

Panel data modeling of financial leverage in listed agro-based firms

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Abstract— Long term sustainable business growth is the primary goal of every company. This is more so for firms involved in primary sector markets like agriculture. The capital structure decision impacts the long-term sustainability of the firm. This decision is very vital because it affects the shareholder's return, financial risk, firm value, and cost of capital along with long-term sustainability. The present paper studies the long-term sustainability of listed agriculture based companies for the sample period of 2007 to 2016 a 10 years data period. While there have been studies in the literature focusing on the association among sustainable growth and capital structure, this is the first study to include the cost of equity capital as the independent variable in explaining the financial leverage decision of the firms. Further, this is one of the first studies to be analyzing this relationship for a primary sector of India. To this extent, this study contributes to the understanding of financial leverage decision impact on long-term sustainability of firms in India.

Keywords- *Financial leverage (Fin-Lev); Agriculture; Sustainable development; Cost of equity capital (COEC) ; Fixed effects model (FEM); Random effects model (REM); Hausman test.*

I. INTRODUCTION

Sustainability of the agriculture is very crucial as it is directly linked to the food security and it would affect India's growth and socio-economic development. Food and agro-based companies in India play a major role in making the food accessible to all people across India. These companies must focus on people, planet, and profit by implementing 'Triple bottom line' approach to sustainability [18]. This focus would generate reputation and investor interest to invest in these companies, which is necessary for the long-term sustainability of the company. This paper focuses on the financial sustainability of the agro-based companies, the most important sustainability criteria of a firm. Capital structure decision is one decision which impacts the long-term financial sustainability of the firm. Financial leverage (*Fin-Lev*) is considered as a measure of long-term financial sustainability [19]. *Fin-Lev* is defined as the extent to which a company uses its borrowing capital to fund its operations. *Fin-Lev* measures the risk of a company. A company with high *Fin-Lev* is considered to have a high risk of bankruptcy and a company with low leverage is considered to have less bankruptcy risk. Hence a firm tries to achieve an optimum *Fin-Lev* so as to

balance maximize profits and minimize losses. The present study aims at analyzing the different factors which determine the financial leverage of the firm. This is the first paper to include the cost of equity capital (COEC) as an independent variable to study the *Fin-Lev* determinants of the firm. Using random effects model (REM) estimation, the study finds that the COEC is positively correlated towards the *Fin-Lev* of the firm.

II. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

A. Capital Structure Theories

Several theories in the literature explain the capital structure of a firm. Capital structure is a part of the financial structure and it is defined as sources of permanent finance that a firm raises. A company can raise the required amount of capital through reinvestment of profits, bank borrowings, an issue of equity shares, an issue of bonds or debentures, and issue of preferred shares [2].

1) *Modigliani and miller theory*: Proponents of this [1] argue that the weighted average cost of capital (WACC) and value of the firm (VOF) are different. A change in the WACC won't affect the VOF. They further point out that the issue of debt increases the financial risk and COEC of the firm.

2) *Pecking order theory*: Proponents of this [2] point out that the shareholders perceive the issue of equity shares negatively and it tells that the management would issue shares only when its securities are overpriced. Further they point out that the management must prefer raising money through its cheapest source and the firm should first opt for retained earnings and only after that it should try for debt and equity financing respectively.

3) *Static trade-off theory*: Proponents of this [3] argue that a company has to balance its cost and benefit by deciding on its debt and equity financing. They further argue that a company by issuing debt can benefit from tax since interest payment on debt act as a tax shield, but it increases the bankruptcy costs which arise due to debt financing. The company has to balance between the interest tax shield and bankruptcy costs.

Thus studying the capital structure decision of firms has remained an interesting area of research. Further firm specific factor that influence the *Fin-Lev* of the firm is discussed below.

B. Firm Specific Characteristics

Studies have further found that several factors influence the capital structure decision of firms. These are discussed below.

