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Michael J. Mauboussin 212/325-3108 *michael.mauboussin@csfb.com*
Bob Hiler 212/325-4341 *bob.hiler@csfb.com*

A Piece of the Action

Employee Stock Options in the New Economy

Volume 6

Contents

Summary

In this report we present a comprehensive framework for analyzing employee stock option (ESO) programs. While ESOs have been the subject of a great deal of commentary, economic rigor has been absent in many of these discussions. We present what we believe is the most in-depth, financially sound, and usable description of ESOs to date. The major points of our analysis are as follows:

- *There is a huge gap between economic reality and accounting convention in dealing with ESOs.* Traditional reckoning for options starts and stops with "diluted" shares, which do not consider either out-of-the money options or the time value of options. Accordingly, current financial statements are of limited help in understanding the impact of ESOs on corporate value. Proper use of FASB 123-mandated information, often buried in the footnotes, is required to appreciate the economic impact of ESOs.

- *Options that have already been granted should be treated as an economic liability for ongoing shareholders.* These options are valued using a Black-Scholes pricing model—subject to some modifications— and are subtracted from corporate value in determining shareholder value. Further, historical option grants convey important information about the total economic cost of employee compensation.

- *Future option grants should be considered in the valuation process.* We prefer to treat future option grants as an expense, similar to any other income statement expense. The result is lower earnings estimates for future years. Alternatively, we leave the income statement value drivers as they are, but subtract the present value of future option "expenses" from corporate value. Once past and future ESO values are quantified, their role in valuation becomes completely transparent.

- *The surge in ESOs is a symptom of the "New Economy."* New economy companies are knowledge-focused. In contrast, old economy businesses are capital-focused. People are becoming the main source of competitive advantage, and people want something that capital never asked for: a piece of the action. In our view, this trend toward more equity-based compensation in new economy businesses is intractable. Hence, it is more important than ever to understand option programs and their impact on corporate value.

- *The timing of option pricings and re-pricings offers interesting signals.* Unfortunately, there does not appear to be a systematic way to exploit these signals. Managers often *price* options ahead of the announcement of good news—and subsequent excess share price returns. But the lag between when the pricings occur and when they are disclosed makes the information unactionable. Separately, managers tend to *reprice* their options following a period of dismal share price performance—the evidence shows that they are good at picking the bottom. Unfortunately, ensuing stock price action tends to be in line with the market, negating the potential for finding outsized returns.

- *There are a host of economic reasons to use ESOs*. These include a reduction in agency costs, enhanced corporate liquidity, and direct equity participation for talented employees. ESOs should only be a concern for shareholders when the performance bar is set too low—that is, there is not enough "incentive" in incentive compensation.

Introduction

Internet tycoons and twenty-something billionaires have focused the world's attention on the incredible riches in employee stock options (ESOs). The spectacular bull market of the last few years has helped executives like AOL's Steve Case and Compaq's Eckhard Pfeiffer get richer—along with option hall-of-famers like Disney's Michael Eisner, Heinz's Anthony O'Reilly, and the entire Microsoft executive suite. And it doesn't take a careful reader of annual reports to notice the large stock option grants awarded to executives, managers, and even the rank and file.

The flow of so much wealth to employees signifies an important shift in our new global economy. Intellectual capital—harnessed brainpower—has increasingly replaced the bricks and mortar of physical capital. In our fast-paced, wired world, people have become the new foundation for competitive advantage. And people want something bricks and mortar never asked for: a piece of the action. That means equity ownership—and lots of employee stock options.[1]

With this surge in the use of employee stock options, it is more important than ever to analyze employee stock options properly. *Indeed, a proper accounting for the economic costs of options materially affects almost all key drivers used to value stocks*. However, the intimidating swirl of mathematics surrounding option valuation has hindered understanding of how options affect shareholder value (see Appendix A for a short primer on the drivers of option value). In addition, traditional options analysis starts and stops with earnings per share dilution, which at best gives an incomplete picture of economic reality.

This report seeks to shed some light on this issue. It is organized into six parts.

- First, we discuss the secular shifts in the economy that make employees demand options and the economic incentives that make companies increasingly willing to grant them. We also elaborate on the major types of ESOs commonly used. Finally, we also examine whether options grants provide a signal about management's confidence in a company's future—and whether we can use this knowledge to make money.

- Second, we look at how current accounting practice distorts economy reality. As with other reports in the Frontiers of Finance series, our focus is on the economic—not the accounting—consequences of corporate decisions.

- Third, we explain how to correct part of this distortion by treating outstanding ESOs as an economic liability, and show how this adjustment affects shareholder value.

- Fourth, we explore a technique for recognizing future option grants. This treatment of "pay-as-you-go" options represents economic reality much more faithfully than the accounting alternative.

- Fifth, since these adjustments change important inputs into the discounted cash flow equation, we explain how they affect an investor's understanding of intrinsic value and market expectations.

- Finally, we analyze "repricing," which occurs when a company lowers the exercise price of an option following a sharp drop in the company's share price.

Following the Conclusion, there are a series of Appendices that provide the practical details needed to undertake a value-based analysis of a company's employee

stock option program. There is also a Glossary that defines key terms used throughout the report.

1. Why Options Are Relevant

The Evolution of the New Economy

The growth in ESOs is a symptom of more profound changes occurring within the economy. For much of the last century, the industries of resource extraction and mass production—powered by the combustion engine, electricity, and the assembly line—have defined how our economy works. The products of this economy tend to be what economist Brian Arthur calls "congealed resources"—lots of extracted resources turned into products with only a little knowledge.[2] Most of the major products of the nineteenth and early twentieth century such as coal, tobacco, and oil—and even early planes, trains, and automobiles—generally fit this description.

In this world, the owners of those congealed resources and the means of processing them captured much of the Industrial Revolution's newfound wealth. As Marx would put it, the real winners were the owners of the means of production (see Table 1).[3] Indeed, the very concept of an assembly line—with repetitious simple jobs performed by workers who were interchangeable with one another—left very little room for value-adding innovation for the average employee.[4] Since labor served as an easily replaceable resource, companies generally paid employees an hourly wage or fixed salary for their services.

Table 1
5 Richest Americans in History Owned the Means of Production in the "Old Economy"

Rank	Tycoon	Source of Fortune	Wealth as % of GNP
1	John D. Rockefeller	Oil	1.53%
2	Cornelius Vanderbilt	Steamboats and railroads	1.15%
3	John Jacob Astor	Fur trade, NY real estate	0.93%
4	Stephen Girard	Shipping	0.67%
5	Andrew Carnegie	Steel	0.60%

Note: Wealth figures calculated by dividing a person's total wealth by America's GNP at the time of the person's death.
Source: *The Wealthy 100*, Michael Klepper and Robert Gunther.[5]

The economy has clearly evolved from one focused on congealed resources. For example, look at three recent successful products—Pfizer's Viagra, Microsoft's Windows, or Disney's Lion King. These products are created not in a factory, but in the heads of knowledge workers in the lab, on the computer, or in the studio. To use Brian Arthur's term, these products are "congealed knowledge"—lots of knowledge with very little physical resources added into the mix. The advent of ever more powerful silicon, cheap software, and connectivity has only increased the value of smart minds.

In this world, workers no longer serve as interchangeable cogs in a great industrial machine. While one bicep is easily replaced with another, each brain possesses potential unique knowledge and skills. Indeed, for many knowledge-intensive companies, the entire value of the firm disappears when employees go home for the night. As Bill Gates says, "In today's emerging information society, the critical natural resources are human intelligence, skill, and leadership."[6]

Unfortunately for shareholders, companies can only rent employees—they cannot own them. Increasingly, knowledge workers have alternatives. They can either join firms where they receive direct ownership in return for their efforts, or they can start their own company. In a competitive labor market, then, employees demand

some form of equity- or performance-based compensation. This shift towards equity compensation may also help explain why so many of the wealthiest living Americans fit the profile of an extremely competent knowledge worker (see Table 2).

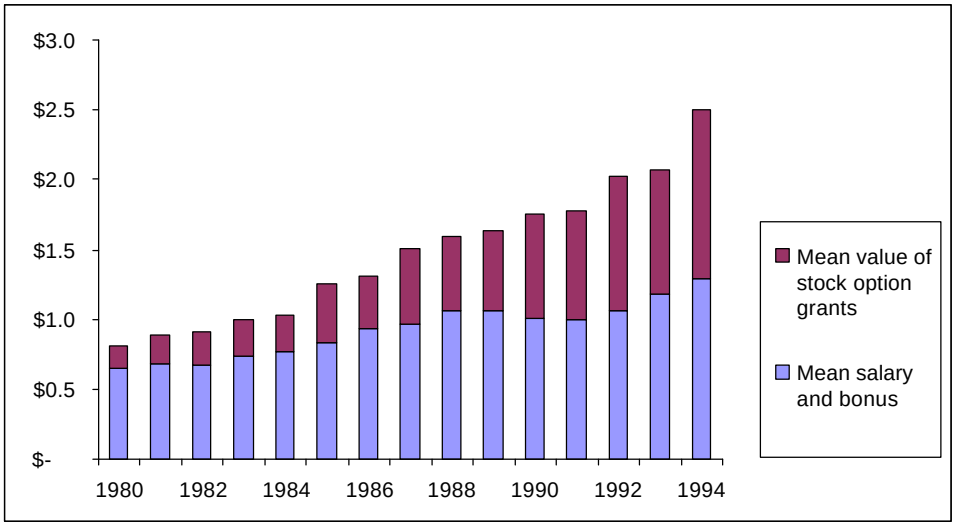
Table 2
The 5 Wealthiest People in 1998's "New Economy" Owned Equity in Knowledge Companies

Rank	Name	Worth ($ bil)	Source
1	Bill Gates	$ 58.4	Microsoft Corp.
2	Warren Buffett	$ 29.4	Berkshire Hathaway
3	Paul Allen	$ 22.0	Microsoft Corp.
4	Michael Dell	$ 13.0	Dell Computer
5	Steve Ballmer	$ 12.0	Microsoft Corp.

