MISVALUATION: ANOTHER EXPLANATION FOR THE FAILURE OF CORPORATE ACQUISITIONS

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Abstract

Every year growth strategies of corporations mean that billions of dollars of acquisitions are approved by boards and senior executives. Yet studies show that 50 percent or more of these acquisitions are unsuccessful. What goes wrong? In this article I argue that much of the blame for these well documented failures stems from weaknesses with the standard valuation methods themselves and the difficulties with implementing the methods. By focussing on the role of the CEO and boards, I suggest a number of steps that could reduce the frequency and size of these failures.

Keywords: Corporate Acquisition, Standard Valuation Methods, CEO, Board of Directors

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Why Make Acquistions?

Corporate strategies generally involve growth and growth frequently means finding, valuing and approving acquisitions.[1] Some view the importance of acquisitions as an outcome of desperation for survival[2] or eat or be eaten.[3] In many cases the driver for making acquisitions comes from outside the company in the form of investment banks and corporate brokers.[4] Unfortunately a surprisingly large proportion of acquisitions fail to live up to expectations.

The usual reason given for these failures is unforseen complexities in integrating the culture of the target company with that of the original company. Another reason is unexpected difficulties in realizing the promised economies of scale and synergies. My research, however, suggests that there are more fundamental problems which lie at the heart of the valuation methods themselves. Using these methods dooms to failure a significant proportion of acquisitions even before the contracts are signed.

Imagine a situation where an acquisition is available for $500 million while the internal estimates of the CEO and purchase committee value it at $800 million. Most boards would vote for the acquisition with little hesitation. Unfortunately too often it is later discovered that it was worth far less, perhaps as little as $250 million, causing the acquisition to be quietly divested.

Such variations in valuation results are a common outcome of the standard methods used to value companies. The variations and uncertainty of the results arise because of a number of traps associated with the methods such as the extreme sensitivity of standard discount valuation methods to the input forecasts and assumptions. Theses valuations are so sensitive that small variations in the forecasts required for the calculations can lead to hugely varying outcomes despite using the same fundamental data. Yet these variations are immaterial from an accounting perspective and untestable from a scientific one

Even worse, exactly the same argument for any of the key forecasts for a $250 million valuation can be used word-for-word for a $800 million valuation, and vice versa. While appearing to be objective, most valuation methods are really highly subjective.

[1] There is a rich literature on the interaction between corporate strategy, growth and acquisitions. Recent examples include Nina Dorata, "Determinants of the Strengths and Weaknesses of Acquiring Firms in Mergers and Acquisitions: A Stakeholder Perspective," International Journal of Management. 29(2) (2012): 578-590; Julia Prats, Marc Sosna and S. Ramakrishna Velamuri, "Managing in Different Growth Contexts," *California Management Review*, 54(4) (2012): 118-142; Antonio Davila, George Foster and Ning Jia, "Building Sustainable High-Growth Startup Companies: Management Systems as an Accelerator," *California Management Review*, 52(3) (2010): 79-105; Han Smit, Thras Moraitis, "Playing at Serial Acquisitions," *California Management Review*, 53(1) (2010): 56-89; and Angelo Dringoli, *Corporate Strategy and Firm Growth: Creating Value for Shareholders* (Cheltenam, UK: Edward Elgar, 2011).

[2] Ji-Yub Kim; Jerayr Haleblian and Sydney Finkelstein, "When Firms Are Desperate to Grow via Acquisition: The Effect of Growth Patterns and Acquisition Experience on Acquisition Premiums," *Administrative Science Quarterly*, 56(1) (2011): 26-60.

[3] Gary Gorton; Matthias Kahl and Richard Rosen, "Eat or Be Eaten: A Theory of Mergers and Firm Size," *Journal of Finance*, 64(3) (2009): 1291-1344.

[4] Janice DiPietro, "Responsible Acquisitions Yield Growth," Financial Executive, 26(10) (2010): 16-19. 4p.

Dismal History of Acquisition Success

Every year billions of dollars of assets are wasted or destroyed through executives and boards of leading companies making ill-judged purchase decisions. Why does this happen? On the surface the process of profiting from acquisitions seems straightforward.

Calculate the values of potential acquisitions until you find one that is highly undervalued. Make the purchase from existing funds, taking on debt, or by raising capital. Reap the reward from the acquisition. In practice, however, the results are dismal.

Dennis Mueller and Mark Sirower studied 168 mergers of public companies from 1978 through 1990. They conclude that the average premium paid for an acquisition was 33.8 percent above the market value of the target firm and that after two years on average the mergers lost $50.7 million with a standard deviation of $1,892 million. Outcomes ranged from a loss of $10,262 million to a profit of $13,647 million.[5]

Other investigators come up with similar results. In 2003 Klaus Gugler and co-authors showed 43 percent of all merged firms worldwide reported lower profits than comparable firms that had not merged.[6] In 1987 Michael Porter described that more than 50 percent of the merged firms he studied ended up being divested.[7]

Explanations for overvaluations are usually pinned on overly exuberant forecasts of the profits that will result from the acquisition. These can be in the areas of valuing accounting intangibles such as corporate integration of the two companies or efficiencies from costing anticipated synergies such as the amalgamation of manufacturing processes. According to evidence gathered by Mathew Hayward in *Ego Check*, often it is hubris that leads to such forecasts.[8]

Problems with Valuation Methods

I contend that even before these explanations of the failure of acquisitions, there are two earlier problems. The first problem is that the standard discount valuation methods are, at best, crude tools to use for acquisition decisions.

