“Credit ratings and firm value”

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CREDIT RATINGS AND FIRM VALUE

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Abstract

A topic of relevance to financial managers is the relation between a credit rating and firm value (V_L). The general aim of this paper is to elucidate this relation with a specific objective of helping C corp managers choose an optimal target rating (*OTR*). To achieve these goals, we use the Capital Structure Model (CSM) to compute a series of firm value (V_L) outcomes matched to credit ratings. The maximum V_L (*max* V_L), among all V_L outcomes, identifies *OTR*. This identification begins with the matching of credit spreads and ratings by Damodaran (2019) for three firm categories: *small*, *large*, and *financial service* (*FS*). Given these spreads, we can compute costs of borrowing with these costs needed to compute V_L and other numerical outcomes. Besides costs of borrowing, our numerical outcomes are based on other key inputs including US $1,000,000 in before-tax cash flows, C corp tax rates, and a sustainable growth rate. Major findings that guide managers include the following. *First*, Moody's A3 is the most common *OTR*. *Second*, growth firms generally require higher ranked *OTRs*. *Third*, compared to *small* and *large* firms, *FS* firms attain greater *max* V_L values, higher optimal debt-to-firm value ratios (*ODVs*), and generally lower ranked *OTRs*. *Fourth*, relative to *small* firms, *large* firms gain less from growth even though they attain greater *max* V_L outcomes. *Fifth*, only for *FS* firms can we find outcomes where operational cash flows are better spent on interest payments than retained internally for growth.

Keywords credit ratings, firm valuation, growth leverage

JEL Classification G32, G35

INTRODUCTION

A credit rating is a measured assessment of the creditworthiness of a borrower in general terms or a debt obligation in specific terms. A vital task for managers is to discern the relation between firm value (V_L) and credit ratings. To discover this relation, we apply the Capital Structure Model (CSM) using inputs consisting of before-tax cash flow, costs of borrowing based on credit spreads, C corp tax rates, and a sustainable growth rate. These inputs enable us to calculate V_L for a sequence of debt-for-unlevered equity choices that are matched to credit ratings.

Using the CSM, we are able to show how V_L changes based on a target credit rating. Given the concave downward shape of the relation between V_L and debt-to-firm value ratios (*DVs*) where each *DV* is associated with a credit rating, we can identify the maximum firm value (*max* V_L) and thus the optimal target rating (*OTR*). Because *max* V_L is tied to *OTR*, it is incumbent on a firm's managers to know and achieve its *OTR*. Whereas a firm can target a credit rating, only a rating agency can assign a credit rating to a firm and thus insure that the managerial choice of an *OTR* is realized.

Firm valuation depends on operating cash flows and how these cash flows are discounted as well as how they growth. For our tests, discount rates (or costs of borrowing) are based on fifteen credit spreads

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that Damodaran (2019) matches to interest coverage ratios (*ICRs*) and credit ratings. Damodaran supplies *ICRs* for the firm categories of *small, large*, and *financial service* (*FS)* enabling us to compare outcomes based on three firm categories. Growth tests require a long-run sustainable growth rate that fits the perpetuity nature of the CSM. For our growth tests, we set the CSM's levered equity growth rate (g_L) at 3.12%, which is a rate consistent with the annual growth in real US GDP as supplied by the US Bureau of Economic Analysis (2019) for the past seventy years. The use of g_L as a proxy for growth in real GDP assumes that GDP mirrors the growth in businesses and, in particular, in the risk-taking residual equity ownership of businesses.

This is the first study to use US data in conjunction with g_L to identify *OTR*s. This study also involves the first application of the CSM that uses real world data where costs of borrowings can be directly matched to *DVs* and credit ratings. As shown in section 3, borrowing costs are derived from credit spreads that are matched by Damodaran (2019) to *ICRs*. Using credit spreads to derive costs of borrowing associated with *DVs* is consistent with researchers (Graham & Harvey, 2001; Kisgen, 2006; Kisgen, 2009) who advocate that credit ratings rank higher than other factors in determining capital structure decision-making.

The remainder of this paper is as follows. Section 1 reviews the literature relevant to this study. Section 2 provides the methodology. In section 3, the results from the tests are presented. Section 4 discusses our results and the final section offers conclusions.

1. LITERATURE REVIEW

This section reviews and identifies effective (average) federal tax rates in the US and overviews capital structure models including the model used in this paper.

1.1. US Effective Federal Tax Rates under Tax Cuts and Job Acts (TCJA)

For this study, we use US data given by Damodaran (2019) who relies on a sample of 7,247 publicly traded US firms with 16.7% being financial service firms. Based on surveying Damodaran's sample, we find that his sample of companies mainly contain the C corps ownership type (as opposed to the pass-through ownership type that does not pay corporate taxes). Thus, our CSM tests use federal tax rates that apply to C corp owners.

In identifying the unlevered and levered tax rates in this section, we follow Hull (2014b) by allowing tax rates to change in their predicted direction for each increasing *P* choice where a *P* choice refers to the proportion of unlevered equity (E_U) retired with a new debt issue. Hull argues that corporate and personal equity tax rates decrease with each increasing *P* choice while personal debt tax rates increase. For our tests, we use a 3% change in a tax rate for each of the fifteen increasing *P* choices with each tax rate fixed at four decimal points. The use of 3% in conjunction with the setting of unlevered tax rates enable us to achieve the desired effective levered tax rates that should occur near the optimal target rating (*OTR*).

