The Flawed Perpetual Growth Assumption and Its Impact on Terminal Value

Article · June 2017

CITATIONS
0

READS
135

1 author:

Gilbert Matthews
Sutter Securities, San Francisco
22 PUBLICATIONS **8** CITATIONS

SEE PROFILE

The Flawed Perpetual Growth Assumption and Its Impact on Terminal Value

GILBERT E. MATTHEWS, CFA

Sutter Securities Incorporated
San Francisco, CA
gil@suttersf.com

Prof. James Morris perceptively points out:

> [R]elatively little attention is given to expected [corporate] life in the valuation literature and in the valuation methods used by practitioners. ... The constant growth model is as accurate as the assumptions on which it is based: an infinite horizon and growth that is expected to be the same rate every period forever. If the firm's circumstances do not fit these assumptions, the model can lead to an inaccurate valuation. How inaccurate depends on how far the assumptions depart from reality.[1]

In the customary determination of terminal value in a DCF valuation, it is assumed that a mature company will grow at a constant rate in perpetuity.[2] Is the assumption of constant perpetual growth valid? If it is not, does the currently used growth model in DCF analyses result in overvaluations by overstating terminal value? This article explains why the perpetual growth concept needs to be reexamined. It also discusses proposals to recognize the risks of corporate decline and corporate mortality and to make correspondingly appropriate adjustments.

NUMEROUS COMPANIES DECLINE OR FAIL

The assumption of perpetual growth does not take into account the risk of unexpected financial disasters, such as those experienced by Enron, WorldCom, HealthSouth, and Bear Stearns. More importantly, it does not consider the impact of technological change, competition and obsolescence.

In the middle of the last century, analysts assumed the continuing growth of steel companies; steel production peaked in the 1960s and electric-arc furnaces, excess capacity, and international competition eroded the revenues and earnings of the major steel producers. Department stores were considered to be a classic example of steady growth, but online distribution and specialty retailers have devastated them. Eastman Kodak and Polaroid, once considered prime growth companies, lost their markets to electronic imaging and went bankrupt. New energy sources are replacing coal. More recently, leading high-tech companies such as AOL and Yahoo have lost out to more nimble competitors.

Data based on both large and small companies confirm decline or death for a sizeable number of companies. The components of the Fortune 500 have changed significantly over time, and the attrition rate has accelerated in recent years. Only 61 companies that were in the 1955 Fortune 500 remain in the 2015 Fortune 500. Companies that were included in the 1958 S&P 500 had been in the index for an average of 61 years (based on seven-year rolling averages). By 1980, the average tenure had declined to about 25 years. Over the decade to 2012, about half the S&P 500 was replaced.[3] Now the average tenure is about 18 years. Many firms were acquired, but a material number of the companies that have dropped from the list did so because of poor performance. **Figure 1** on the next page shows some examples of firms dropped from the S&P 500.

Data from the U.S. Small Business Administration (SBA) shows that about half of all new businesses are still operating five years later and about one-third of those survivors are out of business after ten years.[4] For companies that mature and become listed on an exchange, Loderer, Neusser, and Waelchli concluded in 2011 that the frequency of corporate failure after listing gradually falls "from about 3% [annually] in early years to 0.3% before companies get to be 75."[5]

Many other studies have also posited that the corporate mortality risk decreases with time. However, some studies have reached a contrary and counterintuitive conclusion: a study published in 2015 examined the lifespans of more than 25,000 public companies based on Compustat data and concluded that the mortality rate of public companies is not a function of time.[6]

There is no dispute that the mortality rate is a function of the size of a company. There is a high correlation between corporate mortality and equity value and between corporate mor-

Continued on next page

expert TIP

In the customary determination of terminal value in a DCF valuation, it is assumed that a mature company will grow at a constant rate in perpetuity.[2] Is the assumption of constant perpetual growth valid?

tality and number of employees—the larger the firm, the lower the risk.[7] See **Figure 2** at bottom right, in which the largest firms (by market value of equity) are in decile 1 and the smallest are in decile 10.

WHY DO COMPANIES DISAPPEAR?