For example, as stated earlier, the standard discount valuation formulas are highly unstable. Minute changes in the forecasts needed for the calculations can lead to valuations varying by several orders of magnitude. Almost all acquisitions involve asymmetric information in that the purchaser knows less than the seller about the business. But even with perfect information, because the results depend in an unstable way on input forecasts, the likelihood that the target company will be mispriced is large.

Further to this instability, there are actually dozens of methods that purport to calculate the value of a business providing a bewildering range of outcomes. In some cases one method will show a business is highly undervalued, others that seem just as reasonable will show that it is completely overvalued.

In practice it is much worse than this. Longer term growth forecasts, essential inputs in discount valuation methods, are notoriously inaccurate and optimistic. One study showed that there was no correlation between analyst forecasts over five years and the actual growth of earnings.

When these forecasts are combined with any biases on the part of the CEO and the acquisition committee to present the potential acquisition in a favourable light, the possibility of a costly over-valuation is extremely high.

The second problem is that the methods themselves are poorly understood by those who use them to make acquisition proposals or give final approvals. Apart from general accounting requirements, without a strong background in financial mathematics and the use of infinite processes, it is easy to be misled by what I call mathematical intimidation. Rarely is there a description of the extreme assumptions built into the methods including a proper questioning of their impact on the final valuation.

Despite these problems, acquisitions have to be made and so valuations have to be prepared. Fortunately these valuations can be made with more accuracy and security by understanding the assumptions behind the different methods, their strengths and weaknesses, and which methods apply in different situations. For example, valuation methods for a stable asset-rich target company would not apply to a technology company that has not started to make a profit.

Also, with more knowledge of a variety of valuation methods many of the traps in one method can be avoided by using an alternative method. This is particularly true for discounted cash flow methods and payback methods. Many of the traps with the former methods are avoided by the latter methods.

I will look at four different valuation methods: balance sheet, discounted cash flow, dividend discount and pay back. The emphasis will be on their assumptions, strengths and weaknesses rather than on merely their implementation steps. The goal is to help managers and board members know what questions to ask when faced with merger and acquisition valuation decisions (For more detailed discussion of the

[5] Dennis C. Mueller and Mark L. Sirower, "The causes of mergers: tests based on the gains to acquiring firms' shareholders and the size of premia," *Managerial and Decision Economics*, 24(5) (2003): 373-391.
[6] Klaus P. Gugler, Dennis C. Mueller, B. Burcin Yurtoglu and ChristineZulehner, "The Effects of Mergers: An International Comparison," *International Journal of Industrial Organization*, 21(5) (May 2003): 625-653.
[7] Michael Porter, "From Competitive Advantage to Corporate Strategy," *Harvard Business Review*, (May-June 1987): 2-21.
[8] Mathew Hayward, *Ego Check: Why Executive Hubris is Wrecking Companies and Careers and How to Avoid the Trap* (Chicago, Il: Kaplan Publishing, 2007).

strengths and weaknesses of these and other valuation methods, see John Price, The Conscious Investor (Hoboken, NJ: Wiley, 2011)).

To make the discussion more concrete, the methods will be applied to the 2009 acquisition of Wyeth by Pfizer Inc.

Pfizer and Wyeth

The agreement that Pfizer would acquire Wyeth was announced on January 26, 2009. At the time Jeffrey Kindler, the Chairman and Chief Executive Officer of Pfizer, said: "The combination of Pfizer and Wyeth provides a powerful opportunity to transform our industry. It will produce the world's premier biopharmaceutical company whose distinct blend of diversification, flexibility, and scale positions it for success in a dynamic global health care environment. The new company will be an industry leader in human, animal and consumer health (Press release by Pfizer, January 26, 2009)."

The same announcement stated that Pfizer will pay $50.19 per share for Wyeth or approximately $68 billion. At the end of 2008 the share price of Wyeth was around $40 but by the time of the announcement it had risen to $43.74.

To help finance the acquisition Pfizer took on $22.5 billion of debt. Prior to the acquisition the debt to equity ratio of Pfizer was 14 percent, slightly above its average for the previous eight years of 11.3 percent. After the acquisition it jumped to 40 percent.

Balance Sheet Methods

Looking at the balance sheet is a good place to start for valuing a company. However, simply reading off equity from the balance sheet and comparing it with the asking price is rarely satisfactory. But it can help with timing.

Consider book value or equity per share of Berkshire Hathaway. Over the past 25 years the price to book ratio has ranged from a low of 1.17 to a high of 2.23. Currently it is around 1.26. Being near the low end suggests that this is an appropriate time to buy. In fact, recently Warren Buffett said as much when he reported that the board of Berkshire Hathaway had approved repurchase of its shares at prices no higher than a 10 percent premium over the book value of the shares.

Benjamin Graham was a champion of using the balance sheet of a company to value it. In part this was because he did not want to rely on projections and felt more secure with balance sheets, particularly with their tangible assets. One technique he used was to modify the elements in the balance sheet by giving less weight when they were more risky. Table 1 shows one system described in his book *Security Analysis* (Benjamin Graham and David Dodd, Security Analysis (New York, NY: Whittlesey House, 1934)). The weightings can be further refined by taking into account the liquidity and specialization of the asset.

Table 1. Percentages of Face Value Used to Estimate Liquidation Value

Type of Asset	*Percent of Face Value*	
	Normal Range	*Rough Average*
Cash assets	100%	100.0%
Receivables	75-90%	80.0%
Inventory	50-75%	66.7%
Fixed assets	1-50%	15.0%

The column titled Normal Range is the range of the percentages of the face values, and the column titled Rough Average is an approximate average percentage for each of the classes.

