Valuing Companies with intangible assets

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Aswath Damodaran

Stern School of Business

adamodar@stern.nyu.edu

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As we move from manufacturing to service based economies, an increasing large proportion of the firms that we value derive their value from intangible assets ranging from technological patents to human capital. In this paper, we focus on a few variables that make valuing these service companies different from conventional manufacturing firms. The first is that accountants routinely miscategorize operating and capital expenses, when firms invest in intangible assets. Thus, R&D expenses, which are really capital expenses, are treated as operating expenses, thus skewing both reported profit and capital values. The second is that firms with intangible assets are more likely to use options and restricted stock to compensate employees and the accounting treatment of this compensation can also affect earnings and cash flows. In this paper, we look at how best to correct for the accounting errors and the consequences for valuation.

In the last twenty years, we have seen a shift away from manufacturing firms to service and technology firms in the global economy, with the magnitude of the change greatest in the United States. As we value more and more pharmaceutical, technology and service companies, we are faced with two realities. The first is that the assets of these firms are often intangible and invisible – patents, know-how and human capital. The second is that the way in which accounting has dealt with investments in these assets is inconsistent with its treatment of investments in tangible assets at manufacturing firms. As a result, many of the basic inputs that we use in valuation – earnings, cash flows and return on capital – are contaminated.

In this paper, we begin by looking at the characteristics shared by firms with intangible assets and the valuation issues that follow. We then look at the dark side of valuation, as it manifests itself in these companies, and some remedies. In particular, we focus on two issues: the corrections for accounting inconsistencies in these firms and the how best to deal with the fact that many of these firms are also heavy users of employee options as compensation.

Firms with intangible assets

Looking at publicly traded firms, it is obvious that many firms derive the bulk of their value from intangible assets. From consumer product companies, dependent upon brand names, to pharmaceutical companies, with blockbuster drugs protected by patent, to technology companies that draw on their skilled technicians and know-how, these firms range the spectrum. In this section, we will begin by looking at their place in the market and how it has shifted over time and follow up by identifying characteristics that they share.

Intangible assets in the overall economy

The simplest measure of how much intangible assets represent of the economy comes from the market values of firms that derive the bulk of their value from these assets as a proportion of the overall market. While technology firms have fallen back from their peak numbers in 2000, they still represented 14% of the overall S&P 500 index at the end of 2008. If we add pharmaceutical and consumer product companies to this mix, the proportion becomes even higher.

There have been other attempts to capture the importance of intangible assets in th economy. In one study, Leonard Nakamura of the Federal Reserve Bank of Philadelphia provided three different measures of the magnitude of intangible assets in today's economy – an accounting estimate of the value of the investments in R&D, software, brand development and other intangibles; the wages and salaries paid to the researchers, technicians and other creative workers who generate these intangible assets; and the improvement in operating margins that he attributes to improvements to intangible factors.[1] With all three approaches, he estimated the investments in intangible assets to be in excess of $ 1 trillion in 2000 and the capitalized value of these intangible assets to be in excess of $ 6 trillion in the same year.

Characteristics of firms with intangible assets

While firms with intangible assets are diverse, there are some characteristics that they do have in common. In this section, we will highlight those shared factors, with the intent of expanding on the consequences for valuation in the next section.

1. Inconsistent accounting for investments made in intangible assets: Accounting first principles suggests a simple rule to separate capital expenses from operating expenses. Any expense that creates benefits over many years is a capital expense whereas expenses that generate benefits only in the current year are operating expenses. Accountants hew to this distinction with manufacturing firms, putting investments in plant, equipment and buildings in the capital expense column and labor and raw material expenses in the operating expense column. However, they seem to ignore these first principles when it comes to firms with intangible assets. The most significant capital expenditures made by technology and pharmaceutical firms is in R&D, by consumer product companies in brand name advertising and by consulting firms in training and recruiting personnel. Using the argument that the benefits are too uncertain, accountants have treated these expenses as operating expenses. As a consequence, firms with intangible assets report small capital expenditures, relative to both their size and growth potential.

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[1] Nakamura, L., 1999,. Intangibles: What put the new in the new economy? Federal Reserve Bank of Philadephia Business Review July/August: 3—16.

2. Generally borrow less money: While this may be a generalization that does not hold up for some sub-categories of firms with intangible assets, many of them tend to use debt sparingly and have low debt ratios, relative to firms in other sectors with similar earnings and cash flows. Some of the low financial leverage can be attributed to the bias that bankers have towards lending against tangible assets and some of it may reflect the fact that technology and pharmaceutical firms are either in or have just emerged from the growth phase in the life cycle.
3. Equity Options: While the use of equity options in management compensation is not unique to firms with intangible assets, they seem to be much heavier users of options and other forms of equity compensation. Again, some of this behavior can be attributed to where these firms are in the life cycle (closer to growth than mature), but some of it has to be related to how dependent these firms are on retaining human capital.

Valuation Consequences

The miscategorization of capital expenses, the sparing use of debt and equity-based compensation (options and restricted stocks) can create problems when we value these firms. In this section, we will lay out some of the issues that arise in both discounted cash flow and relative valuation.

- We generally draw on the current earnings and current book value of a firm to derive a value for existing assets. The flawed accounting treatment of intangible assets renders both numbers unreliable, since the reported earnings for a technology firm represent the earnings after reinvestment in R&D, rather than true operating earnings and the book value of assets (and equity) will be understated because the biggest assts for these firms are off the books; if you expense an item, you cannot show it as an asset. This has consequences not only for discounted cash flows valuation, where these numbers become the base from which we forecast, but also in relative valuation, where we compare multiples of accounting earnings and book values across companies.
- If growth is a function of how much firms reinvest and the quality of that reinvestment, the accounting treatment of expenditures on intangible assets makes it

difficult to gauge either number. The reinvestment made by the firm is often buried in the operating expenses (rather than showing up separately as capital expenditures) and the failure to record the book values of intangible assets makes measures like return on equity and capital, widely used to determine the quality of a firm's investments, unreliable.

- In addition to all of the standard variables that affect risk in a company, firms with intangible assets are susceptible to an additional risk. Lenders are wary of lending to firms with intangible assets, since monitoring these assets can be difficult to do. In addition, the values of some intangible assets, like human capital, can dissipate overnight, if a firm gets into trouble or has its reputation besmirched.
- Estimating when a firm with intangible assets gets to steady state can range from simple to complex. Consider the simple scenario first: a biotechnology firm that derives almost all of its growth from a single blockbuster drug, with a patent expiring in 7 years. Having a competitive advantage that comes with a time expiration stamp does make the judgment on when the company will hit stable growth very simple. A more complex scenario is a firm with a well-regarded brand name. Given the durability of consumer brand name as a competitive advantage, analysts face a much tougher task estimating when to put the firm into stable growth. The final and most difficult scenario is a firm, whose biggest intangible asset is human capital – consultants at McKinsey or traders at a private equity fund. Since it is very difficult to lock in human capital, these firms can lose their best assets overnight to the highest bidder. Figuring out how or why these firms manage to hold on to their best personnel is a central component to valuing them correctly.

The defense offered by some analysts is that the rules, flawed though they might be, are the same for all firms within a sector. As we will see in the next section, that does not neutralize the problem.

The Dark Side of Valuation

How do analysts deal with the valuation issues that characterize firms with intangible assets? In many cases, they ignore them and trust historical data or management provided forecasts of the numbers. In some cases, they fall back on the

defense that all of the firms in a sector should be equally impacted by these accounting rules and that comparisons across the firms should therefore not be affected.

Exogenous Growth

The biggest problem with treating capital expenses (such as R&D, training and brand advertising expenses) as operating expenses is that we lose the most potent tool that we have for not only estimating growth but also for checking for internal consistency; the growth rates we use for a firm have to be consistent with our estimates of reinvestment and return on capital for that firm. If we use conventional accounting measures of capital expenditures and capital invested for firms with intangible assets, we will get measures of the reinvestment rate and return on capital that are meaningless. In fact, these conventional measures can result in negative reinvestment rates (since the biggest reinvestment is missed) and overstated returns on equity and capital (because the biggest assets are off the books).

