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Guest Article:

WACC as used in capitalization formula causes overvaluation

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Mike Adhikari

In this article, Mike Adhikari demonstrates how using WACC in the capitalization formula can overstate the value of equity, at least as leverage is decreasing. He dicusses the limited conditions in which using WACC in the capitalization formula is valid. — SP

The capitalization formula with weighted average cost of capital (WACC) is universally used in business valuation. It is quick and convenient. It is used by itself to value 100% of the business, or as part of the excess earnings method, or to calculate the terminal value in a DCF (discounted cash flow) analysis.

In the DCF approach, a large portion of the total value usually is based on the terminal value, which is calculated using the capitalization formula. However, this formula presents certain potentially serious problems.

The capitalization formula implicitly assumes that only the interest cost of debt is relevant to valuation. It ignores the impact of debt repayments to the equity holder's cash flow. Valuation textbooks and literature do not explicitly discuss this subject. Many in the profession believe that debt repayment's impact can be ignored because a typical business has a perpetual ability to continuously refinance the debt at no transaction cost, and because a constant debt-to-equity ratio can be maintained through additional borrowing as the business grows.

Even if one assumed unconstrained and perpetual access to debt refinancing, capitalization formula implicitly assumes that such debt refinancing proceeds are distributable, and are in fact distributed, to the equity holder as dividend, such that each period's cash flow is distributed to each investor in proportion to his or her investment. Such luxury of perpetual debt, perpetual debt/equity ratio, and the option to distribute the refinancing proceeds as dividend, is not realistic for most situations. Therefore, this article analyzes the impact of the preferential distribution of the debt interest and the debt principal repayment on the results of the capitalization formula.

Debt service causes deferral of dividend distribution to the equity holder compared with the proportional distribution implicit in WACC. As a result, the actual return to the equity holder is lower than the cost of equity used in calculating the WACC. In the example shown here, the cost of equity is 30%, the cost of debt is 10%, the debt/equity ratio is 50%, and hence WACC is 20%. Servicing of debt at the expense of distribution to the equity holder reduces the actual return to the equity holders to 23.6% from the 30% cost of equity used in calculating WACC. Reduction in equity return is equivalent to overvaluation. In the example shown here, 20% reduction in equity return is equivalent to approximate 25% overvaluation by the capitalization formula.

Capitalization formula

The capitalization formula is:

$$V_0 = x_1 / (k - g) \qquad (1)$$

where:

- V_0 is the value of the firm at the beginning of year 1
- x_1 is the net cash flow (NCF_i) to investors in year 1
- k is the WACC to the recipients of x_1
- g is the projected growth of x_1, and
- $k = w_e * r_e + w_d * r_d * (1-t_c)$ (2)

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where:

- w_e is the weight of the equity
- r_e is the cost of the equity
- w_d is the weight of the debt
- r_d is the cost of the debt (pretax)
- t_c is the corporate tax rate

Assumptions

To understand the impact of debt service on equity return, assume following simplifying scenario:

- Growth is zero.
- EBITDA = $200; it does not change because g = 0.
- Working capital change = 0, because g = 0.
- Company has no fixed assets, hence depreciation = 0.
- No capital expenditure.
- All of the available cash is used to pay down the debt. In real life, debt usually has a fixed pay-down schedule. This leaves some cash in the company, but lenders restrict it from being distributed to the equity holders.
- All of the available cash flow is distributed to the equity holder if there is no debt outstanding.
- Business is liquidated at the end of the planning period (2 and 5 years in the example). Liquidation value of the business is equal to the original acquisition value. This is a reasonable assumption considering the business is not growing.
- There are no corporate-level taxes on liquidation.
- Proceeds of liquidation are first used to retire existing debt; excess is distributed to the equity holder.
- Business is acquired in a stock purchase rather than in an asset purchase. Hence, the tax benefits of tax-deductible goodwill amortization and asset step-up are absent.