Later Benjamin Graham simplified the weighting. In *The Intelligent Investor* he proposed discounting the non-current assets to zero while leaving everything else fixed. This means that the average percentages of face value in Table 1 are set at 100 percent for the first three items (cash assets, receivables and inventory) and at 0 percent for the fixed assets. This new measure, obtained by subtracting all the liabilities from the current assets, is referred to as net current asset value or NCAV. It is also referred to as Graham's net-net method. Usually NCAV is negative. Occasionally it is positive and even more occasionally it exceeds the share price. This, according to Graham, was a sign to buy.[9]

Several stock market studies have shown that this is a successful approach. In 1986, Henry Oppenheimer reported an average annual return of 28.3 percent for this method over the years 1970 to 1983 compared to 10.7 percent for a benchmark portfolio.[10] A parallel study by Joseph Vu in 1988

[9] See page 391 of *The Intelligent Investor* (Revised Edition) by Benjamin Graham (New York, NY: Harper Business, 2003)

[10] Henry Oppenheimer, "Ben Graham's Net Current Asset Values: A Performance Update," *Financial Analysts Journal*, 42(6) (1986): 40–47.

showed similar results using stocks from Value Line over the period 1977 to 1984.[11]

It would be straightforward to make use of balance sheet methods to value potential acquisitions. Even though they may not provide the full story, they could be part of the presentation to the board providing a type of bedrock valuation.

Equity Valuation of Wyeth

Over the previous five years before the acquisition shareholders' equity of Wyeth grew from $8.7 billion in December 2003 to $18.7 billion in December 2008, a healthy average growth rate of 16.7 percent per year. However, these levels are still far below the price that Pfizer paid for Wyeth so the acquisition does not satisfy any of the requirements asked for by Graham based on the balance sheet.

In fact, the ratio of 3.6:1 between the acquisition price and the equity raises the requirement of a careful analysis of the value of Wyeth apart from what is described on the balance sheet.

We do not know the internal details of the analysis that took place at the time. However, we know that during 2008 the average price to book value ratio for the pharmaceutical industry was around 2.5 and the ratio for Pfizer was approximately 2.0. Hence in terms of multiples of book value, Pfizer paid a premium over both its own and industry levels.

Discounted Cash Flow Methods

Leonardo of Pisa or Fibonacci described discounted cash flow calculations to value bonds and annuities in his book *Liber Abaci* in 1202. In the nineteenth century, T. B. Sprague used this approach to value stocks. Sprague, as the editor of the *Journal of Institute of Actuaries and Assurance Magazine*, described a formula for the discounted present value of "successive annual payments" growing at a specified rate. Instead of using simple dividend yields and book value, the standard methods at the time, investors were invited to calculate a so-called "true" value of the equity using discounted estimates of future dividends. Comparison of this value with the actual market price determined the attractiveness of the investment.

It seems that little use was made of this approach until Robert Wiese popularized it in 1930 in an article he wrote for *Barron's* where he explained that both stocks and bonds could be valued as the discounted value of all future payments.[12] The main point is that he was talking about future income payments and not just the dividend yield. A second point is that he indicated that even if we are talking about a stock, we should perform a present-value calculation just like the well-known method for bonds.

Building on the work of Wiese, John Burr Williams wrote a key book in 1938 called *The Theory of Investment Value*.[13] (He was awarded his doctorate in 1940 by Harvard University for his work.) The book opens with the statement: "Separate and distinct things not to be confused, as every thoughtful investor knows, are real worth and market price." In other words, do not confuse "real worth" with the price in the market. Williams' book is all about valuing stocks as the sum of the dividends discounted back to present time. This is called the *dividend discount valuation method*.

Not all companies pay dividends, and the method has been mostly replaced by the *discounted cash flow* or DCF method as described in books such as *Valuation* by Tim Copeland and co-authors and *Investment Valuation* by Aswath Damodaran.[14]

The general formula is that the value of a company is the discounted value of the free cash flows that are projected to be generated by the company over an infinite lifetime. Broadly speaking, free cash flow starts with earnings before interest and tax (EBIT) and adjusts for non-cash items by adding back the depreciation amount and any changes in working capital. Adjustments also have to be made for taxes payable and new capital spending.

In practical settings the DCF formula is made operational for valuing acquisitions using two different approaches, direct and indirect. In the direct approach, it is assumed that the free cash flows grow at a constant rate over an initial period and then at a different (slower) rate over the remaining period assumed to be infinite. This is called the two-stage discount model. (It is possible to add a third stage as a transition between the initial and final stages. However, this is less common.) Also it is assumed that the discount rate is constant.

The indirect approach requires forecasts of performance data such as revenue and net profit for different divisions and components of the target company. It is also likely to need forecasts of items such as deprecation rates, dividend policies, and capital expenditures. In this approach free cash flow is not discussed directly but the outcome is the same. Calculations are made with inputs that feed through to the forecasts of free cash flows and a discount rate.

This means that both approaches boil down to using the two-stage discount formula, the only difference being the path to the final forecasts.

[11] Joseph Vu, "An Empirical Analysis of Ben Graham's Net Current Asset Value Rule," *Financial Review*, 23 (May 1988): 215–225.

[12] Robert Wiese, "Investing for True Values," *Barron's* (September 8, 1930): 5.

[13] John Burr Williams, *The Theory of Investment Value* (Flint River, Virginia: Fraser Publishing Company, 1997; originally published by Harvard University Press, 1938).