When confronted by these numbers, analysts decide that fundamentals no longer matter, at least for these types of companies, and make their own judgments on future growth, based either on history or conversations with the managers of the company. Not surprisingly, there is a tendency to over estimate growth during good times and under estimate growth in bad times. The history of booms and busts in stock prices at these firms is a testimonial to the consequences of this behavior.

Sector comparison

Analysts who stick with relative valuation often argue that they are unaffected by accounting inconsistencies, since all firms in their sector are affected by these inconsistencies. Thus, they argue that comparing the PE ratio of a software firm to the PE ratio of a steel company is difficult to do, but that comparing PE ratios across software companies is fine. After all, if every software company has R&D expenses and these expenses are all treated (incorrectly) as operating expenses, all of the companies should have earnings and returns that are skewed by the treatment. The problem with this argument is that the effect of the accounting miscategorization of capital expenditures at firms can vary widely across firms within the same sector. As a general rule, the effect will be much greater at younger firm, with growing investments, than at mature firms.

The consequences for earnings and capital will also vary depending upon the time lag between making the investment and earnings; firms with shorter time lags will be less affected than firms with longer time lags.

Simplistic adjustments

Some analysts, recognizing the danger of trusting the accounting numbers at firms where expenses have been systematically miscategorized, try to look for easy solutions to the problem. For instance, rather than compare the PE ratios across technology companies, some analysts compare the multiples of market capitalization to earnings before R&D expenses at which firms trade. Similarly, with equity options, there are many variants of diluted earnings per share that purport to capture the effect of options outstanding.

While the motivation for a simple fix is understandable, it can lull analysts into a false sense of complacency. Adding back R&D to the net income or operating income will not nullify the effects of R&D on the remaining variables. Adjusting the number of shares for options outstanding is a very sloppy way of dealing with these options, not reflecting the probability of exercise or the price at which they will be exercised.

The Light Side of Valuation

To value firms with intangible assets, it would seem to us that we have to deal with the two big problems that they share. First, we have to clean up the financial statements (income statement and balance sheet) and re-categorize operating and capital expenses. The intent is not just to get a better measure of earnings, though that is a side benefit, but to get a clearer sense of what the firm is investing to generate future growth. Second, we need to deal more effectively with equity options – the ones that have been granted in the past as well the ones that we expect to be granted in the future.

Regaining Accounting Consistency

While, in theory, income is not computed after capital expenses, the reality is that there are a number of capital expenses that are treated as operating expenses. A significant shortcoming of accounting statements is the way in which they treat research and development expenses. Under the rationale that the products of research are too

uncertain and difficult to quantify, accounting standards have generally required that all R&D expenses to be expensed in the period in which they occur. This has several consequences, but one of the most profound is that the value of the assets created by research does not show up on the balance sheet as part of the total assets of the firm. This, in turn, creates ripple effects for the measurement of capital and profitability ratios for the firm. We will consider how to capitalize R&D expenses in the first part of the section and extend the argument to other capital expenses in the second part of the section.

Capitalizing R&D Expenses

Research expenses, notwithstanding the uncertainty about future benefits, should be capitalized. To capitalize and value research assets, we have to make an assumption about how long it takes for research and development to be converted, on average, into commercial products. This is called the *amortizable life* of these assets. This life will vary across firms and reflect the commercial life of the products that emerge from the research. To illustrate, research and development expenses at a pharmaceutical company should have fairly long amortizable lives, since the approval process for new drugs is long. In contrast, research and development expenses at a software firm, where products tend to emerge from research much more quickly should be amortized over a shorter period.

Once the amortizable life of research and development expenses has been estimated, the next step is to collect data on R&D expenses over past years ranging back to the amortizable life of the research asset. Thus, if the research asset has an amortizable life of 5 years, the R&D expenses in each of the five years prior to the current one have to be obtained. For simplicity, it can be assumed that the amortization is uniform over time, which leads to the following estimate of the residual value of research asset today.

$$\text{Value of the Research Asset} = \sum_{t=-(n-1)}^{t=0} R\&D_t \frac{(n+t)}{n}$$

Thus, in the case of the research asset with a five-year life, you cumulate 1/5 of the R&D expenses from four years ago, 2/5 of the R & D expenses from three years ago, 3/5 of the R&D expenses from two years ago, 4/5 of the R&D expenses from last year and this year's entire R&D expense to arrive at the *value of the research asset*. This augments the value of the assets of the firm, and by extension, the book value of equity.

Adjusted Book Value of Equity = Book Value of Equity + Value of the Research Asset

Finally, the operating income is adjusted to reflect the capitalization of R&D expenses. First, the R&D expenses that were subtracted out to arrive at the operating income are added back to the operating income, reflecting their re-categorization as capital expenses. Next, the amortization of the research asset is treated the same way that depreciation is and netted out to arrive at the adjusted operating income.

Adjusted Operating Income = Operating Income + R & D expenses – Amortization of Research Asset

The adjusted operating income will generally increase for firms that have R&D expenses that are growing over time. The net income will also be affected by this adjustment:

Adjusted Net Income = Net Income + R & D expenses – Amortization of Research Asset

While we would normally consider only the after-tax portion of this amount, the fact that R&D is entirely tax deductible eliminates the need for this adjustment.[2]

Illustration 1: Capitalizing R&D expenses: Amgen in February 2009

Amgen is a biotechnology/ pharmaceutical firm. Like most such firms, it has a substantial amount of R&D expenses and we will attempt to capitalize it in this example. The first step in this conversion is determining an amortizable life for R & D expenses. How long will it take, on an expected basis, for research to pay off at Amgen? Given the length of the approval process for new drugs by the Food and Drugs Administration, we will assume that this amortizable life is 10 years.

The second step in the analysis is collecting research and development expenses from prior years, with the number of years of historical data being a function of the amortizable life. Table 1 provides this information for the firm.

Table 1: Historical R& D Expenses (in millions)

Year	R& D Expenses
Current	3030.00

[2] If only amortization were tax deductible, the tax benefit from R&D expenses would be:
Amortization * tax rate
This extra tax benefit we get from the entire R&D being tax deductible is as follows:
(R&D – Amortization) * tax rate
If we subtract out (R&D – Amortization) (1- tax rate) and add the differential tax benefit, which is computed above, (1- tax rate) drops out of the equation.

-1	3266.00
-2	3366.00
-3	2314.00
-4	2028.00
-5	1655.00
-6	1117.00
-7	864.00
-8	845.00
-9	823.00
-10	663.00

The current year's information reflects the R&D in the most recent financial year (which was calendar year 2008 in this example).

The portion of the expenses in prior years that would have been amortized already and the amortization this year from each of these expenses is considered. To make estimation simpler, these expenses are amortized linearly over time; with a 10-year life, 10% is amortized each year. This allows us to estimate the value of the research asset created at each of these firms and the amortization of R&D expenses in the current year. The procedure is illustrated in table 2:

Table 2: Value of Research Asset

Year	*R&D Expense*	*Unamortized portion*		*Amortization this year*
Current	3030.00	1.00	3030.00	
-1	3266.00	0.90	2939.40	$326.60
-2	3366.00	0.80	2692.80	$336.60
-3	2314.00	0.70	1619.80	$231.40
-4	2028.00	0.60	1216.80	$202.80
-5	1655.00	0.50	827.50	$165.50
-6	1117.00	0.40	446.80	$111.70
-7	864.00	0.30	259.20	$86.40
-8	845.00	0.20	169.00	$84.50
-9	823.00	0.10	82.30	$82.30
-10	663.00	0.00	0.00	$66.30
			$13283.60	$1,694.10

Note that none of the current year's expenditure has been amortized because it is assumed to occur at the end of the most recent year (which effectively makes it today). The sum of the dollar values of unamortized R&D from prior years is $13.284 billion. This can be viewed as the value of Amgen's research asset and would be also added to the book value

of equity for computing return on equity and capital measures. The sum of the amortization in the current year for all prior year expenses is $1,694 million.