US tax rates became lower with the enactment of the Tax Cuts and Jobs Act (TCJA) during December 2017. The US corporate tax rate (T_C) was lowered from a maximum statutory rate of 35% to a flat rate of 21%. Considering tax credits and deductions, an effective T_C will be below 21%. For our tests, we want an effective T_C around 18%, which is consistent with what the Penn Wharton Budget Model (2017) projections for T_C under TCJA. Since T_C is expected to fall with leverage, we set T_C at its flat rate of 21% when the firm is unlevered so that the effective levered T_C is near 18% when *OTR* is reached. For our fifteen tests the mean (median) effective T_C is 18.23% (18.26%) with a standard deviation of 0.62%. An effective tax rate, be it a corporate rate or a personal tax rate (as discussed below), shows little variation among the three firm categories.

C corps equity investors buy and sell shares and receive non-qualified dividend with a US maximum personal tax rate on equity (T_E) of 37% un-

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der TCJA. However, for qualified dividends as well as capital gains, the typical maximum T_E is 20%. Whereas the extremely wealthy pay 23.8% instead of 20%, lower income investors pay at rates of 0% and 15% with investors having the ability to defer capital gains so that, through charitable contributions and inheritance, T_E can be zero. Given the above information, we advocate a levered effective T_E on equity income of about 14%. To achieve 14%, we set the unlevered T_E at 16%. For our fifteen tests the mean (median) effective T_E is 13.89% (13.91%) with a standard deviation of 0.47%.

Interest distributions for C corp debt owners are taxed at the personal debt tax rate (T_D) that has a US maximum of 37% under TCJA. If debt is held longer than three years, any capital gains is taxed at a lower capital gains rate with a typical T_D of 20%. Wealthier investors who invest in debt can avoid the maximum of 37% by investing in municipal bonds so that T_D is zero. Given the above factoids, we expect most corporate debt to have an effective T_D well below the maximum T_D of 37%. While a wide range of possible T_D outcomes can exist among investors (like all tax rates), we use a levered effective T_D near 21%. To achieve 21%, we set the unlevered T_D at 18%. For our fifteen tests the mean (median) effective T_D is 20.68% (20.63%) with a standard deviation of 0.68%.

1.2. Capital Structure Models

With the fall in T_C under TCJA, the interest tax shield (*ITS*) for a C corp is less of a benefit, albeit this is somewhat offset by lower taxes paid on interest income. Agency models provide a framework where an optimal debt-to-firm value ratio (*ODV*) can exist even without the presence of an *ITS*. Jensen and Meckling (1976) demonstrate how maximum valuation occurs at *ODV* simply from principal-agent valuation effects. As agents of debt owners, equity owners can undertake risky projects to enhance their residual ownership positions at the expense of debt owners. Besides agency effects involving project selection, there are owner-manager agency effects. For C corps with many shareholders, there can be almost perfect separation between owners and managers leading to owner-manager conflicts. For smaller C corps, these problems can be eliminated since owners and managers are more apt to be the same. In general, agency models point out the need to monitor those in charge. For example, consider a firm with a glut of cash flows that leads to unwarranted compensational schemes by those who are in charge. Jensen (1986) points out that such a firm can add value by issuing additional debt because greater interest payments serve to lessen the squandering of cash flows. In conclusion, even in a world without taxes, agency costs and benefits can dictate that an *ODV* exists.

In addition to agency models, pecking order models of financing (Donaldson, 1961; Myers, 1977; Myers & Majluf, 1984) do not depend solely on taxes. For pecking order proponents, the preference in financing is retained earnings (internal equity) followed by debt issuances. New stock issues (external equity) is the last resort due to flotation costs and asymmetric information costs reflected in the negative signaling that accompanies a new stock offering. Pecking order models do not address the high after-tax costs experienced by firms that use internal funds in the form of retained earnings. Prior to TCJA, retained earnings was taxed as a maximum T_C of 35%. Consistent with the empirical research overviewed by McBride (2012) and the general belief, as voiced by Pomerleau (2017), that high taxes are bad for businesses, Hull (2010, 2018) derives growth rate formulas that underscore how high corporate tax rates can make growth through retained earnings too costly to undertake. These formulas take into consideration the unfair and arbitrary tax law (Doran, 2009; Polito, 2017) governing retained earnings and interest where only interest experiences greater tax exemption.

Trade-off theory (Baxter, 1967; DeAngelo & Masulis, 1980; Hackbarth et al., 2007; Berk et al., 2010; Hull, 2018) posit that there is an optimal amount of equity and debt that maximizes firm value. Trade-off models are consistent with empirical research (Graham, 2000; Korteweg, 2010; Van Binsbergen et al., 2010). This research shows that firm value increases from 4% to 10% with debt. While these findings occurred before TCJA, this range is consistent with our *small* firm mean of 5.18% and our *large* firm mean of 9.08% given later in Table 2.

2. METHODOLOGY

In this paper, we use a trade-off model to determine outcomes from potential target credit rating choices. This trade-off model is the Capital Structure Model (CSM). Hull (2018) updates the nongrowth and growth CSM research as applied to C corps. This update includes the modification of the levered equity growth rate (g_L) equation and the introduction of nongrowth and retained earnings (*RE*) constraints when applying the CSM gain to leverage (G_L) equations. These constraints prevent a firm from issuing more debt than its cash flows can support. For our tests, constraints always occur after *OTR* is reached.

