
DETERMINING THE FAIR VALUE OF DEBT WHEN THE ISSUER MAY NOT BE A GOING CONCERN: WHEN IS LIQUIDATION VALUE FAIR VALUE?

By

Axiom Valuation Solutions

Authors

Stanley Jay Feldman, Ph.D.
Chairman and Chief Valuation Officer
stan@axiomvaluation.com

Ryan Tang
Senior Analyst
rtang@axiomvaluation.com

ABSTRACT

Default risk is the uncertainty surrounding a firm's ability to service its debts and obligations. The debt holders of a firm near bankruptcy face significant default risk. If the firm is a going concern at the measurement date but loses this status at some point at or prior to maturity, the traditional YTM approach to calculating fair value will always overvalue the debt obligation. To ensure this does not happen, Axiom Valuation Solutions ("Axiom") first compares the firm's enterprise value with its book value of debt. If there is insufficient coverage, we then employ Merton's contingent claims framework and the underlying Binomial Lattice Model to determine the likelihood that coverage will exceed unity. If the probability is either zero or very low that the coverage ratio will exceed unity at maturity, the fair value of debt is equal to the present value of the liquidation proceeds of assets available at the expected recovery date.

TABLE OF CONTENTS

Company Overview

Valuation Methodology Overview

Risk Assessment Overview

Merton's Contingent Claims Framework

Binomial Tree Model

Fair Value Analysis

Appendices

Appendix A: About Axiom Valuation Solutions

Appendix B: Professional Qualifications

CURRENT COMPANY PERFORMANCE

ABC Inc. is a designer and marketer of toys and is headquartered in New York City. For 2012 YTD, revenues of were 8% behind budget and 20% behind the same period prior year; while Adjusted EBITDA was 15% behind budget and 30% behind the same period prior year. The poor performance was primarily associated with cancelled orders from a group of large clients. The company is highly leveraged at the moment with an 8:1 book value of debt to equity ratio. Total debt outstanding at the measurement date is a \$250 million senior secured loan due in 4 years with the bulk of the principal due at maturity.

VALUATION METHODOLOGY OVERVIEW

Axiom first evaluated the creditworthiness of the borrower using Axiom’s Credit Rating Platform which incorporates in-depth Industry Analysis, Covenant Stress Analysis and Enterprise Value Debt Coverage Analysis. We then evaluate the firm’s capacity to meet the debt obligations associated with the debt using a combination of Merton’s contingent claims framework¹ and the underlying Binomial Lattice Model. If the likelihood of the firm meeting its debt obligations is low, a liquidation recovery analysis is used to develop the fair value of debt.

RISK ASSESSMENT OVERVIEW

At the measurement date, the borrower was in violation of all covenants. While ordinarily such violations would lead to re-pricing, in this case, the severity of current business conditions resulted in non-enforcement of the covenants. The debt’s credit assessment, assuming the firm is a going concern, resulted in the firm being assigned a D rating. As the table below indicates, the Enterprise Value Debt Coverage ratio is 0.14. Given that it is so low, we explored the possibility that the ratio would not exceed unity at maturity. If this were the case, then it would imply that the fair value of debt should not exceed the present value of proceeds from the liquidation of applicable assets.

Table 1-1: ABC Inc. Debt Risk Assessment

Source: Axiom

Test	Score	Interpretation	Primary Factor Measured
Covenant Stress Analysis	Fail	Risky	Cash Flow Coverage Risk
Enterprise Value Debt Coverage	0.14	Risky	Business Value Risk
Competitive Strength Rating	3	Adequate	Competitive Advantage Risk
Debt Credit Assessment	D		Security Credit Risk
Overall Credit Rating Equivalent	Below D		

Since the bulk of the principal is due in 4 years, and given the firm’s current and prospective performance, we investigated whether the enterprise value would ever be large enough to meet its year 4’s principal obligation.

¹ Merton’s model was first commercially used by KMV which was subsequently acquired by Moody’s.