What are the reasons for this attrition? Some companies disappear because they are absorbed in mergers and acquisitions. A substantial portion of these acquired companies are prosperous and growing, but some of the target companies are declining and/or financially troubled. Some companies are dropped from indices because of financial problems that slow or reverse their growth. Others are restructured in bankruptcy, and some simply cease operations and die. Companies that are rescued by acquirors rebut the assumption of perpetual growth, as do companies that cease growing, suffer from severe financial problems, or cease operations.

However, acquisitions of healthy companies have usually been included in studies of corporate mortality. Since these companies, at the time of their acquisition, are normally continuing to grow, their inclusion is inappropriate and distorts the data. Such acquisitions should be distinguished from acquisitions of troubled companies affected by adversity, whose acquisition price is impacted by their poor prospects and weak financial condition.

CORPORATE MORTALITY CAN BE A MATERIAL RISK FACTOR

Morris's article discusses the issue of firm survival and mortality, examines available data for small entities, and addresses its impact on corporate valuation. In **Figure 3** on the next page, he calculates the impact of firm mortality on DCF value, where k = discount rate and g = growth rate.[8]

The impact of disregarding mortality risk can be substantial. For illustrative purposes, if the risk of failure in

Continued on next page

FIGURE 1

EXAMPLES OF COMPANIES DROPPED FROM S&P 500 – 2001-2012

Dropped because of poor performance

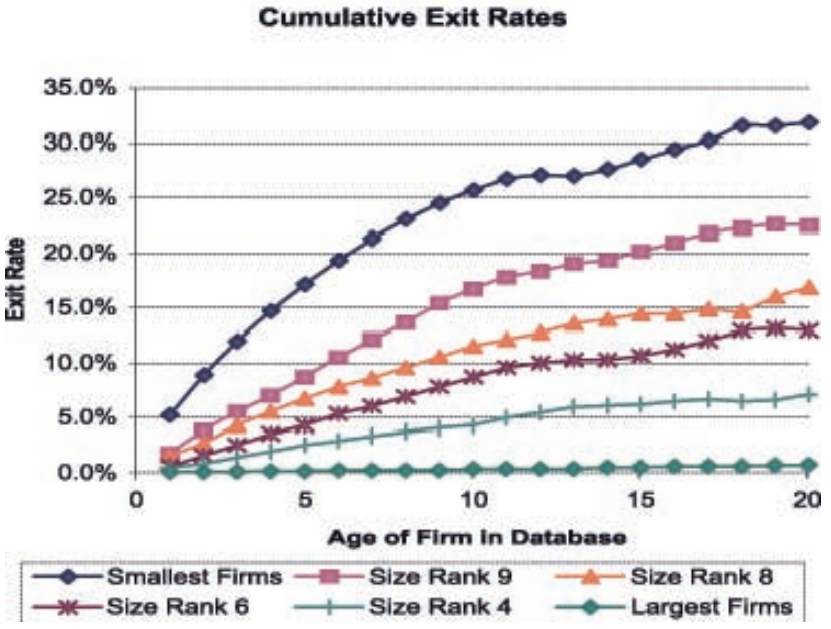
American Airlines	restructured in bankruptcy
Bear Stearns	insolvent, taken over by JP Morgan
Eastman Kodak	restructured in bankruptcy
Enron	bankrupt, ceased operations
Global Crossing	restructured in bankruptcy
Lehman Brothers	bankrupt, ceased operations
Maytag	acquired after material reduction in sales
NY Times	slow growth
Palm	sales decline and financial problems
Radio Shack	financial problems

Healthy companies dropped because of acquisition

Anheuser-Busch	acquired by InBev
May Department Stores	acquired by Federated Department Stores
Toys "R" Us	taken private in LBO
Wendy's	merger with TriArc
Wyeth	acquired by Pfizer

FIGURE 2

EXIT RATES FOR FIRMS DUE TO UNFAVORABLE MORTALITY FOR SELECTED SIZE CATEGORIES



Source: Morris, "Life and Death of Businesses," p. 3, citing Maggie Queen and Richard Roll, "Firm Mortality: Using Market Indicators to Predict Survival," *Financial Analysts Journal*, (1987), vol. 43, p. 9.

any given year is 1 percent and is constant year to year, the cumulative risk of failure within 15 years is 14.0 percent and within 25 years is 22.2 percent, as shown in **Figure 4** at center right. **Figure 5** at bottom right shows that if we assume (again, for illustrative purposes) that the risk declines 5 percent per year after Year 10, the cumulative risk of failure within 25 years is about 82 percent of the cumulative risk at a constant rate.