The final step in the process is the adjustment of the operating income to reflect the capitalization of research and development expenses. We make the adjustment by adding back R&D expenses to the operating income (to reflect its reclassification as a capital expense) and subtracting out the amortization of the research asset, estimated in the last step. For Amgen, which reported operating income of $5,594 million in its income statement for 2008, the adjusted operating earnings would be:

Adjusted Operating Earnings

= Operating Earnings + Current year's R&D expense – Amortization of Research Asset

= 5,594 + 3030 – 1694 = $ 6.930 million

The stated net income of $4,196 million can be adjusted similarly.

Adjusted Net Income

= Net Income + Current year's R&D expense – Amortization of Research Asset

= 4,196 + 3030 – 1694 = $ 5,532 million

Both the book value of equity and capital are augmented by the value of the research asset. Since measures of return on capital and equity are based upon the prior year's values, we computed the value of the research asset at the end of 2007, using the same approach that we used in 2008 and obtained a value of $ 11,948 million.[3]

Value of Research Asset_{2007} = $ 11,948 million

Adjusted Book Value of Equity_{2007}

= Book Value of Equity_{2007} + Value of Research Asset_{2007}

= 17,869 million + 11,948 million = $29,817 million

Adjusted Book Value of Capital_{2007}

= Book Value of Capital_{2007} + Value of Research Asset_{2007}

= $ 21,985 million + 11,948 million = $ 33,933 million

[3] Note that you can arrive at this value using the table above and shifting the amortization numbers by one row. Thus, $ 822.80 million will become the current year's R&D, $ 663.3 million will become the R&D for year –1 and 90% of it will be unamortized and so on.

The returns on equity and capital are estimated by dividing the earnings in 2008 by the capital invested at the end of 2007 and are reported with both the unadjusted and adjusted numbers below:

	Unadjusted	Adjusted for R&D
Return on Equity	$\frac{4,196}{17,869} = 23.48\%$	$\frac{5,532}{29,817} = 18.55\%$
Pre-tax Return on Capital	$\frac{5,594}{21,985} = 25.44\%$	$\frac{6,930}{33,933} = 20.42\%$

While the profitability ratios for Amgen remain impressive even after the adjustment, they decline significantly from the unadjusted numbers.

Capitalizing Other Operating Expenses

While R&D expenses are the most prominent example of capital expenses being treated as operating expenses, there are other operating expenses that arguably should be treated as capital expenses. Consumer product companies such as Gillette and Coca Cola could make a case that a portion of advertising expenses should be treated as capital expenses, since they are designed to augment brand name value. For a consulting firm like KPMG or McKinsey, the cost of recruiting and training its employees could be considered a capital expense, since the consultants who emerge are likely to be the heart of the firm's assets and provide benefits over many years. For many new technology firms, including online retailers such as Amazon.com, the biggest operating expense item is selling, general and administrative expenses (SG&A). These firms could argue that a portion of these expenses should be treated as capital expenses since they are designed to increase brand name awareness and bring in new presumably long term customers.

While this argument has some merit, we should remain wary about using it to justify capitalizing these expenses. For an operating expense to be capitalized, there should be substantial evidence that the benefits from the expense accrue over multiple periods. Does a customer who is enticed to buy from Amazon, based upon an advertisement or promotion, continue as a customer for the long term? There are some analysts who claim that this is indeed the case and attribute significant value added to

each new customer. It would be logical, under those circumstances, to capitalize these expenses using a procedure similar to that used to capitalize R&D expenses.

- Determine the period over which the benefits from the operating expense (such as SG&A) will flow.
- Estimate the value of the asset (similar to the research asset) created by these expenses. This amount will be added to the book value of equity/capital and used to estimate the returns on equity and capital.
- Adjust the operating income for the expense and the amortization of the created asset.

The net effects of the capitalization will be seen most visibly in the reinvestment rates and returns on capital that we estimate for these firms.

Illustration 2: Capitalizing Brand Name Advertising – Coca Cola in 2009

Coca Cola is widely regarded as possessing one of the most valuable brand names in the world. We know that the company has always spent liberally on advertising, partly directed at building up the brand name. In table 3, we report on selling and advertising expenditures at Coca Cola every year for the last 25 years, which we will assume is the amortizable life for brand name. (In truth, we should be going back a lot longer, but data limitations get in the way).

Table 3: Advertising Expenditures at Coca Cola: 1984-2008

Year	Year	SG&A Expense	Selling and Advertising	Brand Name Advertising	Amortization this year	Unamortized Expense
1984	1	$2,314	$1,543	$771	$30.85	$0.00
1985	2	$2,368	$1,579	$789	$31.57	$31.57
1986	3	$2,446	$1,631	$815	$32.61	$65.23
1987	4	$2,665	$1,777	$888	$35.53	$106.60
1988	5	$3,038	$2,025	$1,013	$40.51	$162.03
1989	6	$3,348	$2,232	$1,116	$44.64	$223.20
1990	7	$4,076	$2,717	$1,359	$54.35	$326.08
1991	8	$4,604	$3,069	$1,535	$61.39	$429.71
1992	9	$5,249	$3,499	$1,750	$69.99	$559.89
1993	10	$5,695	$3,797	$1,898	$75.93	$683.40
1994	11	$6,297	$4,198	$2,099	$83.96	$839.60
1995	12	$6,986	$4,657	$2,329	$93.15	$1,024.61
1996	13	$8,020	$5,347	$2,673	$106.93	$1,283.20
1997	14	$7,852	$5,235	$2,617	$104.69	$1,361.01
1998	15	$8,284	$5,523	$2,761	$110.45	$1,546.35
1999	16	$9,814	$6,543	$3,271	$130.85	$1,962.80

2000	17	$8,551	$5,701	$2,850	$114.01	$1,824.21
2001	18	$6,149	$4,099	$2,050	$81.99	$1,393.77
2002	19	$7,001	$4,667	$2,334	$93.35	$1,680.24
2003	20	$7,488	$4,992	$2,496	$99.84	$1,896.96
2004	21	$8,146	$5,431	$2,715	$108.61	$2,172.27
2005	22	$8,739	$5,826	$2,913	$116.52	$2,446.92
2006	23	$9,431	$6,287	$3,144	$125.75	$2,766.43
2007	24	$10,945	$7,297	$3,648	$145.93	$3,356.47
2008	25	$11,774	$7,849	$3,925	$156.99	$3,767.68
Total					$2,150.40	$31,910.23

We assume that two-thirds of the S,G and A expenses are for selling and advertising and that 50% of the selling and advertising expenses each year are associated with building up brand name, with the balance used to generate revenues in the current year. In the second-to-last column, we compute the amortization this year of prior year's expenditure, using straight-line amortization over 25 years. In the last column, we keep track of the unamortized portion of prior year's expenditures. The cumulated value of this column ($31.9 billion) can be considered the capital invested in the brand name.

There are potential refinements that will improve this estimate. One is to use a longer amortizable life and to go back further in time to obtain advertising expenses. The other is to convert the past expenditures into current dollar expenditures, based upon inflation. In other words, an expenditure of $ 771 million in 1984 is really much larger if stated in 2008 dollars.[4] Both of these will increase the capital value of the brand name.

The adjustments to operating income, net income and capital invested, in table 4, mirror those made for Amgen for R&D expenses:

Table 4: Capitalizing Brand Name Advertising- Coca Cola

	Conventional Accounting	Capitalized Brand Name
Operating Income	$8,446	$10,220
Net Income	$5,807	$7,581
Equity invested	$21,744	$53,654
Capital Invested	$31,073	$62,983
ROE	26.71%	14.13%
Pre-tax ROC	27.18%	16.23%

[4] When we use inflation adjusted values, the value of brand name increases to almost $ 40 billion.