Source: "The Forbes Four Hundred, The 1998 Richest People in America." *Forbes,* October 12, 1998.

In support of this point, Harvard economists Brian Hall and Jeffrey Liebman recently calculated that the average CEO in the largest U.S. firms increased their cash compensation levels by only 5% from 1980 to 1994, while the value of options granted rose by almost 16%. As a result, the relative percentage of option grants swelled from 19% of annual compensation in 1980 to 48% in 1994 (see Figure 1).

Figure 1
Value of Cash Compensation and Option Grants for the Average CEO, 1980-94
in millions



Source: Brian J. Hall and Jeffrey B. Liebman, NBER Working Paper 6213, "Are CEOs Really Paid Like Bureaucrats?"

This trend is particularly significant for high tech companies, such as Microsoft—perhaps the company most famous for effectively using employee stock options. By compensating its legions with options, Microsoft has been able to attract, retain, and compensate employees who could work at other high tech firms. As Microsoft's stock increased approximately 72% during its fiscal 1998 year, these ESOs have served as a very important source of compensation. Indeed, using Microsoft's cash flow statement, we can infer that its employees reaped pretax gains

of approximately $4.4 billion by exercising ESOs in 1998—approximately $163,000 per employee![7] This is a significant value transfer for any company, even one as large as Microsoft.

Economic Incentives for Granting Options

The rising use of employee stock options comes in part from a tightening labor market for knowledge workers. However, corporations and investors also have economic incentives to provide options to managers and employees:

- *Reduce agency costs*. Ideally, corporate managers—as the agents of shareholders—will act to maximize value. However, the world is not ideal: rational managers may choose instead to maximize their own happiness by arranging valuable perquisites, building costly "empires" or taking value-destroying actions that serve to entrench them.

To counter this problem, managers often receive large grants of stock or options in order to align their interests with those of shareholders'. For example, given an increase in firm value of $1,000, the wealth of the average CEO in 1994 increased by $39—over three times the $12 amount in 1980. Part of this heightened sensitivity to changes in firm value comes from the increased stock holdings of the average CEO. However, the surge of ESO plans has also driven this trend, as a grant of ESOs has approximately double the pay-to-performance sensitivity as a grant of stock with the same value.[8]

- *Recruit and retain employees*. All things equal, companies that can recruit and retain the best people will win in the marketplace. Large grants of employee stock options can help companies attract the best and the brightest. Furthermore, ESOs can help retain valuable employees by serving as "golden handcuffs." ESOs give employees a reason to stay until their options "vest," which typically takes four or five years. Moreover, since most companies grant ESOs annually, an employee who leaves a firm will have to walk away from valuable unvested options.

- *Liquidity*. Options serve as a noncash form of compensation for cash-strapped companies—such as startups—that can ill afford to pay costly salaries to its employees.

- *Taxes*. The Revenue Reconciliation Act of 1993 created an economic incentive for corporations to pay its executives with options by limiting the deductibility of cash salaries larger than $1,000,000.[9] Because the IRS categorizes ESOs as "objectively determined performance-based compensation," companies can deduct the intrinsic value of an option in the year in which an employee exercises it (see Appendix F). Thus, for companies with high-priced executive talent, using ESOs—or at least, some form of objectively determined performance-based compensation instead of subjectively determined cash bonuses—may represent an optimal tax strategy.

- *Market-linked versus short-term accounting-based compensation*. Some companies compensate their executives based on the attainment of certain targets—such as surpassing a particular level of earnings per share or return on equity. However, for companies with highly volatile results, these financial performance metrics may serve as a poor measure of the quality of managerial decisions. For example, managers may take actions that lower earnings in a given year, but position the firm to earn higher earnings in the future. Using a market-

based compensation plan, such as ESOs, may be a viable way to fairly compensate managers.

- *Earnings management*. Reflecting arbitrary accounting regulations, a firm that replaces executives' cash salaries with at-the-money options maximizes its reported earnings per share. An economic reason for doing this is to avoid violating a debt covenant. In addition, a self-interested manager may do this to achieve a certain accounting target or to try to fool the market with artificially higher reported earnings.

Types of Employee Stock Options

Before we go further, we should define the major types of ESOs commonly granted to employees and executives. While theoretical possibilities are infinite, in practice, certain kinds of ESOs are more popular:

- *At-the-money ESOs*. The vast majority of options are issued at-the-money. This is because accounting regulations state that granting an ESO creates an expense equal to the difference between a company's share price and the option's fixed exercise price. If a company grants at-the-money options, it need not recognize the ESO as an accounting expense at all. Also, shareholders usually balk at options that allow managers to purchase shares at a discount to the market price. For these reasons, companies rarely issue in-the-money options.

In our survey of companies' proxies and annual reports, we found that most ESO contracts have a ten-year life and vest in equal proportions over four or five years.

- *Deep-out-of-the-money ESOs.* In order to create an incentive to dramatically increase the value of the firm, companies sometimes grant deep-out-of-the-money ESOs. That way, managers can profitably exercise their options only if they hit a home run for shareholders. Also, like at-the-money options, accountants view these options as a free gift.

It is important to note that they must be very deep out-of-money options to ensure executives only profit when their stock outperforms the market. This is because most companies grant ESOs with a 10-year life. Thus, even a very deep-out-of-the-money ESO—with an exercise price at a 100% premium to the market price—only requires annual share price appreciation of 7.2% to become in-the-money. This is significantly below the 9% to 12% return desired by most equity investors in public companies.

However, given that executives often have substantial wealth tied up in a single undiversified company, they may be averse to assuming the risk inherent in these deep-out-of-the-money ESOs. When these options are used at all, then, they tend to be granted in large blocks to new CEOs of companies whose boards are dominated by a few shareholders, such as a leveraged buy out (LBO) firm.

- *ESOs with an indexed exercised price*. These ESOs have exercise prices that are matched to the performance of a broader market index—usually the S&P 500 or an industry index. These ESOs have three features that make them tremendously appealing to shareholders. First, they only reward managers who outperform the market. If a company uses these options, there is no risk that mediocre or even poor managers will be overcompensated as a result of a bull market. Second, because the strike price is not fixed and tends to rise every year, an indexed ESO grant will transfer less value than a conventional ESO grant. Third, indexed ESOs

have lower strike prices and higher values even in bad times, making it easier to retain valuable employees just when you need them most.

Ironically, accounting regulations discourage the use of indexed ESOs. The rules stipulate that indexed ESOs are "variable plans" and must be treated differently from ordinary ESOs, which are "fixed plans." According to this syllogism, accountants expense the annual difference in the intrinsic value of vested indexed options. Thus, to the horror of managers, the better the stock does, the worse the company's reported earnings.[10] This is a problem since earnings-based annual and long-term incentive plans typically comprise 37% of a CEO's compensation.[11] Despite the economic benefits to the firm, then, unfavorable accounting deters most companies from using indexed ESOs.

- *Stock appreciation rights (SARs)*. Although SARs are not technically employee stock options, we include them here because companies often use them in a like manner. SARs provide employees with cash payments equal to the appreciation of the company's stock over a specified duration. Thus, like options, SARs provide employees with equity upside without exposure to any downside. Unlike options, SARs result in periodic payments of cash to the executives over the SAR's life. However, managers tend to avoid using SARs as they are subject to the same accounting treatment as indexed options.

Options as a Signal

Companies issue options for a variety of reasons—some good and some bad. For example, a large option grant to a CEO may be motivation to create value for shareholders. Just as plausibly, the option grant may be used to artificially increase earnings per share to "make one more quarterly number."[12]

Owing to this ambiguity, investors seeking to analyze option grants to "beat the market" must do more than crunch numbers from a proxy statement—they must understand the *intent* of an option grant. In our experience and review of the academic literature, two things emerge. First, in analyzing the strength of a signal provided by an option grant, we must look not at ESOs in general, but at the stock options given to *executives* who have the greatest ability to affect firm value. Second, we find that most of the strong market signals associated with executive option grants is due to two things:

- *Reducing agency costs and managerial incentives*. Many firms generate cash well in excess of the amount needed to fund all positive-NPV projects. However, the history of corporate America is rife with examples of managers misspending this excess cash on value-destructive projects. Harvard Business School Professor Michael Jensen has suggested that one way to lower wasteful spending is to use financial leverage. High debt levels force managers to use all excess cash generated to service high interest and principal payments and effectively takes the punch bowl away before the party starts. As this strategy focuses on not wasting cash, it works best with a mature company with stable cash flows.[13]

However, increased leverage comes at the cost of financial flexibility. And, leverage cannot be used to reduce agency costs for companies without the stable and positive cash flows needed to service debt. Paying out cash would be disastrous for most startups as they need to retain earnings for growth. For these companies, then, a board of directors trying to minimize agency costs cannot just lever up the firm—they must award managers for value-creating growth.

