2006-01-01

Determining Discount Rates for Valuing Properties in Distressed Industries

Hal B. Heaton
halheaton@byu.edu

Original Publication Citation

H.B. Heaton. "Determining Discount Rates for Valuing Properties in Distressed Industries," Journal of Property Tax Assessment and Administration, Volume 3, #2 (Fall 26), pp53-6.

Determining Discount Rates for Valuing Properties in Distressed Industries

BY HAL B. HEATON, PHD

In recent years, several industries, such as telecommunications, merchant utilities, airlines, and others, have been through intense periods of distress during which many participants entered bankruptcy or underwent other major reorganizations. The severe price drops and swings in the share prices and debt securities of these industries make estimating cost of capital very difficult.

This study addresses the procedure for determining discount rates for properties in industries under stress. A simple example with fixed and variable costs, which could represent a company in any of these industries, is used to demonstrate the difficulties of using standard approaches for estimating cost of capital.

In distressed circumstances, valuation methodologies such as the cost approach and the stock and debt approach become very unreliable. The income approach becomes the most dependable because it is the only one that uses the ability to obtain financing as the key assumption. Value is usually defined as the price between a willing buyer and a willing seller; thus, the ability of a potential buyer to obtain financing is critical to any transaction.

With distressed properties, the appraiser must first make a credible forecast of the cash flows that a particular property will be able to obtain under the circumstances. Forecasting cash flows is critical because they determine how much and what type of financing is available to a potential purchaser of the property.

Once the cash flow forecast has been made, the appraiser must use market data to estimate the amount and the cost of debt that would likely be available. Data from publicly traded companies in the distressed industry are not much help because they reflect financing obtained in better times. Once the amount and the cost of debt have been determined, the appraiser must estimate the return that an equity investor would require given the amount of debt.

In addition, for distressed industries, once these estimates have been made, the appraiser must use an iterative

Hal B. Heaton, PhD, *is a professor of finance in the Marriott School of Management at Brigham Young University in Provo, Utah. He teaches advanced corporate finance and capital markets. He received a PhD in finance as well as a master's degree in economics from Stanford University. Dr. Heaton also holds an MBA from Brigham Young University.*

process to check and adjust them. The iterative process is necessary since it is difficult to make direct estimates of financing amounts and costs. In the iterative process, the appraiser first estimates the necessary parameters, determines a value under those assumptions, and then checks the assumptions using the value to determine whether the estimates are reasonable. A simplified example follows.

Example of Distressed Property: Normal Circumstances

Suppose that under normal circumstances a property makes 1 million widgets per year at a variable cost of $8.33 per unit and a fixed cost of $25 million and sells them for $50 per unit. A widget simply represents any product or service: for an electric utility it might represent a megawatt of power; for an airline, a seat on a given flight route; for a telecommunications company, a 10-minute call.

Suppose that in normal circumstances the company can finance itself with 50% debt and 50% equity; debt costs 10%; and equity investors require 14% at the 50/50 debt/equity ratio. Under these conditions, the weighted average cost of capital (WACC) is:

$$WACC = w_d \times k_d(1-T) + w_e \times k_e = .5 \times 10\%(1-.4) + .5 \times 14\% = 10\%$$

where w_d represents the weighting on debt, w_e the weighting on equity, k_d the cost of debt, k_e the cost of equity, and T the tax rate of 40% (in this example). Under these assumptions the company produces net operating profits after taxes (NOPAT) of $10 million per year (see table 1).

Under the simplifying assumptions that the depreciation included in fixed costs equals the incremental capital expenditures and working capital needs and that the NOPAT is expected to be constant on average in the future, the value of this property is $10 million NOPAT/.10 = $100 million. If the industry is competitive, then the cost approach should lead to the same $100 million value. If the assets could be created for less than $100 million, then new entrants would enter the industry and drive the price down until value equals the cost of entering the industry. If the assets were to cost more than $100 million, no new competitors would enter or some existing competitors would exit and the remaining competitors would raise prices until they were compensated for their total costs.

Alternatively, if the industry is regulated, then regulators would presumably set rates such that competitors would be compensated for the total cost. As a result, for this study, it is assumed that the cost approach to value also yields $100 million in normal circumstances.

