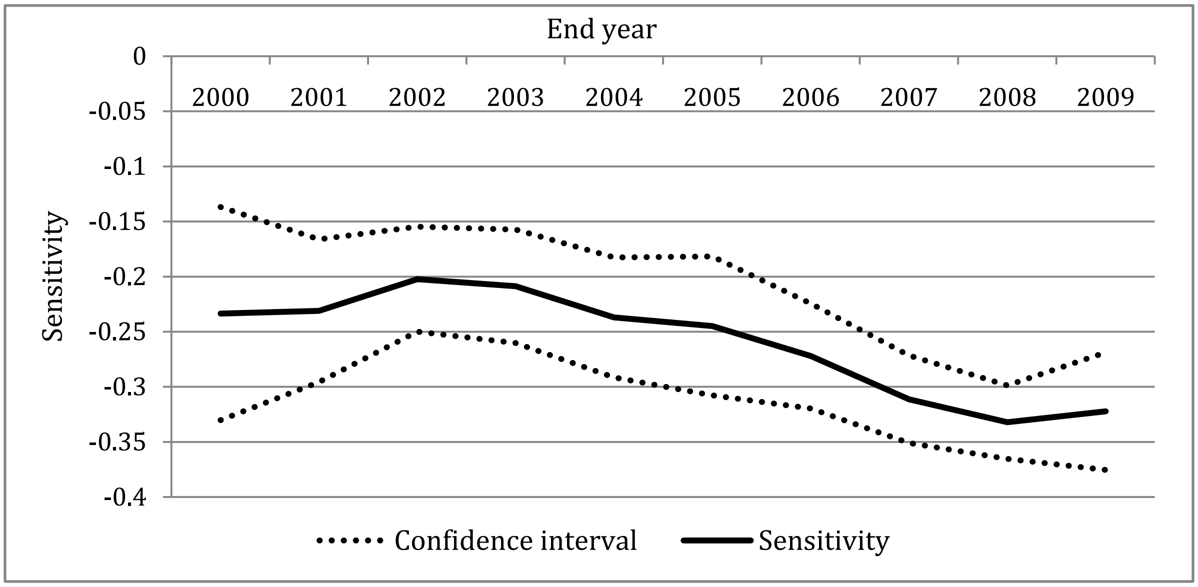
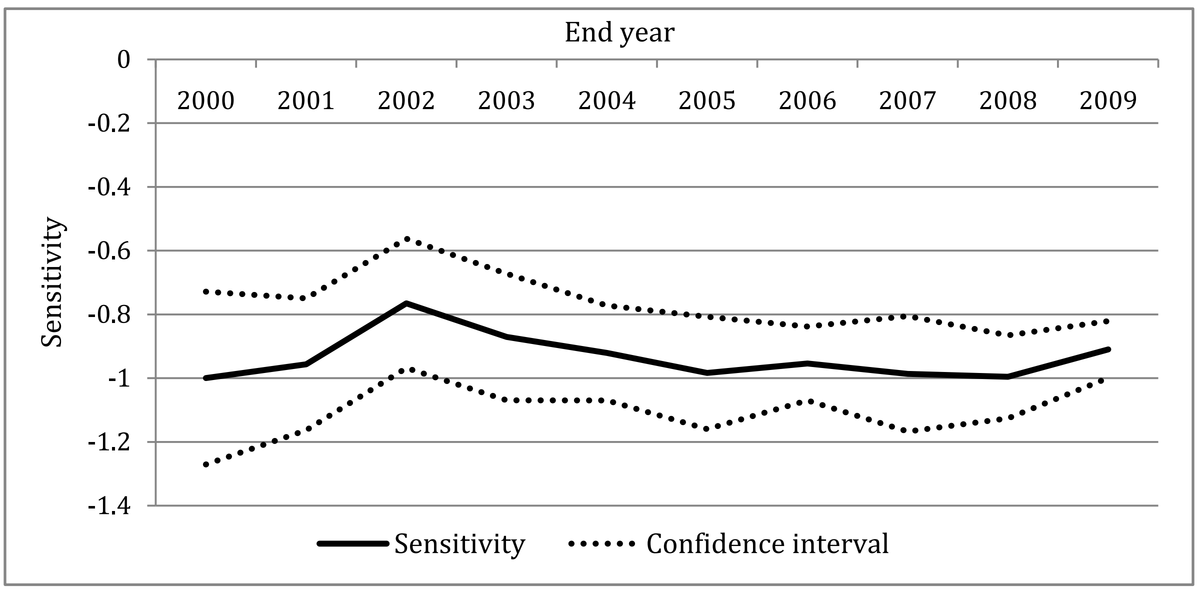


Figure 4: Growth-finance constraints sensitivities for Specification 6



Appendix: Definition of variables

Accelerator- Difference of operating income (sales) in two consecutive years.

Age- Years since the incorporation of the firm.

Asset sales- Proceeds from sale of fixed assets.

Asset Tangibility: Gross fixed assets of a firm.

Capital/Replacement value of capital- We use Perpetual Inventory Method to measure (replacement value of) capital.

Cash flow- Sum of retained profits and depreciation.

Dividend payout- Sum of common and preference dividend.

Export sensitivity- Ratio of export of goods (fob) to sales.

Financial slack- Sum of cash and marketable securities.

Firms' growth- Log differences of total assets from the previous year.

Group affiliation- Dummy which takes the value 1 for a firm belonging to a group.

Industry sales shock- The difference between the average sales growth of an industry over previous three years and the average sales growth across all industries over the same period.

Interest coverage- Ratio of interest accrued to profits before taxes, interest payments, dividends and amortisation.

Investment- Change in capital stock from the previous year.

Long term debt- Loans taken from all sources for a period of more than 12 months.

Net fixed assets- Total fixed assets net of accumulated depreciation.

Short term debt- Loans taken from all sources for a period of less than 12 months.

Tobin's q- It is the ratio of market value of a firm to book value of its assets. Market value is calculated by adding market value of equity to book value of debt. Market value of equity is number of outstanding shares and share price at the closing day of the year.