Executive stock options are just the tool for the job. As with leverage, options reduce agency costs associated with wasteful spending. But options do something that leverage does not: they give managers an incentive to increase the value of the firm. *Thus, large grants of executive stock options can be a positive signal that a company may try to ramp up for profitable growth, especially for companies that have not historically rewarded performance with higher pay.*

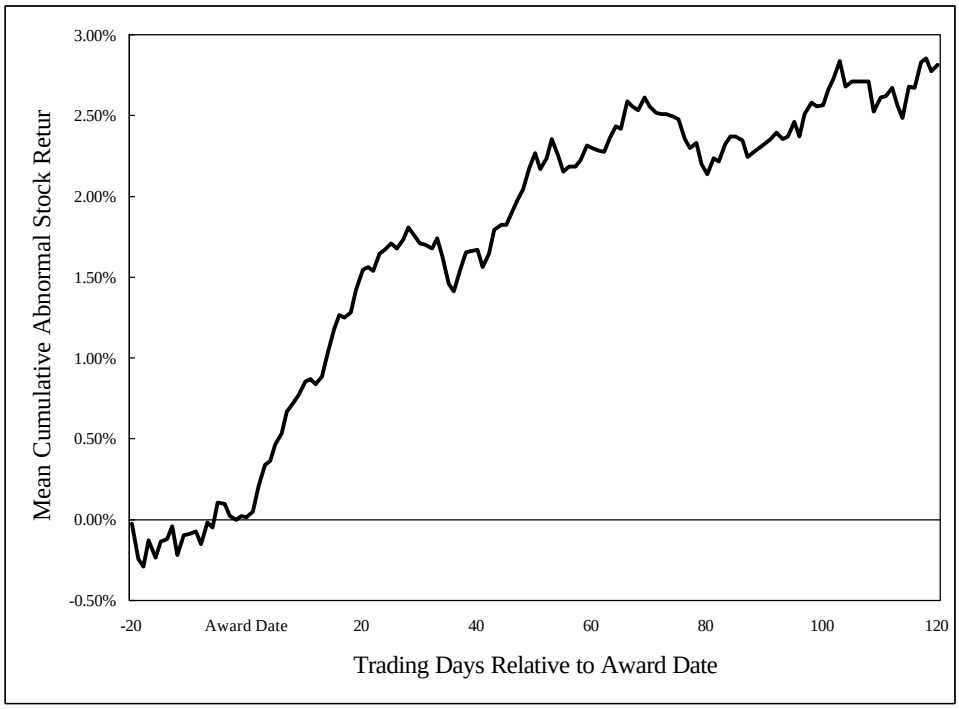
It is important to note that not all option grants are created equal. *The intensity of the market signal provided by option grants is a reflection of how hard managers must work to make their options profitable.* For example, indexed ESOs that require managers to outperform the broader market send a much stronger signal than do ordinary ESOs. After all, if a company's stock simply appreciates at the cost of equity, an ordinary ESO will still allow managers to attain a pot of option gold. Similarly, investors view positively the issuance of very deep-out-the-money options that require managers to dramatically raise the value of the company before they can cash out. The weakest signal is provided by at-the-money options—or even worse, in-the-money options—that require little or no effort to become profitable.

- *Information asymmetry*. An academic who believes in market efficiency would say that there is no possible way for an investor to systematically outperform the market. This is because investors bid assets up and down to reflect all new information.

However, even the most ardent efficient market theorist has to admit that executive stock options provide a loophole in this theory. This is because managers possess significant inside information, and often have it well before it is publicly released. As executive stock options are almost always granted at-the-money, the exercise price of an issued option generally reflects "old" information—not the new inside information. If managers can influence the timing of their stock option grants, they can receive "cheap" options without having to buy or sell publicly traded shares or options. Since executive stock options are not generally disclosed until the company files a proxy—approximately three months after the end of that fiscal year—managers can theoretically exploit this "asymmetric information" to earn an excess return.

In fact, Professor David Yermack of New York University's Stern School of Business recently published a study that found that managers do just that. Professor Yermack tested the hypothesis that "CEOs ... receive stock option awards shortly in advance of favorable news that pushes company stock prices higher." As Figure 2 shows, "Companies making stock option awards to their CEOs outperform the market on a risk-adjusted basis by slightly more than two percent during the period beginning the day after the award and lasting approximately ten weeks."[14]

Figure 2
Abnormal Stock Returns following Receipt of Stock Options by CEOs



Source: David Yermack, "Good Timing: CEO Stock Option Awards and Company News Announcements," *Journal of Finance* 52, No. 20, June 1997.[15]

If some investors could get advance knowledge of executive stock option grants, they too could outperform the market. Unfortunately, stringent SEC regulations assure that only executives are legally allowed to profit from this information.

Interestingly, this result at least slightly contradicts the use of stock options to lower agency costs. By systematically using their influence to get "cheap" options, CEOs co-opt value from the shareholders for whom they ostensibly act as agents. This also means that standard formulas for calculating the cost of executive stock options—which use the "pre-good news" share price as an important valuation parameter—will understate the true cost of option grants. Despite this, however, boards of directors seem to accept this cost as the price of aligning the interests of management with shareholders.

2. Why Accountants and Economists Disagree

How Current Accounting Practice Distorts Economic Reality

As ESOs have become increasingly prevalent, it has become more and more important for managers and investors to properly analyze them. Indeed, the SEC requires the calculation of share count dilution that would occur were employees to immediately exercise all of their in-the-money options. Beyond this, most managers and investors believe that an increase in diluted earnings per share signifies an increase in shareholder value.[16]

However, the diluted EPS accounting calculation significantly distorts economic reality.[17] Before we explain why this is so, we must first delve into how accountants treat employee stock options.

Accountants take a simple approach to options: they assume that all "in-the-money" options will be immediately exercised and turned into extra shares.[18] To do this, accountants create a concept called "diluted shares outstanding." This equals basic shares plus the shares that employees would receive if they exercised their options. To be fair, the accountants do allow companies to assume that hypothetical proceeds from employees exercising their options would be used to repurchase shares. Diluted earnings per share (EPS) are calculated by dividing net income by the number of these diluted shares.[19] For example, Microsoft's diluted EPS of $1.67 in fiscal 1998 was a full 9% below the company's basic EPS of $1.83.

Critically, the accounting approach does not fully reflect economic reality. This is because the diluted share count calculation only reflects the dilution that results from in-the-money stock options. However, options also have value from the possibility that the underlying stock's market price will rise higher than the exercise price before the option expires. Accountants ignore this "time value" for both in-the-money as well as out-of-the-money options. As most companies issue employee stock options that have long lives, this approach significantly understates the value of outstanding and future options. Indeed, the high-tech companies with the largest option packages often have the most volatile stock prices, and hence, the most valuable options (see Appendix A).

It is theoretically possible to refine this approach by properly incorporating the time value of outstanding options into the adjustment of total shares outstanding—the *denominator* in the earnings per share calculation. However, we find this approach to be counterintuitive. *We believe the more intuitive economic approach is to view outstanding options as an off-balance sheet liability. Further, to account for the cost of future option grants, we should adjust the numerator—the firm's income—by subtracting the economic value of annual option grants to employees.*

Microsoft is an example of a company that discloses useful information on its ESOs. While Microsoft's SEC filings state that "no compensation cost is recognized because the option exercise price is equal to the market price of the underlying stock on the date of grant," the company does not stop there. On the contrary, Microsoft does something we have not seen from any other company: it releases "see-through" pro forma income statements that indicate how much it thinks ESOs lower earnings. Specifically, the company subtracts the cost of its ESOs from reported earnings—as measured by the cost necessary to fully hedge the company against the share price appreciation related to its ESO program.

While we have a different opinion on how to calculate the economic cost of a company's annual stock grants, we fully agree with the gist of Microsoft's approach. Indeed, Bill Gates' friend and fellow billionaire Warren Buffett concurs with this view. In his 1997 *Berkshire Hathaway Annual Letter to Shareholders,* Buffett suggested: "[A firm's] true [option] compensation cost ... [should be] brought out of the closet and charged ... against earnings."