The CSM is unique as it is captures the interdependent of growth and debt through a variable, the levered equity growth rate (g_L), that directly ties together the plowback-payout and debt-equity choices. Since retained earnings (*RE*) equals the plowback ratio (*PBR*) times the before-tax cash flows (CF_{BT}) and the g_L is defined in terms of *RE*, the CSM allows us to change *PBR* until our chosen g_L is achieved for the leverage choice that corresponds to a target rating. For our tests, we use the CSM's two component equations that allow for changes in tax rates. This equation does not include a third component that captures wealth transfers (Hull, 2014a).

3. RESULTS

This section provides results using the CSM equations for C corps. *First*, we compute costs of debt (r_D) and costs of equity (r_L). We show how each cost is matched to a *proportion* of unlevered equity retired with debt (*P* choice) and a debt-to-firm value ratio (*DV*). *Second*, we graphical display the concave downward relation between the gain to leverage (G_L) and the debt-to-firm value ratio (*DV*). *Third*, we present eleven outcomes in table format for our fifteen tests. *Fourth*, we graphical display the concave downward shape when plotting firm values versus credit ratings.

3.1. Computing Costs of Borrowing

Table 1 reports outcomes for eight variables in eight columns. The first column has Moody's credit ratings. The other seven columns are ordered as follows: *P* choice; *DV*; credit spread (that relies on http://www.bondsonline.com); cost of debt (r_D); cost of equity (r_L); levered equity growth rate (g_L); and, growth-adjusted cost of equity (r_{Lg}). The data for the credit rating and credit spreads in Table 1 are from Damodaran (2019) who supplies data for three firm categories: *small*, *large*, and *financial service* (*FS*).

Outcomes in Table 1 are for one of our fifteen tests. This test is for a *large* growth firm that targets a Moody's rating of A3. As will be seen in Table 2, this A3 target is also the *OTR*. Results for A3 are in the bold print row of Table 1. According to Morningstar (2019), nearly 30% of all new debt obligations in recent years have a credit rating of A3 even though there are up to twenty-one other possible ratings to choose from. As presented later in this section, an A3 rating is the optimal target rating (*OTR*) for most of our tests.

We begin the process to compute costs of borrowing by retrieving fifteen credit spreads from Damodaran (2019) that are matched to fifteen credit ratings and fifteen interest coverage ratios (*ICR*s) for each of Damodaran's three firm categories. The use of fifteen when referring to Damodaran's data should not be confused with our use of fifteen when referring to our fifteen tests. Damodaran's *small* firm category includes non-FS firms with a market capitalization under five billion US dollars while his *large* firm category consists of non-FS firms that are over five billion US dollars.

Damodaran reports *ICRs* for each firm category in terms of ranges where the upper bound for the first *ICR* is 100,000 implying a virtual unlevered outcome for the highest credit rating of Aaa. Instead of taking the midpoint of this range (as that would still be a virtual unlevered outcome), we reduce the first *ICR* midpoint for each firm category so it yields a first levered *P* choice for a rating of Aaa that is reasonably close to being in the middle between zero (the unlevered *P* choice) and the second levered *P* choice for a rating of Aa2. We use the midpoint for the next thirteen *ICR* ranges to determine the next thirteen *ICRs*. The last range for the *small* firm category has the same problem as the first range with a lower bound range of –100,000. For *small* firms, we use an approach similar to that used for its first range when assigning values. However, for

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Table 1. Costs of Borrowing for Debt and Equity Matched to Credit Ratings

As described in this section, this table reports outcomes for eight variables for a test where a *large* growth firm targets a Moody's rating of A3. This is one of our fifteen tests for which results are reported later in Table 2. A *P* choice is the proportion of unlevered equity (E_U) retired by debt and *DV* is the debt-to-firm value ratio. The bold print row contains the optimal outcomes. Thus, the target A3 rating is also the *OTR*. The gray shaded rows indicate that the *RE* (growth) constraint given by Hull (2018) is violated and so outcomes in these rows are not feasible. For the first row, the costs of borrowing are actually unlevered outcomes. For example, r_D is the risk-free rate; r_L is r_U; g_L is g_U; and r_{Lg} is r_{Ug} where the "U" refers to unlevered outcome. All other rows supply levered outcomes.

Moody's Rating	*P* choice	DV	Credit spread	Cost of debt (r_D)	Cost of equity (r_L)	Levered equity growth rate (g_L)	Growth-adjusted cost of equity (r_{Lg})
	0.0000	0.0000	0.0000%	3.0000%	7.0000%	2.2162%	4.7838%
Aaa	0.1092	0.1052	0.7500%	3.7500%	7.2000%	2.3398%	4.8602%
Aa2	0.2185	0.2047	1.0000%	4.0000%	7.4500%	2.5291%	4.9209%
A1	0.2571	0.2407	1.2500%	4.2500%	7.7000%	2.8592%	4.8408%
A2	0.3073	0.2834	1.3750%	4.3750%	7.8250%	2.8592%	4.9658%
A3	**0.3960**	**0.3575**	**1.5625%**	**4.5625%**	**8.0125%**	**3.1193%**	**4.8932%**
Baa2	0.4757	0.4296	2.0000%	5.0000%	8.4500%	3.7175%	4.7325%
Ba1	0.4580	0.4368	3.0000%	6.0000%	9.4500%	4.9479%	4.5021%
Ba2	0.4643	0.7542	3.6000%	6.6000%	10.0500%	-5.5922%	15.6422%
B1	0.4617	0.7867	4.5000%	7.5000%	10.9500%	-4.8753%	15.8253%
B2	0.4740	0.8401	5.4000%	8.4000%	11.8500%	-4.3259%	16.1759%
B3	0.4880	0.9183	6.6000%	9.6000%	13.0500%	-3.7455%	16.7955%
Caa	0.5213	1.1054	9.0000%	12.0000%	15.4500%	-2.9776%	18.4276%
Ca2	0.6248	1.4108	11.0800%	14.0800%	17.5300%	-2.4699%	19.9999%
C2	0.8505	2.1207	14.5400%	17.5400%	20.9900%	-1.8560%	22.8460%
D2	1.4072	3.9720	19.3800%	22.3800%	25.8300%	-1.2170%	27.0470%

the *large* and *FS* firm categories, we simply use the upper bound of the range since it is the least unfeasible selection. For our fifteen tests, the smallest and largest *ICRs* are 0.05 and 24, respectively.

