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Risk Mitigation through Target Cost of Capital - A Prescriptive Analytic Quadratic Programming Model For Start-Ups

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EDITORIAL BOARD EXCERPT At the starting Time of Submission (ToS) submitted paper had a 07% plagiarism which is an acknowledged fraction for publication. The editorial viewpoint is of an inspection that article had a consecutive close watch by the blind reviewer's which at later stages had been put right and amended by an author (gajapathy) in a variety of phases as and when essential to do therefore. The reviewer's had in a beginning stages talk about with minor revision with a following statement which at a small period rationalized by an authors. The comments related to this document are enormously observable related to **Risk Mitigation through Target Cost of Capital** both subject-wise and research wise by the reviewers during appraisal and further at blind review process too. The author addresses the commonest but cautious challenge to safeguard the welfare of the startups is lying during the incubation stage. His argument that in the pipeline the progress should be evolved to be sustainable so that the entrepreneur and the co-entrepreneurs should disseminate the legacy is well plotted. The Prescriptive Modeling is adding novelty to the whole approach. Later it can be authenticated with further literature if the author wishes to publish more of such papers in the given area. All the comments had been collective at a mixture of dates by the authors' in due course of time and same had been built-in by the author in multiplication. By and large all the editorial and reviewer's comments had been integrated in a paper at the end and further the manuscript had been earmarked and decided under **"Research Thought"** category as its highlights and emphasize the work in relation to use of Risk Mitigation through Target Cost of Capital- A Prescriptive Analytic Quadratic Programming Model For Start-Ups.

ABSTRACT The tie-break between risk and return is a long-term challenge for the risk practitioners. Optimizing between cost of capital and risk proxied by leverages viz., operating and financial leverages is the objective of this model building exercise. The leverages are providing incentives when the cost to the owners and to other stake-holders in terms of risk is pungent. This issue is very rampant among the start-up digipreneurs. To strike a tie between cost of capital, for which Weighted Average Cost of Capital (WACC) is substituted, and leverages, the Quadratic Programming (QP) tool has been utilized. In QP, single linear convex WACC constraint function is strategised with a maximum WACC when the objective quadratic function is utilized with an orientation of maximization. The purpose of this research paper is to bring out a risk mitigation model with high leverage in a given cost of capital. An application of this model will provide a decision support in the areas of determining capital structure, cost of capital, indifference point, risk assumption, and management of cost between leverages. This Model also helps to suggest strategies using sensitivity analytics as extension

KEYWORDS Quadratic Programming | WACC | Leverage | Capital Structure

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Introduction

The commonest but cautious challenge to safeguard the welfare of the startups is lying during the incubation stage. In the pipeline the progress should be evolved to be sustainable so that the entrepreneur and the co-entrepreneurs should disseminate the legacy. Learning from the falling should be strengthened which is necessary condition to the entrepreneurial economy. India's entrepreneurial economic turn along with demographic dividend is sure to harvest good return ahead of the competitive economies.

Review of Literature

The optimum capital structure is defined as the capital structure or combination of debt and equity that leads to the maximum value of the firm(M Y Khan & P K Jain, 2013). Hence, the foremost importance is to identify the costs themselves. If the investigator skips any cost item, that may lead to serious impairment of any decision making model. "It is important to highlight just what our cost functions capture. The cost functions, of course, incorporate the various possible costs of debt (e.g., expected bankruptcy costs, "debt overhang" cost that might discourage a firm from initiating a profitable project because it currently has too much debt, etc.)" (Jules Van Binsbergen J, Graham J R, & Yang J, 2011). For example, excess dependence on debt may lead to possible extinction of the firm itself. "Direct bankruptcy costs can be staggering and may be a disincentive to debt financing. Such costs are referred to as *bankruptcy tax* "(Stephen Ross, Randolph Westerfield, & Bradford Jordan, 2008). Then, "How can we correctly evaluate capital and its market structure for individual projects and companies in general? " (Vigen Minasyan, 2013). Of course, debt capital holds good and bad. "There are disadvantages of debt; and excessive use of debt may cause a rise in the cost of capital owing to the increased financial risk and may reduce the value of the firm" (Schall LD & CW Haley, 1977). However, "the advantage of debt as a cheaper source of finance is exactly offset by the increased equity capitalization rate (M Y Khan & P K Jain, 2013). It is obvious that "the debt trades off the advantage of debt financing (interest tax shields) against the costs of financial distress (consisting of higher interest rates and bankruptcy costs) (M Y Khan & P K Jain, 2013).