MERTON'S CONTINGENT CLAIMS FRAMEWORK

Merton's model is used to explore the link between the market value of the firm's assets and the market value of its equity. Equity has the residual claim on the assets after all other obligations have been met. A call option on the underlying assets has the same properties as the associated equity value. Hence, the relationship between equity value and asset value can be viewed as a two equation system as shown below.

[Equity Value] = *OptionFunction* ([Asset Value], [Asset Volatility], [Capital Structure], [Interest Rate])

[Equity Volatility] = *OptionFunction* ([Asset Value], [Asset Volatility], [Capital Structure], [Interest Rate])

To implement the Merton Model, we calculated the required data from the public comparable companies. The table below shows these calculations.

Table 1-2: Public Comparable Companies' Merton Model
Source: Axiom

Time to Maturity (T)	4	OPQ Inc.	
Total Debt (X)	\$1,778,600		
Risk Free Rate(Rf)	0.55%		
Assets Value (Va)	\$25,882,827	Equity Value (Ve)	\$24,148,167
Assets Volatility (σa) (4)	48.98%	Equity Volatility (σe)	52.50%
	d1 (2)= 3.245593851		d2 (3)= 2.265915513
	N(d1)= 0.99941397		N(d2)= 0.988271722
Equity Value (Ve) (1)	\$24,148,167		
Formulas:			
(1) $Ve = VaN(d1) - e^{-RfT}XN(d2)$		(3) $d2 = d1 - \sigma a\sqrt{T}$	
(2) $d1 = \frac{\ln\left(\frac{Va}{X}\right) + \left(Rf + \frac{\sigma a^2}{2}\right)T}{\sigma a\sqrt{T}}$		(4) $\sigma e = \frac{Ve}{Va}\sigma a$	

Time to Maturity (T)	4	RST Corp.	
Total Debt (X)	\$10,895,000		
Risk Free Rate(Rf)	0.55%		
Assets Value (Va)	\$19,123,007	Equity Value (Ve)	\$11,236,760
Assets Volatility (σa) (4)	55.43%	Equity Volatility (σe)	94.33%
	d1 (2)= 1.081619432		d2 (3)= -0.02691071
	N(d1)= 0.860289167		N(d2)= 0.489265474
Equity Value (Ve) (1)	\$11,236,760		
Formulas:			
(1) $Ve = VaN(d1) - e^{-RfT}XN(d2)$		(3) $d2 = d1 - \sigma a\sqrt{T}$	
(2) $d1 = \frac{\ln\left(\frac{Va}{X}\right) + \left(Rf + \frac{\sigma a^2}{2}\right)T}{\sigma a\sqrt{T}}$		(4) $\sigma e = \frac{Ve}{Va}\sigma a$	

The table below summarizes the results shown in Table 1-2 above.

Table 1-3: ABC Inc. Asset Volatility
Source: Axiom

Firm	Ticker	Equity Value	Asset Value	Equity Volatility	Asset Volatility
OPQ Inc.	QPQ	\$24,148,167	\$25,882,827	52.50%	48.98%
RST Corp.	RST	\$11,236,760	\$19,123,007	94.33%	55.43%
Average		\$17,692,464	\$22,502,917	73.41%	52.21%

An important result from this analysis is that asset volatility is lower than equity volatility for a firm that has debt. Although not shown directly, as leverage increases, equity volatility increases relative to asset volatility. This means that an asset's upside going forward is not as large as the upside implied by the equity volatility. This has important implications for the probability that the debt can be paid back at maturity as we show below.

THE BINOMIAL LATTICE MODEL

Combining ABC's enterprise value with its asset volatility, we developed a Binomial Lattice Model to estimate at what point over the life of the debt the enterprise value would be expected to exceed debt principle. We also assumed the debt would amortize at its contractual rate. As noted earlier, there is little amortization of principal prior maturity. If the enterprise value for a given year is less than the debt level in that year, it indicates the likelihood of default is high and the debt holders are facing great default risk. The table below shows the components of the Lattice model.