Also important to this analysis is some estimate of the volatility or uncertainty of the NOPAT forecast to establish the amount of risk that potential investors would evaluate to determine appropriate discount rates. It is simple to demonstrate that a 1% change in price (a change from $50 to $50.50 or to $49.50) swings both NOPAT and value by 3%. This three times (3%/1% = 3) volatility serves as the base measure of risk.

Example of Distressed Property: Price Fall

What happens to value if the industry starts to experience stress and only the price falls? Usually both quantity and price are affected by an industry downturn, but it is helpful to look at the

Table 1.

Item	($ thousands)
Revenue [$50 x 1 m widgets]	$50,000
Fixed Costs	25,000
Variable Costs [$8.33 x 1m]	8,333
EBIT	16,667
Taxes [40% x EBIT]	6,667
NOPAT	10,000

effect of each variable in isolation before considering the example of both a price and quantity collapse.

Suppose the price falls by 20% from $50 to $40 per unit. Some appraisers may attempt to adjust for value by adjusting the cost approach for economic obsolescence. One such approach would be to look at the 20% fall in revenues and simply reduce value by 20%:

$100 million cost – 20% *x* $100 = $80 million.

This adjustment seriously underestimates the effect of a downturn on value. The fixed-versus-variable-cost makeup of the expenses increases (or leverages) the effect of the drop in revenues on net profits. This effect is referred to as *operating leverage.*

To understand the total effect on value, the effect of the price fall on profits must be computed. The revenue drop leads to a NOPAT of $4,000 (see table 2).

If this revenue drop is considered permanent, the perpetuity formula can be used as before to estimate value. If the same 10% cost of capital were used (erroneously), it might be concluded that value has dropped to

$4 million NOPAT/10% = $40 million,

which is a 60% drop in value, not a 20% drop. Unfortunately, the effect on value is even more severe because the cost of capital has increased due to increased risk. The increased risk stems from the fact that margins are much smaller; hence a 1% change in price from the new $40 price leads to a 6% change in NOPAT and value. Under normal circumstances a 1% change leads to only a 3% change in NOPAT and value. Risk (volatility) doubles! As a result, investors demand rates higher than 10% and value falls more than 60%.

Example of Distressed Property: Quantity Fall

As mentioned before, usually in distressed industries both price and quantity fall. It is helpful to look at the effect of a fall in quantity, holding everything else constant.

Suppose quantity falls by 10%. Again, some appraisers might mistakenly think that this represents a 10% economic obsolescence factor and that value has fallen by only 10%:

$100 million cost – 10% for economic obsolescence = $90 million value.

Again, the operating leverage inherent in the business makes this a substantial understatement of the effect on value. To determine the effect on value, the effect of the 10% decline in quantity on profitability must be calculated (see table 3).

Assuming that this fall in quantity is permanent, value drops by 25% even if the 10% cost of capital remains unchanged:

$7,500/10% = $75 million.

As with a price fall, this adjustment seriously understates the true drop in value because the fall in quantity has made this a much more volatile and risky business with thinner margins. A 1% change in price under the 10% fall in quantity leads to a 3.6% change in value, which is a more volatile earnings

Table 2.

Item	($ thousands)
Revenue [$40 x 1 m widgets]	$40,000
Fixed Costs	25,000
Variable Costs [$8.33 x 1m]	8,333
EBIT	6,667
Taxes [40% x EBIT]	2,667
NOPAT	4,000

Table 3.

Item	($ thousands)
Revenue [$50 x .9 m widgets]	$45,000
Fixed Costs	25,000
Variable Costs [$8.33 x .9 m]	7,500
EBIT	12,500
Taxes [40% x EBIT]	5,000
NOPAT	7,500

stream. Hence investors require a higher rate of return and value drops even more than 25%.

Example of Distressed Property: Both Price and Quantity Fall

Having determined the effect of a price fall and a quantity fall individually, we must investigate the more common effect in a distressed industry of both a price and quantity fall.

Sometimes the market capitalization of a company in an industry is measured by the equity market capitalization (price times number of shares outstanding) plus the book value of debt. Although the market value of debt should be used, debt is not often publicly traded and so the market value of the debt cannot be directly obtained. As a result, many appraisers make the assumption that the book value of debt is a reasonable estimate of the market value of debt. This assumption is a serious mistake for a company in a distressed industry.