While *ICR* is traditionally defined as $EBIT/I$, Damodaran (2019) refers to *ICR* as after-tax operating income divided by interest (I). Thus, for Damodaran, $ICR = (1–T)EBIT/I$ where T is the effective tax rate on business income, which for C corps is the effective corporate tax rate. Rearranging the *ICR* equation and noting that T is the same as the levered corporate tax rate (T_{C2}) used by Hull (2018) and *EBIT* is the accounting term for the CSM's cash flows before taxes (CF_{BT}), we have $I = (1-T_{C2})CF_{BT}/ICR$ where we assign \$1,000,000 to CF_{BT} for all tests. Since there are fifteen *ICR* outcomes per firm category, we can compute fifteen I outcomes for each *small*, *large* and *FS* test. I outcomes are before personal taxes are paid on interest income and thus are the same as that found in a financial statement.

From these fifteen I outcomes for each firm category, we use corresponding outcomes for the effective tax rate on debt (T_D) and the cost of debt (r_D) to calculate fifteen debt (D) outcomes where $D = (1-T_D)I/r_D$. After computing fifteen D outcomes, we compute fifteen P choice outcomes where P choice $= D/E_U$ with E_U standing for unlevered equity. Table 1 reports P choices in the second column. The first row contains the unlevered P choice of zero while the next fifteen rows have levered P choices. It can be noted that outcomes for P choices differ for each test because *ICRs* and/or E_U outcomes change with each test.

The "*DV*" column reports *DV* outcomes where $DV = D/V_L$ with $V_L = G_L + E_U$ where V_L is firm value and G_L is the gain to leverage. This column reveals a sequence of increasing *DV* outcomes that are matched to credit ratings that fall in quality. This sequence is needed to identify the *DV* and the credit rating that correspond to *max* V_L and, respectively, become *ODV* and *OTR*.

To get fifteen costs of debt (r_D) that correspond to fifteen P choices, we add each credit spread to the risk-free rate (r_F) of 3% so that $r_D = r_F$ + credit spread. An r_F of 3% is consistent with the 30-year government bonds as given by FRED (2019a) the past fifteen years. For the credit rating of A3 in Table 1, the credit spread given by Damodaran (2019) is 1.5625%. Thus, for a rating of A3, we have: $r_D = r_F$ + credit spread = 3% + 1.5625% = 4.5625%. This outcome is reported in the bold print row of the "Cost of debt (r_D)" column.

To get the costs of equity (r_L), we add an equity risk premium over a corporate bond portfolio (*EPB*) to each cost of debt. Damodaran (2019) suggests that *EPB* is near 3.1% while FRED (2019b) indicates 3.5% to 4.1% with an average of 3.8%. Since the midpoint of 3.1% and 3.8% is 3.45%, we use *EPB* = 3.45%. By adding 3.45% to our fifteen increasing r_D outcomes, we get fifteen increasing r_L outcomes given by $r_L = r_D + EPB$. Continuing our illustration for an A3 rating, we have $r_L = r_D + EPB = 4.5625\% + 3.45\% = 8.0125\%$, which is reported in the bold print row of the "Cost of equity (r_L)" column. The cost of equity in the first row of 7% is actually the unlevered cost of equity (r_U) as this outcome occurs for the unlevered *P* choice of zero. This outcome of 7% is computed using the CAPM with a market return (r_M) of 8% and the unlevered equity beta (β_U) of 0.8 where r_M and β_U are consistent with data given by Damodaran. To illustrate, we have: $r_U = r_F + \beta_U(r_M - r_F) = 3\% + 0.8(8\% - 3\%) = 7\%$.

The outcomes for the growth test in Table 1 (like all growth tests) are based on choosing a target credit rating and setting the plowback ratio (*PBR*) so that the historical growth rate of 3.12% is achieved for that target. In Table 1, this is achieved in the bold print row where we find 3.1192% in the "Levered equity growth rate (g_L)" column where 3.1192% is the closest approximation to 3.12% when limiting *PBR* to four decimal places. The rate of 3.12% is an historical sustainable rate based on a seventy-year period as described earlier. The first row of this column is actually the unlevered growth rate (g_U). This rate, as derived by Hull (2010), is a function of *PBR*. Each g_U can be different causing a different E_U outcome for each growth test (as will be seen in Panels B, C, and D in Table 2).

The last column provides outcomes for the growth-adjusted cost of equity (r_{Lg}) where the first row is actually the growth-adjusted cost of unlevered equity (r_{Ug}). Outcomes for r_{Lg} are computed as $r_{Lg} = r_L - g_L$ (for the first row, it is $r_{Ug} = r_U - g_U$) While not shown in Table 1, we can compute outcomes for debt betas (β_D) and equity betas (β_E) using the CAPM. For our *large* growth test in Table 1, $\beta_D = 0.3125$ and $\beta_E = 1.0015$ for a rating of A3. The latter is near the market beta (β_M) of 1.00. For all of our tests, the typical *OTR* occurs with a β_E that is close to β_M.