The accountants at FASB tried to implement something akin to this approach in their earlier 1995 encyclical, SFAS 123, *Accounting for Stock-Based Compensation*. In fact, they came very close to requiring that companies subtract the economic costs of employee stock options from net income. [20] However, Dennis Beresford, the chairman of the FASB, backed away from doing so because:

> People said to me, 'If we have to record a reduction in income by 40%, our stock will go down by 40%, our options will be worthless, we won't be able to keep employees. It would destroy all American business and Western civilization.'[21]

While we understand that managers may be averse even to a small risk that their stock price could fall, we would note that academic research has repeatedly shown that when cash and earnings diverge, the market follows cash. Thus, we believe that the market has already taken the cost of the options into account. However, this debate "became so divisive that it threatened the Board's working relationship with some of its constituents." Yielding somewhat, FASB made adoption of the standard voluntary, mandating only that companies disclose the economic costs of employee stock options in the footnotes of their SEC filings. SFAS 123 is still very useful, however, as it discloses valuable information to investors.[22]

3. Options as a Liability

How Outstanding Options Affect Shareholder Value

Many firms have substantial amounts of outstanding ESOs that exist from past grants. Over time, the owners of these ESOs will convert their options into regular shares or allow them to expire worthless. At any point in time, however, these options definitely have value. *Indeed, we believe that the value of outstanding ESOs must be viewed as an economic liability that has been incurred by the firm.*

This logic rests on solid corporate finance. The economic value of a firm is the present value of future cash flows. This economic value can be thought of as a pie. In exchange for providing capital, the investors agree to share the wealth created by that firm—that is, to slice the pie up—according to certain rules.

Bondholders, by contractual agreement, get timely interest payments and a return of capital. In accordance with the established pecking order, bondholders get "first dibs" on any cash to be returned to investors.

Shareholders are a residual claimant on a firm's assets. That is, shareholders get whatever is left of the pie after bondholders have gotten their prenegotiated fill. In an efficient market, the per-share value of a firm will be the amount of economic value that is left after debt takes its share, divided by the number of outstanding shares. While there is a risk that there will be no pie left, there is also the possibility of receiving a potentially huge pie.

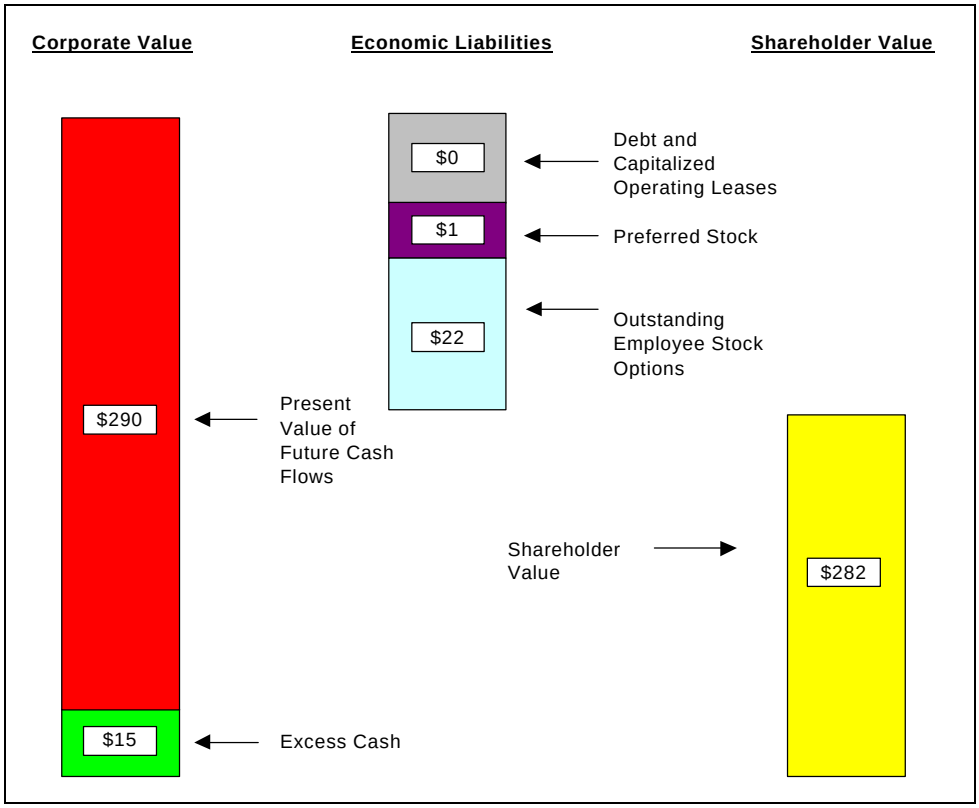
In the context of this model, then, we believe that—just like debt—ESOs represent an economic liability that must be subtracted from the value of a firm to calculate shareholder value. This is because the value claimed by ESO owners comes from the same source as the value claimed by ordinary shareholders: the possibility of the firm increasing in value and creating a "huge pie."[23]

To value the economic liability represented by Microsoft's outstanding ESOs, we use the information provided in Microsoft's recent SEC filings as inputs into the standard Black-Scholes option pricing model (see Appendix D for details on our methodology). We also incorporate expected option cancellations from employee defection, the dilution from option exercise, and the tax deductibility of ESOs upon exercise. Using this information, we estimate that employees who owned ESOs laid claim to approximately $22 billion of value at the end of Microsoft's 1998 fiscal year. As Figure 3 illustrates, this lowers the residual value to which ordinary

shareholders can lay claim. Note that the residual claim is then divided by basic shares outstanding, as the valuation process captures all previous grants.

While Microsoft's total corporate value of $305 billion dwarfs this amount, outstanding ESOs still represent an impressive 7% of this total. The following figure captures the economic value of past grants with great clarity.

Figure 3
How the Market Views the Effect of Outstanding ESOs on Microsoft's Valuation
$ in billion



Note: Diagram is not drawn to scale.
Source: CSFBC analysis.

In addition to our analysis of Microsoft, we also valued the outstanding ESOs for eight other firms. In addition to testing the robustness of our analysis, we wanted to test the hypothesis that a "New Economy" company with lots of knowledge workers would tend to have higher relative levels of employee stock options than a similar "Old Economy" company in the same industry (see Table 3 on next page).

To adjust for the relative size of each company, we then divided the amount of these ESOs by the total market capitalization of the company. This gave us outstanding ESOs as a percent of total market capitalization for each matched pair of companies (see Table 4 on next page).

Table 4 shows that, with one exception, this percentage tends to be markedly higher for our "New Economy" companies than our "Old Economy" companies. Indeed, in the media industry, Yahoo!'s percentage is over 7 times that of the

Table 3
Outstanding ESOs for "Old" versus "New Economy" Companies
all prices as of last fiscal year

Industry	Company	"Old" or "New" Economy Company	Main Product or Service	Fiscal Year	Value of Outstanding ESOs (in millions)
Retail	Barnes and Noble	"Old"	Largely Bricks-and-mortar Bookstore	1/31/98	$ 138
	Amazon.com	"New"	Internet Bookstore and Retailer	12/31/97	$ 27
Media	New York Times	"Old"	Traditional Media: Newspaper	12/28/97	$ 21
	Yahoo!	"New"	New Media: Portal Web Site	12/31/97	$ 70
Chemicals	DuPont	"Old"	Chemicals	12/31/97	$ 1,566
	Pfizer	"New"	Designer Pharmaceutical Drugs	12/31/97	$ 3,059
Semiconductors	Texas Instruments	"Old"	Memory Semiconductors	12/31/97	$ 395
	Intel Corporation	"New"	Microprocessor Semiconductors	12/27/97	$ 5,998

Source: SEC filings and CSFBC analysis.
Note: Capitalized operating leases calculated by discounting disclosed non-cancelable payments under operating leases to the present value using a constant interest rate of 8%.

Table 4
Outstanding ESOs as Percent of Total Market Capitalization for "Old" versus "New Economy" Companies
all prices as of last fiscal year

Industry	Company	Value of Outstanding ESOs (in millions)	Basic Equity Market Cap. (in millions)	Debt, Capitalized Operating Leases and Preferred Stock (in millions)	Total Market Cap. (in millions)	Outstanding ESOs as Percent of Total Market Cap. (%)
Retail	Barnes and Noble	$ 138	$ 2,157	$ 2,075	$ 4,231	**3.3%**
	Amazon.com	$ 27	$ 1,304	$ 116	$ 1,421	**1.9%**
Media	New York Times	$ 21	$ 6,190	$ 643	$ 6,834	**0.3%**
	Yahoo!	$ 70	$ 3,117	$ 10	$ 3,127	**2.2%**
Chemicals	DuPont	$ 1,566	$ 69,238	$ 1,496	$ 70,733	**2.2%**
	Pfizer	$ 3,059	$ 96,484	$ 2,984	$ 99,468	**3.1%**
Semiconductors	Texas Instruments	$ 395	$ 17,566	$ 1,660	$ 19,226	**2.1%**
	Intel Corporation	$ 5,998	$ 115,385	$ 663	$ 116,048	**5.2%**

Source: SEC filings and CSFBC analysis.

New York Times, while in the semiconductor industry, Intel's percentage is over twice that of Texas Instruments. Our comparison in the "chemicals" industry of Pfizer and DuPont—which probably can only be judged an "Old Economy" company relative to a pharmaceutical firm—also yields a higher percentage for the "New Economy" company.

We cannot conclusively explain away our outlier of Barnes and Noble versus Amazon.com. Since Barnes and Noble also owns Amazon's largest on-line competitor, BarnesandNoble.com, our choice of comparable companies may be flawed. In addition, it appears that Barnes and Noble's ESOs are unusually high—executives received an unusually large ESO grant 4 years ago—while Amazon.com's ESOs are unusually low—perhaps owing to its relatively small number of employees. We would expect this ranking to change over time.

