Optimal Capital Structure under the prevalent and the OECD-proposed BEPS Corporate Income Tax Regimes

Myuran Rajaratnam (corresponding and presenting author),
School of Economics and Business Sciences, University of the Witwatersrand, Private Bag 3, Wits, 2050, South-Africa,
+27-118702272 (t), +27-118702000 (f), myuran.raj@gmail.com

Bala Rajaratnam,
Department of Statistics, Stanford University, USA, Financial and Risk Modeling Institute, Stanford University, USA; brajaratnam01@gmail.com

Kanshukan Rajaratnam,
Department of Finance and Tax & African Collaboration for Quantitative Finance and Risk Research, University of Cape-town, South-Africa,
kanshukan.rajaratnam@uct.ac.za

Abstract: We propose a novel approach for studying optimal capital structure under the prevalent corporate income tax regime where full tax deductibility of interest is permitted. Then, following the OECD proposed BEPS (Base Erosion and Profit Shifting) framework, we impose an EBITDA-based limit on the tax deductibility of interest to gauge its impact on a firm’s optimal capital structure. Though largely fit for purpose, we show that the BEPS framework can affect optimal capital structure in firms with lower EBITDA to Asset ratios and potentially have negative economy-wide implications from an aggregate capital provision point of view in such firms. Therefore, we propose a modification to the BEPS regime. We show that our modified BEPS proposal largely retains the benefits of the original BEPS regime but reduces the capital structure impact on firms with lower EBITDA to Asset ratios.

EFM Classification Code: 140 – Capital Structure

JEL Classification Code: G32 Capital and Ownership structure, H21 Optimal Taxation

Keywords: Optimal Capital Structure, Competitive Advantage, Tax, Value-investing, OECD BEPS project
1. Introduction

The seminal work by professors Modigliani and Miller (1958) initiated the in-depth study of optimal capital structure. In subsequent literature, optimal capital structure is generally obtained using one of two models: the Capital Asset Pricing model (Sharpe, 1964) or Merton’s structural form model (Merton, 1974). In the former approach, the Weighted Average Cost of Capital, based on the CAPM model, is adjusted to incorporate the increasing tax benefits but also the increasing bankruptcy risks of rising debt to obtain the optimal capital structure\(^1\). In a competing approach, Leland (1994) shows how optimal capital structure may be obtained when a firm’s assets follow a geometric Brownian motion by incorporating the tax advantage of debt and bankruptcy costs into the Merton model. Both approaches grapple with certain difficulties in the search for optimal capital structure. CAPM based models do not easily lend themselves to easy calculation of optimal capital structure given that it is difficult to obtain endogenous expressions for corporate debt yields within that framework. Mertonesque models (including the Leland approach) struggle with the “credit-spread puzzle phenomenon” (see, for example, Huang and Huang (2012)) and therefore it is not clear how the under prediction of spreads (a la Huang and Huang) affects optimal capital structure. Furthermore, the Leland model can exhibit some unusual characteristics in that the firm value and equity value increase with increasing tax rates – this is because asset values are not taxed explicitly within this model and the firm value is only affected by taxes through the value of the tax benefits (which has no negative impacts).

In this paper, we present an alternative approach to optimal capital structure. The key difference between our model and existing models is that existing models place large significance on volatility - the CAPM employs beta whereas Mertonesque models employ

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\(^1\) See, for example, corporate finance textbooks such as Brealey and Myers (2003) for more on this so-called Trade Off Theory of Capital Structure.
asset volatility to capture risk. Instead, we follow the approach by Rajaratnam et al. (2014, 2016) and place greater weight on the competitive advantage of the firm. As shown by Rajaratnam et al. (2016), it is possible to obtain endogenous expressions for corporate treasury yield spreads using their model. Furthermore, their model does not appear to struggle with the “credit-spread puzzle phenomenon” to the same degree. In this paper, we obtain optimal capital structure under alternate corporate income tax regimes, including the recently proposed BEPS (Base Erosion and Profit Shifting - Action 4) OECD tax regime (2015). The BEPS framework limits the maximum tax deductibility of interest payments to a certain proportion of a company’s EBITDA (Earnings Before Interest, Tax, Depreciation and Amortization). We show that the BEPS proposal (Action 4) appears to affect adversely the optimal capital structure in firms with low EBITDA to Asset ratios. We conjecture that this potentially has negative economy wide implications in terms of lower production volumes and / or permanently higher prices for the goods and services produced by such firms.

Governments face certain complexities with the prevalent corporate income tax (PCIT) system where full tax deductibility of interest payments is permitted. First, there is the earnings-stripping issue: multi-national companies sometimes employ aggressive tax structuring to benefit from the tax deductibility of interest payments. Governments are keen to limit this earnings-stripping by multinationals whereby firms typically deploy high levels of intra-company loans from low corporate income tax rate (CIT) countries to subsidiaries in high CIT countries to strip earnings (operating profit) from the subsidiaries and thereby reduce the amount of profits in the subsidiaries (and in the overall group) that are liable for Corporate Income Tax. A recent important and effective policy framework to combat this is the BEPS project study by the OECD (2015). The OECD estimates that between $100bn and $240bn is lost to global profit shifting every year. Clausing (2016) suggests a loss of around $100bn to the US and around $300bn to the world from profit shifting. The European
Parliamentary Research Service puts the revenue lost to corporate tax avoidance in the EU at around 70bn Euros. Clearly, the BEPS proposal is long overdue. Second, there is the *over-leverage issue*: firms have a general tendency to over-leverage given the favorable tax treatment of debt. This characteristic is not limited to multinationals and can also be found in pure domestic companies. Over-leverage can lead to outsized returns to equity holders during economic booms but also can put the firm in financial difficulties when the inevitable slowdown in the economy eventually arrives. To limit the impact on financial stability as well as employment, governments are keen that firms do not employ too much leverage. Third, there is the *tax timing / tax burden imbalance in retirement funds* issue. Many countries attempt to neutralize the favorable tax treatment of debt by taxing interest earned at a typically higher personal income tax rate in the hands of the recipient but allow a lower tax rate on dividends (the so-called “share-holder relief system”) given that the source of dividends, viz., company profits, already incurs taxation in the form of corporate income taxes. However, many European countries, with share-holder relief systems, still appear to discriminate equity finance over debt finance since the high personal income tax rates on interest earned don’t fully negate the higher overall tax burden on equity finance (see Overesch and Voeller, 2008). Furthermore, a significant portion of debt (and equity for that matter) in issue globally is owned by tax deferral vehicles such as pension funds, 401k plans, IRAs, Unit trusts and mutual funds that invariably delay taxation from the hands of the ultimate beneficiaries (see, for example, Rosenthal and Austin (2016)). There are a few important issues here. In countries like the UK and South Africa, a lump sum tax free withdrawal of a portion of one’s pension funds is possible at retirement. Within the confines of this lump sum tax free withdrawal, interest earned on debt is provided with a conduit to completely escape the tax net (unlike equity - given Corporate Income Tax). This is an unfortunate tax timing / tax
burden imbalance between debt and equity\textsuperscript{2}. Second, many countries enforce or recommend annuitisation or retirement drawdown products, whereby the pensioner buys such products with the remaining funds (post lump sum withdrawal) and pays income tax on the income from these products. This means that the original interest earned as well as dividend earned (prior to retirement) when they become income in the hands of the pensioner are all being taxed at the same personal income tax rate. This leads to a cumulatively higher tax burden on equity than debt (especially in present value terms) due to prior annual corporate income tax on the profits earned on equity. Such tax timing / tax burden imbalances provide another reason to reduce the favorable treatment of debt versus equity. Fourth, there is the excessive \textit{LBO/PE issue}: the favorable treatment of debt has boosted the growth of the Leverage Buyout (LBO) and Private Equity (PE) industries which have regularly structured takeover deals with large amounts of debt with the singular purpose of improving their internal rate of returns (IRRs). Invariably, this has the knock on effect of reducing tax payments to governments from interest earned on debt because the earlier mentioned tax deferral vehicles (such as pension funds) also invest in the leveraged loan market that funds LBO / PE take-outs. There is further potential for tax leakage when the above mentioned tax deferral vehicles also invest in bank debt that funds banks who themselves invest in leveraged loans. Fifth, there is the \textit{helping hand for SME issue}: completely removing the tax deductibility of interest payments is also not a realistic solution for governments given potential adverse effects. It is arguable that Small and Medium Enterprises (SMEs) are an important engine of growth and employment in the economy. However, SMEs are sometimes growth constrained as they find it difficult to access new debt capital given their shorter existences and their lack of solid asset bases / provable cash-flows to entice investors. In such a scenario, the tax deductibility of interest proves to be a positive consideration in the eyes of debt investors.