1) *Financial leverage (Fin-Lev)*: *Fin-Lev* is a measure of financial risk indicating the percentage of debt present in the total assets. The variable measures the effect of financing decisions taken by the company in its past [6], [7] and [9]. This is considered as a dependent variable in this paper.

2) *Profitability*: Studies like [4], [5] and [6] shows that the firms which are profitable would rely less on external finance since they have high retained earnings and thus the firm is faced with a low risk of bankruptcy. Further a more profitable firm is seen to borrow at a lower interest rate as the firm is less risky for the lenders. Profitability is defined using return on assets (ROA). Our study hypothesizes that

Ha1: Profitability impacts the *Fin-Lev*

3) *Liquidity*: Liquidity tells about the amount available to meet the current liabilities or expenditure [5] and [8]. It talks about a firm's ability to meet its short-term obligations. [9] Liquidity is measured using current ratio in the present study. The hypothesis tested in the present study is

Ha2: Liquidity positively impacts the *Fin-Lev*

4) *Non-debt tax shields [NDTS]*: Studies like [7], [8], [12] and [20] measure NDTS as depreciation and amortization divided by total assets. These studies show that the NDTS reduces the taxable income of a company. A variable which helps in reducing tax apart from interest expenses is known as non-debt tax shield [11]. Our study hypothesizes that

Ha3: NDTS significantly impacts the *Fin-Lev*

5) *Firm size*: Firm size can be measured using total assets or total sales. Studies like [5], [9] and [12] measure firm size as the natural logarithm of total assets and other studies like [10], [11] and [13] measure using natural logarithm of sales. Since the sale revenue is volatile and affected due to seasonality, firm size has been defined as natural log of total assets in this paper. Further the study hypothesizes that

Ha4: Firm size positively impacts the *Fin-Lev*

6) *Firm age*: Firm age is measured by number of years since the establishment of the business [7] and [12]. These studies find that this measure talks about the

reputation/goodwill the firm acquired through experience over the years and they also show that as the firm grows older the asymmetric information reduces. The hypothesis tested in the present study is

Ha5: Firm age positively impacts the *Fin-Lev*

7) *Collateral value of asset (CVA)*: The collateral value of the asset (CVA) is the measure of asset tangibility. Studies [5], [7] and [11] find that the higher CAV would reduce risk and increase VOF. The CVA is defined as net fixed assets divided by total assets. Our hypothesizes that

Ha6: CVA positively impacts the *Fin-Lev*

8) *Business risk*: Business risk is a measure of volatility or probability of bankruptcy. This is measured by standard deviation of sales in [7], the standard deviation of return on assets [11], the standard deviation of cash flow in [9] and standard deviation on EBIT in [8]. In this paper, we have considered standard deviation of EBIT as a measure of business risk since that is considered as the measure of exact risk. The hypothesis tested in the present study is

Ha7: Business risk negatively impacts the *Fin-Lev*

9) *Effective tax rate*: The studies [14] and [15] find that effective tax rate has an impact on financial leverage. The effective tax rate is measured using tax divided by the total income. The hypothesis tested in the present study is

Ha8: Effective tax rate positively impacts the *Fin-Lev*

10) *Uniqueness*: The study [4] finds that the costs that a firm imposes on the customers directly or indirectly are relevant to capital structure decisions and so it is said that uniqueness has an impact on financial leverage. Uniqueness can be measured by research and development expenditure over sales or by selling expenses over sales [4] and [8]. This paper uses research and development expenditure over sales as a measure of uniqueness. The hypothesis tested in the present study is

Ha9: Uniqueness negatively impacts the *Fin-Lev*

11) *Debt service capacity*: Debt service capacity talks about the capacity of the firm to meet its interest obligation [8] and [9]. A firm with higher debt service capacity has a good ability to meet its interest obligation. It is measured by using EBIT over interest. The hypothesis tested in the present study is