[Options aren't] necessarily the end of the world, but [they do] result in a significant valuation difference. And it's not reported under standard accounting. So we think the quality of earnings as reported by a company with significant stock option grants every year is dramatically poorer than one where that doesn't exist. And a lot of companies fall in that category.

—Warren Buffett[24]

4. Options as a Cost

How Annual ESO Grants Affect a Firm's Return on Capital and Free Cash Flow

Now that we have dealt with past grants, we turn to the value of future grants. As we believe that ESOs represent an economic cost like any other, they should reduce a company's cash earnings or net operating profit after taxes (NOPAT).

In order to do this, we estimate the economic value of ESO grants using the Black-Scholes method and information provided under FASB 123. We further adjust this value for expected option cancellations from employee defection, the dilution from option exercise, and the tax deductibility of ESOs upon exercise (see Appendix E for details on our methodology).

We used the information in Microsoft's latest 10-K to value the economic cost of its ESO grants. We calculated that Microsoft granted ESOs with an after-tax value of $873 million in 1998 (see Appendix D). This translates into 4.9% of Microsoft's sales—including deferred revenues—of $17.8 billion. This percentage remained approximately constant at 5% from 1995 to 1998 (see Table 5).

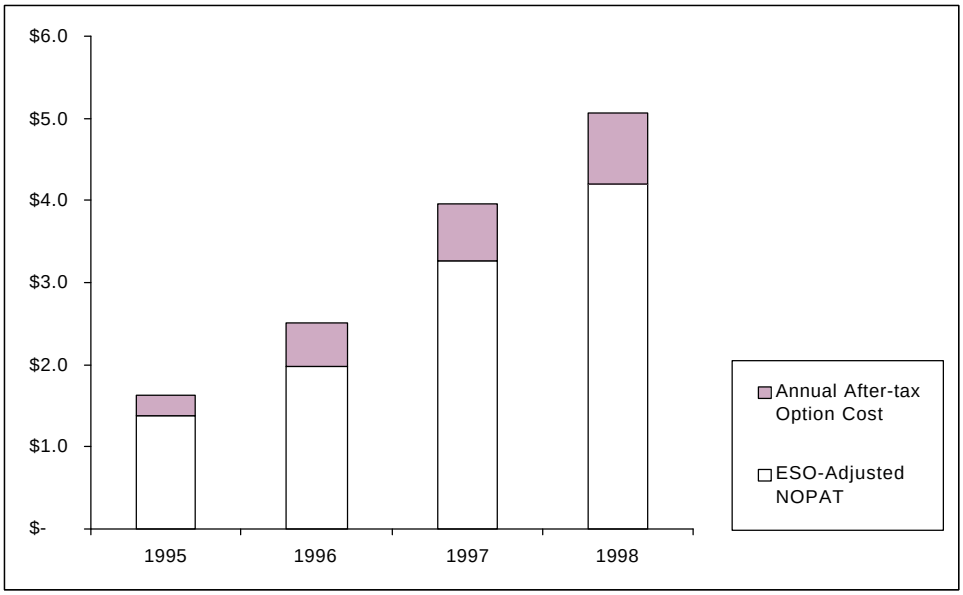
Table 5
Microsoft's After-Tax Option Cost as a Percent of Sales, 1995-98
in millions

Year	Revenue	Expected After-Tax Economic Value Imparted to Employees	Option Cost as a Percent of Sales
1998	$ 17,752	$ 873	4.9%
1997	$ 12,959	$ 690	5.3%
1996	$ 9,654	$ 541	5.6%
1995	$ 6,006	$ 247	4.1%

Source: Microsoft SEC Filings and CSFBC analysis.

The cost of Microsoft's ESOs represented a larger percentage of the company's cash earnings. While this percentage varied more over time, it ranged from 21.6% of Microsoft's cash earnings of $2.5 billion in 1995 to 17.2% of Microsoft's cash earnings of $5.1 billion in 1998 (see Figure 4).

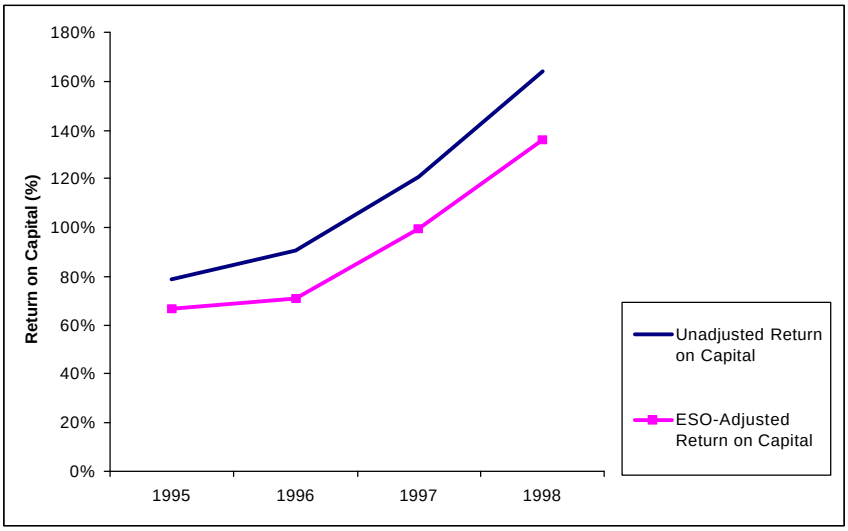
Figure 4
Microsoft's Cash Earnings Adjusted for Annual ESO Grants, 1995-98
in billions



Source: Microsoft SEC filings and CSFBC analysis.

By lowering calculated cash earnings, ESOs also lower Microsoft's return on capital. For example, this adjustment lowers Microsoft's return on capital from 164% to 136% in 1998. This pattern also holds true for 1995 through 1997 (see Figure 5).

Figure 5
Microsoft's Return on Capital Adjusted for Annual ESO Grants, 1995-98



Source: Company SEC filings and CSFBC analysis.

One might argue that we are overstating the effect of ESOs, since we subtract their full cost from cash earnings every year rather than amortizing this cost over the five-year vesting period. To address this, we estimated what Microsoft's expense would be if it amortized its ESOs.[25] We do arrive at a lower ESO expense of $517 million in 1998. However, if we took this approach, we would also have to capitalize the value of unamortized ESOs and add them to our estimate of net cash invested in the business—its invested capital. This would add approximately $1.4 billion to Microsoft's invested capital base of $3.1 billion in 1998. Thus, this approach would result in a *lower* return on capital of 111%.

To continue our analysis of "Old" versus "New Economy" companies, we repeated this analysis on our four matched pairs of companies. Again, we wanted to test the hypothesis that a "New Economy" company with lots of knowledge workers would tend to have higher relative levels of employee stock options than a similar "Old Economy" company in the same industry. To adjust for the relative size of each company, we then divided the economic value of annual ESO grants by annual sales. This gave us annual ESO grants as a percent of sales for each matched pair of companies (see Table 6).

Table 6
Annual ESO Grants as Percent of Sales for "Old" versus "New Economy" Companies
all prices as of last fiscal year

Industry	"Old" or "New" Economy Company	Company	Value of ESO Grant (in millions)	Annual ESO Grants as Percent of Sales (%)
Retail	"Old"	Barnes and Noble	$ 10.4	0.4%
	"New"	Amazon.com	$ 10.1	6.8%
Media	"Old"	New York Times	$ 24.3	9.2%
	"New"	Yahoo!	$ 37.2	55.2%
Chemicals	"Old"	DuPont	$ 175.2	0.4%
	"New"	Pfizer	$ 144.3	6.5%
Semiconductors	"Old"	Texas Instruments	$ 69.5	0.7%
	"New"	Intel Corporation	$ 611.0	2.4%

Source: SEC filings and CSFBC analysis.

This time, our results were unambiguous: all four "New Economy" companies had much higher annual ESOs as a percent of sales than its "Old Economy" counterpart. For rapidly growing companies such as Amazon.com and Yahoo!, this result is perhaps not surprising. However, our results also held for more mature companies with more stable sales, such as Pfizer versus DuPont and Intel versus Texas Instruments. This suggests that accounting for ESOs will become increasingly important as the world evolves into a knowledge-intensive "New Economy."

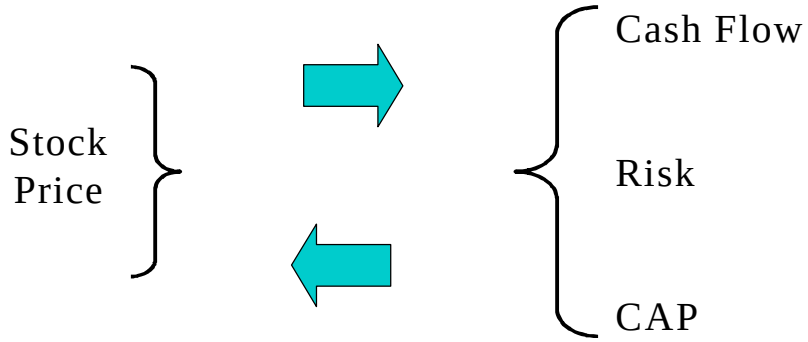
5. Options and Valuation

How ESOs Enter into the Valuation Equation

Using this framework, we can incorporate our estimates of the cost of outstanding and future options into a discounted cash flow (DCF) analysis. This is important for two reasons. First, many investors use a DCF analysis to calculate a stock's intrinsic value—that is, they discount future cash flows to the present value using a risk-adjusted required rate of return. Value creation occurs over a certain number

of years, estimated by the company's Competitive Advantage Period or CAP. (For a graphic representation of this mental model, read Figure 7 from the right to the left.) Alternatively, investors can start with the stock price, and then reverse-engineer what these value drivers must be in order to justify the price. Investors can then compare their expectations with those of the market to see whether or not they find a stock to be attractive. (For a graphic representation of this mental model, read Figure 7 from the left to the right.)