Capitalizing brand name advertising substantially decreases both the return on equity and capital invested for Coca Cola.

Illustration 3: Capitalizing Recruitment and Training Expenses: Cyber Health Consulting

Cyber Health Consulting (CHC) is a firm that specializes in offering management consulting services to health care firms. CHC reported operating income (EBIT) of $51.5 million and net income of $23 million in the most recent year. However, the firm's expenses include the cost of recruiting new consultants ($ 5.5 million) and the cost of training ($8.5 million). A consultant who joins CHC stays with the firm, on average, 4 years.

To capitalize the cost of recruiting and training, we obtained these costs from each of the prior four years. Table 5 reports on these expenses and amortizes each of these expenses over four years.

Table 5: Human Capital Expenses: CHC

Year	Training & Recruiting Expenses	Unamortized Portion		Amortization this year
Current	$ 14.00	100%	$ 14.00	
-1	$ 12.00	75%	$ 9.00	$ 3.00
-2	$ 10.40	50%	$ 5.20	$ 2.60
-3	$ 9.10	25%	$ 2.28	$ 2.28
-4	$ 8.30	-	$ 0.00	$ 2.08
Value of Human Capital Asset =			$ 30.48	
Amortization this year =				$9.95

The adjustments to operating and net income are as follows:

Adjusted Operating Income = Operating Income + Training and Recruiting expenses – Amortization of Expense this year = $ 51.5 + $ 14 - $ 9.95 = $ 55.55 million

Net Income = Net Income + + Training and Recruiting expenses – Amortization of Expense this year = $ 23 million + $ 14 million - $ 9.95 million = $ 27.05 million

These adjusted earnings numbers in conjunction with the value of the human capital asset, estimated in table 6, are used to compute the returns on equity and capital.

Table 6: Returns on Equity and Capital – Conventional versus Adjusted

	Conventional accounting	Capitalized Training Expenses
Net Income	$23.00	$27.05
Operating Income	$51.50	$55.55

Book Equity	$125.00	$155.48
Book Capital	$250.00	$280.48
ROE	18.40%	17.40%
Pre-tax ROC	20.60%	19.81%

As with Amgen and Coca Cola, capitalizing training expenses decreases the returns on equity and capital for the company.

Consequences for valuation

When we capitalize R&D, brand name advertising and training expenses, there are significant consequences for both discounted cash flow and relative valuation. In discounted cash flow valuation, our estimates of cash flows and growth can be dramatically altered by the use of the adjusted numbers. In relative valuation, comparisons of firms within the same sector can be skewed by where they are in the life cycle.

a. Discounted Cashflow Valuation

When we capitalize the expenses associated with creating intangible assets, we are in effect redoing the financial statements of the firm and restating numbers that are fundamental inputs into valuation – earnings, reinvestment and measures of returns.

a. Earnings: As we have noted with all three examples of capitalization (R&D, brand name advertising and training/recruiting expenses), the operating and net income of a firm will change as a consequence. Since the adjustment involves adding back the current year's expense and subtracting out the amortization of past expenses, the effect on earnings will be non-existent if the expenses have been unchanged over time, and positive, if expenses have risen over time. With Amgen, for instance, where R&D expenses increased from $663 million at the start of the amortization period to $3.03 billion in the current year, the earnings increased by more than $1.3 billion as a result of the R&D adjustment.
b. Reinvestment: The effect on reinvestment is identical to the effect on earnings, with reinvestment increasing or decreasing by exactly the same amount as earnings.

c. Free Cash flow to the equity(firm): Since free cash flow is computed by netting reinvestment from earnings, and the two items change by the same magnitude, there will be no effect on free cash flows.
d. Reinvestment Rate: While the free cash flow is unaffected by capitalization of these expenses, the reinvestment rate will change. In general, if earnings and reinvestment both increase as a consequence of the capitalization of R&D or advertising expenses, the reinvestment rate will increase.
e. Capital Invested: Since the unamortized portion of prior year's expenses is treated as an asset, it adds to the estimated equity or capital invested in the firm. The effect will increase with the amortizable life and should thererfore be higher for pharmaceutical firms (where amortizable lives tend to be longer) than for software firms (where research pays off far more quickly as commercial products).
f. Return on equity (capital): Since both earnings and capital invested are both affected by capitalization, the net effects on return on equity and capital are unpredictable. If the return on equity (capital) increases after the recapitalization, it can be considered a rough indicator that the returns earned by the firm on its R&D or advertising investments is greater than its returns on traditional investments.
g. Expected growth rates: Since the expected growth rate is a function of the reinvestment rate and the return on capital, and both change as a result of capitalization, the expected growth rate will also change. While the higher reinvestment rate will work in favor of higher growth, it may be more than offset by a drop in the return on equity or capital.

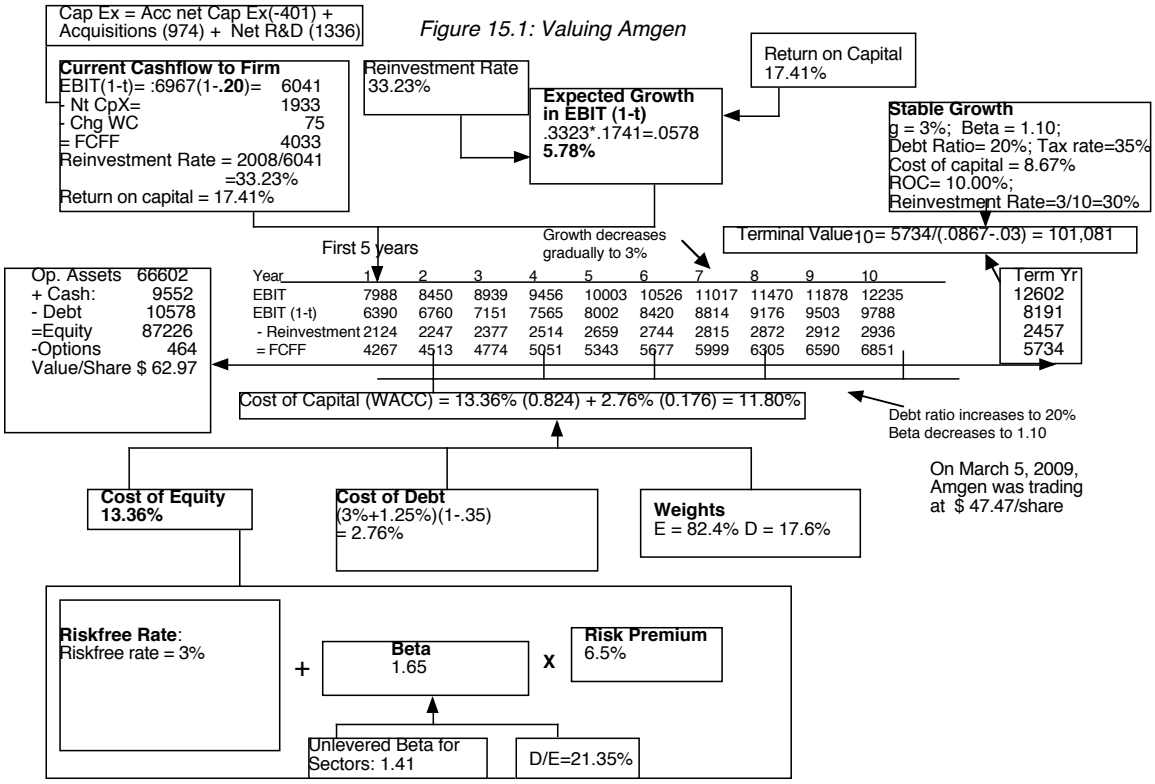
In summary, the variables that are most noticeably affected by capitalization are the return on equity/capital and the reinvestment rate. Since the cost of equity/capital is unaffected by capitalization, any change in the return on capital will translate into a change in excess returns at the firm, a key variable determining the value of growth. In addition to providing us with more realistic estimates of what these firms are investing in their growth assets and the quality of these assets, the capitalization process also restores consistency to valuations by ensuring that growth rates are in line with reinvestment and

return on capital assumptions. Thus, technology or pharmaceutical firms that want to continue to grow have to keep investing in R&D, while ensuring that these investments, at least collectively, generate high returns for the firm.

