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Mind Matters

The dangers of DCF

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Theoretically, discounted cash flow (DCF) is the correct way of valuing an asset. However, as Yogi Berra noted, "In theory there is no difference between theory and practice. In practice there is." The implementation of a DCF is riddled with problems. First off, we can't forecast, which kind of puts the kibosh on the whole exercise. Even if we choose to ignore this inconvenient truth, problems with the discount rate still make a mockery of the whole idea of DCF. No wonder DCF has such a poor reputation. The good news is that several alternatives exist. We explore three that avoid forecasting altogether!

■ Whilst the algebra of DCF is simple, neat and compelling, the implementation becomes a minefield of problems. The problems can be grouped into two categories: problems with estimating cash flows and problems with estimating discount rates.

■ One of the recurring themes of my research is that we just can't forecast. There isn't a shred of evidence to suggest that we can. This, of course, doesn't stop everyone from trying. Last year, Rui Antunes of our quant team looked at the short-term forecasting ability of analysts. The results aren't kind to my brethren. The average 24-month forecast error is around 94%, the average 12-month forecast error is around 45%. My work on long-term forecasts is no kinder to the analysts: they are no better at forecasting long-term growth than they are short-term growth.

■ Even if we ignore the inconvenient truth of our inability to forecast, we still get derailed by problems with the discount rate. The equity risk premium creates a headache, as no one seems to be able to agree what it is. Then we have all the fun and games over beta. Questions such as which time interval, which market, over what time period all have to be dealt with. And then you come up with a beta which unfortunately has no relationship with return at all (in direct contrast to classical theory).

■ As if these problems weren't bad enough, they interact with each other when it comes to the terminal value calculation. In most DCFs this is the major contributor to the end value. If we assume a perpetual growth rate of 5% and a cost of capital of 9% then the terminal multiple is 25x. However, if we are off by one percent on either or both of our inputs, then the terminal multiple can range from 16x to 50x!

■ The good news is that we don't have to use DCF in this fashion. Alternatives do exist. For instance, using a reverse engineered DCF avoids the need to forecast (and avoids anchoring on the current market price). Of course, the discount rate issues remain.

■ Ben Graham provided two methods for calculating intrinsic value. One based upon asset value, the other based upon earnings power (normalised earnings). Both of these methods can be implemented relatively easily and without the inherent problems of the DCF approach. Simpler, neater and more present based (as opposed to forecast based) methods are more likely to uncover opportunities with the markets. DCF should be consigned to the dustbin of theory, alongside the efficient markets hypothesis, and CAPM.

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The dangers of DCF

Ever since John Burr Williams wrote *The Theory of Investment Value*, we have known the correct way to value an asset is via the present value of its discounted cash flows. That is to say, an asset's value is nothing other than the sum of the cash flows that it can deliver (obviously discounted to reflect the impact of time). This is, of course, theoretically correct. However, as Yogi Berra opined "In theory there is no difference between theory and practice. In practice there is."

When it comes to implementation, the DCF approach is riddled with problems. Whilst the algebra of the DCF is simple and neat, when implemented, the DCF becomes a minefield of problems.

From my perspective, the problems with DCF-based valuations can be split into two groups: problems with estimating cash flows, and problems estimating the discount rates. Let's take each in turn.

Problems with estimating cash flows

As regular readers will know, I believe that forecasting is a waste of time (see chapter 9 of Behavioural Investing for the details). From the point of view of DCF, the forecasts are central. Most DCFs are based on relevant cash flows years into the future. However, there is no evidence that analysts are capable of forecasting either short-term or long-term growth.