Ha10: Debt service capacity positively impacts the *Fin-Lev*

12) *Dividend payout*: The study [16] finds that the dividend payout would impact the financial leverage. Dividend payout is measured by Dividend paid/Net income. The hypothesis tested in the present study is

Ha11: Dividend payout positively impacts the *Fin-Lev*

13) *Growth*: The studies [5], [6] and [13] find that growth rate is an indication or measurement of the financial strength of a company. Further the studies find that a firm with a higher growth would need higher capital requirement. This is measured by using total assets/no of shares. The present study hypothesizes that

Ha12: Growth negatively impacts the *Fin-Lev*

14) *Cost of equity capital (COEC)*: This paper is the first to include the COEC as an independent variable in explaining *Fin-Lev* determinants. The cost of capital is measured by capital asset pricing model [17]. The COEC positively impacts the *Fin-Lev* [1]. The hypothesis tested in the present study is

Ha13: Cost of equity capital positively impacts *Fin-Lev*

15) *Inflation*: CPI Inflation rate is also included to study its impact on financial leverage. The hypothesis tested in the present study is

Ha14: Inflation positively impacts *Fin-Lev*

Further the dependent variable *Fin-Lev* is measured as debt ratio [8], [9] and [12].

III. DATA DESCRIPTION AND METHODOLOGY

A. Data Description

The sample consists of 145 listed firms from the food and agro based industries for the 10-year period of 2007 to 2016. The data was collected from CMIE-Prowess.

B. Methodology

To analyze the determinants of financial leverage, sample data is collected for 145 listed firms across 10 year period of 2007-2016. As the data collected is panel data, two models fit our methodology which is fixed effects model (FEM) and REM. Gretl was used for the analysis.

Following is the general model used for the study

$$Y_{it} = \beta_0 + \beta_i X_{it} + \mu_{it} \quad (1)$$

Where Y_{it} is the dependent variable, X_{it} $i= 1$ to N and $t= 1$ to T are the independent variables and μ_{it} is the error term. The other studies which have employed FEM and REM are [16] and [21]. Time dummies along with individual firm dummies have been included in the above model.

All the variables including the dependent variable is defined in Table I.

TABLE I. VARIABLE DEFINITION

Variable	Definition
<i>Fin-Lev</i>	Debt ratio
Profitability	ROA

Liquidity	Current ratio
NDTS	Depreciation and amortization to total assets
Size	Natural logarithm on total assets
Age	Age of the firm since establishment
CVA	Net fixed asset to total assets
Business risk	Standard deviation of EBIT
ETR	Tax to income
Uniqueness	Research and expenditure to sales
DSC	Profit before depreciation, interest and tax to Total interest
Dividend payout	Dividend/Net income
Growth	Net asset/Number of total shares
COEC	Risk free rate + Beta * Risk premium
Inflation	Yearly CPI inflation rate for India

1) *Fixed effects model (FEM)*: The FEM allows each firm to have its own intercept value and it is time-invariant [24] and [25]. The following is the fixed effects model. Hence the equation (1) is modified as

$$Y = \beta_0 + \beta_i X_{it} + \lambda_t + \alpha_i + \mu_{it} \quad (2)$$

Where λ_t =Time dummies, α_i =Firm specific effects introduced as differential intercepts and μ_{it} =Pure random error term.

2) *Random effects model*: The REM allows each firm to have its own intercept values that are drawn randomly and it allows for individual effects. The composite error term (W_{it}), is called the idiosyncratic term because it varies over cross-section as well as over time [23] and [24]. The REM is defined as follows.

$$Y = \beta_0 + \beta_i X_{it} + \lambda_t + \alpha_i + w_{it} \quad (3)$$

Where λ_t =Time dummies, α_i =Firm specific effects introduced as differential intercepts and w_{it} = Individual specific effect.