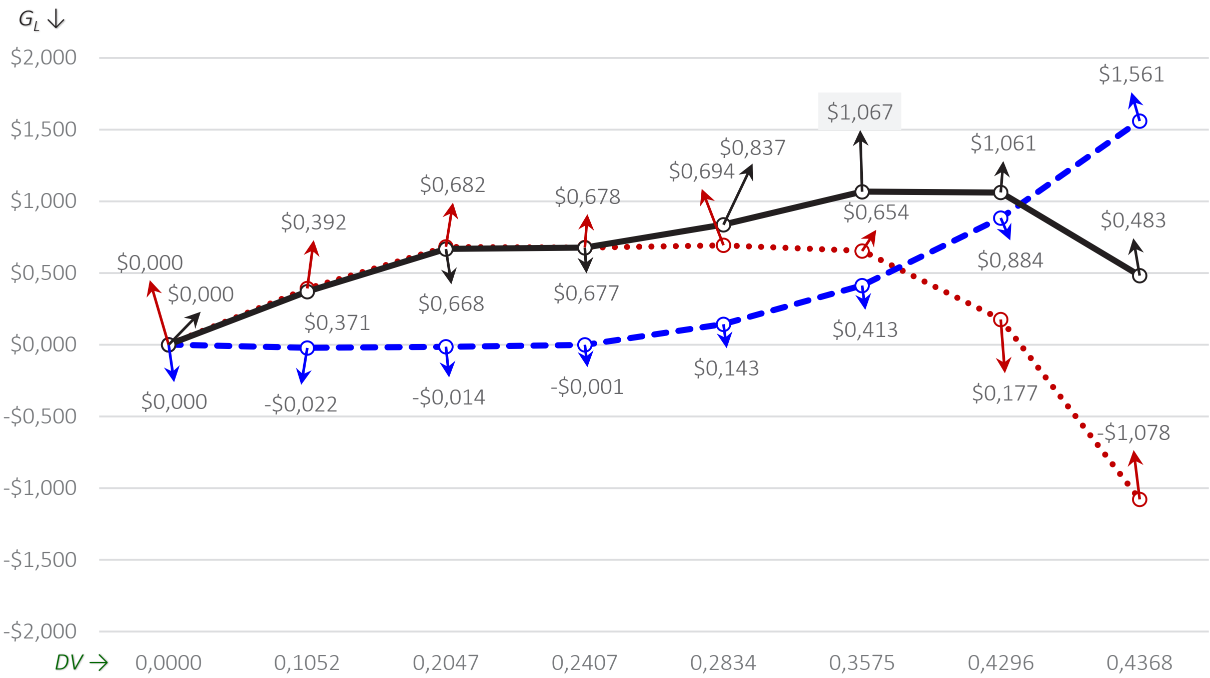

Figure 1. Gain to Leverage (G_L) Results for *Large* Growth Test with Target Credit Rating of A3. G_L and its two components in millions of dollars are plotted against feasible *DV* outcomes. The solid line is G_L. The dotted line is the 1st component of G_L. The dashed line is the second component of G_L.

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Table 2. Eleven Outcomes for Fifteen C Corp Tests

As described in Section 3.3, this table reports eleven outcomes for fifteen tests. Panel A has the nongrowth results for the three firm categories of ***small***, ***large***, and ***financial service*** (*FS*). Only one test is needed to determine a nongrowth ***OTR***, which is reported in the first column. Panels B, C, and D have the growth results for the four medium IG tests for each firm category with the three bold print rows containing the ***OTRs***. The four medium investment grade (IG) ratings of A1, A2, A3, and Baa2 are those used by Damodaran (2019).

Credit Rating	*P* choice	DV	PBR	g_U	g_L	E_U	G_L	V_L	$\%\Delta E_U$	NB
Panel A. Nongrowth										
Small OTR: **A3**	0.2856	0.2667	0.0000	0.00%	0.00%	\$9.480	\$0.674	\$10.154	7.11%	24.91%
Large OTR: **A3**	0.4137	0.3648	0.0000	0.00%	0.00%	\$9.480	\$1.271	\$10.751	13.41%	32.41%
FS OTR: **Baa2**	1.3014	0.8719	0.0000	0.00%	0.00%	\$9.480	\$4.670	\$14.150	49.26%	37.85%
Panel B. *Small* Growth										
A1	0.1757	0.1688	0.3175	2.57%	3.12%	\$10.230	\$0.420	\$10.649	4.10%	23.36%
Small OTR: **A2**	**0.2171**	**0.2059**	**0.3087**	**2.47%**	**3.12%**	**\$10.126**	**\$0.550**	**\$10.676**	**5.43%**	**25.03%**
A3	0.2712	0.2546	0.2953	2.32%	3.12%	\$9.987	\$0.649	\$10.636	6.50%	23.98%
Baa2	0.3117	0.2978	0.2702	2.05%	3.12%	\$9.779	\$0.457	\$10.236	4.67%	15.00%
Mean	0.2439	0.2318	0.2979	2.35%	3.12%	\$10.030	\$0.519	\$10.549	5.18%	21.84%
Panel C. *Large* Growth										
A1	0.2503	0.2342	0.3130	2.52%	3.12%	\$10.175	\$0.696	\$10.871	6.84%	27.34%
A2	0.3024	0.2788	0.3030	2.40%	3.12%	\$10.064	\$0.853	\$10.917	8.48%	28.04%
Large OTR: **A3**	**0.3960**	**0.3575**	**0.2861**	**2.22%**	**3.12%**	**\$9.903**	**\$1.067**	**\$10.970**	**10.78%**	**27.21%**
Baa2	0.4865	0.4413	0.2555	1.90%	3.12%	\$9.683	\$0.991	\$10.675	10.24%	21.05%
Mean	0.3588	0.3280	0.2894	2.26%	3.12%	\$9.956	\$0.902	\$10.858	9.08%	25.91%
Panel D. *FS* Growth										
A1	0.6855	0.5597	0.2863	2.22%	3.12%	\$9.905	\$2.228	\$12.132	22.49%	32.81%
A2	0.8703	0.6790	0.2650	1.99%	3.12%	\$9.743	\$2.744	\$12.487	28.16%	32.36%
FS OTR: **A3**	**1.1001**	**0.8212**	**0.2342**	**1.69%**	**3.12%**	**\$9.573**	**\$3.251**	**\$12.823**	**33.96%**	**30.87%**
Baa2	1.3104	0.9693	0.1851	1.26%	3.12%	\$9.415	\$3.313	\$12.728	35.19%	26.85%
Mean	0.9916	0.7573	0.2427	1.79%	3.12%	\$9.659	\$2.884	\$12.542	29.95%	30.72%