This magnitude of the impact of firm mortality on firm value is a function not only of the mortality risk, but also of the growth rate and the discount rate. The impact increases at higher growth rates and decreases at higher discount rates.

ADJUSTING FOR CORPORATE MORTALITY

Prof. Sherrill Shaffer points out that since "most of the value of a stream of discounted cash flows stems from the distant future, ... the correct adjustment for the risk of failure may imply quite different values of equity than those given by the standard model."[9] The risk of corporate decline and mortality is not reflected in customary CAPM calculations,[10] particularly in a single-projection model. Since the risk of corporate decline or failure exists in most valuations, valuators need to make appropriate adjustments. Various authors have begun to address the problem and have proposed a variable, "p," for adjusting valuations for the risk of business decline and failure.

Shaffer believes that the Gordon growth formula should be adjusted to reflect risk of failure. Shaffer proposes adjusting the Gordon growth formula for "p," which he defines as the probability that "the asset may irreversibly default (i.e., the issuing company may fail) in any given year."[11] He then solves his formula to determine *"R,"* (the discount rate adjusted for p):[12]

$$R = \frac{p\,(1 + r)^2}{1 + g - p\,(r + g + 2)}$$

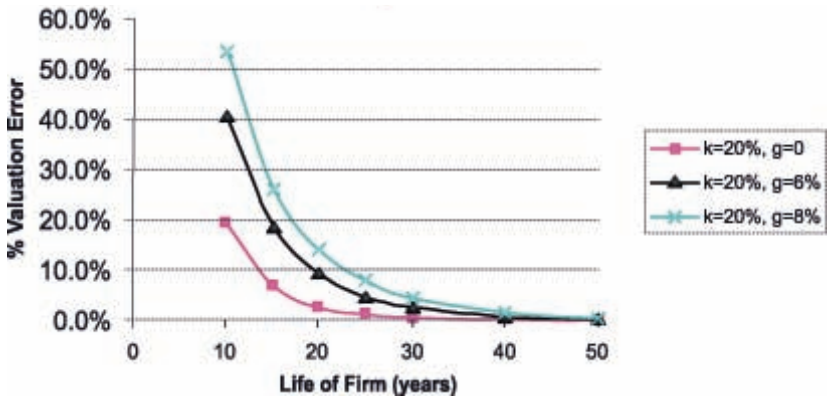
where:

r = discount rate

g = long-term growth rate

FIGURE 3

VALUATION ERROR @ k =20%



Source: Morris, "Life and Death of Businesses," p. 3

FIGURE 4

CUMULATIVE RISK OF FAILURE ASSUMING CONSTANT ANNUAL RATE

	Per year:	0.25%	0.5%	1.0%	1.5%	2.0%
Cumulative risk:	10 years	2.5%	4.9%	9.6%	14.0%	18.3%
Cumulative risk:	15 years	3.7%	7.2%	14.0%	20.3%	26.1%
Cumulative risk:	20 years	4.9%	9.5%	18.2%	26.1%	33.2%
Cumulative risk:	25 years	6.1%	11.8%	22.2%	31.5%	39.7%

FIGURE 5

CUMULATIVE RISK OF FAILURE ASSUMING THAT RISK DECLINES 5% PER YEAR AFTER YEAR 10

Risk in first 10 years	0.25%	0.5%	1.0%	1.5%	2.0%
Risk in Year 15	0.19%	0.39%	0.77%	1.16%	1.55%
Risk in Year 20	0.15%	0.30%	0.60%	0.90%	1.20%
Risk in Year 25	0.12%	0.23%	0.46%	0.69%	0.93%
Cumulative risk: 15 years	3.5%	6.9%	13.4%	19.4%	25.1%
Cumulative risk: 20 years	4.3%	8.5%	16.2%	23.4%	29.9%
Cumulative risk: 25 years	4.9%	9.6%	18.4%	26.3%	33.5%

Shaffer writes:

> The simplest way to estimate p is to use historical average business failure rates, which are widely available. ... Recognizing that different industries sometimes exhibit very different failure rates, sector-specific failure rates may be more appropriate. ... A more detailed and forward-looking approach would involve statistical models predicting firm-specific probabilities of failure, based on current financial data for each firm and calibrated using historical linkages between financial ratios and subsequent failure.[13]

Continued on next page

Prof. Aswath Damodaran, also recognizing the issue, presents the following formula for adjusting enterprise value for the risk of financial distress:[14]

$$AV = PV (1 - p) + DSV \times p$$

where:

AV = present value adjusted for risk of financial distress
PV = unadjusted present value based on DCF
DSV = distressed sales value
p = probability of distress

Damodaran posits that statistical techniques can be applied to historical data to determine the probability of distress as a function of observable variables. He notes that factors such as high debt ratios and negative cash flows increase the risk of failure, and he points out that bond ratings and the historical relationship between ratings and defaults can be used to estimate mortality risk.

Atanu Saha and Burton Malkiel, like Shaffer, propose adjustments to terminal value calculations. They point out:

> Because CAPM-based discount rates only account for market risk, valuation models may greatly underestimate the discount rate in settings where the idiosyncratic risk of the cash flows matters. This is especially so in cases where there is a significant probability that the future stream of cash flows may completely cease. This is a risk that the CAPM ignores because that model assumes it is a risk that can be diversified away. ... [W]e believe that an additional adjustment to the discount rate is warranted to account for cash flow cessation probability, in settings where such a possibility is not immaterial.[15]

They develop a framework for calculating present value when free cash flow (FCF) has a constant probability of cessation at each period:[16]

$$AV = \frac{FCF(1 + g)(1 - p)}{r - g + p(1 + g)}$$

Based on this formula:[17]

$$R = \frac{p + r}{1 - p}$$

The authors then present a more complex formula based on the assumption that the cessation risk declines as the firm ages.[18] They estimate the time-varying discount rate based on the observed attrition rate for companies backed by venture capital or private equity firms, utilizing separate data for IT firms and for all other companies.[19] The data are summarized in **Figure 6** below. Valuators should review the procedure proposed by Saha and Malkiel and consider its applicability to their specific valuations.

CONCLUSION

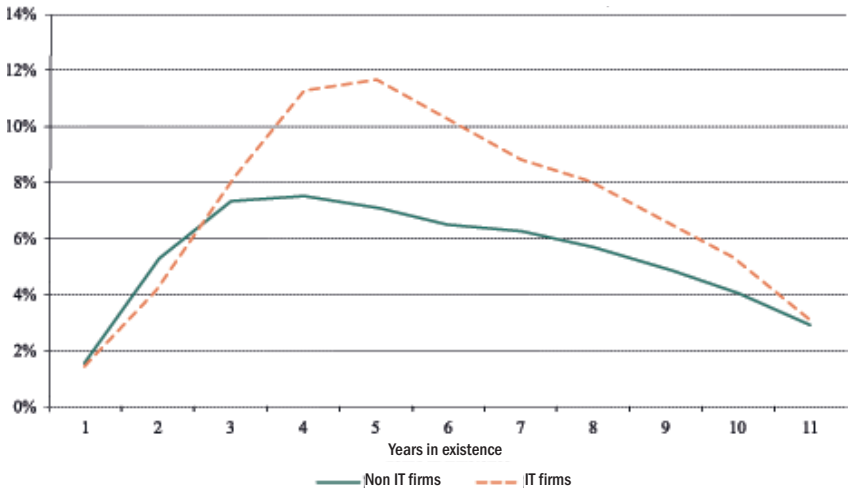
The general practice of assuming a constant perpetual growth rate for calculating terminal value needs to be reexamined. Adjustments for firm mortality or for the risk of decelerating growth must be considered. For companies with a low mortality risk, the impact may be immaterial. On the other hand, the risk for young companies, particularly in biotech and high-tech companies, is clearly material. Discount rates used by venture capital investors include mortality risk—venture capitalists have always accounted for the substantial possibility that a start-up company may not succeed by using discount rates of 35 percent or more. However, mortality risk is not normally included as a factor when discount rates are determined using CAPM or the build-up method.