IV. ESTIMATION

The results of the FEM and REM estimation are given in the table II

TABLE II. RESULTS

Independent variable	FEM	REM
Const	-0.2513	-0.1130***
Lqduy	0.0020***	0.0020***

COEC	0.0639	0.0551*
Age	0.0362**	0.0278*
Pftbty	-0.5656***	-0.5256***
NDTS	-0.0680	-0.0226
Size	0.0508***	0.0406***
Unqness	-1.4716***	-1.3301**
DSC	0.0000	0.0000
CVA	0.2894***	0.2978***
Dpayout	-0.0004**	-0.0003*
Brisk	0.1724**	0.1931***
ETR	-0.1153***	-0.0745**
Gwth	-3593.4400***	-3412.3200***
Ifltn	0.0287	0.0152***
dt_2	0.0210	0.0217
dt_3	0.0415*	0.0418*
dt_4	0.0153	0.0114
dt_5	0.0378*	0.0366
dt_6	0.0175	0.0164
dt_7	0.0259	0.0266
dt_8	0.0457**	0.0458**
dt_9	0.0373	0.0323
dt_10	0.0145	0.0131

***p<0.01, **p<0.05, *p<0.10

Hausman test was conducted to identify the better model [22]. The null hypothesis tested is as follows

H0: Fixed effects model is the better model

The below table shows the result from Hausman test

TABLE III. HAUSMAN TEST

Results
Asymptotic test statistic: Chi-square(23) = 104.09
p-value = 0.00000000000027

***p<0.01, **p<0.05, *p<0.10

Since the p-value is significant at 1% level of significance, the null hypothesis is rejected and REM is the better fit model to estimate *Fin-Lev*.

Results from Table II for REM estimate indicate that the COEC positively impacts the *Fin-Lev* of the firm at 10% level of significance. This tells that when the COEC, which is payable to the shareholders increases the *Fin-Lev* of the firm also increases [1]. Liquidity positively impacts the *Fin-Lev* of the firm at 1% level of significance as mentioned in studies [5], [8] and [9]. Profitability negatively impacts the *Fin-Lev* of the firm at 1% level of significance as mentioned in the studies [4], [5] and [6]. Firm size positively impacts the *Fin-Lev* of the firm at 1% level of significance as stated in the studies [5], [10] and [11]. Firm age positively impacts the *Fin-Lev* of the firm at 10% level of significance as stated in the studies [7]

and [12]. CVA positively impacts the *Fin-Lev* of the firm at 1% level of significance as mentioned in the previous studies [5] and [11]. Uniqueness negatively impacts the *Fin-Lev* of the firm at 5% level of significance as stated in the studies [4] and [8]. Dividend payout negatively impacts the *Fin-Lev* of the firm at 10% level of significance [16]. Growth negatively impacts the *Fin-Lev* of the firm at 1% level of significance as mentioned in studies [5], [6] and [13]. Inflation rate positively impacts the *Fin-Lev* of the firm at 1% level of significance. Business risk positively impacts the *Fin-Lev* of the firm at 1% level of significance unlike studies [7], [8] and [11] and this says that the business risk increases with an increase in financial risk. Effective tax rate negatively impacts the *Fin-Lev* of the firm 5% level of significance unlike studies [14] and [15].

V. CONCLUSION

The long-term financial sustainability of agriculture based companies is positively impacted by COEC of the firm. As the COEC of the firm increases the *Fin-Lev* of the firm also increases, which means that company would prefer debt financing rather than equity financing when the cost of equity capital increases. The long-term financial sustainability of the firm is positively impacted by the variables like liquidity, the COEC, firm age, firm size, and inflation and it is negatively impacted by profitability, dividend payout, effective tax rate and growth. A company has to take these factors into consideration in order to achieve long-term financial sustainability.

VI. LIMITATIONS

This paper has some limitations and this provides which provides the scope of future research. This study does not consider the quality of management, ownership and economic factors which may also influence the long-term financial sustainability of the firm. The study can be extended by adding the above-mentioned variables and also to other industries.

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