Illustration 4: Valuing Amgen

In illustration 1, we capitalized R&D expenses for Amgen and computed the adjusted operating income, reinvestment and return on capital at the firm. We used the restated numbers to estimate the value of the firm and equity per share. The valuation, where we assume ten years of high growth, is summarized in Figure 1:

Figure 1: Valuing Amgen – March 2009



Our estimate of value of equity per share is $62.97 a share, well above the prevailing stock price of $ 47.47.

An intriguing question is how the capitalization of R&D expenses affected value. To investigate, we compared the valuation fundamentals for Amgen, with conventional accounting, and with R&D treated as capital expenses in table 7:

Table 7: Valuation Fundamentals – With and Without R&D Capitalization

	Conventional	Capitalized R&D
After-tax ROC	14.91%	17.41%
Reinvestment Rate	19.79%	33.23%
Growth Rate	2.95%	5.78%
Value per share	$43.63	$62.97

We then revalued the firm, using both sets of fundamentals. As the table indicates, the value per share would have been $43.63, if we had used conventional accounting numbers. Clearly, capitalization matters and the degree to which it matters will vary across firms. In general, the effect will be negative for firms that invest large amounts in R&D, with little to show (yet) in terms of earnings and cash flows in subsequent periods. It can be positive for firms that reinvest large amounts in R&D and report large increases in earnings in subsequent periods. In the case of Amgen, capitalizing R&D has a positive effect on value per share, because of its track record of successful R&D.

b. Relative Valuation

It is true that all technology and pharmaceutical companies operate under the same flawed accounting rules, expensing R&D, rather than capitalizing it. That does not mean, though, that there are no consequences for relative valuation. As we noted in the last section, the effect of capitalizing R&D on earnings and book value can vary widely across firms and will depend upon the following:

a. Age of the firm and stage in life cycle: Generally speaking, the effects of capitalization will be much greater at young firms than at more mature firms. Consider, for instance, the capitalization of R&D expenses. Capitalizing these expenses will increase earnings far more at young firms for two reasons: (a) R&D expenses will comprise a much larger proportion of the total expenses at these firms and (b) R&D expenses are more likely to have increased significantly over time.
b. Amortizable life: The effect of capitalizing expenses will be much greater as we extend the amortizable life of R&D, especially on capital invested. If we assume that all firms in a sector share the same amortizable life for R&D, this will not be an issue, but to the extent that different firms within the same business may

convert research into commercial products at different speeds, the effect on earnings of capitalizing R&D can vary across firms

If we ignore accounting inconsistencies and use the reported earnings and book values of firms in the computation of multiples, we are likely to find that younger firms or firms that have R&D with longer gestation periods are overvalued. Their earnings and book value will be understated, leading to much higher PE, EV/EBITDA and book value multiples for these firms.

There are two ways we can incorporate these factors into relative valuation. The first is to capitalize the expenses associated with investing in intangible assets for each firm and to compute consistent measures of earnings and book value to use in multiples. This approach, while yielding the most precision, is also the most time and data intensive. The second is to stick with the reported accounting values for earnings and book value, which controlling for the factors listed above.

Illustration 5: Valuing large pharmaceutical firms with PE ratios

To examine the effect of R&D, we estimated the PE ratios, in February 2009, for pharmaceutical firms, using several measures of net income in table 8:

Table 8: PE Ratios for Pharmaceutical Companies – February 2009

Company Name	*Market Cap $ (Mil)*	*Net Income*	*R&D expense*	*R&D net of amortization*	*PE*	*P/(E+R&D)*	*P/(E+ Net R&D)*
Merck & Co.	$46,702	$7,804	$4,805	$302	5.98	3.70	5.76
AstraZeneca PLC	$44,366	$6,130	$5,179	$650	7.24	3.92	6.54
GlaxoSmithKline ADR	$77,596	$10,619	$6,707	$225	7.31	4.48	7.16
Lilly (Eli)	$31,232	$3,863	$3,840	$410	8.08	4.05	7.31
Sanofi-Aventis	$67,924	$7,068	$4,575	$450	9.61	5.83	9.03
Novartis AG ADR	$79,954	$8,163	$1,834	$76	9.79	8.00	9.70
Pfizer Inc.	$85,433	$8,104	$7,945	$550	10.54	5.32	9.87
Biogen Idec Inc.	$12,732	$783	$1,072	$415	16.26	6.86	10.63
Wyeth	$54,391	$4,417	$3,373	$155	12.31	6.98	11.90
Bristol-Myers Squibb	$35,019	$2,165	$3,585	$710	16.18	6.09	12.18
Schering-Plough	$26,475	$1,903	$850	$135	13.91	9.62	12.99
Allergan Inc.	$10,901	$577	$798	$255	18.89	7.93	13.10
Teva Pharmac. (ADR)	$34,279	$2,374	$786	$221	14.44	10.85	13.21
Genzyme Corp.	$14,348	$421	$1,308	$622	34.08	8.30	13.76
Novo Nordisk	$28,165	$1,681	$1,368	$355	16.76	9.24	13.83

Abbott Labs.	$71,357	$4,881	$2,689	$250	14.62	9.43	13.91
Gilead Sciences	$40,310	$2,011	$721	$375	20.04	14.75	16.89
Celgene Corp.	$18,302	$226	$399	$215	80.84	29.26	41.46

To contrast with the conventional PE ratio, which is based on reported net income, we computed two alternative measures of earnings. In the first, we use the simplistic adjustment of adding back R&D expenses to net income to arrive at a multiple of the market price to earnings before R&D expenses. In the second, we make the full adjustment for R&D, adding back the R&D and subtracting out the amortization of R&D to arrive at an adjusted net income.

The results are revealing. On all three measures of PE, Merck looks like it is the most undervalued company in the group. As we add back R&D, the differences between the earnings multiples decreases, with Celgene remaining the outlier. Finally, when we compute the multiple of earnings with net R&D added back, the more mature pharmaceutical companies with less attractive growth prospects emerge with lower PE ratios, whereas the smaller, higher growth companies trade at higher multiples of earnings.

Dealing with Equity Options

In the last two decades, firms have increasing turned to compensating managers using equity, with options being a key component, for several reasons. The first is to align management interests with stockholders, i.e, to make managers think like stockholders by giving them an equity stake. The second is it allowed cash-poor firms with significant growth prospects to compete for employee talent against deep-pocketed rivals; young technology firms are prime users of options. The third is that the accounting for options woefully understated the true cost of these options, allowing these firms to report much positive earnings, even as they gave away big chunks of equity to managers.

Firms that pay managers and others with equity options create a second claim on the equity on top of the claim that common stockholders have. Since we are called up to estimate the value of equity per common share, we have to consider how to allocate the aggregate equity value across the two claimholders. In this section, we will first examine how to deal with options that a firm may have granted to managers in the past, that have

not been exercised yet; this is the option overhang. In the second section, we will extend the analysis to look at how best to deal with options that may be granted in the future to employees and how to bring the consequences of such grants into the value of equity per share today.