Table 1-4: Enterprise Value Binomial Tree Model
Source: Axiom

Enterprise Value Table				
Base Period	Year 1	Year 2	Year 3	Year 4
\$68,126,897	\$114,826,721 \$40,419,809	\$193,538,477 \$68,126,897 \$23,981,144	\$326,205,797 \$114,826,721 \$40,419,809 \$14,228,055	\$549,814,298 \$193,538,477 \$68,126,897 \$23,981,144 \$8,441,530
Debt				
Base Period	Year 1	Year 2	Year 3	Year 4
\$250,000,000	\$247,500,000	\$245,000,000	\$242,500,000	\$240,000,000
Value Difference Table				
Base Period	Year 1	Year 2	Year 3	Year 4
(\$181,873,103)	(\$132,673,279) (\$207,080,191)	(\$51,461,523) (\$176,873,103) (\$221,018,856)	\$83,705,797 (\$127,673,279) (\$202,080,191) (\$228,271,945)	\$309,814,298 (\$46,461,523) (\$171,873,103) (\$216,018,856) (\$231,558,470)
Probability Table				
Base Period	Year 1	Year 2	Year 3	Year 4
1	0.38 0.62	0.14 0.47 0.39	0.05 0.27 0.44 0.24	0.02 0.13 0.33 0.36 0.15
Total	1	1	1	1

As shown above, only the upper branch in year 3 and year 4 shows an enterprise value greater than the debt level. The corresponding probabilities for these 2 points are 5%, and 2% respectively which means the likelihood of this outcome happening is very low. Overall, the results indicate that using a going-concern assumption is not consistent with how a market participant would value the firm's debt. The December 31, 2011 audit indicated the following: *"The consolidated financial statements have been prepared assuming that the Company will continue as a going concern. The Company has incurred recent net losses and negative cash flows from operating. In addition, if the Company's sales continue to decline as they have through 2011, the Company may not have sufficient cash flows to meet its operating obligations through the end of 2012. This raises substantial doubt about the Company's ability to continue as a going concern. The financial statements do not include adjustments that might result from the outcome of this uncertainty."*

FAIR VALUE ANALYSIS

Based on our analysis, Axiom concludes that an informed market participant would value this credit on a liquidation of asset basis. Since management projected the book value of assets at year-end 2012, we used this as the starting point for our recovery analysis. While the firm does not have to repay the bulk of the principal until 2015, removal of the going-concern assumption means that an informed market participant would fair value the debt based on the best estimate of liquidation value at the measurement date which in this case is based on the proceeds that would be captured upon liquidation of marketable tangible and intangible assets at year-end 2012. Based on expected business developments, the expected recovery is shown in the table below.

Table 1-5: Recovery Analysis
Source: Axiom

Item	Projected 2012 Book Value	Recovery Ratio	Projected 2012 Recovery Value (1)
Cash and Cash Equivalents	\$18,287,000	100%	\$18,287,000
Accounts Receivable	\$13,568,000	80%	\$10,854,400
Inventory	\$11,269,000	50%	\$5,634,500
Tax Refund	\$25,000,000	100%	\$25,000,000
Net Fixed Assets	\$7,859,000	25%	\$1,964,750
Intangible Assets	\$168,000,000	15%	\$25,200,000
	Sum		\$86,940,650
	6 Months Risk Free Rate		0.15%
	Discount Factor (2)		0.999
	Recovery Value as of Valuation Date		\$86,864,667
Note (1): Recovery Value = Book Value * Recovery Ratio			
Note (2): Discount Factor = 1/(1+6M Risk Free Rate) ^ Discount Period			

Table 1-6: Debt Fair Value

Source: Axiom

Row	Item	Value	Source
1	Recovery Value	\$86,864,667	Table 1-4
2	Market Value of Senior Debt	\$86,864,667	R1
3	Par Value of Senior Debt	\$250,000,000	ABC Inc.
4	Axiom Price	34.75	R2 / R3 * 100

The percentage of assets recovered is based on Axiom's assessment of how marketable the identified assets are. In the case of intangibles, the only assets that are marketable are the brand names. The customer list has little value since market participants are already doing business with the bulk of the customer base. Based on the recovery analysis, the fair value of ABC Inc.'s debt is \$86,864,667 which is equivalent to about 35% of the face amount of the debt.