Figure 7
How Cash Flows, Risk, and CAP Affect the Stock Price (Reading Right to Left)
How to Derive Market Expectations of Cash Flows, Risk, and CAP (Reading Left to Right)



Source: CSFBC Analysis.

To continue our case study of Microsoft, we used Value Line forecasts to forecast future sales, cash earnings, and net investment. In the previous section, we calculated that Microsoft's ESOs were approximately 5% of sales from 1995 to 1998. ***As investors, our primary goal is to use this historical information to estimate what future cash flows will be.*** If we assume that Microsoft's after-tax ESO cost will continue at approximately 5% of sales, we can arrive at an annual estimate of the future costs of ESOs. This gives us estimates of the company's "adjusted" NOPAT. We then subtract net investment to arrive at an adjusted estimate of free cash flow (see Table 8).

Table 8
Microsoft's Unadjusted versus ESO-Adjusted NOPATs and Free Cash Flows, 1999-2002
in millions

Year	1999E	2000E	2001E	2002E
NOPAT	6,319	7,476	8,876	10,755
Investment	550	520	520	1,079
Unadjusted FCF	5,769	6,956	8,356	9,675
NOPAT	6,319	7,476	8,876	10,755
Estimated After-Tax Option Cost	875	1,081	1,335	1,615
Adjusted NOPAT	5,444	6,395	7,541	9,140
Investment	550	520	520	1,079
Adjusted FCF	4,894	5,875	7,021	8,061

Source: SEC filings, Value Line estimates, and CSFBC analysis.

To perform an analysis of market expectations, we first determined the market value of all Microsoft securities, including debt, preferred stock, basic shares, and outstanding ESOs (see Table 9).

Table 9
Microsoft's Total Enterprise Value
$ in millions, except per share data

Stock Price	$	105
Basic Shares		2,672
Basic Equity	$	281,714
Outstanding ESOs	$	22,060
Debt	$	-
Preferred Stock	$	1
Enterprise Value	$	303,775

Source: CSFBC analysis.

Then, using an estimated cost of capital of 12.1%, we calculated the present value of future cash flows assuming the company could make positive-NPV investments for a range of 1 to 25 years (see Table 10 for an excerpt of this analysis).

Table 10
Market-Implied Competitive Advantage Period (CAP) Analysis
$ in millions, except per share data

	2019E	2020E	2021E	2022E
Year in Future	21	22	23	24
NOPAT	$ 143,166	$ 163,210	$ 186,059	$ 212,107
Estimated After-Tax Option Cost	21,496	24,506	27,937	31,848
Adjusted NOPAT	121,670	138,704	158,122	180,259
Investment	9,092	10,365	11,816	13,471
Adjusted FCF	112,578	128,338	146,306	166,789
PV of Adjusted FCF	10,734	10,926	11,122	11,322
Cumulative PV of Adjusted FCF	166,730	177,656	188,778	200,100
Residual Value	1,156,565	1,318,484	1,503,072	1,713,502
PV of Residual Value	110,276	112,253	114,265	116,313
Corporate Value	277,006	289,909	303,043	316,413
Excess Cash	15,021	15,021	15,021	15,021
Total Debt	-	-	-	-
Preferred stock	980	980	980	980
Total Value of Options	22,060	22,060	22,060	22,060
Net Economic Liabilities	8,019	8,019	8,019	8,019
Shareholder value	268,987	281,890	295,024	308,394
Number of basic shares	2,672	2,672	2,672	2,672
Value per share	$101	$106	$110	$115

Source: SEC filings, Value Line estimates, and CSFBC analysis.

Using these value drivers, then, we can see that the current stock price of $106 implies a CAP of 22 years.

This market-implied CAP of 22 years differs substantially from the MI-CAP of 17 years produced by a standard DCF analysis that ignores options. Put another way, the present value of estimated future option grants over the 22 year CAP—overlooked in a traditional DCF model—equals a staggering $53 billion. Combined with the $22 billion in outstanding options, Microsoft's past and future options have a present value of $75 billion. This is equivalent to 25% of Microsoft's total market capitalization of $304 billion.

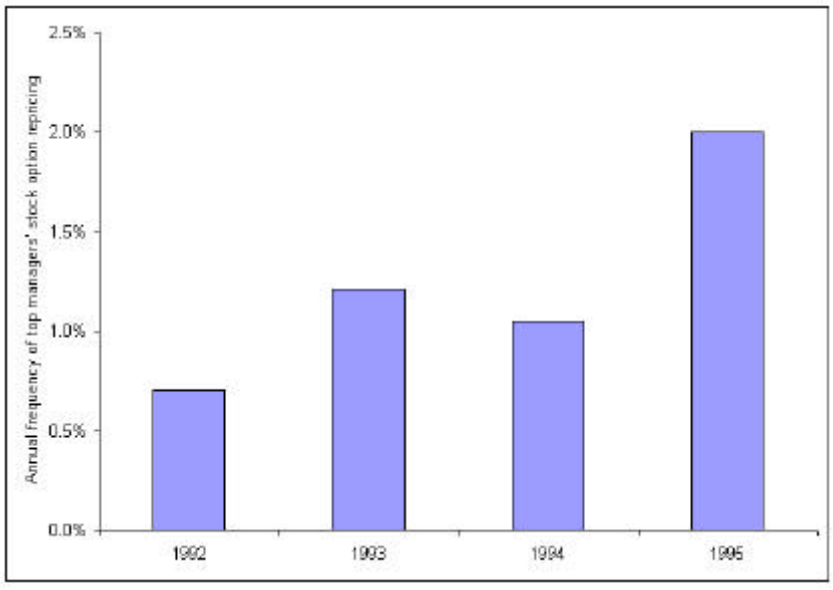
6. Options as an Inalienable Right

If At First You Don't Succeed, Try to Reprice!

One of the major reasons to grant ESOs is to give managers an incentive to create value and drive the stock price up. Unfortunately, this happy scenario does not always unfold. If a company's stock price falls precipitously, an ESO that was granted at-the-money may become deep out-of-the-money. At this point, companies often choose to "reprice" or "reload" the ESOs by lowering the exercise price. This is also sometimes accompanied by an extension of the maturity of the life of the option.

NYU Stern Business School Professors Menachem Brenner, Rangarajan Sundaram, and David Yermack recently studied this increasingly popular phenomenon. They found that while only 0.7% of executives in the S&P ExecuComp database had their options repriced in 1992, almost 2.0% of executives had their options repriced in 1995 (see Figure 8). While this is the last year in which analysis has been completed, anecdotal evidence suggests that this number has increased since then. More relevant, we expect to see a wave of repricings after the recent market correction, as we saw after the 1987 stock market crash.

Figure 8
Increasing Frequency of Executive Stock Options
annual frequency of stock option repricings for top managers covered by the S&P ExecuComp database, 1992–95



Note: Sample comprised of compensation for executives from 1,500 firms, including those in the S&P 500, MidCap 400, and the SmallCap 600 indices.

Source: Menachem Brenner, Rangarajan Sundaram and David Yermack, "Altering the Terms of Executives Stock Options."

Companies tend to reprice ESOs for three reasons:

1. *Retain employees*. The major concern is that the specter of worthless options will prompt executives and talented employees to jump ship to a competitor. As Netscape's spokesperson said after the company repriced its ESOs for its non-executive employees in January 1998: "We did it because we'd like to attract and retain employees."[26]

2. *Reduce agency costs*. The board of directors may also worry that unless they reprice underwater stock options for their executives, formerly enthusiastic senior managers will abandon value-maximization and attempt instead to maximize their consumption of perquisites and compensation. This reasoning is most defensible when done in reaction to a marketwide fall in equity prices, such as the wave of repricings that followed the Crash of 1987.[27]

3. *Lower executive risk taking*. An executive with deep-out-of-the-money stock options will only become wealthy if the company's stock price increases spectacularly. Thus, there is an incentive to pick highly risky projects, so as to increase the chance of hitting a jackpot. However, this would hurt bondholders, who abhor risk and just want to get their principal back. Thus, if a firm's stock is low because it is near bankruptcy, creditors may apply pressure to reprice options to avoid "excessive" managerial risk taking.

Shareholders understand the economic justifications given for repricing ESOs to retain employees and reduce agency costs. After all, it's better to accept dilution of your ownership of a valuable business than to own 100% of a company with no employees.