The Option Overhang

There are three approaches that are widely used to deal with outstanding options, issued in prior periods. The crudest way is to assume that all or some of the options will be exercised in the future, adjust the number of shares outstanding and divide the value of equity by this number to arrive at value per share; this is the diluted shares approach. The second and slightly more tempered approach is to incorporate the exercise proceeds from the options in the numerator and then divide by the number of shares that would be outstanding after exercise; this is the treasury stock approach. The third and preferred approach for dealing with options is to estimate the value of the options today, given today's value per share and the time premium on the option. Once this value has been estimated, it is subtracted from the estimated equity value, and the remaining amount is divided by the number of shares outstanding to arrive at value per share.

I. Use fully diluted number of shares to estimate per-share value

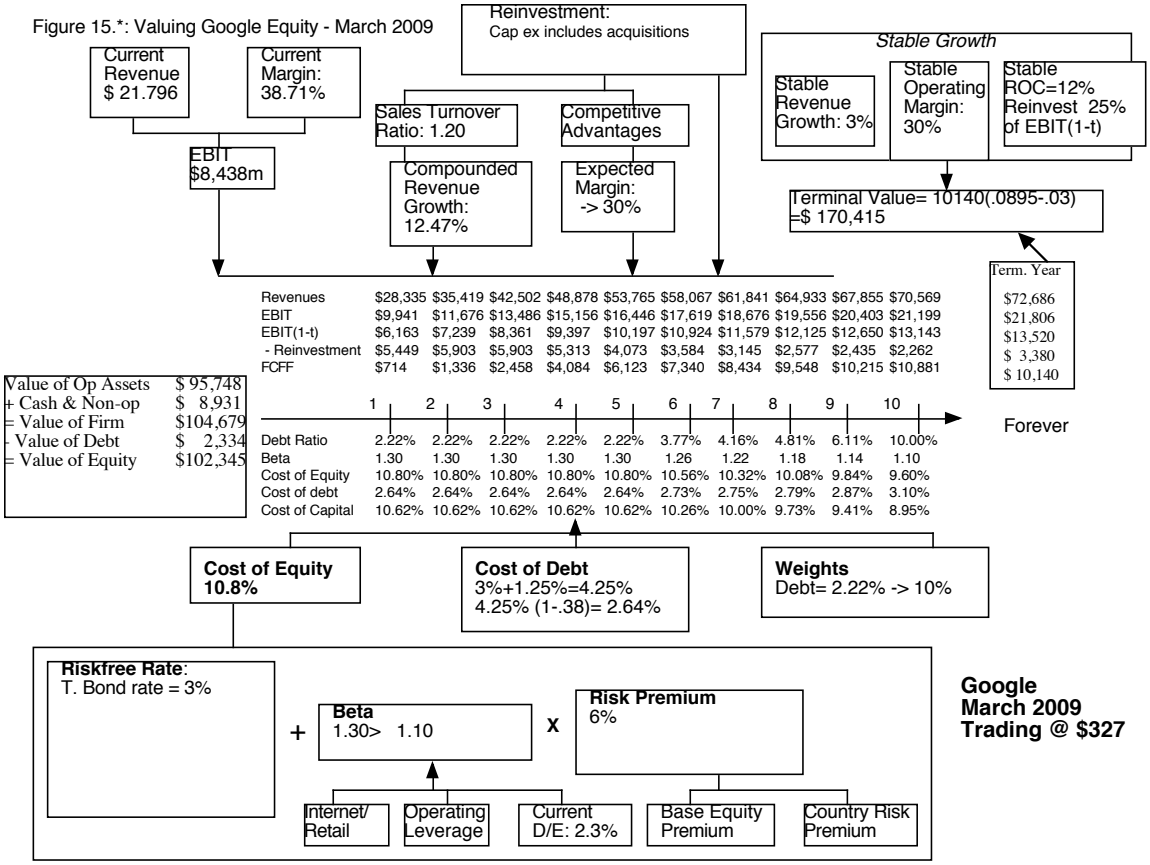
The simplest way to incorporate the effect of outstanding options on value per share is to divide the estimated value of equity from a discounted cash flow model by the number of shares that will be outstanding if all options are exercised today – the fully diluted number of shares. While this approach has the virtue of simplicity, it will lead to too low of an estimate of value per share for three reasons:

- It considers all options outstanding, not just ones that are in the money and vested. To be fair, there are variants of this approach where the shares outstanding are adjusted to reflect only in-the-money and vested options.
- It does not incorporate the expected proceeds from exercise, which will comprise a cash inflow to the firm.
- Finally, this approach does not build in the time premium on the options into the valuation.

Illustration 6: Fully Diluted Approach to estimating Value per Share

To apply the fully diluted approach to estimate the per share value, we will value a company with a significant option overhang –Google. We begin by valuing equity in the aggregate, capitalizing R&D along the way (we used a four year amortizable life for Google's R&D) and using a ten-year high growth period. Figure 2 summarizes the value of equity.

Figure 2 Valuing Google's Equity – March 2009



In February 2009, Google had 315.29 million shares outstanding and 13.97 millioin in options outstanding. To estimate the value of equity per share, we divide the aggregate value of equity estimated in figure 2 by the total number of shares outstanding.

Diluted value of equity per share

$$= \frac{\text{Aggregate Value of Equity}}{\text{Fully diluted number of shares}} = \frac{102345}{(315.29 + 13.97)} = \$310.83/share$$

This value, however, ignores both the proceeds from the exercise of the options as well as the time value inherent in the options. At Google, for example, a significant number of the options issued in past years are out-of-the-money and may never be exercised.

A modified version of this approach counts only in-the-money options when computing diluted shares. Of Google's 13.97 options outstanding, 4.75 million were in-the-money, with an exercise price < stock price. If we count only these shares outstanding, the value of equity per share is $319.79:

Partially diluted valued of equity per share

$$= \frac{\text{Aggregate Value of Equity}}{\text{Fully diluted number of shares}} = \frac{102345}{(315.29 + 4.75)} = \$319.79/share$$

II. Treasury Stock Approach

This approach is a variant of the fully diluted approach. Here, the number of shares is adjusted to reflect options that are outstanding, but the expected proceeds from the exercise (the product of the exercise price and the number of options) are added to the value of equity. The limitations of this approach are that, like the fully diluted approach, it does not consider the time premium on the options and there is no effective way of dealing with vesting. Generally, this approach, by under estimating the value of options granted, will over estimate the value of equity per share.

The biggest advantage of this approach is that it does not require a value per share (or stock price) to incorporate the option value into per-share value. As we will see with the last (and recommended) approach, there is a circularity that is created when the stock price is an input into the process of estimating option value which, in turn, is needed to obtain the value per share.

Illustration 7: Treasury Stock Approach

To use the treasury stock approach with Google, we first estimated the average exercise price across all options outstanding and added the exercise proceeds to the estimated value of equity, before dividing by the fully diluted number of shares outstanding. (We used the average exercise price of $391.40 across all options in making this estimate.)

Treasury stock value of equity per share

$$= \frac{\text{Value of Equity + Options outstanding * Average Exercise Price}}{\text{Fully diluted number of shares}}$$

$$= \frac{\$102{,}345 + 13.97 * \$391.40}{(315.29 + 13.97)} = \$327.44/share$$

As with the diluted approach, there are modified versions of this approach where only in-the-money options are considered. This will reduce the value per share for Google considerably since the average exercise price for the in-the-money options, at $185, is much lower than the weighted average exercise price of $391.40.

Treasury stock value of equity per share (based on in-the-money options)

$$= \frac{\text{Value of Equity + Options outstanding * Average Exercise Price}}{\text{Fully diluted number of shares}}$$

$$= \frac{\$102{,}345 + 4.75 * \$185}{(315.29 + 4.75)} = \$314.45/share$$

III. Valuing Options

The problem with both the diluted stock and the treasury stock approaches is that they miss the essence of options. After all, the value of an option should include not only the current exercise value (recognized by the treasury stock approach) but also the time premium, reflecting the fact that the option still has life and the underlying stock is volatile. Much of the debate on dealing with options has raged around how well option pricing models work in valuing employee options. In this section, we will review some of this discussion and examine how to adapt conventional option pricing models to value these options.