APPENDIX A: ABOUT AXIOM VALUATION SOLUTIONS

Axiom is a global provider of expert valuation services for businesses, illiquid securities, fixed income portfolios, intangible and tangible assets, and other hard-to-value assets. We value thinly traded public companies and divisions of public companies for a variety of purposes. Examples include:

- Fair value reviews of fixed income portfolios with private company loans to meet FAS 157/ASC Topic 820
- Fair value determinations of Guaranteed Investment Contracts to meet FAS 157/ASC Topic 820 for year-end audits
- Certified valuations of stock option grants consistent with IRS Section 409A and determination of related option expenses under FASB 123R/ASC Topic 718
- Review of acquisition purchase price allocations under FAS 141R/ASC Topic 805 and goodwill impairment testing under FAS 142/ASC Topic 350
- Return authentication analyses of hedge fund and private equity interests for institutional investors consistent with FAS 157/ASC Topic 820
- Certified valuations of businesses and ESOPS fully compliant with IRS Revenue Ruling 59-60
- Certified valuations of limited liability corporations, family limited partnerships, and other special purpose entities used in estate planning fully compliant with IRS Revenue Ruling 59-60
- Accurate and cost-effective value estimates of private businesses for use in financial planning, risk management, strategy analysis, and initial ESOP assessments

Valuation issues are becoming increasingly complex and central to financial reporting for many organizations. Mastering these valuation challenges requires multi-disciplined expertise in finance, accounting, and economics; in-depth understanding of evolving financial markets; and skills in using and managing complicated valuation metrics. Our staff meets those requirements. They have undertaken extensive finance research and they have published in peer-reviewed journals, but their work is grounded in real world valuation experience.

Our staff members also have many years of effective interaction with auditors of the Big 4, and other firms and their valuation specialists. This combination enables Axiom to deliver an unparalleled level of service to clients.

Axiom sells these standard services primarily through referral by accounting firms, law firms, private equity firms, hedge funds, and financial advisory firms. In addition, Axiom provides expert, valuation-related consulting services in the following areas:

- Merger and acquisition advisory services and fairness opinions
- Litigation consulting and expert testimony on valuation-related issues

APPENDIX B: PROFESSIONAL QUALIFICATIONS

STANLEY J. FELDMAN, PH.D.

Dr. Feldman is Chairman and co-founder of Axiom Valuation Solutions based in Wakefield, Massachusetts. He is an expert in the valuation of complex financial securities, including thinly traded equity and fixed income instruments, and public and privately held businesses. He is the architect of Axiom's credit risk and valuation platforms which are used to fair value both liquid and illiquid investments of retirement plans, endowment funds and hedge funds. Dr. Feldman is a Certified Patent Valuation Analyst Faculty member and a leading expert in valuation issues related to Purchase Price Accounting (FAS 141R) and Goodwill Impairment (FAS 142), particularly as they impact the valuation of intangible assets. Dr. Feldman has extensive background in valuing complex capital structures of early and late stage VC and private equity financed firms and has conducted numerous assignments to meet the requirements of FAS 123R and IRS 409A. He is a Daubert-qualified expert and has provided expert testimony on numerous and complicated valuation issues. He has taught and researched valuation issues as a tenured Associate Professor of Finance at Bentley University in Waltham, Massachusetts. Dr. Feldman was a member of the Financial Accounting Standards Board's (FASB) Valuation Resources Group, an external advisory committee on valuation issues.

Dr. Feldman is the author of a professional book *Principles of Private Firm Valuation* published by John Wiley Publishers in 2005. He is also the principal author of *What Every Business Owner Should Know about Valuing Their Business* published by McGraw-Hill Professional Books in November 2002. He contributed the "The Valuation of Private Firms" chapter for Fabozzi's Handbook of Finance (2008).

Dr. Feldman is also an expert on industry revenue and profit forecasting. He served as Senior Vice President for Industry and Regional Services at DRI/McGraw-Hill in the late 1980s. He directed DRI's successful expansion into detailed industry forecasting by region and by state for private sector and government clients.