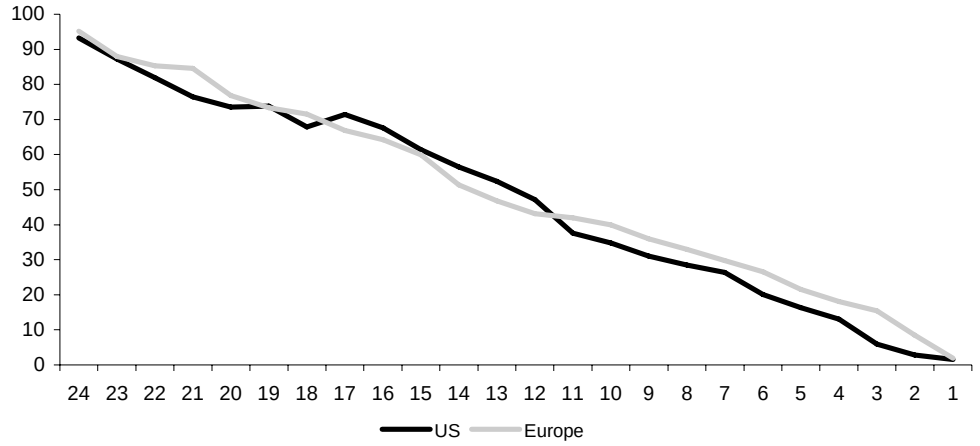
Last year, Rui Antunes of our quant team investigated the scale of analysts' forecast errors over the short term. Rather than doing the analysis at the aggregate level, ever the pedant, Rui looked at the individual stock level.

The chart below shows the average scale of analysts' forecast errors over time. They start some two years before the actual reporting occurs, and trace out how the forecasts change as we head towards the announcements.

In the US, the average 24-month forecast error is 93%, and the average 12-month forecast error is 47% over the period 2000-2006. Just in case you think this is merely the result of the recession in the early part of this decade, it isn't. Excluding those years makes essentially no difference at all.

The data for Europe are no less disconcerting. The average 24-month forecast error is 95%, and the average 12-month forecast error is 43%. Frankly, forecasts with this scale of error are totally worthless.

Forecast error over time: US and European markets 2001-2006



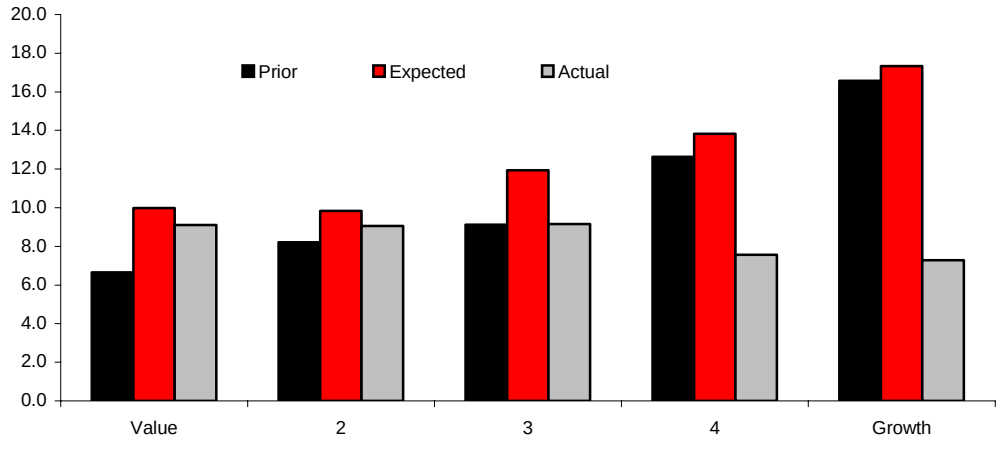
Source: SG Equity Research

Long-term forecasts are no better. As I have shown many times before, analysts have no idea about long-term growth forecasts. As the charts below show, the inability to accurately assess growth is particularly pronounced where it is most important – in terms of the growth stocks.

In the US, the portfolio of cheapest stocks on price to book (labelled value in the chart below) is expected to grow its earnings by around 10% p.a. according to the analysts. This is higher than the average growth rate of just 7% achieved in the prior five years. In terms of the actual growth that is delivered, these stocks generate an average of just over 9% - pretty close to the analysts' forecasts.

However, at the other end of the spectrum we find a very different picture. Analysts expect growth stocks to generate around 17% p.a. (against a prior 16% p.a.). However, the actual delivered growth has been a meagre 7% p.a. on average!