However, shareholders still have several valid objections to repricing:

1. *Employee's lack of exposure to downside*. Employees who have their ESOs repriced receive a benefit that shareholders do not. Virginia Tech Professors Don Chance and Raman Kumar and Boston University Professor Todd recently published a study that shows that repricings of executive options follow approximately one-year periods during which the average firm sees its shares lose one quarter of its value. Furthermore, on average, these repricings lower the exercise price by approximately 41%. This increases the economic value of the average executive stock option package by 16%.[28]

It is particularly frustrating to shareholders when executives—not just employees—get their options repriced. It does not seem fair to allow executives to "double-dip" by receiving options that not only never have downside, but will always be adjusted so executives make money. Indeed, if executives can become wealthy without working, options lose their power to lower agency costs.

2. *"Inalienable Options" are expensive*. We can clearly calculate the increase in option value following a repricing. Using some fancy math, we can also calculate the value of a "repriceable" option at grant date. If companies grant options that can never expire worthless, those options have to be more valuable at grant date than ordinary options without a similar "phone call from the governor" feature. Professors Chance, Kumar, and Todd conservatively estimate that a "repriceable" option is 7% to 10% more valuable than a normal "unrepriceable" option.[29] Using

this logic, some investors may wish to add a premium to the Black-Scholes calculated value of an option grant.

Moreover, once a company acquires a taste for repricing, it seems to retain it. The same study found that 45% of companies that repriced once did it at least once more. One company even repriced six times. Thus, the estimate of a 7% to 10% premium—the calculation assumes only one repricing—may be too low.

3. *Perverted management incentives*. Habitual repricing may cost shareholders more than the value given to employees by the lowering of the ESOs' exercise price. The real costs of habitual repricing may result from the perversion of management incentives. Companies grant ESOs mainly to make sure that managers deliver good shareholder returns. However, the very executives who made the strategic or execution blunders that resulted in a lower share price end up benefiting in a repricing. Thus, a cynical, yet savvy, manager has a real incentive to drive the stock down, get his options reset, and *then* try to restore the company's fortunes. So, while options by themselves should *lower* agency costs, options coupled with habitual repricings may *raise* agency costs.

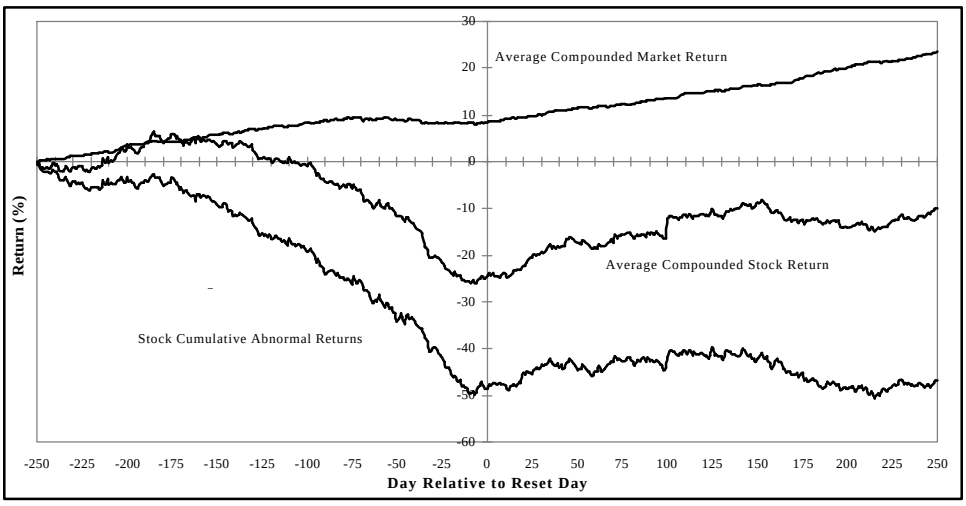
If shareholders had their way, repricing as an unadulterated practice would end. However, there are ways to mitigate the costs of repricing. For example, repricings typically involve a one-for-one exchange of options with high exercise prices for options with a low exercise price. Even if a company needs to reprice ESOs to keep employees or reduce executive risk-taking, the board can lower the number of repriced options issued to make the repricing value-neutral. A company can also lower the contractual life of the options or increase the number of years before the options vest. Above all, investors would like any ESO modifications to be subject to shareholder approval.

These steps would go a long way toward removing the salt from investors' wounds. This rapprochement might also help a stock recover from its lows. A company whose investors trust its managers to take shareholder-friendly actions may see this trust reflected in a higher valuation.

Option Repricings as a Signal

One interesting hypothesis is that even a shareholder-unfriendly option repricing represents a positive signal to the market. The idea is that a company's insiders—with the best knowledge of a company's prospects—make the decision to reprice the options. Thus, the timing of the repricing represents the best guess of the "smart money" as to when the stock's tailspin will end. Indeed, analysis of recent repricings made by Professors Chance, Kumar, and Todd seems to support this hypothesis: option repricings seem to happen when a company's share price halts its free fall (see Figure 9 on the following page).

Figure 9
Cumulative Average Residuals and Average Compounded Returns on Stocks for Firms that Reprice Executive Stock Options on Day Zero



Source: Don Chance, Raman Kumar, and Rebecca Todd, "The 'Repricing' of Executive Stock Options."
Cumulative average residuals and average compounded returns on stocks on which the firms reprice their executive stock options on day zero and average compounded returns on the CRSP value-weighted stock index. The risk adjustment is made by estimating a market model regression over days - 500 to -251. Coefficients from that regression are then applied to the returns over days -250 to +250. The sample is selected from among a larger sample of firms identified through a key word search on the NAARS (National Automated Accounting Research System) on Lexis/Nexis. The sample consists of 37 firms and 53 events.

However, a detailed analysis of the underlying data indicates a company's stock price essentially trades in line with the market following a repricing. Supporting this, the cumulative abnormal return (CAR) earned on the average stock only rose 1.7% during the 250 days following a repricing. The positive signal associated with repricings may in fact exist in particular cases. However, *the evidence indicates that, on average, investing in a stock when it reprices its ESOs will not lead to meaningful market outperformance.*

Option Repricing Accounting and the End of an Era?

Lenient accounting contributes to the widespread use of option repricings. A company can reprice by canceling its old out-of-the-money options and replacing them with new at-the-money options and still get cosmetically favorable accounting treatment. As with "normal" options, current accounting regulations do not view the new at-the-money option grants as an expense.[30]

However, a proposed change in accounting regulations may spell the end to option repricings. The FASB recently tentatively decided that an option repricing transforms an ordinary ESO from a so-called "fixed option plan" into a "variable plan." This would subject a repriced ESO to the same accounting treatment as an indexed ESO or an SAR—that is, changes in the intrinsic value of vested repriced options would have to be recorded as an expense (or, more rarely, a credit) to reported accounting earnings. Given managers' aversion to lowering reported earnings, if this regulation is adopted, we would expect the repricing of options to become much less common.[31]

Conclusion

What This Paper Does Not Claim

Our economic framework urges investors to treat outstanding ESOs as a liability and future options as a cost. Both of these adjustments reduce shareholder value. However, this does not imply that we believe that stocks are overvalued just because investors do not explicitly factor ESOs in their calculations. On the contrary, we believe that the market excels at efficiently pricing stocks without explicitly using this economic framework. Accordingly, as with other reports in the Frontiers of Finance series, our focus is on the economic—not the accounting—consequences of corporate decisions.

What This Paper Does Claim

We believe that this economic framework for valuing ESOs does have several important implications. Most important, the correct treatment of options allows us to understand better the economics of a business. This has become increasingly important with the rise in option-laden knowledge workers.

If the investors are to beat the market, they must have a "variant perception"—that is, a perception of value materially different than market expectations. Since options significantly affect a DCF analysis, using this framework is important for companies with meaningful option-based compensation programs.

Finally, this framework gives investors a starting point to value more precisely option-laden private companies that cannot ask the stock market to value their company for them. This is particularly important for cash-strapped startups that use options as a way to conserve cash and attract talented employees. Thus, investors contemplating purchase of such a company in an Initial Public Offering may wish to incorporate options in their valuation equation.