Beginning with a rating of Ba2, the rows in Table 1 are shaded gray to indicate that ratings below Ba1 are not feasible as the *RE* (growth) constraint given by Hull (2018) is violated. Thus, all numbers in these rows are not feasible. These unfeasible choices come after the *OTR* of A3 and the *ODV* of 0.3575 are attained. Of interest, the rating of Ba1 is the first non-investment grade that is characterized as speculative. Thus, besides being unfeasible, ratings below Ba1 would not be desired.

The growth tests in this section cover the four medium investment grade (IG) ratings of A1, A2, A3, and Baa2 that Damodaran (2019) uses. We limit the reporting to these four ratings, not only for brevity's sake, but because medium IG ratings are the most common attainable target ratings. For example, from June 12, 2018 through April 29, 2019, Morningstar (2019) reports that 61 of the 75 newly rated debt issues had a medium IG credit ratings. Thus, less than one-fifth of the ratings are either higher IG ratings or non-IG ratings. Morningstar's article is consistent with the fact that the highest IG rating of Aaa is becoming extinct. To illustrate, the *Financial Times* (2019) reports that there were 98 US companies that held the rating of Aaa in 1992 but currently there are only two. For our tests, targets below Baa2 are never *OTRs*, which is consistent with their rarity among recent debt issues.

3.2. Graphical Display of the Gain to Leverage and Its Two Components

Using the growth G_L equation for C corps as given by the CSM, Figure 1 graphically displays G_L and its two components when plotted against feasible *DV* outcomes. This figure uses the *large* growth test that was featured in Table 1. Figure 1 excludes outcomes that are not feasible due to violation of the CSM's *RE* (growth) constraint.

Figure 1 shows that the first component of G_L (dotted line) is generally concave downward peaking at \$0.694M (M = millions) where *DV* is 0.2834.

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The second component (dashed line) is concave upward bottoming out early at –\$0.022M where *DV* is only 0.1052. Together these two components that represent G_L (solid line) are concave downward peaking at the *ODV* of 0.3575 at which point the *max* G_L of \$1.067M is achieved. At this point, Moody's rating is A3 and so this rating is the *OTR*.

3.3. Eleven Outcomes

Table 2 reports eleven outcomes for our fifteen C corp tests that are based on before-tax cash flows (CF_{BT}) of \$1,000,000. The outcomes given in the eleven columns are as follows. Credit rating in Panel A refers to the *OTR* for the three nongrowth tests. For Panels B, C, and D, credit rating refers to the medium IG credit ratings for which outcomes are reported with the *OTR* identified in each panel by the bold print row. *P* choice is the proportion of unlevered firm value retired by debt. *DV* is the debt-to-firm ratio. *PBR* is the plowback ratio, g_U is the unlevered equity growth rate, and g_L is the levered equity growth rate. E_U is unlevered firm value, G_L is the gain to leverage, and V_L is firm value. The dollar values for E_U, G_L, and V_L are in millions. $\%\Delta E_U$ is the percentage change in E_U (or G_L as a percent of E_U). Net benefit from leverage (*NB*) is G_L as a percent of *D* and reveals the percentage gain per dollar of debt.

Each test in Table 2 involves either a nongrowth or growth situation for one of the three firm categories of *small*, *large*, or *FS*. For the nongrowth results in Panel A, each firm category requires only one test to identify optimal outcomes. This is because each medium IG rating does not have to attain the same growth rate for all four medium IG ratings by engineering *PBR* since it is zero for all nongrowth tests. Whereas a nongrowth firm could target a credit rating that differs from its *OTR*, it would not want to do this unless its *OTR* could not be achieved. Of importance, our three nongrowth tests identify an *OTR* that is a commonly attainable medium IG rating, namely, A3 and Baa2.