Consider trying to value the company above when price falls from $50 to $45 and quantity falls from 1,000,000 to 900,000 widgets. NOPAT falls to $4.8 million under this scenario (see table 4).

Even if the old 10% WACC were used, value falls to less than $50 million, which is less than the face amount of the debt. However, under these assumptions, risk increases dramatically: a 1% change in price now results in a 5% change in NOPAT and value. Because of this dramatic increase in volatility compared to that in normal times, investors require even higher rates of return.

Table 4.

Item	($ thousands)
Revenue [$40 x .9 m widgets]	$40,500
Fixed Costs	25,000
Variable Costs [$8.33 x .9 m]	7,500
EBIT	8,000
Taxes [40% x EBIT]	3,200
NOPAT	4,800

Why does equity have any value at all when the value of the asset is less than the face amount of debt outstanding? As long as the company does not declare bankruptcy, the equity is very much like an out-of-the-money call option.

Call options cannot be valued by using standard discounted-cash-flow analysis. Call options are typically valued with formulas derived under different sets of assumptions that exploit arbitrage relationships between leveraged positions in the underlying stock and the call option. The Black-Scholes formula (Black and Scholes 1973) is one well-known formula for valuing stock options.

Equity value stays positive even for distressed industries because equity investors have limited downside risk. Just like investors in call options, investors in equities can lose only their investment. In contrast, investors in physical assets that have used debt to purchase the asset without incorporation are subject to losses of more than their equity investment. Debt holders may have the right to seize other assets held by investors and equity investors may lose even more than the equity invested in the asset.

Equity investors in distressed companies for which the assets are worth less than the debt outstanding are essentially placing a bet similar to that of an out-of-the-money call option. For example, how much would an investor pay for the right to buy Dell Computer stock for $30 about 6 months from now if the current price of Dell Computer were $25? Note that the price gain necessary to compensate for the investment would represent a gain of over 20% in 6 months or an annualized return of over 40%—an unlikely event. Still, the current price in markets today (June 2006) for this call option is $.70. Much, if not most, of the time, deep out-of-the-money options expire worthless.

Why would investors buy them? The answer is the limited downside. The most the investor can lose in the case of the Dell option is $.70. But what if Dell stock were

to return to the high of over $40 that it attained about a year ago? The investor would net over $10 for the $.70 bet.

Similarly, in distressed industries, equity investors pay a (small) positive price for the equity even though the underlying assets are worth less than the face amount of the debt outstanding in the hope (perhaps unlikely) of an industry recovery.

Also, note that the market value of the debt for distressed companies is much less than the face value. In addition, the standard yield-to-maturity calculations used to estimate the cost of debt in normal circumstances are no longer reliable for calculating capital.

For example, Calpine Corporation, a merchant utility, in 2003 had debt trading for less than $.45 on the dollar of face value. A yield-to-maturity calculation on the debt at the time produced a yield to maturity of over 24%. Is that the expected return or "cost" of debt at the time? No. That is the return only if Calpine does not default on the debt and it remains in place to maturity—it is not the expected but rather the promised rate of return. Clearly investors did not expect Calpine to pay what was promised if they were willing to pay only $.45 on the dollar for the debt.

As a result, the standard yield-to-maturity calculations for debt cannot be used to estimate cost of debt for distressed industries. However, for equity investors in Calpine at the time, the 24% yield does represent a minimum rate of return. Because of the seniority of debt to equity in bankruptcy, equity investors receive a payoff only if the debt holders are paid off first. Hence the equity holders must require a return in excess of 24%. If they thought the equity would have any value in bankruptcy, then they must believe all debt claims will be satisfied and the debt investors will receive a 24% rate of return. The equity investors could buy the debt claims for the 24% return with much less risk than the equity claims. As a result, they must require a return of more than 24% on the equity.

Another problem in appraising properties in distressed industries stems from using debt/equity ratios of traded companies to estimate the appropriate debt/equity ratio for the WACC calculation. Appraisers should use market values of debt/equity ratios (*not* the book value debt/equity ratios) from comparable companies in normal circumstances. For distressed industries, however, this approach can no longer be used.