\textsuperscript{2} Note that we are not objecting to the availability of the option for retirees to draw a lump sum tax free, we are just pointing out that such an option accentuates the tax timing / tax burden imbalance between equity and debt.
since they are effectively given seniority over the tax authorities in the Income statement. Sixth, there is the *debt as an important asset class issue*. Debt, as an asset class, is hugely important to investors. This is especially true for entities that employ asset-liability matching. It is also an important asset class for mature (late life stage) investors who value the stability and income producing capacity of debt instruments. There would be a number of negative consequences from completely removing the tax deductibility of interest payments on such a large and important asset class and may lead to diminished issuance. Finally, there is the *ease of mobility of capital issue*: governments need to be cognizant of the ease of mobility of international capital, the scope for tax competition amongst countries and the potential for disadvantaging the home country when considering changes to their respective CIT systems.

A number of alternate CIT regimes have been proposed to overcome these challenges. In this paper, we examine optimal capital structure under three corporate income tax regimes: the PCIT regime, the BEPS regime and a Modified BEPS (M-BEPS regime). For this purpose, we use the theoretical framework proposed by Rajaratnam et al. (2014, 2016). In Rajaratnam et al. (2014), the authors present an approximate equity valuation model to apply the principles of value-investing as laid out by Benjamin Graham and Warren Buffett (1977-present). This discrete-time free-cash-flow model was specifically formulated with the competitive advantage of businesses in mind. In Rajaratnam et al. (2016), the authors present an approximate model for the term structure of corporate credit by extending their earlier firm model. They compensate the bond holder for expected losses at the end of competitive advantage and then provide an additional spread based on the tax deductibility of interest payments. They show that this simple intuitive model overcomes some of the well-known shortcomings of structural credit risk models.

The current paper contributes to the literature in four important respects: First, we employ the simple discrete-time model provided by Rajaratnam et al. (2014, 2016) (henceforth the
“Rajaratnams’ model”) to examine optimal capital structure for the Prevalent Corporate Income Tax system where full tax deductibility of interest is permitted\(^3\). Second, ours is one of the earliest studies to examine optimal capital structure under the OECD proposed BEPS framework (2015). Third, we show that the original BEPS proposal can impact optimal capital structure in firms with lower EBITDA to Asset ratios. The BEPS proposal can significantly reduce the optimal leverage ratio in lower EBITDA to Asset ratio firms. This may have the unfortunate result of undercapitalizing in aggregate such firms (i.e. providing less than optimal levels of capital) and therefore leading to potentially suboptimal outcomes for the wider economy and society at large. To remedy this, we propose a modest modification to the original BEPS proposal (the M-BEPS) in a way that appears to limit the impact on the capital structure of firms with lower EBITDA to Asset ratios without losing the benefits of the original BEPS. As shown later, the Rajaratnams’ model easily lends itself to the study of optimal capital structure under more intricate tax regimes (like BEPS and M-BEPS), in contrast, for example, to Merton-based models. Fourth, we examine the impact of the three alternate CIT regimes on the over-leverage issue, the excessive earnings stripping issue, the tax timing / tax burden imbalance in retirement funds issue, the excessive LBO/PE issue, the SME helping hand issue and the debt as an important asset class issue to gauge if the proposed tax regimes help with the tax related complexities faced by government treasuries. We now present a quick summary of the Rajaratnams’ approach. More in-depth detail can be found in the original publication [Rajarajnam et al. (2016)]

\(^3\) Note that we obtain optimal capital structure from the point of view that the investors in both debt and equity of a firm are largely the tax deferral vehicles that we mentioned earlier. Modifications to incorporate personal income taxation are not too difficult within our framework but are avoided here given that tax deferral vehicles like pension funds own significant swathes of listed equity and debt (Rosenthal and Austin, 2016). Furthermore, such vehicles exert a significant influence on firm management decisions (such as optimal capital structure) due to their shareholder activism / proxy voting power compared to the more silent role that traditional retail investors typically play.
2. The Rajaratnams’ approach to modelling a firm’s debt

Consider a mature firm that grows its profits at a constant annualized rate of growth. Assume for now that this mature firm is completely equity-funded. Rajaratnam et al (2014) show how the equity in this unlevered firm may be valued using a probabilistic equity valuation model under the assumption that the only risk (which matters) that is faced by the firm is the risk that its competitive advantage may end. Assume for now that the corporate income tax regime in the resident country does not permit the tax deductibility of interest payments. Assume, also for now, that the coupon rate on any potential debt assumed by the firm exactly covers the expected loss to the debt holder based on the end of competitive advantage and the subsequent liquidation of the firm. Now consider the choice facing the manager of the firm whose sole object, we assume, is to maximize the expected present value of the equity in the firm. What is the optimal capital structure for this firm, or equivalently, what is the optimal permanent level of debt to assets that should be introduced to the balance sheet of the firm.

Under these idealized conditions (including no tax deductibility of interest but bankruptcy permitted), it is not difficult to show that capital structure is irrelevant. This is because, as shown by Rajaratnam et al. (2016, pp 12), there is no change to the expected present value of this mature firm by the issuance of debt since the original debt issuance at par value exactly equals the expected present value of subsequent coupon and principal payments. The equity holder is no better off by the introduction of debt of any amount given that the coupon rate exactly covers expected future losses and given that there is no tax benefit to the debt.

4 It is assumed that extraneous equity capital after the introduction of debt is paid out as a special dividend: this is because our mature firm is assumed to have no new growth opportunities and that optimal capital structure is a pure financing decision (a la Modigliani and Miller). Furthermore, to allow for low EBITDA to Asset ratio firms in our considerations, we assume that the shareholders, given the upfront special dividend, are not loathe to have the firm raise small amounts of capital, if necessary, to fund coupon payments. We also assume that tax arrangements are symmetrical: a positive profit before tax implies cash payments to the tax authorities, whereas a negative profit before tax implies payments from the authorities. In this manner, we avoid coupon risk before the end of competitive advantage (similar to the Rajaratnams’ type I model).
Now consider the case where tax deductibility of interest payments is permitted but all other assumptions from above stay the same. As shown by Rajaratnam et al. (2016, pp 12), this now permits the transfer of wealth of that which was previously paid to the tax authorities to both the equity and debt holders of the firm. The portion that is allocated to debt holders, according to the Rajaratnams, compensates the debt holders by way of a risk premium over and above the coupon rate that which covers just expected losses.