Objectives

To develop a Quadratic Programming (QP) model with an objective of minimising the Leverages of a start-up subject to the constraint of maximum Wegithed Average Cost of Capital (WACC).

Research Methods

One of the drawbacks of linear programming is in its linearity assumption, primarily in the objective function. This forces us to scout with a constant marginal rate of substitution and constant return to scale. However, this assumption is at variance with the economists' preference postulates. This paper presents an application of quadratic programming in corporate particularly in capital structure planning formulations. QP envelopes a variety of applications—'portfolio selection, monopolists' profit maximization, inequality constrained least-squares estimation, spatial equilibrium analysis, goal programming with quadratic preferences, and optimal decision rules' (Frederick S. Hillier, Gerald J. Lieberman, Bodhibrata Nag, & Preetam Basu, 2012).In the functional management areas, 'QP is applicable to problems in economics, such as demand-supply response and enterprise selection. In finance, it is used in portfolio analysis; in agriculture, in crop selection'(Bruce A McCar, Herbert Moskowitz, & Hartley Furtan, 1977). Here, the QP is posted to optimize the risk emanating from changes in leverages with respect to cost of capital.'Despite all this research, a consensus view on optimal capital structure has yet to emerge. In many cases it is difficult to make a specific recommendation about howmuch debt a given company should use' (Jules Van Binsbergen J, Graham J R, & Yang J, 2011).

Rationale behind the Model

Debt plays a crucial role in growth of a firm… The periodic interest payments reduce managerial discretion over internal funds(G Jagan Mohan & Puja Padhi, 2018). The cost of financing is affected when the levered firms are gearing up its profit further through leverage. This increases the exposure for the digipreneurs and deters sustainability as well as continuity of business. Hence, the question is how and how far to gear up the leverage, given target cost of capital. 'The benefit functions are downward sloping reflecting that the incremental valueof debt declines as more debt is used. The cost functions are upward sloping, reflecting therising costs that occur as a firm increases its use of debt. The cost functions vary by firm toreflect the firm's characteristics such as asset collateral and redeployability, asset size, thebook-to-market ratio, profitability, and whether the firm pays dividends' (Jules Van Binsbergen J, Graham J R, & Yang J, 2011). If the leverage is increased for equity-holders given cost of capital (whether marginal cost of capital or Weighted Average Cost of Capital (WACC)), it is justified that the risk is mitigated due to administered cost of capital. However, in this model, the WACC is taken to have long-term solution. The sustainability shall be established when one "manage to long-term, not to short-term… The revenue and shareholder value a firm create are an imperfect proxy for the value it creates for consumers and society". (*emphasis added*) (Kenneth Frazier, 2018). However, any risk investigator cannot decouple the risk and return. The Quadratic Programming, here,is called for optimizing task either using QP algorithm or Modified Simplex Method algorithm under the Karush-Kuhn-Tucker (KKT) conditions(Frederick S. Hillier, Gerald J. Lieberman, Bodhibrata Nag, & Preetam Basu, 2012). In this linearly constrained optimization study the objective function is operating and financial leverages in the concave fashion when the single constraint function is linear.