Measurement Issues

Option pricing models have been widely used, to good effect, for almost four decades now for valuing listed and traded options on the option exchanges. In valuing employee options, however, there are five measurement issues that we have to confront.

a. Vesting: Firms granting employee options usually require that the employee receiving the options stay with the firm for a specified period, to be able to exercise the option (at which point they are vested). When we examine the options outstanding at a firm, we are looking at a mix of vested and non-vested options. The non-vested options should be

worth less than the vested options, but the probability of vesting will depend upon how in-the-money the options are and the period left for an employee to vest.

b. Illiquidity: Employee options cannot be traded. As a result, employee options are often exercised before maturity, making them less valuable than otherwise similar traded options that are marketable. In a comprehensive study of 262,931 option exercises of employee options between 1996 and 2003 by U.S. companies, Brooks, Chance and Cline (cited above) note that 92.3% exercise early. On average, they find that exercise takes place 2.69 years after vesting, with 4.71 years left to expiration. Put another way, an employee option with a stated maturity of 10 years is usually exercised in 5.29 years.

c. Stock price or stock value: While conventional option pricing models are built around using the current market price as a key input, we do come up with estimates of value per share when we value companies, and these estimates can be very different from current stock prices. We have to consider whether we want to use our estimates of value per share, rather than the market prices, to preserve valuation consistency.

d. Dilution: Unlike listed options on exchanges, where the exercise of the option has no impact on the number of shares outstanding or the share price, the exercise of employee options can alter both.

e. Tax consequences: Firms are allowed to deduct the difference between the stock and the exercise price of an option at exercise and there is potential tax saving at the time of option exercise. This potential tax benefit reduces the drain on value created by having options outstanding.

f. Unobservable inputs: The final issue relates to options granted at private firms or firms on the verge of a public offering. Key inputs to the option-pricing model, including the stock price and the variance, cannot be obtained for these firms, but the options have to be valued nevertheless.

Modifying Option Pricing Models

With all of these issues affecting valuation, how do we adapt conventional option pricing models to value employee options? This question has been addressed both by academics who value options and by FASB, in its attempts to give guidance to firms that have to value these options for expensing.

Modified Black Scholes

The conventional Black Scholes model is designed to value European options on traded assets and does not explicitly factor in the dilution inherent in employee options or the illiquidity/vesting issues specific to these options. However, adaptations of the model provide reasonable estimates of value:

1. Build in expected dilution into the stock price: One of the inputs into the Black Scholes is the current stock price. To the extent that the exercise of options increases the number of shares outstanding (at a price less than the current stock price), the stock price will drop on exercise. A simple adjustment to the stock price can incorporate this effect:

   $$\text{Adjusted Stock Price} = \text{Current Stock Price} \left[\frac{n_{\text{shares outstanding}}}{(n_{\text{shares outstanding}} + n_{\text{options}})} \right]$$

   The resulting lower adjusted stock price will also reduce the option value.[5]

2. Reduce the life of the option to reflect illiquidity and early exercise: Earlier in this paper, we noted that employees often exercise options well before maturity because these options are illiquid. Typically, options are exercised about half way through their stated lives. Using a reduced life for the option will reduce its value.
3. Adjust option value for probability of vesting: The vesting adjustment can be made in the process of calculating of the option value. If we can assess the probability of vesting, multiplying this probability by the option value will yield an expected value for the option.

While purist would still resist, the model has provided remarkably resilient even in environments where its basic assumptions are violated.

Binomial Models

The possibility of early exercise and non-vesting, which is substantial in employee options, leads many practitioners to argue for the use of Binomial lattice models to value employee options. Unlike the Black-Scholes, these models not only can

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[5] A modified version of the adjustment allocates the overall value of equity across all potential shares outstanding:

$$\text{Adjusted Stock Price} = \left[\frac{\text{Share Price} * n_{\text{shares outstanding}} + \text{Value per Option} * n_{\text{options}}}{(n_{\text{shares outstanding}} + n_{\text{options}})} \right]$$

model for early exercise, but can be modified to allow for other special features specific to employee options, including vesting. In addition, binomial models allow for more flexibility on inputs, with volatility changing from period to period rather than remaining constant (which is the assumption in the Black-Scholes model). The limitation of the binomial models is that they are more information intensive, requiring the user to input prices at each branch of the binomial model. In any realistic version of the model, where the time intervals are short, this could translate into hundreds of potential prices.

The primary benefit of binomial models comes from the flexibility that they offer users to model the interaction between the stock price and early exercise. One example is the Hull-White Model, which proposes reducing the life used to value employee options to a more realistic level.[6] This model take into account the employee exit rate during the vesting period (thus taking into account the probability that options will end up unvested and worthless) and the expected life of the option after they get vested. To estimate the latter, the model assumes that there will be exercise if the stock price reaches a pre-specified multiple of the exercise price, thus making exercise an endogenous component of the model, rather than an exogenous component. The resulting option values are usually lower than those estimated using the Black-Scholes model.

Simulation Models

The third choice for valuing employee options is Monte Carlo simulation models. These models begin with a distribution for stock prices and a pre-specified exercise strategy. The stock prices are then simulated to arrive at the probabilities that employee options will be exercised and an expected value for the options based upon the exercise. The advantage of simulations is that they offer the most flexibility for building in the conditions that may affect the value of employee options. In particular, the interplay between vesting, the stock price and early exercise can all be built into the simulation rather than specified as assumptions. The disadvantage is that simulations require far more information than other models.

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[6] J. Hull and A. White, How to Value Employee Stock Options, Financial Analysts Journal 60 (1) (2004), 114{119.

How much does the model matter?

How much does the model used to value employee options matter? Are there significant differences in values when we use alternative models to value employee options? For the most part, the biggest single component determining employee option value is the life of the option. Using the stated life of employee options in the Black-Scholes models yields too high a value for these options. If we use an expected life for the option (which takes into account early exercise and vesting probabilities), the values that we arrive at are not dissimilar using different models. Ammann and Seiz (2003) show that the employee option pricing models in use (the binomial, Black Scholes with adjusted life and Hull White) all yield similar values.[7] As a consequence, they argue we should steer away from models that require difficult to estimate inputs (such as risk aversion coefficients) and towards simpler models.

Illustration 8: Option Value Approach

In Table 9, we begin by estimating the value of the options outstanding at Google, using the Black-Scholes model, adjusted for dilution and using half the stated maturity (to allow for early exercise). To estimate the value of the options, we first estimate the standard deviation of 50% in stock prices[8] over the previous 2 years. Weekly stock prices are used to make this estimate, and this estimate is annualized[9]. All options, vested as well as non-vested, are valued and there is no adjustment for non-vesting.

Table 9: Estimated Value of Options Outstanding

	Google
Number of Options Outstanding	13.97
Average Exercise Price	$391.41
Estimated Standard Deviation (Volatility)	50%
Average stated maturity	7.00
Maturity adjusted for early exercise	3.50
Stock Price at time of analysis	$326.6
Value per option	$ 103.6

[7] Ammann, M., and R. Seiz, 2003, *Does the Model Matter? A Valuation Analysis of Employee Stock Options*, Working Ppaer, SSRN.

[8] The variance estimate is actually on the natural log of the stock prices. This allows you us to cling to at least the possibility of a normal distribution. Neither stock prices nor stock returns can be normally distributed since prices cannot fall below zero and returns cannot be lower than –100%.

[9] All of the inputs to the Black Scholes model have to be in annual terms. To annualize a weekly variance, we multiply by 52.

Value of options outstanding	$ 1,447
Tax Rate	38.00%
After-tax Value of options outstanding	$ 897

In estimating the after-tax value of the options at these companies, we have used the marginal tax rate of 38%. Since the tax law allows for tax deductions only at exercise and only for the exercise value, we are potentially overstating the possible tax benefits (and understating the costs).