The main result from Rajaratnam et al. (2016, type I model) is that the annual coupon rate covering only expected loss, \( y^* \), for a fixed-coupon bond of maturity of \( N \) years in a leveraged, mature business is given by the relationship\(^5\):

\[
1 + r_N = (1 + y^*) - \frac{(1+y^*)^{k+2} p l^{k+1}}{k+2} \quad \text{for } l(1 + y^*) \leq f \\
y^* = \frac{r_N p - \frac{f(k+1)l}{k+2}}{1-p} \quad \text{for } l(1 + y^*) > f
\]

Where:

- yield, \( r_N \), is the yield on the risk free yield curve at maturity of \( N \) years;
- leverage, \( l \), is the debt (\( D \)) to asset (\( A \)) ratio\(^6\) (i.e., \( l = D / A \));
- competitive advantage parameter, \( p \), is the annual probability with which the business can lose its competitive advantage. The ending of competitive advantage is a simple discrete time hazard process and its ending heralds a drop in the return on net operating assets. Similar to the Rajaratnams, we assume that the firm is no longer a

\(^5\) Note that equations (1) and (2) are continuous at the break-point \( l(1+y^*)=f \) and take the same value \( y^*=[r_N p/(1-p)][(1-p)(k+2)]/[(1-l-p)(k+2)] \) at this point. It is also worth noting, for use later, that both equations assume the same derivative value with respect to leverage: \( dy^*/dl = [(1+y^*)/(p(k+1)(k+2))]/(1-p) \) at this point.

\(^6\) Similar to the Rajaratnams we assume that the firm maintains a constant debt to asset ratio over time. For simplicity sake, we place the additional constraint that the replacement cost of assets is the same as the book value of the assets on the balance sheet (see Rajaratnam et al. (2016) for more on this).
going concern and its assets are liquidated. Rajaratnam et al. (2016, footnote 6 and Appendix B) show how the probability parameter, $p$, can be approximately estimated via either a Bayesian or a Frequentist interpretation of probabilities.

- maximum asset recovery ratio, $f$, is the maximum ratio of the assets on the balance sheet that can be recovered when competitive advantage ends and the firm is liquidated. In other words, the expression, $1-f$, is the deadweight liquidation / bankruptcy costs.

- the Rajaratnams assume that the asset recovery ratio is a random variable with a maximum $f \leq 1$ of the assets on the balance sheet and has a simple monomial cdf $F(x)$ of $k^{th}$ degree:

$$F(x) = \frac{1}{f^{k+1}} x^{k+1} \quad for \ 0 \leq x \leq f, k \geq 0$$ (3)

By allowing a portion of the tax benefit due to interest deductibility to be allocated to debt holders, the Rajaratnams propose that the actual coupon rate, $y$, catering for a risk premium over and above expected loss is:

$$y = y^* \left(1 + \frac{TL}{(1-T)}\right)$$ (4)

where $T$ is the corporate income tax rate.

Although equation (2) is explicitly solved for the coupon rate covering expected loss, equation (1) does not appear to be solvable algebraically (other than for small integral values of $k$). Therefore, to simplify things further, in our analysis, we consider the special case where $k=0$. In other words, we assume that the asset recovery process during the liquidation of assets follows a uniform distribution. In the results section, we show that this simplifying assumption is not punitive in terms of accuracy when calculating corporate treasury yield.
spreads within the Huang and Huang (2012) framework. Solving the resulting quadratic equation and choosing the more appropriate root, we get the following coupon rate, $y^*$:

\[
y^* = \frac{f - \sqrt{f^2 - 2pf(1+r_N)}}{pl} - 1 \quad \text{for } l(1 + y^*) \leq f \tag{5}
\]

\[
y^* = \frac{r_N + p - pf}{1 - p} \quad \text{for } l(1 + y^*) > f \tag{6}
\]

3. Optimal Capital Structure

3.1 The PCIT (Prevalent Corporate Income Tax) regime

As suggested by Rajaratnam et al (2016) and many others before them, the tax deductibility of interest payments in PCIT systems may be an accident of history. One of the few reasons why, in our view, tax deductibility of interest should be allowed is to enhance returns to equity holders in low return businesses which are essential to the wider economy and society at large, and which businesses, without the incentive brought to bear by the tax deductibility of interest, may not exist in appropriate size or volume (due to the diminished returns earned by equity holders) and thereby make society less well-off.

The pre-tax, pre-interest earnings of a firm are assumed to be independent of capital structure and tax considerations (i.e., they are determined by the firm’s competitive advantage and not by the firm’s capital structure or the corporate tax regulations in the geography where the firm operates). In line with Modigliani and Miller’s original insight, the capital structure and the tax regulations simply determine how the pre-tax, pre-interest earnings and therefore the firm’s value is shared amongst the debt holders, the equity holders and the tax authorities – the tax authorities, in this case, representing the government treasury and ultimately the general populace in a democratic nation.
The total tax shield benefit to the firm, $BF$, (both equity and debt holders) due to the tax deductibility of interest coupon in a given year, relative to the unlevered scenario, is:

$$BF = yDT$$  \hspace{1cm} (7)

As per Rajaratnam et al. (2016), the benefit from the tax shield is shared between the debt and equity holders and the portion of the tax benefit allocated to the debt holders, $BD$, in a given year is:

$$BD = D(y - y^*) = D y^* \frac{Tl}{(1 - Tl)}$$  \hspace{1cm} (8)

Therefore, the annual benefit apportioned to the equity holder from the tax deductibility of interest coupons\(^7\) is the difference, $BE = BF - BD$:

$$BE = \left( \frac{f-\sqrt{f^2-2pf(1+p)} - 1}{pl} - 1 \right) \left( \frac{AT(1-l)}{1-Tl} \right) \quad \text{for } l(1 + y^*) \leq f$$  \hspace{1cm} (9)

$$BE = \left( \frac{rN+p}{1-p} \right) \frac{AT(1-l)}{1-Tl} \quad \text{for } l(1 + y^*) > f$$  \hspace{1cm} (10)

where $A$ is the assets on the balance sheet of the company. The managers of a firm are agents of the equity holders of the firm. They would therefore optimize the firm’s capital structure to maximize the benefit to equity holders. Given that the function, $BE$, is real and differentiable (also see footnote 5), takes the value zero at the points $l=0$ and $l=1$, and assumes at least some positive values in between these points, by Rolle’s theorem, the derivative of $BE$ at some point in between these points equals zero and therefore $BE$ attains a maximum. This optimal leverage ratio can be obtained by taking the first order derivative of the above equations with respect to the leverage ratio $l$ and setting the results to zero and then solving for $l$. The first order derivatives of equation (9-10) are:

\(^7\) The total expected present value of the benefit to equity holders from the annual tax deductibility of interest can be easily obtained using the identities in Appendix A of Rajaratnam et al (2016).
\[ \frac{dB_E}{dt} = \frac{AT}{p(1-Tl)^2} \left[ pf(1+r_N) - p \right] (1 - l) (1 - Tl) + \left( f - \sqrt{f^2 - 2plf(1+r_N) - pl} \right) (T - 1) \]

for \( l(1 + y^*) \leq f \)  \hspace{1cm} (11)

\[ \frac{dB_E}{dt} = \frac{AT}{2(1-p)(1-Tl)^2} \left[ (2r_N + 2p)(1 - l) (1 - Tl) + (2r_N l + 2pl - pf) (T - 1) \right] \]

for \( l(1 + y^*) > f \)  \hspace{1cm} (12)

Thereafter, it is quite straightforward to obtain the optimal leverage ratio by setting the appropriate equation to equal zero and solving the equation numerically for the optimal leverage ratio (via, for example, the goal seek function in MS-Excel).

Results: Accuracy of the proposed model for determining yield spreads

First, we empirically test the coupon rates from the proposed model (equations 4-6) using the Huang and Huang (2012) framework. Huang and Huang calibrate a number of structural models to standard firm related parameters (such as leverage ratios, equity risk premia, bankruptcy costs and cumulative default probabilities) and show that standard structural models typically explain only about 20%-30% of the observed corporate-Treasury yield spreads for corporate credit having investment grade credit ratings. Huang and Huang consider corporate debt with maturities of 4 years and 10 years in their study. Table 1 presents the Huang and Huang calibration data.

Table 1: Target parameters for calibration and the historical observed average corporate-treasury yield spreads

This table presents the target parameters for calibration and the historical average corporate-treasury yield spreads for each credit rating scale from Huang and Huang (2012). The target calibration parameters include the Leverage Ratios, the Equity Premiums and the Cumulative Default Probabilities (for both 4 year and 10 year maturity corporate bonds) in each credit rating scale. The table also presents the Observed Corporate Treasury Yield Spreads for both maturity types in each credit rating scale.