[14] Standard texts are *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* by Aswath Damodaran (Hoboken: NJ: Wiley, 1996) and *Valuation: Measuring and Managing the Value of Companies* (5th Edition) by Tim Koller, Marc Goedhart and David Wessels (Hoboken, NJ: Wiley, 2010).

In practice everything is done through a two-part spreadsheet. The first part is an executive dashboard where key assumptions and forecasts are entered. The second part consists of sheets, usually a large number, containing tables and calculations as templates based on the inputs from the dashboard. The results of these calculations are then fed back into the dashboard where they are displayed.

Hence, one way or another, intrinsic value calculated using the two-stage DCF method depends on five inputs consisting of one observable financial quantity and four forecasts:

- Initial free cash flow;
- Length of initial growth period;
- Growth of free cash flows over the initial period;
- Growth of free cash flows for the remaining period (assumed to be infinite); and
- Discount rate in perpetuity.

Once the inputs are decided, standard summation methods are used to calculate the intrinsic value.

Consider a target with initial free cash flow $10 million. Assume that its growth forecast is 15 percent per year for the first five years and 5 percent per year after that. Suppose the discount rate is 10 percent. Then the intrinsic value is $319.51 million.

However, suppose the results from the spreadsheet being prepared by the acquiring company concludes that the free cash flow will grow by 16 percent over the next five years instead of 15 percent. This change could easily occur in one of two ways depending whether it is a direct or indirect dashboard.

If it is a dashboard requiring direct inputs, then one of these inputs is the initial growth of free cash flow. Any argument used to support a growth of 15 percent could be used to support a growth of 16 percent. It would be virtually impossible to argue that 16 percent is likely to be a more accurate forecast over the next five years than 15 percent. Hence the input is simply changed to the higher number.

Alternatively, if it is a dashboard requiring indirect inputs, the initial growth of free cash flow is a consequence of other forecasts such as return on equity and cost of equity. Since these are forecasts, as before no change would need to be made in the argument to ensure the forecasts slightly change growth of 15 percent to growth of 16 percent.

Similar small changes can be made for the forecasts of the long-term growth rate and the discount date. In some cases this causes the intrinsic value to drop to $223 million, in others to more than double to over $540 million.

Even worse, if the initial growth period is assumed to be 10 years (again, a completely defensible position in the majority of cases), the valuation can exceed $800 million! (If, as stated above, five year forecasts are well-known to be highly inaccurate, we can expect the forecasts over the terminal period to be far worse. In fact, since they are over an infinite period, they cannot even be properly tested.) Table 2 contains a summary of the effect of small changes of the inputs on the final valuations.

The point is, with no change in the stated argument, the PowerPoint slides or the mathematical steps, the valuation can vary by huge amounts, in this case by almost 400 percent.

That a word-for-word same argument that gives a forecast of 15 percent over the next five years can be used to give forecasts of 14 per percent, 16 percent or even wider may come as a surprise. However, reading a few of the arguments and then placing different forecasts at the end makes this uncertainty clear. Typical arguments contain sentences such as: "Following organic growth of 11 percent last year we forecast a slowing to 5 percent …", "We think XYZ is well-positioned to benefit from any strengthening in the global economy …", and "We expect pro forma margins to widen slightly because of more discipline." After a few paragraphs of such sentences, it is as if the final forecast is just tagged on at the end without much relationship with the actual argument.

This is even more dramatic in the case of the discount rate and the long-term forecast since they involve making assumptions in perpetuity.

My research shows that junior analysts in investment banks quickly learn how to make these adjustments in the forecasts (and perhaps even reword the arguments to slant them towards the preferred forecasts) to get the result anticipated by their bosses. Tired of having to go back and nudge the inputs to get the desired figure, before preparing a new valuation one analyst I spoke to would ask: "Are we on the buy side or the sell side?"

Table 2. Extreme Sensitivity of Valuations

Free	Cash Years	Initial	Growth Terminal	Discount	Rate Valuation
$10	5	15%	5%	10%	$319.51
$10	5	16%	6%	9%	$542.83
$10	5	14%	4%	11%	$223.97
$10	10	16%	6%	9%	$801.50
$10	4	14%	4%	11%	$208.07

Small "immaterial" changes in the inputs lead to large variations in the final valuation.

Table 2 gives an idea of how easy it is for the board to be put in an impossible position. For example, suppose the acquisition is available for $500 million. A presentation, complete with "rigorous" assumptions feeding into "iron tight" mathematics, could be made to the board that fully justified a value of $800 million. Hence the acquisition would likely proceed. However, when the purchase is made, the actual value is just as likely to be in the order of $250 million as it is to be $800 million.

In the 2002 annual report Warren Buffett wrote about how awkward it is for board members "to question a proposed acquisition that has been endorsed by the CEO, particularly when his inside staff and outside advisors are present and unanimously support his decision." As we have seen it is actually much worse than this since the same reasons can be used to support slightly different forecasts ultimately leading to valuations varying by several multiples.

Despite these difficulties, DCF methods are the standard workhorse when valuations of companies are required. So much so that whenever the term intrinsic value is mentioned it is assumed that a DCF method was used. The following is a brief summary of the strengths of the method.

Strength 1: Clear rational definition. The definition is quite specific in terms of the input variables and the calculations used to combine them. It also extends the calculation of value of a standard bond.

Strength 2: Easy interpretation. It is easy to interpret the outcome of a DCF calculation as the true value of a target acquisition and to compare it to the asking price.

Strength 3. Wide applicability. The method is applicable to a wide variety of companies, private and listed.