Growth: past, expected and actual (US 1985-2007)

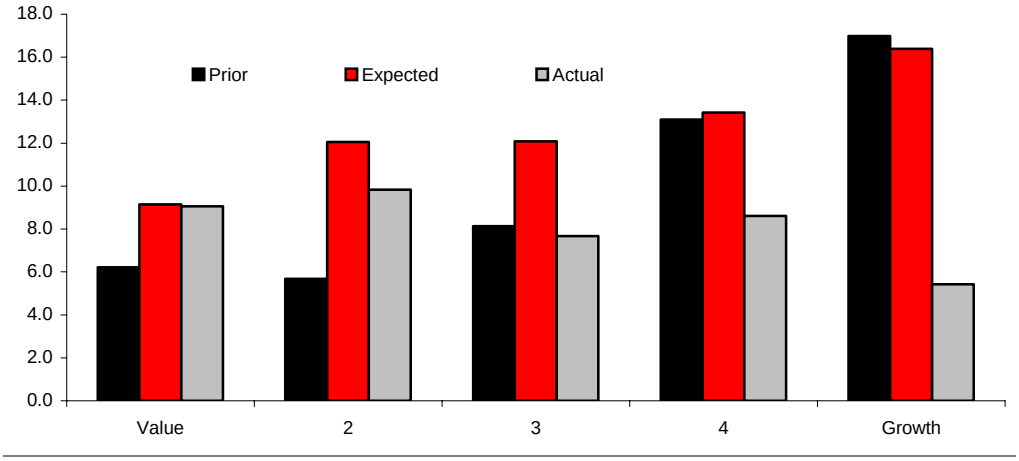


Source: SG Equity Research

The evidence for Europe looks very similar. Analysts expect the cheapest portfolio of stocks to grow earnings by around 9% p.a. over the long term. Once again, this is higher than the historically delivered growth of 6% on average in the prior five years. When it comes to how these value stocks actually perform in terms of earnings deliverance, they almost exactly match expectations, delivering around 9% p.a. over the long term.

Once again, the evidence at the other end of the spectrum is very different. Here analysts expect the growth stocks to deliver around 16% p.a. (close to the historical performance of 17% p.a.). In terms of the actual delivered growth, the most expensive stocks generate around 5% p.a. over the long term. So, regardless of market, it appears that analysts are most wrong on the things they are most optimistic about!

Growth: past, expected and actual (Europe 1985-2007)



Source: SG Equity Research

As Bruce Greenwald observes in his wonderful book, *Value Investing: From Graham to Buffett and Beyond*, "Profit margins and required investment levels, which are the foundations for cash flow estimates, are equally hard to project accurately into the far future".

Problems with the discount rate

Not only is the estimation of the cash flows next to impossible, the estimation of the discount rate is also fraught with problems. The risk free rate is the least controversial of the elements of the discount rate – most of us can agree that something like a long bond yield is a pretty good approximation. However, thereafter everything goes to pot.

The equity risk premium is an arena of enormous disagreement. The text books generally use the ex post (after the fact) equity risk premium (ERP) which is substantially higher than any kind of measure of the ex ante ERP. Way back in 2001, Andy Lapthorne and I ran a survey of what our clients thought the ERP should be, in general a range of 3.5-4% was the outcome.