<table>
<thead>
<tr>
<th>Credit</th>
<th>Leverage</th>
<th>Equity</th>
<th>Cumulative</th>
<th>Cumulative</th>
<th>Observed</th>
<th>Observed</th>
</tr>
</thead>
</table>

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We set our leverage ratio to be the same as that given by Huang and Huang. We employ the same deadweight bankruptcy costs (15%) as suggested by them and set our maximum asset recovery factor $f=100\%-15\%=85\%$ for all credit ratings. As discussed in section 2, we set our monomial degree factor, $k=0$. Finally, we convert the cumulative default probabilities provided by Huang and Huang into annual probabilities of default and then from the expressions for annual default probabilities we solve for the implied competitive advantage parameter, $p$, using equations (18-19) from Rajaratnam et al (2016). Note that our expressions for annual default probabilities require an estimate of the coupon rate, $y$, therefore we solve for, $p$, and calculate, $y$, in an iterative manner. Table 2 provides our results for corporate debt of 10 year maturity and table 3 provides our results for corporate debt of 4 year maturity:

**Table 2: Accuracy of our proposed model when calibrated to Huang and Huang (2012) for 10 year maturities.**

This table presents the accuracy of our proposed model [equations (4-6)] for calculating corporate-treasury yield spreads when calibrated to Huang and Huang (2012) for 10 year maturity corporate debt. The table presents the Competitive Advantage Parameters obtained after calibration was performed. The table compares the spread obtained from our proposed model with the observed spreads from Huang and Huang (2012). Model accuracy is Model Spread divided by Observed Spreads in percentage terms.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Competitive Advantage</th>
<th>Annual Default</th>
<th>Model Spread</th>
<th>Observed Spreads</th>
<th>Model Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aaa</td>
<td>13.08</td>
<td>5.38</td>
<td>0.04</td>
<td>0.77</td>
<td>0.55</td>
</tr>
<tr>
<td>Aa</td>
<td>21.18</td>
<td>5.60</td>
<td>0.23</td>
<td>0.99</td>
<td>0.65</td>
</tr>
<tr>
<td>A</td>
<td>31.98</td>
<td>5.99</td>
<td>0.35</td>
<td>1.55</td>
<td>0.96</td>
</tr>
<tr>
<td>Baa</td>
<td>43.28</td>
<td>6.55</td>
<td>1.24</td>
<td>4.39</td>
<td>1.58</td>
</tr>
<tr>
<td>Ba</td>
<td>53.53</td>
<td>7.30</td>
<td>8.51</td>
<td>20.63</td>
<td>3.20</td>
</tr>
<tr>
<td>B</td>
<td>65.70</td>
<td>8.76</td>
<td>23.32</td>
<td>43.91</td>
<td>4.70</td>
</tr>
<tr>
<td>Rating</td>
<td>Parameter, $p$, (%)</td>
<td>Probability (%)</td>
<td>Model Spread (%)</td>
<td>Observed Spreads (%)</td>
<td>Model Accuracy (%)</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------</td>
<td>-----------------</td>
<td>------------------</td>
<td>----------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Aaa</td>
<td>0.46</td>
<td>0.08</td>
<td>0.41</td>
<td>0.63</td>
<td>66</td>
</tr>
<tr>
<td>Aa</td>
<td>0.36</td>
<td>0.10</td>
<td>0.67</td>
<td>0.91</td>
<td>74</td>
</tr>
<tr>
<td>A</td>
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<td>0.16</td>
<td>1.06</td>
<td>1.23</td>
<td>86</td>
</tr>
<tr>
<td>Baa</td>
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<td>0.45</td>
<td>1.63</td>
<td>1.94</td>
<td>84</td>
</tr>
<tr>
<td>Ba</td>
<td>3.23</td>
<td>2.28</td>
<td>3.21</td>
<td>3.20</td>
<td>100</td>
</tr>
<tr>
<td>B</td>
<td>6.31</td>
<td>5.62</td>
<td>6.05</td>
<td>4.70</td>
<td>129</td>
</tr>
</tbody>
</table>

Table 3: Accuracy of type I models when calibrated to Huang and Huang (2012) for 4 year maturities.

This table presents the accuracy of our proposed model [equations (4-6)] for calculating corporate-treasury yield spreads when calibrated to Huang and Huang (2012) for 4 year maturity corporate debt. The table presents the Competitive Advantage Parameters obtained after calibration was performed. The table compares the spread obtained from our proposed model with the observed spreads from Huang and Huang (2012). Model accuracy is Model Spread divided by Observed Spreads in percentage terms.

<table>
<thead>
<tr>
<th>Credit Rating</th>
<th>Competitive Advantage Parameter, $p$, (%)</th>
<th>Annual Default Probability (%)</th>
<th>Model Spread (%)</th>
<th>Observed Spreads (%)</th>
<th>Model Accuracy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aaa</td>
<td>0.06</td>
<td>0.01</td>
<td>0.31</td>
<td>0.55</td>
<td>56</td>
</tr>
<tr>
<td>Aa</td>
<td>0.21</td>
<td>0.06</td>
<td>0.54</td>
<td>0.65</td>
<td>82</td>
</tr>
<tr>
<td>A</td>
<td>0.22</td>
<td>0.09</td>
<td>0.84</td>
<td>0.96</td>
<td>87</td>
</tr>
<tr>
<td>Baa</td>
<td>0.56</td>
<td>0.31</td>
<td>1.30</td>
<td>1.58</td>
<td>82</td>
</tr>
</tbody>
</table>
As can be seen from Tables 2 and 3, the proposed model does not appear to suffer from the credit spread puzzle phenomenon to the degree that structural form models do.

**Results: Optimal Capital Structure under the PCIT regime**

To study optimal capital structure, we assume that the maximum recovery ratio, \( f = 0.85 \), effective tax rate \( T = 35\% \) and the probability of end of competitive advantage is taken from the set, \( p \in \{0.01, 0.05, 0.1, 0.2\} \). In our choice for risk free rates we consider both developed and emerging markets. In figure 1, we plot the coupon rate, \( y \), offered to debt holders for different leverage ratios under the assumption that the risk free rate \( r_N = 0.02 \) (which is typical of long term interest rates in developed markets).

In figure 2, we plot the coupon rate, \( y \), offered to debt holders for different leverage ratios under the assumptions that the risk free rate \( r_N = 0.10 \) (a much higher risk free rate than figure 1 and is more typical of the levels of long-term risk free rates found in emerging markets).
In both figures 1 and 2, as to be expected, the coupon rate increases with increasing leverage. Also higher coupon rates are offered under the same leverage ratio when the firm has a higher competitive advantage parameter – this is also to be expected as a higher probability of competitive advantage ending means more risk.
In figures 3 and 4, we plot the annual (normalized\(^8\)) benefit to equity holders from the tax deductibility of interest payments in relation to different leverage ratios and different competitive advantage parameters. In figure 3, we set the risk free rate as 0.02 and in figure 4 as 0.10. As can be seen in both figures, the portion of the tax benefit received by the equity-holders under the PCIT regime not only stays low under very low leverage ratios but also under very high leverage ratios, but reaching a maximum at medium leverage ratios. As discussed earlier, the managers of the firm would attempt to reach the optimal leverage ratio that maximizes the portion of the tax benefit received by equity-holders.

To view the optimal leverage ratios in a different manner, in figure 5, we plot just the optimal leverage ratio for the two risk free rates and for a wide range of probabilities of end of competitive advantage.