Strength 4. Consistent basis. The calculation of intrinsic value by the DCF method provides a consistent basis for comparing possible acquisitions. For example, the value ratios (intrinsic value divided by price) can be calculated for a range of companies, with the companies with the highest ratios singled out as more attractive acquisitions compared to those with lower ratios.

Strength 5. Wide acceptance. Perhaps the greatest strength of DCF methods is that they are very widely accepted. The methods are taught in most finance and valuation courses as the standard way to calculate intrinsic value. In fact, in the literature and the finance industry, DCF methods are often synonymous with intrinsic value. This means that when a valuation is done using a DCF method, it is frequently accepted with little further discussion.

The following is a list of weaknesses associated with the use of DCF methods.

Weakness 1: Unstable results. All the formulas are highly unstable, meaning that small changes in the input numbers lead to extremely large variation in the output. Table 2 gives examples of this instability.

Weakness 2: Easily manipulated. Another consequence of the instability of DCF methods is that the final result for intrinsic value is easily manipulated by making small changes in the input variables. Because these changes are so small, they are easily defended. The outcome is that it is easy to get an intrinsic value result that supports almost any opinion about a target acquisition, ranging from highly overvalued to greatly undervalued. This is particularly dangerous when the valuation is influenced by hubris to make the acquisition seem desirable at the asking price. DCF methods are simply not equipped to signal to the board that the price of the target is unreasonable.

Weakness 3: Untestable inputs. It is impossible to test the accuracy of key inputs in the formulas, such as the terminal growth rate and the discount rate, because they require forecasts out to infinity. For example, if I forecast the long-term growth rate of a target as 4 percent and you forecast it as 3 percent, we can never decide who made the more accurate forecast. Karl Popper referred to such situations where falsification is not possible as "metaphysical speculation."[15]

Even if we wait 100 years and compare the forecasts with the actual results, we still cannot test the forecasts since we still do not meet the requirement of waiting for an infinite number of years. Moreover, as we saw earlier, the differences of a few percent can make an enormous difference in the outputs.

To avoid the problem of instability and making untestable inputs, some analysts suggest using a two-stage model with the first stage as 10 years, and only consider the contribution to the valuation from the first stage. Then all the inputs are over the testable period of 10 years. However, it is easy to come up with examples where the contribution from the second stage is far greater than the first stage.

This is particularly true for newer companies where the initial growth is anticipated to be comparatively low. Hence, by omitting the second stage and only using the first stage, you could be losing 90 percent of the calculated value or more. A corollary to this is that to get acceptable results using DCF methods requires fairly accurate forecasts decades, and even centuries, into the future.

Weakness 4: Anchoring vulnerability. The potential bias of anchoring in behavioural investing consists of the tendency to focus on numbers that have already been presented to you or that are already known. All estimates and forecasts are vulnerable to this bias, which would express itself as new forecasts or estimates *anchoring* on those that are already known.

[15] Karl Popper, *The Logic of Scientific Discovery* (London, UK: Hutchinson, 1972), page 34.

However, in most cases the true results of any estimates or forecasts can be verified at a later date. If an earnings or revenue forecast is made for the next financial year, it can be verified at that time. Hence it is reasonable to suppose that there is some control over the forecasts that are made, due to the fact that their accuracy can eventually be tested. But this control disappears for the inputs of the discount rate and the long-term growth rate in the discount models since, as just explained, they cannot be tested.

Consider Google, Inc and Emerson Electric Co, two completely different companies operating in quite different business sectors. Table 3 contains other differences. For example, Google has no debt and pays no dividends whereas Emerson has a debt to equity ratio of 42 percent and a dividend yield of 2.8 percent. Also the average annual growth rate of Google for the past five years was 34 percent compared to 7.8 percent for Emerson.

The different historical growth rates flow into the consensus forecasts for the next five years: 18.8 percent per year for Google compared to 11.5 percent for Emerson. Yet, when it comes to the long-term forecasts for the infinite period after five years, Standard and Poor's set them both at 3 percent.

Table 3. Anchoring Vulnerability

	Dividend Yield	Debt to Equity	Growth of EPS over Past 5 Years	Consensus Forecast over Next 5 Years	Forecast of Perpetual Growth after 5 Years
Google	0.0%	0.0%	34.0%	17.0%	3.0%
Emerson	2.8%	42.0%	7.8%	11.5%	3.0%

The S&P long-term forecasts for Google and Emerson are identical even though almost everything else about the two companies is different.

One reason why a long-term growth rate of around 3 percent is chosen is that it is approximately the long-term average growth of U.S gross domestic product. But to lump the long-term forecast of all companies under a single historical average makes little sense.

In fact, it is hard not to believe that anchoring plays a major role in the long-term forecasts. Past forecasts have been shown to give reasonable values for the intrinsic value, so new forecasts are anchored on these with almost no regard for the individual companies. (Quite likely anchoring also plays a role in the short-term forecast with the forecasts anchored on the historical growth rate of the previous five years.)

I know of no study that has gone back 20 years or more, looked at the long-term forecasts made back then for individual companies, and compared the forecasts with the actual results. However, if we assume that the long-term forecasts made 20 years ago were the standard 3 percent, then up until now they are far from accurate.

Finally, I doubt that many analysts and institutional investors really believe that the growth of Google is going to drop to 3 percent per year in five years. Yet, calculations are done using this forecast.