The debt/equity ratios for distressed industries are distorted dramatically too high. Often the equity values plunge, frequently well over 90%. Most debt is not publicly traded, but market value usually falls dramatically, as illustrated in the Calpine example above. As a result, book values dramatically overstate the value of debt. Even if the market value of the debt is obtainable, the debt/equity ratio is not relevant. Value is the price between a willing buyer and a willing seller in an arm's-length transaction. The debt/equity ratios of existing comparable companies reflect debt obtained in better times. It is often very difficult for a potential buyer to obtain debt for a purchase in a distressed industry at all, let alone on the terms the industry received in better times.

Determining the WACC

To determine the cost of capital for a potential buyer, the appraiser must determine the amount of debt and the terms a buyer could obtain for the distressed asset at the time of the purchase. An appraiser should not use a buyer's own cost of debt for this number; this debt is often secured by other assets. To value a property, an appraiser cannot directly or indirectly use assets outside of the asset appraised. The appraiser must determine how much debt and on what terms debt is available for the subject property on a nonrecourse basis, that is, on a stand-alone basis without recourse to other assets as collateral.

In practice, the buyer must visit a num-

ber of potential debtholders, present the facts of the asset itself, and effectively sell the debt. To do this, the buyer must present credible forecasts of revenues and expenses to the potential purchasers of the debt securities. Debtholders carefully look at, among other items, the forecasted Earnings Before Interest Taxes Depreciation and Amortization (EBITDA) as a measure of cash flow available to pay interest. They then compute ratios of debt service to cash flow to determine the risk of the debt. Table 5 shows ratios for various grades of debt.

These ratios usually determine the amount of debt and/or the credit rating that a purchaser of the distressed property could obtain on the property. For example, if the purchaser desires a BBB rating, then the forecasted EBITDA should be about 5.5 times the interest on the amount of debt requested. This fact limits the amount of debt obtainable.

For example, suppose that a distressed property has the cash flow forecast of table 4 and fixed costs include $1 million of depreciation. EBITDA is

$$\$8 \text{ million} + \$1 \text{ million} = \$9 \text{ million}.$$

Suppose too that table 6 reflects capital market data for interest rates on various grades of debt at the time of the appraisal.

The appraiser might estimate that the distressed property is able to obtain a BBB rating on 20-year debt if debt represents 60% of the capital structure. According to table 6, BBB-rated debt for U.S. industrials costs 7.46%. Suppose the appraiser estimates that the equity investors require a 20% return (to be discussed later) for the remaining 40% of capital. The resulting WACC is

$$.6 \times 7.46\% \times (1 - .4) + .4 \times .20 = 10.68\%.$$

At this discount rate, the value of the property is

$$\$4.8 \text{ million}/.1068 = \$44.9 \text{ million}.$$

Using the estimated 60% debt/capital ratio, this implies that

$$60\% \times \$44.9 \text{ million} = \$27 \text{ million}$$

of debt would be utilized. Assuming the BBB rating on 20-year debt is obtained, this implies that

$$\$27 \text{ million} \times 7.46\% = \$2.01 \text{ million}$$

in interest would be payable. However, this would imply an interest coverage of only

$$\text{EBITDA/interest} = \$9 \text{ million}/\$2.01 = 4.5.$$

This is probably not sufficient to obtain the BBB rating based on the ratios in table 5, which indicates that the EBITDA coverage ratio needs to be about 5.5 for the debt to qualify for a BBB rating—especially for a property in a distressed industry.

As a result, the appraiser must revisit the assumption that 60% debt is obtainable.

If the appraiser now estimates that debt has to be limited to 50% of capital

Table 5. Adjusted Key Industrial Financial Ratios, Long-Term Debt

Three-year (1999–2001) Medians

	AAA	AA	A	BBB	BB	B	CCC
EBIT interest coverage (x)	23.1	11.4	6.2	3.8	2.2	0.9	0.1
EBITDA interest coverage (x)	24.0	14.3	8.5	5.5	3.1	1.7	0.9
FFO/total debt (%)	152.3	62.2	44.1	31.0	18.8	9.6	2.0
Free oper. cash flow/total debt (%)	97.3	27.6	17.5	9.3	4.3	(0.3)	(4.5)
Return on capital (%)	40.7	23.5	18.5	14.5	11.5	7.4	0.5
Oper. income/sales (%)	25.0	21.0	18.5	16.1	17.1	14.2	11.1
Long-term debt/capital (%)	4.4	23.0	33.3	41.5	56.4	73.6	59.8
Total debt/capital (%)	4.5	34.1	42.9	47.9	59.8	76.0	75.7
No. of companies per rating category	7	27	119	227	256	277	31

Source: Wesley Chinn, 2002, Corporate Ratings Criteria Book and CreditStats. Material is reproduced with permission of Standard & Poor's, a division of The McGraw-Hill Companies, Inc.

to obtain the BBB rating and that, as a result of the lower leverage, equity holders are willing to accept a return of 18%, the new WACC becomes

.50 x 7.46% x (1 – .4) + .50 x 18% = 11.24%.