\(^8\) Normalized by Asset Values
As can be seen, for a wide ranging competitive advantage parameters ranging from 0.01 to 0.2, the optimal leverage ratio occurs within the range 55%-70%. As shown by Rajaratnam et al. (2014), a competitive advantage parameter, $p$, implies a certain expected competitive advantage period $ECAP$ - given by the relationship $ECAP = (1-p)/p$. $ECAP$ is the expected number of years for which a company can hold its competitive advantage. The range of competitive advantage parameters we use implies expected competitive advantage periods ranging from 4 years to 99 years and covers a very large spectrum of companies.

3.2 The BEPS regime

The main feature of the BEPS regime, in so far as interest deductibility is concerned, is that the maximum tax deductibility of interest payments is limited to a certain fraction of the firm’s EBITDA. The OECD BEPS study suggests a best practice corridor of 10% to 30% as the limit that countries should implement. The study also offers the guidance that higher interest rate countries should implement the limit at a higher level. Furthermore, the BEPS
project study shows that at a limit level of 30% of EBITDA, around 90% of legitimate third-party interest payments would not be affected by the BEPS interest limitation rule. However, at the same time, the 30% of EBITDA rule would effectively limit excessive earnings stripping by multinationals. It must be remembered that the main purpose of the BEPS framework is to prevent the egregious use of intra-company loans to strip profits and not to limit legitimate third-party interest deductions. Therefore, we employ the 30% of EBITDA limit as the limit for interest deductions in our study.

We model the BEPS framework under the strict assumption of ease of mobility of capital. In other words, we assume that capital is mobile from a cross border point of view and would seek out the geographies with the best returns for the same risk. To explain in a different way, consider two fundamentally identical companies resident in two separate countries that share the same currency (e.g., Euro area countries). Both countries are quite similar in most respects. They have the same corporate tax rate but one country has the PCIT regime and the other turns to implement the BEPS regime. Since capital is mobile and since both companies’ debt, by definition, faces the same fundamental risks, by virtue of the ease of mobility of capital issue, debt investors would demand the same debt coupon rate, \( y \), in the BEPS country as that in the PCIT country. In other words, we assume that the coupon rate in both countries would be that given by equations (4-6) irrespective of whether the country has implemented PCIT or BEPS\(^9\). This means that the debt holder is not prejudiced by the change in the tax

\(^9\) We admit that this is a strong assumption. In reality, the mechanics of BEPS (or modified BEPS in later sections) may warrant the bond holder to demand a higher coupon rate than in the PCIT scenario. But higher coupon rates under BEPS means that the main conclusion of our paper is even stronger. The main conclusion of our exposition is that BEPS adversely and significantly lowers the optimal leverage ratio in low EBITDA to Asset ratio companies. In such firms, where optimal leverage ratio is significantly lowered, the optimal leverage ratio, \( l \), is given by the equation, \( yl=0.3 \, \text{EB \_ AS} \), as discussed in the text immediately above equation (22). In this equation, if the coupon rate, \( y \), under BEPS is higher than that of PCIT, then the optimal leverage ratio would be lower, making our main conclusion, that BEPS significantly lowers the optimal leverage ratio in low EBITDA to Asset ratio companies, even stronger.
regime. However, the equity holder’s position is different in the two countries. In the country with BEPS, the equity holder will now face a limit to the tax deductibility of interest if the 30% of EBITDA threshold is breached and will bear the brunt of the reduction to the tax shield. It is worth pointing out that one of the key advantages of the rudimentary model by the Rajaratnams is that it is quite flexible in accommodating a change to the tax regime without a commensurate increase in tractability. It is simple to incorporate an EBITDA based rule within the Rajaratnams’ model to see the impact on optimal capital structure. This is not the case with conventional Mertonesque type models which, over above the usual complexities, typically only model the “stock” effect (i.e. asset values) rather than the “flow” effect (i.e. EBITDA profitability). The Rajaratnams’ model, by contrast, easily incorporates both stock and flow effects at the same time.

To model the EBITDA of a company we define the ratio $EB_{AS}$ as the EBITDA of the firm divided by the Assets of the firm. As can be expected, the $EB_{AS}$ ratio varies from company to company depending on a number of issues including how asset intensive the business is and how strong the competitive position is. Although $EB_{AS}$ is not a conventional parameter, its profile (and probability distribution) can be approximately inferred from figure 8 in Damodaran (2007) using the probability distribution of $ROIC$ (Return on Invested Capital) of different firms. Note that $ROIC$ is a more conventional parameter and is defined as EBIT $(1-TaxRate)/Invested$ Capital. Note that in our simple firm model, Assets equal Invested Capital. Assuming some typical Depreciation to Capital rates and Amortization to Capital rates in relation to the information from the chart in Damodaran (2007), we can choose a representative range of $EB_{AS}$ ratios for use in the results section later in our study.

Under BEPS, the total tax shield benefit to the firm, $B_F$, (both equity and debt holders) due to the tax deductibility of interest coupon in a given year is:
\[ B_F = yDT \quad \text{for} \quad yl \leq 0.3\ EB\_AS \quad (13) \]

\[ B_F = AT \ 0.3\ EB\_AS \quad \text{for} \quad yl > 0.3\ EB\_AS \quad (14) \]

As assumed earlier, the portion of the tax deductibility of interest coupons allocated to the debt holders, \( B_D \), in a given year is simply:

\[ B_D = D \ (y - y^*) = D \ y^* \frac{Tl}{1 - Tl} \quad (15) \]

Therefore, the annual benefit apportioned to the equity holder from the tax deductibility of interest coupons is the difference, \( B_E = B_F - B_D \):

[1] For \( yl \leq 0.3\ EB\_AS \):

\[ B_E = \left( \frac{-\sqrt{f^2 - 2pf(1+r_N)}}{pl} - 1 \right) \left( AT \frac{(1-l)}{1-Tl} \right) \quad \text{for} \quad l(1+y^*) \leq f \quad (16) \]

\[ B_E = \left( \frac{r_N+p-\frac{pf}{2l}}{1-p} \right) \left( AT \frac{(1-l)}{1-Tl} \right) \quad \text{for} \quad l(1+y^*) > f \quad (17) \]

[2] For \( yl > 0.3\ EB\_AS \):

\[ B_E = AT \ 0.3\ EB\_AS - \left( \frac{-\sqrt{f^2 - 2pf(1+r_N)}}{pl} - 1 \right) \left( AT \frac{l^2T}{1-Tl} \right) \quad \text{for} \quad l(1+y^*) \leq f \quad (18) \]

\[ B_E = AT \ 0.3\ EB\_AS - \left( \frac{r_N+p-\frac{pf}{2l}}{1-p} \right) \left( AT \frac{l^2T}{1-Tl} \right) \quad \text{for} \quad l(1+y^*) > f \quad (19) \]

The managers of a firm are agents of the equity holders of the firm. They would therefore optimize the firm’s capital structure to maximize the benefit to equity holders.

For \( yl \leq 0.3\ EB\_AS \): The optimal leverage ratio, if it occurs under this condition, can be obtained by taking the first order derivative of equations (16-17) with respect to the leverage ratio \( l \) and setting the results to zero and then solving for \( l \). The first order derivatives of equation (16-17) are:
\[
\frac{dB_E}{dt} = \frac{\Delta T}{p(1-Tl)^2} \left[ \left( \frac{pf(1+l)}{\sqrt{f^2 - 2plf(1+r_N) - pl}} \right) (1 - l)(1 - Tl) + \left( f - \sqrt{f^2 - 2plf(1+r_N) - pl} \right) (T - 1) \right] \quad \text{for } l(1 + y^*) \leq f
\]

\[
\frac{dB_E}{dt} = \frac{\Delta T}{2(1-p)(1-Tl)^2} \left[ (2r_N + 2p)(1 - l)(1 - Tl) + (2r_Nl + 2pl - pf)(T - 1) \right] \quad \text{for } l(1 + y^*) > f
\]

Thereafter, it is quite straightforward to obtain the optimal leverage ratio by setting the
appropriate equation to equal zero and solving the equation numerically.