Let us also assume the following:

Corporate tax rate:	t_c	= 0
Equity weight:	w_e	= 50%
Debt weight:	w_d	= 50%
Cost of equity:	r_e	= 30%
Pretax cost of debt:	r_d	= 10%

The weighted average cost of capital is 20%, calculated as follows:

$$k = w_e * r_e + w_d * r_d * (1-t_c)$$
$$= 0.5 * 30\% + 0.5 * 10\% * (1-0)$$
$$= 20\%$$

Two-year scenario

The net cash flow (NCF_i) available to investors, x_1, is equal to EBITDA, because there are no taxes, no capital expenditures, and no working capital changes. Therefore, the value of the firm V_0 is $1000, calculated as follows:

$$V_0 = x_1 / (k - g)$$
$$= \$200/(0.2 - 0)$$
$$= \$1000$$

Debt is 50% of the purchase price of $1000. Hence, debt equals $500, and equity is also $500.

The company's EBITDA is $200, the interest cost is $50 ($500 * 10%), and there are no other expenses; hence, taxable income is $150 ($200 – $50). There are no taxes so net income is $150, as shown in *Table 1*.

Free cash flow to equity (FCFE) is equal to net income minus capital expenditures and working capital changes, plus noncash expenses. It is $150 in our example because there are no capital expenditures, no working capital changes, and no noncash expenses.

We are assuming, for the sake of simplicity, that all of the FCFE of $150 is used to pay down the debt. Hence, at the end of year 1, debt will reduce by $150, from $500 to $350 ($500 –$150). In year 2, EBITDA is still $200 (no growth), the interest will reduce to $35,

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due to lower debt ($350 * 10%) and thus, the FCFE in year 2 is $165 ($200 – $35). All of the FCFE is used to pay down the debt. This will reduce the outstanding debt at the end of year 2 to $185 ($500 – $150 – $165).

Business is liquidated at the end of year 2 for the same price as the original price of $1000 at the beginning of period 1. (This is a result of zero growth assumption, and it further assumes that the capital markets at the end of year 2 will be the same as that at the beginning of period 1.) We are assuming no liquidation taxes. Therefore, cash available to the equity holder is the liquidation proceeds of $1000 less the outstanding debt of $185, which equals $815 ($1000 – $185).

Table 1 provides the above analysis in a tabular form.

Five-year scenario

In real life, the liquidation event generally occurs at 5 years (primarily driven by the debt terms). *Table 2* (on page 4) shows the results of stretching the above example to 5 years. In this case, the equity holder's actual ROI will be 23.6 %—6.4% less than the expected equity return of 30%.

In the above example, the actual equity return is approximately 20% (6.4/30) lower than the expected equity return. Essentially, the equity holder is overpaying at a value of $1000. The equity holder can increase the return back to 30% by lowering the price. At a reduced price of $800 (see note at the end of this paragraph), the equity holder's return will be 30%. The $200 difference in the valuation ($1000 – $800) is the amount of overvaluation by the capitalization approach. Thus, in the example here, *the capitalization formula is overvaluing the business by 25%* ($200/$800). This is significant by any standard.

[Note: Value of $800 is derived by trial and error. At 40% expected equity return, and 50% debt/equity ratio, WACC is 25% and V_0 = $800. The actual equity return will be 30%).

Why does the capitalization approach overvalue?

The mathematics of the capitalization formula, using WACC, assumes that the cash flow of each period will be distributed in that period to all the investors in proportion to their holdings. No class of investors is assumed to have distribution priority over others. However, in most real life situations, especially in leveraged acquisitions, the debt holder has a priority claim on the cash flow. He gets paid before the equity holder. The equity holder builds equity in the enterprise, but the actual cash payment is pushed back in the future. This timing delay causes the actual equity return to be lower than the one used in calculating WACC. Leveraged equity investment is like a zero coupon bond—it pays only when it matures. Capitalization formula does not recognize this, and thus its results under leverage overvalue the company.

Impact of taxes, growth, capital expenditures and working capital

In the above example, a few assumptions were made to simplify the analysis. The basic conclusion that capitalization formula using WACC overvalues businesses does not change when these assumptions are relaxed to accommodate taxes, capital expenditures, working capital changes, and growth. These parameters further reduce the cash available for equity distribution, thus increasing the wait time for the start of equity holder's payday. The net effect will be that the amount of overvaluation by the capitalization formula will increase, not decrease, when these assumptions are relaxed.

What impacts the amount of overvaluation?

Of the many factors that could affect overvaluation, two are discussed below.

The amount of overvaluation by the capitalization formula increases as the spread between the equity cost and the debt cost increases. The higher the equity cost, the more expensive it is for the equity holder to use the available cash to pay down the less expensive debt holder.