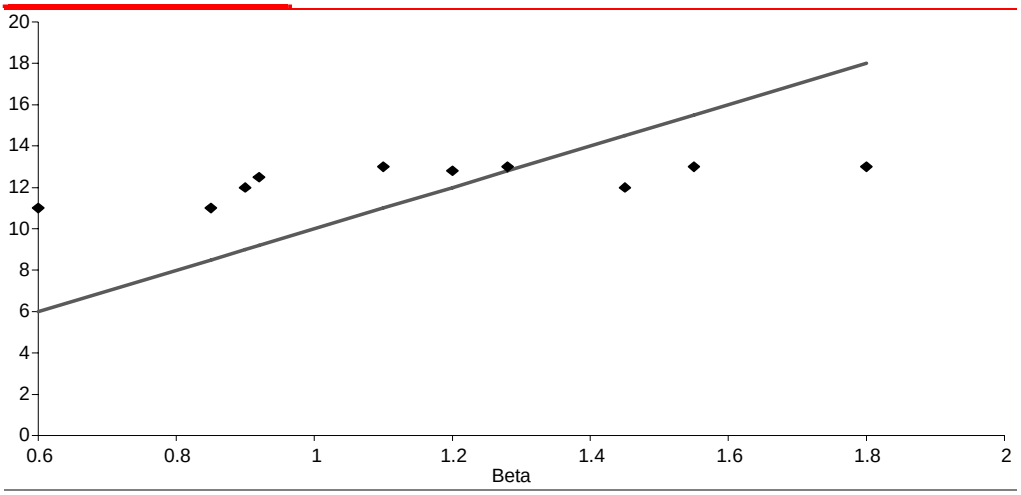
Internally, our analysts use a nonsensical measure of the ERP – effectively an implied ERP. There is nothing wrong with using an implied ERP to evaluate the attraction of the overall market, but it makes no sense to then use this as an input into a stock valuation model, as you will end up with a circular outcome.

Even if everyone could agree on ERP, then we need an estimate of beta (according to the classical approach). However, beta is bedeviled by issues. At least five issues have to be dealt with. Firstly, betas are inherently unstable. Fernandez[1] calculated the betas of some 3,813 companies using 60-month returns each day from Dec 01 to Jan 02. The median of the maximum betas recorded was three times greater than the median of the minimum betas recorded! Even when measured on an industry basis (rather than an individual stock basis) the maximum beta of an industry was nearly three times the minimum beta. Moves of 100bp in beta value were not uncommon!

Second, betas depend significantly on the index used to calculate them against. Third, the beta also depends upon the time period used to derive the estimate, i.e. do we use 6 months, 52 weeks, or 36 months of back history. Fourth, the interval of return estimation also makes a big difference to beta estimates. Betas based on daily returns are often very different from betas based on monthly, or quarterly data.

Finally, the biggest hurdle to using beta is the fact that it simply doesn't work. As I have shown before, far from the positive relationship predicted by theory, there is actually no (perhaps even an inverse) relationship between beta and returns. (see Chapter 35 of Behavioural Investing for more on the uselessness of CAPM).

US portfolio returns by beta decile (1923-2003) % p.a.



Source: Fama and French (2004) SG Equity Research

Interaction problems

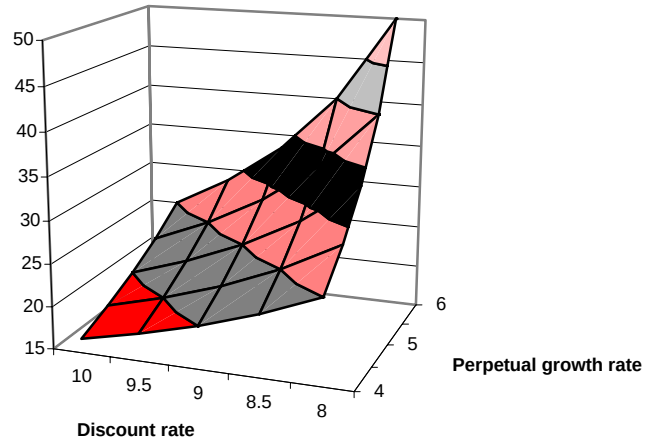
The final problem from my perspective in the DCF calculations concerns the interaction of these previous two sets of problems. Pretty much every DCF is closed out with a terminal value calculation. This involves taking our ten-year forecasts and then estimating a growth rate from year ten to forever, then capitalising this via a multiple.