**For \( yl > 0.3 \text{ EB}_A S \):** The optimal leverage, if it occurs under this condition, is reached when
\( yl = 0.3 \text{ EB}_A S \). This is because the expressions in the curly brackets \{ . \} in equations (18-19)
increase with increasing \( l \) for \( 0 \leq l \leq 1 \). Therefore the optimal leverage ratio may be obtained by
setting, \( yl = 0.3 \text{ EB}_A S \) which is the same as:

\[
\left( \frac{f - \sqrt{f^2 - 2plf(1+r_N)} - pl}{pl} - 1 \right) \left( \frac{l}{1-Tl} \right) = 0.3 \text{ EB}_A S \quad \text{for } l(1 + y^*) \leq f
\]

\[
\left( \frac{r_N + pf - pl}{1-p} \right) \left( \frac{l}{1-Tl} \right) = 0.3 \text{ EB}_A S \quad \text{for } l(1 + y^*) > f
\]

The above is an intuitive result and in some respects model independent. It is uncontroversial
to say that the tax shield, under PCIT, is a monotonously increasing function in leverage. It is
also uncontroversial (both theoretically and empirically) to say that the risk premium offered
to debt holders over and above expected loss is also monotonously increasing in leverage. If
we now assume that the benefit to equity holders comes from the difference between the two
(as suggested by the Rajaratnams), then the introduction of a cap on the tax shield via BEPS
automatically means that the maximum benefit to equity holders (i.e., the optimal leverage
ratio) must occur at or before the leverage ratio where the BEPS limitation first occurs
irrespective of the firm model used. This is because the first function is capped via BEPS but
the second one is not. However, the issue, for example, in using a Mertonesque type of model in place of the Rajaratnams’ model is that the credit spread puzzle phenomenon may underestimate coupon rates at low leverage levels when correctly calibrated to default probabilities and therefore overestimate the leverage ratio where the BEPS limitation first occurs in the equation $yl=0.3 \text{EB}_\text{AS}$.

*Results for the BEPS regime*

In the results section, as before, we assume that the maximum recovery ratio, $f=0.85$, effective tax rate $T = 35\%$ and the probability of end of competitive advantage is taken from the set, $p \in \{0.01, 0.05, 0.1, 0.2\}$. As before, we consider both a developed market risk free rate of 0.02 and an emerging market risk free rate of 0.10. The coupon rates offered to the debt holders (by the ease of mobility of capital assumption) are the same in the BEPS regime compared to the PCIT regime and therefore we do not repeat those results here. In figures 6 and 7, we plot the annual benefit to equity holders (normalized by asset values) from the tax deductibility of interest payments in relation to different leverage ratios where the $\text{EB}_\text{AS}$ ratio is 60%. In figures 8 and 9, we plot the (normalized) annual benefit to equity holders from the tax deductibility of interest payments in relation to different leverage ratios where the $\text{EB}_\text{AS}$ ratio is 25%.
As can be seen from figures 6-9, the interest limitation rule has a variable effect on the tax benefit received by the equity-holders under the BEPS regime. In some cases, it can
significantly affect optimal leverage ratios whereas in others it has less of an impact. As mentioned earlier, the interest limitation rule does not affect the coupon rate offered to debt holders. These coupon rates are the same for the PCIT and BEPS regimes. However, the effect of capping the tax deductibility of interest at 30% of EBITDA means that as soon as the cap kicks in for larger leverage ratios, the total tax benefit (to both equity and debt holders) is capped under the BEPS regime - unlike the PCIT regime where it increases continuously with increasing leverage. This means that the portion of the tax benefit received by the equity-holders immediately starts reducing beyond the point where the capping occurs.

This makes the leverage ratio at which the capping first occurs the optimal leverage ratio – unless, of course, the optimal leverage ratio has already been reached, at a lower leverage ratio, before the capping occurs. For firms with larger EBITDA to Asset ratios (e.g., \( EB\_AS=60\% \)), as can be seen from figures 6 and 7, the optimal leverage ratio is not that affected by the BEPS interest limitation rule. This is because larger EBITDA to Asset ratios means that leverage ratios need to get to very high levels before debt coupon rates are high enough to cause capping to occur. However, for firms with smaller EBITDA to Asset ratios (e.g., \( EB\_AS=25\% \)), as can be seen from figures 8 and 9, the optimal leverage ratio is more affected by the BEPS interest limitation rule. This is because smaller EBITDA to Asset ratios means that leverage ratios need not get to very high levels before debt coupon rates are high enough to cause capping to occur.

As mentioned in section 3.1, one of the reasons to allow the tax deductibility of interest is to enhance returns to equity holders in low return businesses which are vital to the economy and the wider society. However, the introduction of BEPS can reduce the optimal leverage ratio in low return businesses and thereby reduce the total debt capital that is appropriate for such businesses. This means that such low return businesses may in aggregate be capitalized at lower levels, and therefore produce goods and services in aggregate at a suboptimal size or
volume because the equity holders are not receiving the appropriate rate of return they are seeking. In other words, lower optimal leverage ratio leads to lower debt, leads to lower return for equity holders, leading to lower aggregate capital provision by equity holders, leading to lower production volumes in such firms. This has the potential of being negative for the wider economy and society at large.

To better view the effect on optimal leverage ratios as a result of implementing the BEPS regime, in figures 10 and 11, we plot just the optimal leverage ratio for the two risk free rates and for a wide range of probability of end of competitive advantages and a wide range of \( EB_{AS} \) ratios.

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10 Lower production volumes may not be the only outcome. Alternatively, if demand remains constant then pricing power will return to such firms, leading to higher prices and commensurately higher profits for equity holders, who will then be incentivized to provide sufficient capital that enables the production of sufficient volumes. We conjecture that the impact of implementing BEPS in low EBITDA to Asset ratio firms will be lower volumes and / or permanently higher prices for the goods and services produced by such firms.
From figures 10 and 11, it is clear that, the lower the $EB_{AS}$ ratio of the firm, the more it is impacted by the BEPS regime and the lower its optimal capital ratio. It is easy to explain the mechanics of why this occurs via the EBITDA based rule. However, although it is probably the lesser of two evils, it is a little unexpected that the design of the BEPS regime permits such a result. After all, it can be argued that higher $EB_{AS}$ firms earn higher economic rent whereas lower $EB_{AS}$ firms earn lower economic rent. In that sense, it is surprising that the BEPS regime appears to affect the lower economic rent earning companies more than their higher economic rent earning counterparts – to us, it seems more appropriate that higher economic rent earning firms should be the more natural target for tax measures$^{11}$.

$^{11}$ In fact, if natural persons pay a progressively higher tax rate on higher personal incomes, it seems sensible to us that legal persons (corporates) should pay progressively higher tax rates on higher rates of return earned on their assets.
3.3 The Modified BEPS (M-BEPS) regime

We now propose a modest modification to the BEPS regime. The original BEPS regime applies a flat rate as the limit on interest deductibility (which we set to 30% of EBITDA in this study). In our modified BEPS (M-BEPS) regime, we propose a progressive rate that is dependent on the firm’s EBITDA to Asset ratio. This progressive interest limitation policy (which is similar in concept to the progressive rates in personal income taxation) is spelled out in Table 4\(^\text{12}\) and presented figuratively in figure 12:

Table 4: Progressive Interest limitation policy

<table>
<thead>
<tr>
<th>EBITDA to Asset ratio</th>
<th>Maximum Interest Deductibility as % of EBITDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10%</td>
<td>50%</td>
</tr>
<tr>
<td>10-20%</td>
<td>50% maximum interest deductibility on the initial EBITDA equal to 10% of Assets; thereafter 30% maximum interest deductibility on the remaining EBITDA</td>
</tr>
<tr>
<td>20%+</td>
<td>40% maximum interest deductibility on the initial EBITDA equal to 20% of Assets; thereafter 10% maximum interest deductibility on the remaining EBITDA</td>
</tr>
</tbody>
</table>

\(^{12}\) Note that the parameters presented in Table 4 are for illustrative and explanatory purposes only. The actual progressive rates to be implemented can vary based on the risk free rate in a particular country (similar to the BEPS flat rate).
Let us look at some examples on how the table operates. Say for example, a firm has a 5% EBITDA to Asset Ratio. In this case, as per the table (row 1), the M-BEPS framework limits the maximum tax deductibility of interest payments to 50% of the company’s EBITDA. Now say, for example, a firm has a 15% EBITDA to Asset Ratio. In this case, as per row 2, the M-BEPS framework limits the maximum tax deductibility of interest payments to effectively 43.33% of the company’s EBITDA (obtained as 43.33%=[50% x 10% x Assets + 30% x (15%-10%) x Assets]/(15% x Assets)).