The valuation community—and the academic community—should consider how to quantify the risks not only of mortality but also of declining (or negative) long-term growth. How

Continued on next page

FIGURE 6

OBSERVED ATTRITION RATE FOR NON-IT AND IT FIRMS, 1987-1999



Source: Saha and Malkiel, "Variation of Cash Flows with Time-Varying Cessation Risk," p. 11.

can these risks be reflected in higher discount rates and/or lower long-term growth rates? As Morris notes, "There are no generally accepted mortality tables for businesses."[20] He discusses several studies, but the sources he cites (which includes academic studies for disciplines other than finance) are of limited use. His industry table is based on SBA data that are dominated by very small companies, and other data that he cites are too granular, focusing on individual plants rather than companies as a whole.

Further empirical research into firm decline and mortality is necessary to develop the appropriate risk premiums. Studies of corporate decline and mortality should focus on companies who suffer material declines because of poor performance or whose existence terminates. Healthy companies that are acquired have not "died" and should be excluded from these studies. The studies need to analyze the data by industry and should measure the effect of size on mortality. Analyses of size should consider, among other things, such variables as revenues, number of employees, and net asset value.

A company-specific factor that valuators should consider is the impact of financial strength on corporate mortality. For this purpose, studies of financial distress as a function of credit ratings would be useful. Unlike most factors considered in estimating company-specific risk, credit risk can be supported by empirical data.

Although the available data on corporate mortality are limited, it should not be ignored. Failing to consider this factor may result in material overvaluations. Until further research is undertaken to provide better generally accepted data to aid in quantifying corporate mortality, valuators are compelled to supplement the existing data with their own subjective judgment.

1 James R. Morris, "Life and Death of Businesses: A Review of Research on Firm Mortality," *Journal of Business Valuation and Economic Loss Analysis,* vol. 4 (October 2009), p. 1; see also Morris, "Firm Mortality and Business Valuation," *Valuation Strategies* (September/October 2009), pp. 6-13, 46-47.

2 There are some companies for which perpetual growth is usually not assumed, e.g., companies in extractive industries with diminishing reserves and companies dependent on patent protection.

3 Richard N. Foster, "Creative Destruction Whips through Corporate America," Innosight Executive Briefing, Winter 2012, available at www.innosight.com/insight/creative-destruction-whips-through-corporate-america-an-innosight-executive-briefing-on-corporate-strategy/.

4 James R. Morris, "Firm Mortality and Business Valuation," *Valuation Strategies* (September/October 2009), p. 10. The data cover the years 1990–2004.

5 Claudio F. Loderer, Klaus Neusser, and Urs Waelchli, "Firm Age and Survival," SSRN (2011), available at www.ssrn.com/abstract=1430408.

6 Madeleine I.G. Daepp, Marcus J. Hamilton, Geoffrey B. West, and Luís M. A. Bettencourt, "The Mortality of Companies," *Journal of The Royal Society Interface* (2015), available at rsif.royalsocietypublishing.org/content/12/106/20150120. However, their definition of lifespan included mergers and acquisitions, which were the terminal events for about half of the companies.

7 Morris, "Life and Death of Businesses," p. 4.

8 Ibid., p. 3.

9 Sherrill Shaffer, "Equity duration and convexity when firms can fail or stagnate," Financial Research Letters, vol. 4 (2007), p. 235.

10 Although company-specific risk may include risk based on a company's financial condition, it may not include risks of factors such as technological change, competition, and obsolescence.

11 Sherrill Shaffer, "Corporate Failure and Equity Valuation," *Financial Analysts Journal,* vol. 62 (2006), p. 73.

12 Ibid., 74.

13 Sherrill Shaffer, "Equity duration and convexity," p. 239.

14 Aswath Damodaran, *Investment Valuation,* 3rd ed. (Wiley, 2012), pp. 319-320.

15 Atanu Saha and Burton K. Malkiel, "Valuation of Cash Flows with Time-Varying Cessation Risk," *Journal of Business Valuation and Economic Loss Analysis,* vol. 7 (2012), p. 1.

16 Ibid.

17 Ibid.

18 Ibid., 5-6.

19 Ibid., 9-14.

20 Morris, "Life and Death of Businesses," p. 2.