Very small alterations in the underlying assumptions generate enormous differences in outcomes. If future perpetual growth is 5% and the future cost of capital is 9%, then the terminal value multiple is 25x. If the estimates are off by only 1 per cent in either direction for either the cost of capital, the growth or both, the terminal value multiple can range from 50x to

[1] Fernandez (2004) Are calculated betas worth for anything?, available from www.ssrn.com

16x. Given that the terminal value is often the biggest contribution to the DCF, these issues are non-negligible.

Terminal multiple in DCF as a function of the perpetual growth and discount rate



Source: SG Equity Research

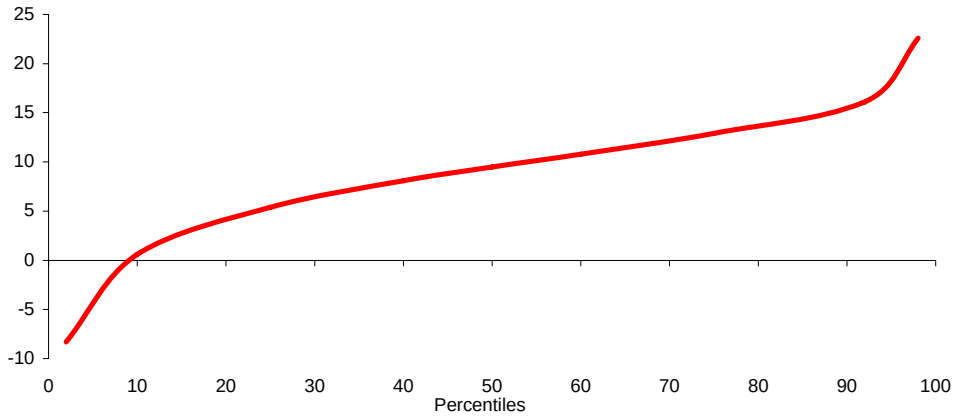
Alternatives

Sensitivity analysis is often presented as a solution to the problems inherent within the practical application of the DCF methodology. However, whilst this has the admirable benefit of making the uncertainty of the DCF transparent, it also has the potential to render the DCF useless, as the output from sensitivity analysis can easily justify any recommendation.

Reverse engineered DCF

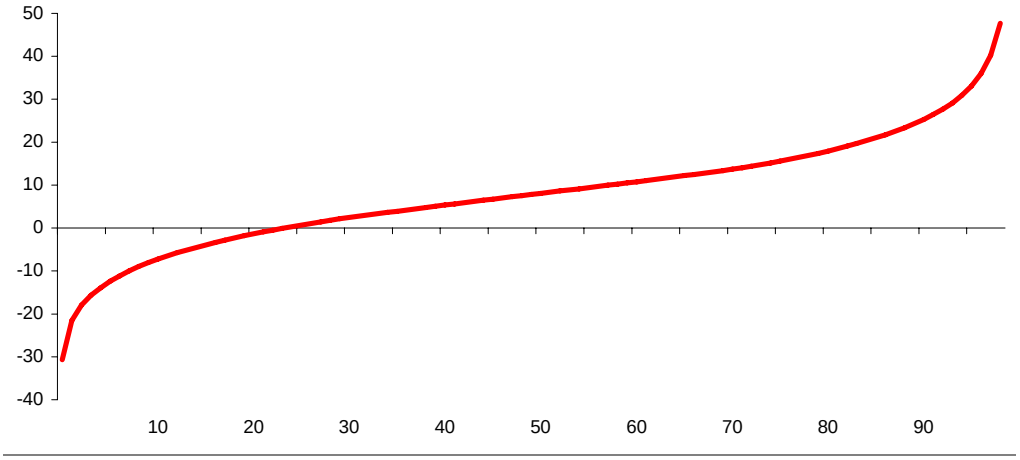
So, if one can't use DCF how should one think about valuation? Well, one solution that I have long favoured is the use of reverse engineered DCFs. Instead of trying to estimate the growth ten years into the future, this method takes the current share price and backs out what is currently implied. The resulting implied growth estimate can then be assessed either by an analyst or by comparing the estimate with an empirical distribution of the growth rates that have been achieved over time, such as the one shown below. This allows one to assess how likely or otherwise the implied growth rate actually is.