Weakness: 5 Infinite sums. As stated earlier, the DCF formula is an infinite series. As such, it requires an infinite number of inputs for the values, which cannot be done one at a time and must be specified through a rule. This is a limitation on the values that are possible for the inputs. A second limitation is that mathematics only allows the summation of certain types of infinite sums. There are no formulas to calculate most infinite sums. A third limitation is that in the terminal period, the growth rate of the free cash flow must be less than the discount rate, otherwise the series would have an infinite sum. At first it may look as if it would be desirable since it is saying that the intrinsic value is so high it is infinite. However, it removes the ability to properly compare acquisitions with rates satisfying this condition.

Weakness 6*: False objectivity.* Discounted cash flow methods give the appearance of objectivity because of terminology such as intrinsic value with an implication that it is the true value. Also the term forecast has a ring of certainty about it when usually they are no more than weakly plausible guesses.

Likewise, since the use of college-level mathematics, such as the requirement to sum infinite series, would be unfamiliar to most people, it leads to mathematical intimidation. Who is going to question the accuracy of intricate mathematical formulas? Yet they are only theoretical expressions which may or may not represent the "true" value of an acquisition. Finally the results are highly subjective because of the instability of the calculations and the impossibility of verifying key input variables.

Weakness 7: Limited research. Despite the widespread use and acceptance of DCF methods, the large number of books published on it, and its universal appearance in college courses on investing and finance, there is actually limited academic research on the method. This is probably because the calculation of value using DCF methods is highly variable depending on the input variables, and so is less amenable to rigorous research.

DCF Valuation of Wyeth

As seen, crucial inputs for a DCF valuation are growth rates of the company. Before looking at any growth forecasts by the CEO and acquisition committee or making any detailed analyses, it is practical for the board to see what is reasonable based on past growth rates.

Table 4 shows the levels of earnings per share (EPS) and dividends per share (DPS) for the past 10 years. It also shows the average annual growth up until December 2008. For example, the average annual growth of EPS from 2001 until 2008 was 9.61 percent. The year 2004 was exceptional in that the company recorded an abnormal loss because of a $4.5 billion charge due to diet drug litigation.

Table 4. Growth of Earnings and Dividends for Wyeth

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
EPS	-$0.92	-$0.69	$1.72	$3.33	$1.54	$0.91	$2.70	$3.08	$3.38	$3.27
Growth	NR	NR	9.61%	-0.30%	16.25%	37.68%	6.59%	3.04%	-3.25%	
DPS	$0.91	$0.92	$0.92	$0.92	$0.92	$0.92	$0.94	$1.01	$1.06	$1.14
Growth	2.54%	2.72%	3.11%	3.64%	4.38%	5.51%	6.64%	6.24%	7.55%	

The second row shows the EPS for Wyeth for the years 1999 to 2008 ending December 31. The third row shows that average annual growth of EPS for each year until the year 2008. Row 4 shows the dividends per share (DPS) while row 5 shows average annual growth of DPS for each year until the year 2008.

Because of the instability of the EPS there is a large variation in the average annual growth. However, we will incorporate this variation by expanding the range of the forecasts. We are not trying to make an exact forecast. Rather we just want a plausible range of possibilities.

Using Table 4 as a guide, at the low end suppose that the forecast is 3 percent per year for 5 years while at the high end suppose that it is 10 percent per year for 10 years. (This upper estimate exceeds the historical record of any major listed US drug company in recent history. Further, the consensus current growth forecast for the industry is 5.80 percent per year. For Pfizer it is 3.60 percent.)

After the initial period, suppose the forecast of the growth rate is 3 percent. The average free cash flow per share (FCFPS) for the past five years was $1.93. With a discount rate of 11 percent, the intrinsic value per share ranges from $24.85 to $41.07. See Table 5.

Table 5. DCF Valuations of Wyeth

FCFPS	Years	Initial Growth	Terminal Growth	Discount Rate Forecast	Valuation
$1.93	5	3.0%	3%	11%	$24.85
$1.93	5	3.6%	3%	11%	$25.48
$1.93	10	3.6%	3%	11%	$25.93
$1.93	10	10.0%	3%	11%	$41.07

Share price valuations range from $24.85 to $41.07 compared to the acquisition price of $50.19.

Since the price paid by Pfizer for Wyeth was $50.19, from these calculations Pfizer paid a premium of between 22 percent and 102 percent over the "fair" value of the company. The conclusion is that rather than buying the company based on its intrinsic value calculated using a DCF method, the board of Pfizer appears to be relying on a large component of the purchase price paying for corporate control or anticipated synergies.

Dividend Discount Methods

Even though dividend discount methods were developed before the use of free cash flow, they are used only infrequently these days. The basic idea is the same as the DCF method except that free cash flows are replaced by dividends.

Where there is a marked difference is that to get around the problem of forecasting dividends out to infinity, sometimes this method is recast in terms of return on equity and the payout ratio. It also uses an assumption called the clean surplus relationship which asserts that equity at the end of the year is equal to the equity at the start plus net profit less dividends paid.

Suppose that the initial equity is $100 million, return on equity is 15 percent and the dividend payout ratio is 30 percent. This means that the net profit in the first year is 15 percent of $100 million or $15 million. The payout ratio is 30 percent and so the dividends are $4.5 million.

The next step is to apply the clean surplus relationship to calculate the equity at the end of the first year. In this case, the required equity is (in millions of dollars) $100 + $15 - $4.5 or $110.5 million. Now repeat this step for year 2 and so on. This process leads to forecasts of dividends in perpetuity. Just as for the DCF methods, these are discounted by a specified discount rate and summed to get the intrinsic value.

The strengths and weaknesses of the dividend discount method are essentially the same as those for the DCF methods.