Unlike the nongrowth tests in Panel A where each credit rating has the same *PBR* of zero, the growth tests in Panels B, C, and D require that we engineer *PBR* to obtain the same g_L of 3.12% for each

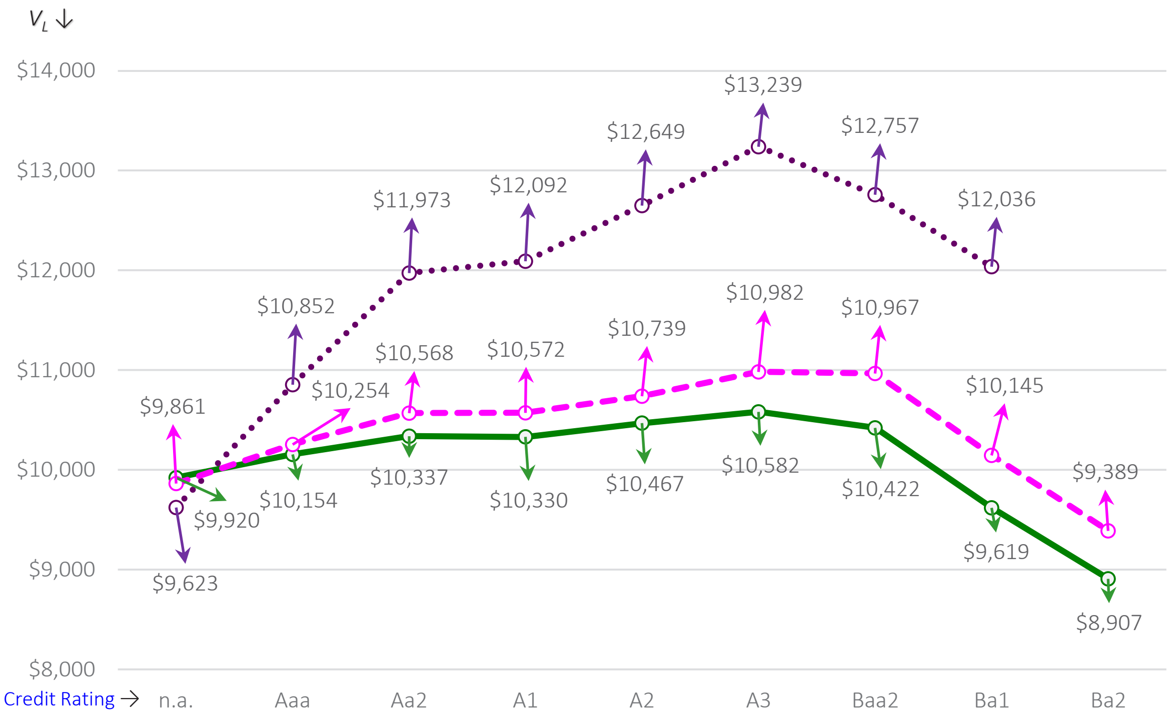

Figure 2. Firm Value (V_L) Mean Outcomes for Five *Small* Tests, Five *Large* Tests, and Five *FS* Tests. Mean V_L outcomes (in millions of dollars) are plotted against credit ratings. The solid, dashed, and dotted lines represent *small*, *large*, and *financial service* (*FS*) firms, respectively. NOTE: "n.a." stands for not applicable as this is the unlevered situation.

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of the four medium IG ratings. This requires four separate tests for each firm category of *small*, *large*, and *FS*. From each set of four tests we can discover *max* V_L, which identifies *OTR*. For Panels B, C, and D, the optimal row is in bold print as this row gives the highest V_L (or *max* V_L) from among the four V_L outcomes reported in each panel.

3.4. Plotting V_L Outcomes against Credit Ratings

Table 2 only reports outcomes for medium IG ratings. In Figure 2 we expand on this by plotting mean V_L outcomes (in millions) against credit ratings from Aaa to Ba2. The mean V_L outcomes are the averages for three sets of five tests, namely, five *small* tests, five *large* tests, and five *FS* tests. We stop at Ba2 because credit ratings with lower quality are not only suboptimal but often unfeasible. Every mean V_L plot point does not consist of outcomes from all five tests (one nongrowth test and four growth tests) because growth tests experience violation of the *RE* constraint. While the violations lower the number of observations used in computing a V_L mean, these violations occur after the *OTR* is reached.

The top trajectory (dotted line) in Figure 2 displays higher mean V_L outcomes for *FS* firms, while the bottom trajectory (solid line) displays the lower mean V_L outcomes for the *small* firms. Except for the downward bump for an A1 credit rating for the *small* firm trajectory, the three trajectories in Figure 2 are concave downward with the *small* firm and *large* firm trajectories manifesting some flatness around their *OTRs*. Noteworthy, the *OTR* for all three trajectories using mean V_L outcomes is A3. This differs from that found for individual tests presented in Table 2 where only *large* firms had an A3 outcome for both nongrowth and growth tests.

4. DISCUSSION

In this section, we discuss the results presented in the previous section.

From Figure 1, we see that the use of real world data shows strong support for trade-off theory that predicts the downward concave shape found when plotting G_L versus *DV*. The general downward concave shape also holds for other tests. For example, as seen in Figure 2 where we plot mean V_L outcomes against credit ratings, we also find downward concave shapes.

For *small* nongrowth firms in Table 2, we find that *max* V_L is associated with an *OTR* of A3, which is the second lowest of the four medium IG credit ratings used by Damodaran (2019). For *small* growth firms, we discover that *max* V_L is affiliated with an *OTR* of A2, which is a notch above the nongrowth rating. Thus, managers of *small* nongrowth firms should aim for a higher ranked *OTR* if they contemplate growth. All four of the IG medium rating tests for *small* growth firms have greater V_L outcomes compared to their nongrowth *max* V_L outcome. In terms of how much it pays, the *max* V_L for *small* growth firms is 5.13% greater than their nongrowth *max* V_L. We conclude:

It pays for managers of *small* firms to aim for growth regardless of which one of the four medium IG ratings they think is achievable.