Distribution of growth in operating income before depreciation over 10 years (US 1951-1998)



Source: Chan et al, SG Equity Research

Distribution of growth in EBIT over 10 years (Europe 1990-2007)



Source: SG Equity Research

Of course, this model solves the problem of not being able to forecast the future, but it doesn't tackle the discount rate problems outlined above. We still need an estimate of cost of capital. My own approach to this is to set an ERP of around 4% and then I take a guess as to the beta of the stock – which reflects my own arbitrary judgment of the fundamental risk of the business.

When I am teaching on behavioural bias, I often use the reverse engineered DCF approach as an example of avoiding the common pitfall of anchoring in the context of valuation. All too often, I have seen analysts return from company meetings raving about the management and working themselves into a lather over the buying opportunity this stock represents. They then proceed to create a DCF that fulfils the requirements of a buy recommendation (i.e. 15% upside, say). They have effectively become anchored to the current price. When a reverse engineered DCF is deployed this obsession with the current price is removed, as the discussion now takes place in terms of growth potential.

Asset value

As ever in matters of investment, when confused it pays to return to the words of Ben Graham. He suggested two ways of approaching valuation. The first was asset based, and effectively represents a liquidation value for the firm. As Graham wrote "The first rule in calculating liquidating value is that the liabilities are real but the assets are of questionable value." In order to reflect this Graham suggested the following rough rules of thumb for the value of assets.

% of liquidating value to book value

Type of asset	Normal Range	Rough Average
Current Assets:		
Cash assets (and marketable securities)	100	100
Receivables (less usual reserves)	79-90	80
Inventories (at lower of cost or market)	50-75	66 2/3
Fixed assets and Misc		
Real Estate, buildings, machinery, equipment, intangibles	1-50	15 (approx)

Source: Security Analysis, Graham and Dodd 1934

Of course, if this is a strict fire sale items such as intangibles have no worth at all. If, however, the business is being sold as a going concern then intangibles have some value. Graham himself, obviously, preferred only working with current assets, and then deducting all liabilities to generate the famous net-nets of which he was so fond. Note the absence of forecasting in the asset value approach.

Earnings power

The second method Graham favoured was what he called earnings power. He opined that "What the investor chiefly wants to learn… is the indicated earnings power under the given set of conditions, i.e. what the company might be expected to earn year after year if the business conditions prevailing during the period were to continue unchanged". He continued "It combines a statement of actual earnings, shown over a period of years, with a reasonable expectation that these will be approximated in the future, unless extraordinary conditions supervene. The record must over a number of years, first because a continued or repeated performance is always more impressive than a single occurrence, and secondly because the average of a fairly long period will tend to absorb and equalise the distorting influences of the business cycle".

Once earnings power has been computed it can either be capitalised at the cost of capital to give an estimate of value, or it can be compared to the price to generate a PE of sorts which Graham suggested should be no more than "sixteen times" because that "Is as high a price as can be paid in an investment purchase of a common stock… ten times earnings ratio is suitable for the typical case".

Such an approach can be relatively easily operationalised. The method I use is to take an average EBIT margin over a reasonable time period (five to ten years), then multiply this by the average sales over the last five years, say. This gives me a normalised EBIT. Then I subtract interest payments and remove taxes to end up with an estimate of earnings power – all done without any of the messiness of forecasting!

These methods have been extended and refined by many over the years. For a full introduction to a value oriented approach to asset valuation I can do no better than once

again refer the reader to Bruce Greenwald's insightful book which details a modern take of these timeless approaches and extends them into the realm of franchise value as well.

So here we have at least three methods of valuing an equity, none of which require us to leap through the same hoops as the DCF. Whilst the DCF approach is the only theoretically correct approach to valuation, the assumptions and forecasts it requires for implementation remain a task beyond Hercules himself. Simpler, neater and more present (as opposed to forecast) based methods are far more likely to lead us to uncovering the opportunities within the markets, or at the very least stop us from falling victim to undue optimism.

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