The prerequisite for the model in study is enumerated as follows:

a. The capital structure is formed only through two sources viz., perpetual riskless debt and ordinary shares.

b. This model castaway the corporate taxes.

c. It is assumed that the Dividend Pay-out Ratio is 100.

d. The total financing is constant.

e. EBIT is assumed to be constant.

f. Going concern philosophy is adopted. The life of the firm is perpetual.

g. Weighted Average Cost of Capital based on Market Value Weights is used in linear Convex constraints for a sustainable decisions. If it is for short-term decision, the WACC may be substituted by Marginal Weights.

h. Overall cost of capital is assumed to be EBIT/TOTAL VALUE OF THE FIRM (%)

i. Total value of the firm = market value of the equity and market value of the debt. (M Y Khan & P K Jain, 2013)

A Prescriptive Analytic Quadratic Programming Model

The following is exhibiting a standard QP model which is to be applied in achieving risk reduction with WACC constraint.

Maximise

$$f(x) = cx - \frac{1}{2}x^T Qx$$

Subject to

$$Ax \leq b \text{ and } x_j \geq 0$$

Where the row vector is c, and x and b are column vectors. When subscript denotes transpose, Q and A stands for matrices. The q_{ij} (elements of Q) are given constants such that $q_{ij} = q_{ji}$ (which is the reason for the factor of ½ in the objective function). By performing the indicated vector and matrix multiplications, the objective function then is

expressed in terms of these q_{ij} and c_j (elements of C), and the variables as follows (Frederick S. Hillier, Gerald J. Lieberman, Bodhibrata Nag, & Preetam Basu, 2012):

$$f(x) = cx - \frac{1}{2}x^T Qx$$

$$= \sum_{j=1}^{n} c_j x_j - \frac{1}{2}\sum_{i=1}^{n} \sum_{j=1}^{n} q_{ij} x_i x_j$$

The objective function is to maximise the operating and financial leverages whose function is notated as follows:

Degree of operating leverage[1]

$$= \frac{Percentage change in EBIT}{Percentage change in Sales}$$

Degree of financial leverage[2]

$$= \frac{Percentage change in EPS}{Percentage change in EBIT}$$

The sales, EBIT (Earnings Before Interest and Tax) and EPS (Earnings Per Share) are changing in a non-linearly manner due to, for example, price elasticity of demand, change in economic condition, change in tastes and preferences, change in rate of interest, etc. The cost of capital and the operating and financial leverages are changing depending on the debt-equity ratio. If the debt-equity ratio is increased, the cost is also increasing and hence the leverage. But the cost of debt influences the operating leverage and financial leverage whose behavior is non-linearly quadratic. However, the cost of capital is also non-linear though in this study it is kept linear for analytic purposes. Therefore, the objective function may be written as

Maximize

$$f(OL, FL) = (OL)(FL) = \frac{CONTRIBUTION}{EBIT - I}$$

Subject To

$$(OL_c) + (FL_c) \leq b \qquad \text{(WACC constraint)}$$

Where the $(OL_c) and (FL_c)$ are cost associated to operating leverage (OL) and financial leverage (FL) respectively. Contribution is sales adjusted against variable cost and EPS (Earnings Per Share) is earnings available to every shareholder or EBIT minus interest payments (I).

Conclusion

The outcome would be the variables of OL and FL post-iterations through KKT conditions or Modified Simplex Algorithms. In other words, the extent of maximal OL and FLwill be determined with the expected WACC constraint. This model will suggest solutions in areas of dilemmadetermining capital structure, cost of capital, indifference point, risk assumption, and management of cost between leverages. As the extension of utility of this model, this also helps to suggest strategies using sensitivity analytics.

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1 DOL is 'the firm's ability to use fixed operating costs to magnify the effects of changes in sales on its earnings before interest and taxes' (M Y Khan & P K Jain, 2013).

2 DFL is 'the firm's ability to use fixed financial charges to magnify the effects of changes in EBIT on EPS' (M Y Khan & P K Jain, 2013)

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The Editorial Board had used the ithenticate plagiarism [http://www.ithenticate.com] tool to check the originality and further affixed the similarity index which is 7% in this case (See Annexure-I). Thus the reviewers and editors are of view to find it suitable to publish in this Volume-10, Issue-3, July-Sep, 2018

RISK MITIGATION THROUGH TARGET COST OF CAPITAL - A PRISCRIPTIVE ANALYTIC QUADRATIC PROGRAMMING MODEL FOR START-UPS

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