Dividend Valuation of Wyeth

Table 4 shows that the per-share dividends paid by Wyeth for the four years prior to the acquisition were approximately one-third of the earnings. Assuming this payout ratio was to continue, the valuation of Wyeth using dividend discount methods would be roughly one-third of corresponding DCF valuations.

Payback Methods

In the end it is vital to know how long a particular acquisition will take to pay for itself. When it has paid for itself, then the cash that is generated by the acquisition can be used for expansion of the original company, other acquisitions or returned to shareholders.

Instead of trying to place a dollar value on a target company, the idea is to estimate how long it will take to get your money back, where the money can be measured in assets such as free cash flows or dividends. It is also possible to build into the valuation an allowance for the risk associated with the capacity for the target company to generate the free cash flows or dividends at the specified rate.

In a DCF method, the higher the discount rate the lower the intrinsic value. And a low intrinsic value means a less attractive acquisition. The parallel situation for the payback method is the higher the discount rate, the longer the payback period. And a longer payback period means a less attractive acquisition.

As an example, suppose that the cash that is expected to be generated in the first year is $20.00 million growing at 12 percent per year. This means that the cash generated in year 2 is $22.40 million and so on.

Forgetting about any discount factors, then the total cash generated over the years is given in Table 6. After 4 years the amount paid back is $95.59 million and after 5 years it is $127.06 million. This means that if the asking price is $100 million, the payback period is between 4 and 5 years. (More precise calculations show that it is 4.15 years.)

Table 6. Payback Schedule

Year	Payback Amount	Total Payback
1	$20.00	$20.00
2	$22.40	$42.40
3	$25.09	$67.49
4	$28.10	$95.59
5	$31.47	$127.06
6	$35.25	$162.30

Schedule of anticipated free cash flows and the total amount at the end of each year. It is assumed that the free cash flow start with $20 million and grows by 12 percent per year. The table shows that it will take between four and five years to pay back $100 million.

Now suppose that there is a risk associated with the payments. Also there is an opportunity cost for having the capital tied up in the acquisition. So, just as in the DCF methods, we need a discount rate. Suppose that it is 9 percent. Table 7 shows the amount paid back on a year-by-year basis assuming this discount rate. After 5 years the amount paid back is $94.28 million and after 6 years it is $114.17 million. This means that if the asking price is $100 million, the payback period is between 5 and 6 years. (More precise calculations show that it is 5.29 years.)

TABLE 7. Payback Schedule Assuming a Discount

Year	Payback Amount	Discounted Amount	Total Payback
1	$20.00	$18.18	$18.18
2	$22.40	$18.51	$36.69
3	$25.09	$18.85	$55.54
4	$28.10	$19.19	$74.73
5	$31.47	$19.54	$94.28
6	$35.25	$19.90	$114.17

Schedule of anticipated free cash flows and the total amount at the end of each year. It is assumed that the free cash flow start with $20 million and grows by 12 percent per year. Also a discount rate of 9 percent is included. The table shows that it will take between five and six years to pay back $100 million.

It is possible for the calculations for the payback period to arrive at an infinite number of years. This simply means that the cash generated by the acquisition will never cover the asking price. Presumably such an acquisition would not be approved.

This means that the payback method really only needs to be applied when the time taken is finite. Already this is a huge boon. For example, it means that forecasts need only be made for a finite number of years. It also means that the outcome will be less sensitive to the input forecasts. Table 8 gives an example of the payback period for a range of input forecasts.

Table 8. Examples of Payback Periods

Free Cash Flow	Years	Initial Growth Forecast	Terminal Growth	Discount Rate	Payback Period (Years)
$10	5	15%	5%	10%	10.3
$10	5	16%	6%	9%	9.4
$10	5	14%	4%	11%	11.7
$10	10	16%	6%	9%	8.5
$10	4	14%	4%	11%	12.7

Examples of payback periods in years for a range of forecasts. In each case the price of the target acquisition is assumed to be $100 million. Just as for the DCF methods, the growth is forecast in two periods.

The main strength of the payback period method is that it brings a new perspective to discount methods while at the same time overcoming many of their weaknesses. The following is a summary of its strengths, followed by a summary of its weaknesses.

Strength 1: Easy interpretation. It is easy to compare two companies as potential acquisitions: Simply choose the one with the shortest payback period. In addition, since it easy to calculate the payback period of a fixed-interest investment, it is simple to compare potential acquisitions with fixed-interest instruments.

Strength 2: Based on DCF method. The method is based on the discounted cash flow method. The key difference is that the discounting is over a finite time frame instead of an infinite period. This means that the payback method inherits many of the advantages of the discounted cash flow methods, such as a widely accepted conceptual framework.

Strength 3: Finite forecast period. The major weaknesses of the discounted cash flow method are that forecasts of growth rates and discount rates have to be made over an infinite period, leading to the impossibility of testing their accuracy, the instability of the intrinsic value that is calculated, and anchoring vulnerability. The payback method only uses forecasts over finite periods and so the results are more stable.

The main weakness of the payback period method is that it is not a standard measure of value. The following is a summary of this and other weaknesses.

Weakness 1: Nonstandard measure. The first weakness is that the result of the payback calculation is neither intrinsic value nor an estimate of percentage return. Even though it is expressed in years, it is not a standard measure of value that is expressed in dollars (for intrinsic value) or a percentage (for expected return methods).

Weakness 2: Longer-term forecasts. Forecasts of growth rates and discount rates need to be made for the entire payback period. Even though the method avoids the infinite periods required for the discounted cash flow methods, the period may still be lengthy.