Under M-BEPS, we define $\Lambda$ as the effective interest limitation rate from Table 4. Thereafter, the total tax shield benefit to the firm, $B_F$, (both equity and debt holders) due to the tax deductibility of interest coupon in a given year is:

$$B_F = \gamma DT \quad \text{for} \quad \gamma l \leq \Lambda EBITDA$$ (24)

$$B_F = AT \Lambda EBITDA \quad \text{for} \quad \gamma l > \Lambda EBITDA$$ (25)
As shown in the previous section, the portion of the tax deductibility of interest coupons allocated to the debt holders, $B_D$, in a given year is simply:

$$B_D = D (y - y^*) = D y^* \frac{Tl}{(1 - Tl)} \quad (26)$$

Therefore, the annual benefit apportioned to the equity holder from the tax deductibility of interest coupons is the difference, $B_E = B_F - B_D$ is:

**[1] For $y l \leq \Lambda_{EB\_AS}$:**

$$B_E = \left( \frac{f - \sqrt{f^2 - 2pT(1 + r_N)}}{pT} - 1 \right) \left( \frac{A l T (1 - l)}{1 - Tl} \right) \quad \text{for } l(1 + y^*) \leq f \quad (27)$$

$$B_E = \left( \frac{r_N + p}{1 - p} \right) \left( \frac{A l T (1 - l)}{1 - Tl} \right) \quad \text{for } l(1 + y^*) > f \quad (28)$$

**[2] For $y l > \Lambda_{EB\_AS}$:**

$$B_E = AT \Lambda_{EB\_AS} - \left( \frac{f - \sqrt{f^2 - 2pT(1 + r_N)}}{pT} - 1 \right) \left( \frac{A l^2 T}{1 - Tl} \right) \quad \text{for } l(1 + y^*) \leq f \quad (29)$$

$$B_E = AT \Lambda_{EB\_AS} - \left( \frac{r_N + p}{1 - p} \right) \left( \frac{A l^2 T}{1 - Tl} \right) \quad \text{for } l(1 + y^*) > f \quad (30)$$

The managers of a firm are agents of the equity holders of the firm. They would therefore optimize the firm’s capital structure to maximize the benefit to equity holders.

**For $y l \leq \Lambda_{EB\_AS}$:** The optimal leverage ratio, if it occurs under this condition, can be obtained by taking the first order derivative of equations (27-28) with respect to the leverage ratio $l$ and setting the results to zero and then solving for $l$. The first order derivatives of equation (27-28) are:
\[
\frac{dB_E}{dl} = \frac{AT}{p(1-Tl)}\left[\left(\frac{pf(1+r_N)}{\sqrt{f^2-2pf(1+r_N)}} - p\right)(1-l)(1-Tl) + (f - \sqrt{f^2-2pf(1+r_N)} - pl)(T-1)\right]
\]  
for \(l(1+y') \leq f\) \hspace{1cm} (31)

\[
\frac{dB_E}{dl} = \frac{AT}{2(1-p)(1-Tl)^2}\left[(2r_N + 2p)(1-l)(1-Tl) + (2r_N l + 2pl - pf)(T-1)\right]
\]  
for \(l(1+y') > f\) \hspace{1cm} (32)

Thereafter, it is quite straightforward to obtain the optimal leverage ratio by setting the appropriate equation to equal zero and solving the equation numerically.

**For \(yl > A\) EB\_AS:** The optimal leverage, if it occurs under this condition, is reached when \(yl = A\) EB\_AS. This is because the expressions in the curly brackets \{ . \} in equations (29-30) increases with increasing \(l\). Therefore the optimal leverage ratio may be obtained by setting, \(yl = A\) EB\_AS which is the same as:

\[
\left(\frac{f - \sqrt{f^2-2pf(1+r_N)}}{pl} - 1\right)\left(\frac{l}{1-Tl}\right) = A\ EB\_AS
\]
for \(l(1+y') \leq f\) \hspace{1cm} (33)

\[
\left(\frac{r_N + p - pf}{2l}\right)\left(\frac{l}{1-Tl}\right) = A\ EB\_AS
\]
for \(l(1+y') > f\) \hspace{1cm} (34)

**Practical implications of the proposed M-BEPS**

The M-BEPS proposal has some distinct advantages:

- The M-BEPS proposal allows higher interest deductibility in lower EBITDA to Asset Ratio companies. This is quite beneficial for highly capital intensive firms (including public private partnership, utilities, long-term construction projects etc.) which invariably have lower EBITDA to Asset ratios and which were put at a disadvantage by the original BEPS rule. They will now be allowed larger interest deductibility.

- The M-BEPS proposal reduces the interest deductibility at higher thresholds of EBITDA to Asset ratios. It may be argued that higher EBITDA to Asset ratio
companies are more rent seeking in nature than lower ratio companies and therefore it seems only proper that they are the focus of limiting the revenue leakage from the fiscus.

- Invariably, during business cycles, the EBITDA to Asset ratio of a firm changes in a cyclical manner. The structure of the M-BEPS proposal is that firms enjoy larger effective caps on interest deductibility (that is, they are allowed larger portions of EBITDA to be deductible for interest purposes) at lower EBITDA to Asset ratios meaning that firms enjoy a more favorable treatment at the recessionary low point in the business cycle.

We also propose a number of practical implementation rules for the M-BEPS as follows. The EBITDA of a company in the EBITDA to Asset ratio should be calculated as per the original OECD BEPS proposal. It is on the calculation of the Asset Value of the company that we provide some suggestions:

- The Asset Value of the company should be the historical accounting based Asset Value on the latest Balance sheet of the company (post the usual deductions such as accumulated depreciation);

- The Asset Value should be adjusted down for acquisition related Goodwill on the Balance sheet (or anything that can be deemed to be acquisition related Goodwill). It is our simple view that governments should lean towards providing a more favored status for interest deductibility that arises when firms invest in real assets as opposed to largely financial assets (like the equity or debt of another company). This view appears to be in the same direction as the 2016 US treasury’s preliminary proposals.

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13 Note that the modifications that we suggest here for determining the Asset values only apply to the Asset values in the EBITDA to Asset ratio (EB_AS) calculation and nowhere else.
on preventing tax inversions that limit the interest deductibility of intercompany debt issued after 4 April 2016 to the extent that it does not finance US investments.

- The Asset Value should exclude or be adjusted down for any equity accounted investments by the firm in question (i.e., any investment where it does not hold a majority stake). This is to discourage companies from using debt to take equity investments in other businesses and then expect larger interest deductibility in Table 4 as a result of the purchase.

- The Asset Value should be adjusted down for all loans or debt instruments on the Asset side of the balance sheet. To be clear, these are loans provided by the company and not to the company as they sit on the asset side of the balance sheet. Our proposal would help limit the use of intercompany loans to obtain an artificially higher Asset figure and therefore benefit from better interest deductibility in Table 4.

- The Asset Value should be adjusted down for all related party transactions listed on the asset side of the balance sheet whether they are physical assets or financial assets. In many countries, related party transactions are founds in the Notes to the annual financial statements of a firm.