The amount of overvaluation by the capitalization formula also increases as the debt-to-equity ratio increases. As

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TABLE I: TWO YEAR SCENARIO

	Year-0	Year-1	Year-2
EBITDA		200.0	200.0
Interest		-50.0	-35.0
Taxable Income		150.0	165.0
Taxes		0.0	0.0
Net Income		150.0	165.0
Free CF to Equity		150.0	165.0
Debt Payment		-150.0	-165.0
Cash to Equity		0.0	0.0
Beginning Debt		500.0	350.0
Debt Payment		-150.0	-165.0
Ending Debt		350.0	185.0
Debt holder ROI			
Principal	-500.0		
Interest		50.0	35.0
Repayment		150.0	165.0
@ Liquidation			185.0
	-500.0	200.0	385.0
IRR	**10%**		
Equity holder ROI			
Investment	-500.0		
Distribution		0.0	0.0
@ Liquidation			1000.0
Remaining Debt			-185.0
	-500.0	0.0	815.0
IRR **27.7%**			

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debt increases relative to equity, the wait time for the equity holder's payday gets longer.

Does the capitalization formula work in any circumstances?

The capitalization formula will work (ignoring its other limitations discussed below) under the following circumstances: 1) There is no debt and hence all the free cash flow can be distributed to the equity holder; 2) If one assumes that debt is "evergreen", that is, debt is perpetual, never requiring repayment, and the debt holder will permit dividend distribution to cover the cost of equity; 3) If the equity holder can continuously refinance the debt (i.e., replace old debt with new debt of same amount) at no transaction cost, and that the lender will allow such refinanced portion of the debt to be distributed to the equity holder to cover the cost of equity; or 4) The spread between the cost of debt and the cost of equity is small, such that the time value of deferring equity cash flow is insignificant.

Summary

The capitalization formula with WACC is the backbone of most valuation methods today. It is a simple and a quick method. However, the capitalization approach with WACC overvalues businesses. The amount of overvaluation can be significant. In a simple example presented here, the overvaluation is 25%.

Such overvaluation is caused by capitalization formula yielding a lower return to the equity holder than the one used in calculating WACC. Capitalization formula assumes a proportional distribution of cash flow to each investor in each period. However, in real life debt interest payments and debt principal payments get paid first. As a result, payments to the equity holder are delayed relative to what they are supposed to be according to the capitalization formula. Such delay in payments to the equity holder causes the actual equity return to be lower than the one used in WACC. The capitalization formula does not recognize disproportionate distribution of the cash flow to the investors.

The capitalization formula and WACC works only if there is no debt, or if one assumes perpetual debt, perpetual debt/equity ratio, and no dividend restrictions. Otherwise, its use with WACC risks overvaluation of the business. **BVU**

TABLE 2: FIVE-YEAR SCENARIO

	Year-0	Year-1	Year-2	Year-3	Year-4	Year-5
EBITDA		200.0	200.0	200.0	200.0	200.0
Interest		-50.0	-35.0	-18.5	-0.4	0.0
Taxable Income		150.0	165.0	181.5	199.7	200.0
Taxes		0.0	0.0	0.0	0.0	0.0
Net Income		150.0	165.0	181.5	199.7	200.0
Free CF to Equity		150.0	165.0	181.5	199.7	200.0
Debt Payment		-150.0	-165.0	-181.5	-3.5	0.0
Cash to Equity		0.0	0.0	0.0	196.2	200.0
Beginning Debt		500.0	350.0	185.0	3.5	0.0
Debt Payment		-150.0	-165.0	-181.5	-3.5	0.0
Ending Debt		350.0	185.0	3.5	0.0	0.0
Debt holder ROI						
Principal	-500.0					
Interest		50.0	35.0	18.5	0.4	0.0
Repayment		150.0	165.0	181.5	3.5	0.0
@ Liquidation		0.0	0.0	0.0	0.0	0.0
	-500.0	200.0	200.0	200.0	3.9	0.0
IRR	**10%**					
Equity holder ROI						
Investment	-500.0					
Distribution		0.0	0.0	0.0	196.2	200.0
@ Liquidation		0.0	0.0	0.0	0.0	1000.0
Remaining Debt		0.0	0.0	0.0	0.0	0.0
	-500.0	0.0	0.0	0.0	196.2	1200.0
IRR	**23.6%**					