The value per share is computed by subtracting the value of the options outstanding from the value of equity and then dividing by the primary number of shares outstanding:

$$\text{Value of equity per share} = \frac{\text{Value of equity - Value of options}}{\text{Primary shares outstanding}}$$

$$= \frac{102{,}345 - 897}{315.29} = \$321.76$$

The inconsistency averred to earlier is clear when we compare the value per share that we have estimated in this table to the price per share that we used in the previous one to estimate the value of the options. For instance, Google's value per share is $321.76, whereas the price per share used in the option valuation is $ 326.60. If we choose to iterate, we would revalue the options using the estimated value, which would lower the value of the options (to $1,406 million) and increase the value per share, leading to a second iteration and a third one and so on. The values converge to yield a consistent estimate of $321.84, close to our original estimate. That is because we estimated a value per share close to the current price; as the difference widens, the effect of doing the iterative process on value per share will also increase.

Future Option Grants and Effect on Value

Just as options outstanding represent potential dilution or cash outflows to existing equity investors, expected option grants in the future will affect value per share by increasing the number of shares outstanding in future periods. The simplest way of considering why future option grants affect value is to treat them as employee compensation. The resulting increase in operating expenses will decrease operating

income and after-tax cash flows in future years, thus reducing the value that we would attach to the firm today.

There are two things to note here. The first is that this process is on top of the adjustment made to equity value per share for the option overhang. It does not represent double counting, because it captures two different drains on equity value per share, one from past option grants and one from expected future grants. However, if we do this, we should not also increase the number of shares outstanding to reflect future option exercise. That would be double counting. The second is that making this estimate has become immeasurably easier, now that the accounting rules have changed to require firms to show option grants as expenses. The operating and net income for most firms now should be after the option expense, and if we forecast future values based on these numbers we are incorporating the expenses associated with future grants into our cash flows. The only note of caution that we would add is that as firms become larger, the option grants as a percent of revenues or value will tend to become smaller. Thus, we should move option grants for firms towards industry averages or mature firm practices as we forecast out further into the future. [10]

Illustration 9: Valuing with expected option issues

When valuing Google, the current operating income was a key input. The way the firm has dealt with employee option expenses will play a key role in what operating income we will use in valuation. Over the past three years, the firm has shifted to expensing employee options. In its 2008 annual report, for instance, the firm highlights employee option expenses as a proportion of total revenues and table 10 summarizes the numbers:

Table 10: Employee Option Expenses – Google

Year	Value of Employee options granted	As % of Revenues
2006	$458.10	4.30%
2007	$868.60	5.20%

[10] If the firm is not expensing options, the current earnings of the firm may already include the expenses associated with option exercises in the current period. If the effect on operating income of option exercise in the current period is less than the expected value of new option issues, we have to allow for an additional expense associated with option issues. Conversely, if a disproportionately large number of options were exercised in the last period, we have to reduce the operating expenses to allow for the fact that the expected effect of option issues in future periods will be smaller.

2008	$1,119.80	5.10%

Note that the expense associated with employee options is a significant drain on income and shows no signs of abating as Google becomes larger as a company.

Relative Valuation

Just as options affect intrinsic valuations, they also affect relative valuations. In particular, comparing multiples across companies is complicated by the fact that firms often have varying numbers of employee options outstanding and these options can have very different values. A failure to explicitly factor these options into analysis will result in companies with unusually large or small (relative to the peer group) numbers of options outstanding looking misvalued on a relative basis.

To see the effect of options on earnings multiples, consider the most widely used one, which is the PE ratio. The numerator is usually the current price per share and the denominator is earnings per share. Analysts who use primary earnings per share are clearly biasing their analysis towards finding companies with higher option overhang to be undervalued. To see why, note that the price per share should incorporate the effect of options outstanding – the market price will be lower when there are more employee options outstanding, but the denominator does not since it reflects actual shares outstanding and does not capture potential dilution. Note that this bias will not disappear when firms switch to expensing options.

To counter this, analysts often use fully diluted earnings per share to incorporate the effect of outstanding options, thus penalizing companies with large numbers of options outstanding. The problem with this approach is that it treats all options equivalently, with the number of shares increasing by the same unit whether the option is out-of-the-money and has three weeks left to expiration or deep in-the-money and has five years left to maturity. Clearly, firms that have more of the latter should trade at lower market values (for any given level of earnings) and will look cheaper on a diluted basis.

What is the solution? The only way to incorporate the effect of options into earnings multiples is to value the options at fair value, using the current stock price as the basis, and add this value on to the market capitalization to arrive at the total market value

of equity.[11] This total market value of equity can be divided by aggregate net income to arrive at a PE ratio that incorporates (correctly) the existence of options. This will allow analysts to consider all options outstanding and incorporate their characteristics into the value.

$$\text{Option corrected PE} = \frac{(\text{Market Capitalization} + \text{Estimated value of options oustanding})}{\text{Net Income}}$$

The net income used should be the earnings estimated on the assumption that employee options are compensation and operating expenses. With the adoption of 123R, this has become a little easier to do, though many companies still reports net income before and after these expenses.

Everything that we have said about earnings multiples can also be said about book value multiples. Failing to incorporate the value of equity options into the market value of equity will make option-heavy companies look cheaper, relative to companies that have fewer options outstanding. The solution is the same as it was for earnings multiples. Estimating the value of employee options and adding them to market capitalization will almost always eliminate the bias in the comparison process.

Illustration 10: Adjusting PE ratio for options outstanding

To examine the effects of options outstanding on relative valuation, we will compare Google and Cisco, two technology firms with a history of using employee options. In table 11, we estimate the conventional PE ratio and contrast it with the adjusted PE ratio, using the approach described above:

Table 11: PE ratio versus Adjusted PE ratio: Google and Cisco

	Google	Cisco
Stock price	$326.60	$16.23
Primary Shares outstanding	315.29	5986.00
Number of options outstanding	13.97	1199.00
Primary EPS	$13.40	$1.47
Diluted EPS	$12.83	$1.23
Primary PE	24.37	11.04
Diluted PE	25.45	13.25
Market Capitalization	$102,975	$97,153

[11] Harking back to the last section, the value of options used should be calculated based upon the current stock price (rather than an estimated value) and on a pre-tax basis.

Value of Options	$1,406	$3,477
Market Value of Equity (Market capitalization + Value of options)	$104,381	$100,630
Net Income before option expensing	$5,347	$8,802
Net Income after option expensing	$4,227	$8,052
Adjusted PE (Market value of Equity/ Net income after option exp)	24.69	12.50

Note that for Google, the effects of incorporating options into the market value of equity and using net income after option expensing does not have a material impact on the PE ratio. For Cisco, the effects are much stronger with the PE ranging from 11 to 13.25, depending on how we deal with options.

Conclusion

In this paper, we examine the two key issues that we face when valuing firms with substantial intangible assets. The first is that the accounting treatment of what comprises capital expenditures at these firms is inconsistent with the accounting treatment of capital expenditures at manufacturing firms. R&D expenses, brand name advertising and employee recruitment and training expenses are treated as operating, rather than capital expenses. As a result, both the earnings and book value numbers at these firms are skewed and using them in valuation can lead to poor estimates of value. We examined ways of correcting for this accounting inconsistency and the resulting effect on value. In general, firms that can convert R&D expenditures more efficiently and profitably into commercial products will see their estimated values increase, as a result of the correction, whereas firms that spend significant amounts on acquiring intangible assets with little to show for it in terms of higher earnings will see their estimated values decrease.

The second issue that we consider is the use of equity options to compensate employees. We look at two traditional approaches for dealing with these options – the diluted stock and treasury stock approaches – and discard them. Instead, we argue for valuing these options using modified option pricing models and adjusting the value of common shares today both for options that have been granted in the past (the option overhang) and expected future option grants.