Payback Valuation of Wyeth

For the acquisition of Wyeth the payback method asks how long it would take for a designated per share amount to pay off the purchase price of $50.19. For consistency we follow the assumptions used for the earlier DCF valuations. The result is that the payback period ranges from 28 years to over 47 years. See Table 9.

Table 9. Payback Periods for Wyeth

FCFPS	Years	Initial Growth	Terminal	Discount Rate	Payback Period
$1.93	5	3.0%	3%	11%	37.0
$1.93	5	3.6%	3%	11%	36.0
$1.93	10	3.6%	3%	11%	47.9
$1.93	10	10.0%	3%	11%	28.0

Examples of payback periods in years for a range of forecasts.

If such calculations were presented to the board at the time of the acquisition, it would be up to them to decide whether such periods were reasonable. If a shorter period was required, then it is easy to calculate what growth rates would be needed to achieve them. This would raise the second question whether such growth rates could be attained and, if so, what strategies would be needed.

It makes sense to answer questions such as these as part of a checklist to work through before any acquisitions are made.

Checklist for Executives and Board Members

The great majority of acquisitions are made because the acquiring company believes there is a special relationship between the two companies. After the acquisition the expectation is that the purchaser will be able use this relationship to unlock hidden value. Included in the buying price will be a premium for the benefits of this special relationship.

The two most common special relationships used to justify an acquisition are gaining corporate control and increased synergies. The idea of corporate control is that target companies are identified for prices lower than they would be if run by more able or motivated managers. Upon taking control of the company, the goal is to add value by changing its policies or replacing key management personnel. The successful bidder benefits when the new management team gets results in the form of improved corporate performance and higher profits.

The second reason for making an acquisition or merger is the belief that there are synergies between the two companies. By making the acquisition the acquiring company hopes to utilize structures, processes and products within the acquired company to increase overall efficiency. Examples of possible synergies are that the acquiring company can use its sales team to sell the products of the new company and even cross-sell to existing customers. Or it might simply be combining two departments, thereby cutting costs. Other synergies are based on the ability to manufacture the same product as component parts for both companies.

The acquisition is presented to the board with the likelihood that the cost of the acquisition will be less than the hidden value that will be unlocked through any special relationships. We saw earlier how hard it was to value on-going businesses even without building in any special events or developments that could enhance its value. Once we include intangibles such as gaining corporate control or increased synergies, which may not even occur, then the difficulties rise exponentially.

In a small number of cases, acquisitions are made simply as stand-alone businesses. The acquisitions made by Berkshire Hathaway fall into this category. The same applies to some of the acquisitions made by United Technologies.

Companies, however, could learn from the actions of these conglomerates. To have any chance of arriving at a well-considered price for a target acquisition, it is essential that it should first be carefully valued as a stand-alone investment. Only then can the size of the claims relating to the benefits of any special relationships between the acquiring company and the target be properly evaluated.

The following is a checklist for the CEO and board members to assess the potential acquisition as a stand-alone business before trying to determine the extra value from its special features vis-à-vis the original company.

Questions for CEO and Board Member to Ask Before Making an Acquisition

1. Equity: What is the level of equity? What happens when the items in the balance sheet are modified according to the ideas of Benjamin Graham described earlier?
2. Revenue and net profit: Have the revenue and net profit grown over the past five years? What have been their growth rates? How stable was the growth?
3. Return on equity: Has return on equity been high and stable over the past five years?
4. Debt: What are the debt levels? What has the debt been used for? Has it been productive?
5. Remuneration: What is the remuneration policy for the CEO and senior management? Does it reward prudent growth of the company or risk taking activities?
6. Management: Is management honest and rational?
7. Valuation as stand-alone business: After making the required forecasts, calculate the intrinsic value and the payback period. Is the acquisition attractive?
8. Margin of safety: Now apply a margin of safety to the forecasts and recalculate the intrinsic value and payback period. Is the acquisition still attractive?
9. Final valuation: What are the valuation forecasts assuming the anticipated benefits from the special relationship between the two companies? How do they compare to the forecasts in the previous two questions? What are the intrinsic value and the payback period?
10. Reasonableness: Are the higher forecasts in Question 9 reasonable? How reasonable are the assumptions of the benefits due to a special relationship between the companies?

Implications for Authors of Finance Texts

The existing texts on valuation methods give lip service to some of the weaknesses and traps

mentioned above. In a 400 or 500 page book at most all we see is a brief remark or two talking about instability with lines such as: "Even at the end of the most careful and detailed valuation, there will be uncertainty about the final numbers, colored as they are by assumptions that we make about the future of the company and the economy." and "A high-quality estimate of continuing value is essential to any valuation, because continuing value often accounts for a large percentage of the total value of the company."

Afterwards the authors proceed as if the methods, particularly discounted cash flow methods, provide the answer to valuing companies. For example, their case studies of publicly listed companies usually come up with results that are in close proximity to their current market prices. There is no hint that by making and using slightly different forecasts the results could vary by hundreds of percent. And certainly no mention how controversial it is to make forecasts in perpetuity.

Since most professors and teachers rely on these text books and their associated teaching materials, these neat views of valuation methods are passed on to students. When the class examples are public companies, they quickly learn how to choose forecasts that give results close to market prices. Students repeatedly told me stories such as, "We would check with each other to adjust inputs to get close to the current price, perhaps a few dollars higher. Otherwise we would be marked down." These students are the future managers, executives and board members of our companies.

It is time that investment courses and texts were more upfront about the difficulties of valuation methods and less concerned with polished mathematical formulas. As we have seen, these formulas often lead to the serious unintended consequence of extreme mispricing of acquisitions.