A sample of Dr. Feldman's valuation-related experience includes:

- Valuing small cap public companies with thinly traded securities in U.S. and international stock markets
- Valuing unregistered shares of a publicly held company for gifting purposes prior to an acquisition
- Valuing GICs, CMOs, CDOs, CDSs, ABSs, Pass-throughs, structured investment vehicles and credit linked notes
- Determining the fair value of alternative investments, such as hedge funds, funds of funds, and private equity funds for pension and endowment funds
- Valuation for acquisitions and divestitures
- Valuation of complex securities including warrants and contracts with embedded options
- Valuation of loans and other illiquid fixed income securities for well-known hedge funds
- Valuation of Auction Rate Securities for a large university which served as the basis of a tender offer for repurchase by the university
- Valuation of the Guaranteed Investment Contracts owned by the 401(k) fund for a union of elevator installation, repair, and maintenance workers
- Valuation of endowment fund investments made up of level 2 and 3 securities

Related Experience

Dr. Feldman. Tenured Associate Professor of Finance, taught courses in corporate finance, business and financial policy, and investments at both the graduate and undergraduate levels at Bentley University - Waltham, MA for twenty years. He was for many years a member of the Board of Directors of the New England Economics Project, a regional forecasting consortium. Professor Feldman has written extensively on issues related to business valuation and small business financing for both the Boston Herald and the Boston Business Journal.

Prior to joining Data Resources, Professor Feldman was a senior economist with Prudential Insurance Company. In this capacity, he analyzed financial markets, forecasted interest rates and helped develop asset allocation strategies for those retirement assets that were actively managed by Prudential. Before joining Prudential, Professor Feldman was an economist with the Federal Reserve Bank of New York. Professor Feldman received a B.A. in economics from Hunter College, City University of New York, and a Ph.D. from New York University.

Selected Publications

"The Valuation of Private Firms", *Handbook of Finance*, Fabozzi, Editor, John Wiley, 2008.

"Overcoming IRS Challenges to the Amount of Marketability Discount", *Estate Planning*, January 2005, pp. 33-35.

Principles of Private Firm Valuation, John Wiley, March 2005

What Every Business Owner Should Know About Valuing Their Business (with Dr. Tim Sullivan and Roger Winsby), McGraw-Hill Professional Books, November 2002.

"A Note on Using Regression Models to Predict the Marketability Discount", *Business Valuation Review*, September, 2002

"Calculating Goodwill Impairment: Valuation Issues Raised by Financial Accounting Statement 142", Terra-Firma Publications, May 2002.

"Investor Attitudes Toward the Value of Corporate Environmentalism: New Survey Findings" (with Peter Soyka) *Journal of Environmental Quality Management*, Autumn 1998.

"Does Improving a Firm's Environmental Management System and Environmental Performance Result in a Higher Stock Price?" (with Peter Soyka and Paul Ameer). *Journal of Investing*, Winter, 1997.

"Capturing the Business Value of EH&S Excellence" (with Peter Soyka). *Environmental Management Journal*, Winter, 1997.

"Sources of Structural Change in the United States, 1963-1978: An Input-Output Perspective" (with David McClain and Karen Palmer). *Review of Economics and Statistics*, Vol. LXIX, No. 3, August, 1987, pp. 503-510.

"Industry Analysis and Investment Decision-making Under Conditions of Uncertainty." *Managerial and Decision Economics*, Vol. 4, No. 3, 1983, pp. 193-207.

"The Determinants of Profit Growth in the Manufacturing Sectors" (with Richard DeKaser). *Profits, Deficits, and Instability*, D.B. Papadimitriou ed., Macmillan, 1992.

"The Impact of Productivity, Pricing, and Sales on Shareholder Wealth" (with Timothy Sullivan). *Data Resources Long-term Review*, Summer, 1992, pp. 19-23.

"Has the Private Rate of Return on Industry R&D Increased?" (with Timothy Sullivan and Richard DeKaser). *Data Resources Long-Term Review*, Winter, 1991, pp. 21-24.

Evaluation of Citibank's Debt Rating Model. This report reviewed Citibank's debt rating model, made suggestions for possible improvements and reviewed the literature on credit risk and default modeling, October, 1997.