Most of our suggestions above are to prevent companies from engaging in balance sheet manipulation to artificially benefit from M-BEPS, for example, by issuing shares and artificially inflating the asset side of the balance sheet. Even with these measures, we can envisage scenarios where companies can artificially modify their Asset figure higher to get better interest deductibility in the M-BEPS regime. To discourage this behavior, authorities can resort to more traditional mechanisms such as anonymous whistle blowing and penalties.
Results for the M-BEPS regime

To better view the effect on optimal leverage ratios as a result of implementing the M-BEPS regime, in figures 13 and 14, we plot the optimal leverage ratio for the two risk free rates and for a wide range of probability of end of competitive advantages and a large range of $EB_{AS}$ ratios under the M-BEPS regime and compare these results to those obtained under the original BEPS regime.
The general theme of the results is that for lower EBITDA to Asset ratios, the optimal leverage ratio is higher within the M-BEPS regime compared to the BEPS regime. This is because for $EB_{AS}=10\%$, the M-BEPS regime caps the interest limitation at 50% of EBITDA whereas BEPS regime limits it at the fixed rate of 30% of EBITDA. At the EBITDA to Asset ratio of 30%, both M-BEPS and BEPS regimes result in the same optimal leverage for all competitive advantage parameters, $p$. This is because as per table 4, the effective cap on interest deductibility is derived to be 30% of EBITDA in the M-BEPS regime which is the same as the flat rate in the BEPS regime. At the high EBITDA to Asset ratio of 50%, the M-BEPS regime, as per table 4, leads to an effective cap at 22% of EBITDA which is lower than 30% of EBITDA rate in the BEPS regime and therefore for high competitive advantage parameters, the M-BEPS regime has slightly lower optimal leverage ratios than the BEPS regime.
Discussion

In this paper, we present a novel approach to optimal capital structure. The key difference between our model and existing models is that existing models place large significance on volatility - the CAPM employs beta whereas Mertonesque models employ asset volatility to capture risk. Instead, we follow the approach by Rajaratnam et al. (2014, 2016) and place greater weight on the competitive advantage of the firm. As shown by Rajaratnam et al. (2016), it is easy to obtain endogenous expressions for corporate treasury yield spreads under their model. We first obtain optimal capital structure under the prevalent corporate income tax regime where full tax deductibility of interest is permitted. Then we employ the recently proposed BEPS (Base Erosion and Profit Shifting) OECD best practice framework and institute an EBITDA-based limit on the tax deductibility of interest to gauge the impact of the BEPS framework on a firm’s optimal capital structure. We show that BEPS can significantly and adversely reduce the optimal leverage ratio in firms with lower EBITDA to Asset ratios and potentially reduce the aggregate capital available to such firms. We conjecture that this may cause negative economy wide implications in the form of either lower production volumes and / or permanently higher prices for the goods and services produced by such firms. Thereafter, we propose a modification to the original BEPS framework and show that our modification can provide some benefits to firms with lower EBITDA to Asset ratios.

Governments face a number of difficulties with the prevalent corporate income tax regime. In table 5, we present our view on how well the PCIT and BEPS regimes handle these difficulties\textsuperscript{14}.

\textsuperscript{14} Incidentally, an alternate tax regime that has been mooted is the proposal by Pozen and Goodman [2012]. They suggest that, in the US, corporates should only be allowed to deduct 65\% of their interest expense and that this simultaneously allows the corporate tax rate to be reduced from 35\% to 25\%. Our initial studies suggest that the Pozen and Goodman proposal can potentially be quite punitive on the optimal leverage ratio and in a much
Table 5: Pros and Cons of implementing the PCIT versus the BEPS and M-BEPS regimes

<table>
<thead>
<tr>
<th>Issues facing Governments</th>
<th>PCIT regime</th>
<th>BEPS and M-BEPS Regimes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Earnings Stripping Issue</strong></td>
<td>Exposed to earnings stripping</td>
<td>Designed to discourage earnings stripping but allow the majority of legitimate 3rd party interest payments</td>
</tr>
<tr>
<td><strong>Over Leverage Issue</strong></td>
<td>Encourages over leverage due to the tax favored status of debt</td>
<td>By-product of the BEPS interest limitation rule: discourages over-leverage, especially in low EB_AS firms M-BEPS regime, on the other hand, allows for somewhat higher leverage in low EB_AS firms, compared to BEPS However, in a general sense, both BEPS and M-BEPS discourage extreme over leverage.</td>
</tr>
<tr>
<td><strong>Tax timing / Tax burden imbalance in retirement funds issue</strong></td>
<td>Exposed to the favored status of debt versus equity</td>
<td>Largely similar exposure as the PCIT regime</td>
</tr>
<tr>
<td><strong>Excessive LBO/PE issue</strong></td>
<td>Exposed to the excessive LBO/PE issue</td>
<td>Reduces excessive LBO/PE</td>
</tr>
</tbody>
</table>

wider range of companies than BEPS. This is because, the two elements of their proposal, lower corporate tax rates and lower tax deductibility, both work in concert to (1) increase the yield required by bond holders compared to the original pre-proposal scenario and therefore (2) drastically reduce the value available for equity holders from the tax deductibility of interest expense.
<table>
<thead>
<tr>
<th><strong>Helping Hand for SME issue</strong></th>
<th>Tax favored status of debt may be a helping hand for SME</th>
<th>Designed to allow most of legitimate 3rd party interest payments and has a de-minimis rule to help small firms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Debt as an important asset class issue</strong></td>
<td>Tax favored status of debt allows debt to continue being a large and important asset class</td>
<td>Majority of debt in issue (value wise) is investment grade: BEPS (or for that matter M-BEPS) was designed not to affect a large portion of legitimate 3rd party interest payments and therefore should continue to support debt as an important asset class</td>
</tr>
</tbody>
</table>

The PCIT regime is clearly exposed to the earnings stripping issue. On the other hand, the BEPS and M-BEPS regimes, by design, do not permit tax deduction of intra-company or 3rd party interest payments over and above a fixed proportion of the firm’s EBITDA. It must be pointed out that the design of BEPS was with a very specific goal in mind – to discourage earnings stripping. On this aspect, the BEPS regime (Action 4: Interest Deductions and Other Financial Payments) is largely fit for purpose and has largely been designed to avoid the many loopholes that companies may employ to create avenues for earnings stripping [OECD (2015)]. This does not mean that we do not think that there is room for improvement on the BEPS regime for some of the other issues mentioned in table 5. As discussed in section 3.3, our modified BEPS (M-BEPS) has some distinct advantages over BEPS, in terms of [a] not being punitive on lower EBITDA to Asset ratio companies, [b] being a little stricter with higher EBITDA to Asset ratio companies in terms of profit shifting and [c] being a little more responsive to the business cycle.
As a by-product of the EBITDA based interest limitation rule, the BEPS and M-BEPS regimes will discourage excessively overleveraged LBO / Private equity deals. However, further study is necessary before a more conclusive statement is possible. On the over leverage issue, compared to the PCIT regime, the BEPS regime discourages over-leverage by companies which have lower $EB/AS$ ratios (by reducing their optimal leverage point). However, as shown in the results section, the BEPS regime does not affect high $EB/AS$ ratio firms. Our modification to the BEPS regime allows lower EBITDA to Asset ratio companies to attain higher optimal leverage levels. However, on final analysis, both BEPS and MBEPS will naturally discourage extreme leverage in firms due to limitations on interest deductibility.

Although they help by reducing the tax favored status of debt, complementary rules to the BEPS/MBEPS regimes may be appropriate to further reduce the tax timing / tax burden imbalance in retirement funds issue. Given that the BEPS/MBEPS regimes were designed to allow a large portion of legitimate 3rd party interest and given that they have a de-minimis rule, we feel that the BEPS/MBEPS regimes are reasonably useful in providing a helping hand for SMEs and for maintaining debt instruments as an important asset class relative to the PCIT regime.

References