For *large* nongrowth firms in Table 2, we find an *OTR* of A3, which is the same as that found for *small* nongrowth firms. Despite having the same *OTR*, *large* nongrowth firms have a 5.87% firm valuation advantage over *small* nongrowth firms when comparing *max* V_L outcomes. Like *large* nongrowth firms, *large* growth firms have an *OTR* of A3, which is a notch below the *OTR* of A2 found for *small* growth firms. The *max* V_L for *large* growth firms is 2.76% better than that for *small* growth firms. The *max* V_L for *large* growth firms is only 2.04% greater than that the *max* V_L for *small* nongrowth firms, which is less than 5.13% found for the same *small* firm comparison. We conclude:

Growth for *large* firms is not as lucrative as that for *small* firms despite the fact that *large* growth firms have a valuation advantage over *small* growth firms.

For nongrowth *financial service* (*FS)* firms in Table 2, we find that *max* V_L occurs for an *OTR* of Baa2, which is a notch below the *OTR* of A3 found for *small* and *large* nongrowth firms. *FS* nongrowth firms have 39.35% and 31.61% valuation advantages over *small* and large nongrowth firms, respectively. In contrast, the *max* V_L for *FS* growth firms is 20.11% and 16.89% better than the *small* and *large* growth *max* V_L outcomes, respectively. For *FS* growth firms, we find that *max* V_L identifies A3 as the *OTR*, which is the same as *large* growth firms. However, the least V_L for *FS* growth firms occurs for the highest medium IG rating of A1. This contrasts with the findings for *small* and *large* growth firms where the lowest medium IG rating of Baa2 generates the least V_L. Of importance, the four *FS* growth tests produce V_L outcomes that are inferior to their nongrowth *max* V_L. We conclude:

Compared to managers of *small* and *large* firms, *FS* managers can profit more from using their operational cash flows for interest payments on debt rather than for retained earnings earmarked for growth.

In terms of optimal debt-to-firm ratios (*ODVs*) that correspond to *OTRs*, *FS* firms have the greatest *ODVs* with *large* firms placing a distant second and *small* firms placing an even more distant third. For example, growth *ODVs* have respective outcomes of 0.2059, 0.3575, and 0.8212 for *small*, *large*, and *FS* firms at *OTRs*. In terms of the gain to leverage (G_L) and the percentage increase in unlevered firm value ($\%\Delta E_U$), *FS* growth firms are the clear winner over *small* and *large* firms even though *FS* firms are still better off not growing. The results of the $\%\Delta E_U$ for *small* and *large* firms are consistent with the empirical research (Graham, 2000; Korteweg, 2010; Van Binsbergen et al. 2010). Finally, *small* firms utilize the highest plowback ratios and *FS* firms the lowest.

While we do not report detailed outcomes for the two high IG ratings (Aaa or Aa2) of Damodaran (2019) for growth tests, we can point out that a growth firm can achieve a greater V_L outcome if they can achieve either of these higher ratings while sustaining a growth rate of 3.12%. In contrast, an *OTR* is not achieved with a high IG rating for our nongrowth tests.

Finally, Figure 2 reveals that a Moody's credit rating of A3 is the dominant *OTR*. This is consistent with the results in Table 2 where A3 is the most common *OTR* with these two exceptions: the *OTR* attains a higher quality rating of A2 for *small* growth firms and a lower quality rating of Baa2 for *FS* nongrowth firms.

CONCLUSION

In this paper, we explore the relation between credit ratings and firm valuation. We do this by using data supplied by Damodaran (2019) within the framework of the Capital Structure Model (CSM) where we are able to compute firm values matched to credit ratings. From the firm value computations, we can determine the maximum firm value (*max* V_L) and optimal target rating (*OTR*) thereby offering insight to US C corp managers. This insight covers nongrowth versus growth situations and three firm categories of *small*, *large*, and *financial service* (*FS*).

This is the first study to use real world data along with the CSM's levered equity growth rate to identify *OTR*s. This enables us to provide unique findings on the topic of target credit rating and firm valuation. Focusing on medium investment grade ratings that contain over 80% of the recent ratings, we show which of these ratings offer superior valuation outcomes for growth based on its firm category. For growth tests, we use a long-run sustainable growth rate of 3.12% that is consistent with seventy years of annual growth in real US GDP. We show that firm valuation outcomes that are a by-product of the target credit rating, firm characteristics (*small*, *large*, and *financial service*), and the capacity of a company to grow.

In terms of future research, this study can be extended by using a greater growth rate than the historical sustainable rate of 3.12%. For example, the Tax Policy Center (2018) and Tax Foundation (2018) predict that lower taxes under TCJA are expected to lead to an increase in growth of 0.8% and 1.7%, respectively. Future research can investigate the relation between a credit rating and firm value for other US ownership types besides C corp, namely, pass-throughs and nonprofits. In addition, future research can perform comparative studies between ownership types where we assume similar risk classes so that differences

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in *OTRs* are a function of the way different ownership forms are taxed. Future research can also explore ownership types in other countries to find what credit ratings are associated with *OTRs*. Researchers needs to continue to explore credit ratings for future years as ratings and spreads change over time. This will tell us how sensitive a current *OTR* is to changes in credit ratings and spreads. Finally, this study can be duplicated with other reasonable tax rate scenarios besides those corporate and personal tax rates that this study used.

AUTHOR CONTRIBUTIONS

Conceptualization: Robert M. Hull.
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Funding acquisition: Robert M. Hull.
Investigation: Robert M. Hull.
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Supervision: Robert M. Hull.
Validation: Robert M. Hull.
Visualization: Robert M. Hull.
Writing – original draft: Robert M. Hull.
Writing – review & editing: Robert M. Hull.

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