At this new WACC, value becomes

$4.8 million/.1124 = $42.7 million.

At the assumed 50% debt/capital ratio, the amount of debt necessary falls to

50% x $42.7 million = $21.4 million.

At the assumed BBB rating, the amount of interest payable falls to

$21.4 million x 7.46% = $1.59 million.

At this amount, the EBITDA interest coverage ratio becomes

EBITDA/interest = $9 million / $1.59 million = 5.5,

which would probably qualify for the BBB rating according to table 5.

These calculations have focused on the EBITDA/interest ratio since it is usually the most critical benchmark for determining the credit rating, but in practice, of course, the other ratios also have to be checked for reasonableness.

Determining a reasonable cost of equity is particularly problematic. For distressed properties there are only a handful of potential investors. Unfortunately there is no direct method for determining the cost of equity for distressed properties. The appraiser would have to contact private equity portfolios or other potential investors to obtain direct evidence of reasonable discount rates. Using a formula such as the Capital Asset Pricing Model (CAPM) directly usually results in poor estimates because the dislocation in the industry usually causes the stock prices to behave erratically. As a result, the beta estimates needed for the CAPM from traded "comparable companies" are very unreliable. Scanning current finance trade journals can often provide evidence of the rates of return required by private equity investors in high-risk properties. As a benchmark, returns for equity investment are currently 20% or more for turnaround and highly leveraged transactions. For particularly high-risk investments, such as venture capital, required rates of return in excess of 25% are not unusual.

Summary

Determining the value of distressed properties is one of the most difficult problems for an appraiser. Old benchmarks are no longer reliable; stock and debt market data often produce bizarre numbers; and few transactions can be drawn upon for market data.

In such a situation, the appraiser must return to basic principles: make a credible forecast of cash flows (EBITDA), estimate how much debt is obtainable and at what rates based on the forecasted EBITDA, estimate a cost of equity given the amount of debt, determine the WACC, and then use the WACC to estimate value.

Table 6. Treasury and Corporate Bond Yields

		—U.S. Industrials—						—U.S. Utility—	
Maturity	Treasurys	AAA	AA	A	BBB	BB+	BB/BB–	A	BBB
5	3.01	3.75	3.96	4.43	6.21	9.07	8.76	4.80	6.65
10	4.05	4.98	5.17	5.64	7.14	9.82	10.29	5.93	7.47
15	4.31	5.34	5.52	5.98	7.32	9.90	N.A.	6.23	7.59
20	4.56	5.66	5.84	6.30	7.52	N.A.	N.A.	6.52	N.A.
25	4.81	5.97	6.14	6.61	N.A.	N.A.	N.A.	N.A.	N.A.

**Note: Data as of 12/17/2002. U.S. Industrials include Yankee bond issues. Minimum $100 million outstanding.*

Source: Global Fixed Income Research Department, and Creditweek Publication *(December 17, 2002 and January 1, 2003). Material is reproduced with permission of Standard & Poor's, a division of The McGraw-Hill Companies, Inc.*

Following this determination of value, the appraiser must check the standard ratios at the estimated numbers to determine whether the ratios are compatible with current ratios in the market. If the ratios are within a reasonable range of the market, the appraiser can feel comfortable that the valuation is reasonable. If not, the appraiser must adjust the estimated amount of debt and/or credit rating and repeat the process until the ratios are compatible with market requirements.

Determining value in distressed markets requires understanding the current market for such properties without being able to rely on many—if any—transactions for basic data. The appraiser must compile data from transactions as similar as can be found and then present the existing evidence for the reasonableness of the estimates.

Reference

Black, F., and M. Scholes. 1973. The pricing of options and corporate liabilities. *The Journal of Political Economy* 81 (May-June): 637-654.