N.B.: CREDIT SUISSE FIRST BOSTON CORPORATION may have, within the last three years, served as a manager or co-manager of a public offering of securities for or makes a primary market in issues of any or all of the companies mentioned. Closing prices are as of October 27, 1998:

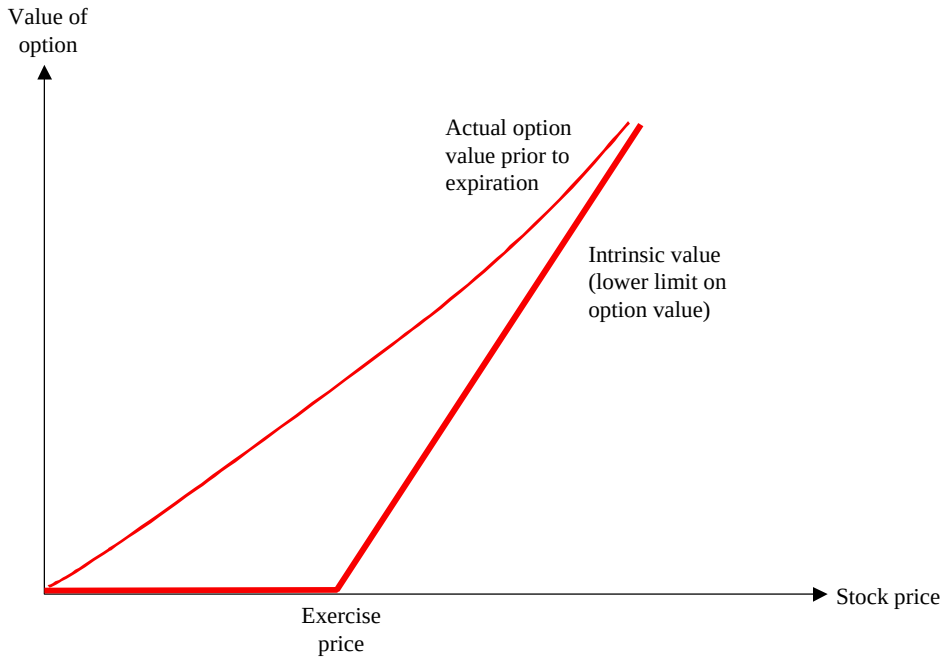
Amazon.com (AMZN, $116^{5}/_{16}$, Buy) *
Barnes and Noble (BKS, $28^{5}/_{8}$, Not Rated)
DuPont (DD, $59^{9}/_{16}$, Hold) *
Intel (INTC, $87^{5}/_{16}$, Buy) *
Microsoft (MSFT, $105^{7}/_{16}$, Strong Buy) *
New York Times (NYT, 28, Buy) *
Pfizer (PFE, $106^{5}/_{16}$, Hold) *
Texas Instruments (TXN, $60^{1}/_{2}$, Buy) *
Yahoo! (YHOO, $123^{3}/_{4}$, Buy) *

* Followed by a different CSFBC analyst.

Appendix A A STOCK OPTION PRIMER

An option gives its owner the right—but not the obligation—to buy or sell an asset at a certain prenegotiated price. For example, a call option on a stock gives its owner the right to buy a stock at a fixed price—called an option's exercise or strike price—regardless of the stock's market price. A call option, then, is valuable if the stock's price rises past the exercise price before expiration. However, if the stock price falls below the option's exercise price, the owner will choose not to exercise the option so as not to lose money. Thus, an option offers exposure to a stock's upside potential and limits exposure to possible downside (see Figure 10).

Figure 10
A Call Option's Intrinsic Value Increases as the Stock Price Increases, but Never Falls below Zero



Source: *Principles of Corporate Finance*, Richard A. Brealey and Stewart C. Myers.

While this complicated payoff scheme makes pricing an option a mathematical ordeal, we can intuitively understand the drivers behind an option's value using simple concepts. This is because Nobel Prize winning work by Fisher Black and Myron Scholes resolved the precise role of these drivers in the market's assessment of an option's value.[32]

The most obvious determinant of an option's value is its *intrinsic value*, or the amount of money one will make upon immediately exercising the option. This amount, defined as the stock price less the exercise price, ultimately determines how much money the option holder makes.

- *Exercise price*. The less an investor has to pay to convert an option into a more valuable share, the greater the option's worth. Thus, a lower exercise price means a more valuable option.

- *Stock price*. Because an investor benefits by receiving a more valuable share upon exercising an option, a higher stock price means a more valuable option.

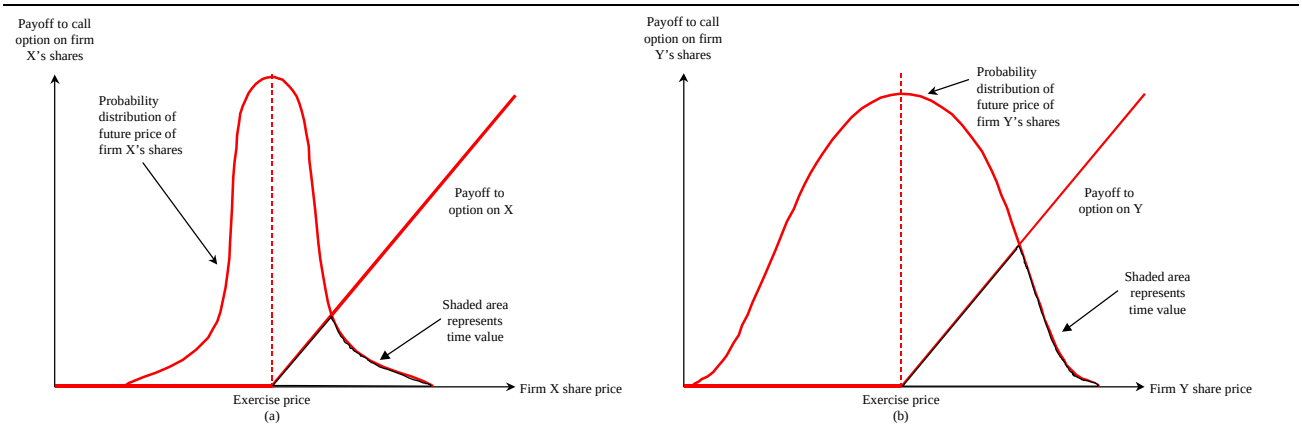
However, even if an option has no intrinsic value, it can still be valuable. This is because, while it may not be currently profitable to exercise an option, the possibility exists that the option can be profitably exercised in the future.

The value of this possibility is called an option's *time value* and is determined by three factors:

- *Volatility*. As volatility increases, there is a higher probability that the stock will dramatically increase or decrease in value. Viewed from the perspective of the option owner, if the stock has a huge run-up, the option increases in value from its upside exposure. However, if the stock goes down a lot, the option's downside exposure is limited. This makes option owners prefer high volatility in the price of the underlying stock, as it increases the chance that his option will be very valuable without exposing him to large losses.

We can represent this concept graphically as well. Scenario A of Figure 11 shows an option on a low volatility stock. This option has a narrow price distribution that clusters around the exercise price. In contrast, Scenario B shows a similar option on a high volatility stock with a wide price distribution. By overlaying these price distributions over a standard option payoff diagram, we can estimate the probability that the underlying stocks will rise above the option's exercise price. The larger shaded area in Scenario B shows that the more volatile the stock, the higher the chance that the option will be profitable. All things equal, then, higher stock price volatility translates into a higher time value.

Figure 11
A Call Option's Time Value Increases as Stock Price Volatility Increases



Source: *Principles of Corporate Finance*, Richard A. Brealey and Stewart C. Myers.

- *Length of time before an option expires*. The longer an option holder has before his option expires, the higher the probability that the stock price will end up above the exercise price. This makes options with long lives more valuable than similar options with short lives.

- *Risk-free rate*. This variable enters the equation in a subtle way. Purchasing an option gives an investor the right to purchase a share at a fixed price in the future. In essence, an option gives its owner an interest-free loan in the amount of the exercise price for the length of the option. The value of this loan increases with the length of the option life and the risk-free rate. Thus, an option's value increases as the risk-free rate increases.

Before we finish our option primer, we should note two practical considerations that will affect our valuation of employee stock options:

- *Dividends*. In an efficient market, the value of a stock is the present value of future cash dividends. When a stock pays a dividend, the stock owner will be as well off as he was before the dividend was paid. However, after an investor receives cash-in-hand from a dividend payment, the stock's price will fall by precisely that amount. Thus, while dividends may be an important part of total shareholder returns, it always lowers a stock's absolute price level. Accordingly, the value of an option to buy that stock will also fall.

Thus, when valuing an option with a short lifetime, we should lower the option's underlying share price by the present value of dividends expected to be received over the option's life.[33] When valuing options with a longer life, we should use Robert Merton's adaptation of the Black-Scholes option pricing formula that incorporates an estimate of a stock's long-term dividend yield (see Appendix B for more information on how to adjust the Black-Scholes option pricing model for dividends).[34]

- *European versus American options*. These catchy titles refer to two flavors of options. The European option can only be exercised on the last day of the option's life, while the American option can be exercised on any day that the option exists. The increased flexibility of American options makes them slightly more valuable—although it makes them more mathematically difficult to value. Regardless, investors often use the Black-Scholes model to value American calls as prematurely exercising an option involves forfeiting an often hefty time value.

Appendix B HOW TO USE THE BLACK-SCHOLES OPTION PRICING MODEL

Before Fisher Black and Myron Scholes came along in 1973, economists had tried for years to develop satisfactory models to price options. In part, these would-be Nobel Prize winners were stymied by the lack of advanced mathematics in classical economics training. Fortunately, we do not need to know how to derive the Black-Scholes model in order to use it. Indeed, we do not even need to know the Black-Scholes formula in order to understand what value drivers make options valuable (see Appendix A).

In this Appendix, we present the generalized Black-Scholes formula, leaving the derivation of the equation to option textbooks.[35] We do this so readers can enter the formula into a spreadsheet in order to value options. Following this presentation, we also walk through an example applying the formula to a sample option.

The Black-Scholes Formula

The Black-Scholes formula values a European call or put option as follows:

$$\text{Value of Call} = S\,e^{(b-r)T}N(d_1) - X\,e^{-rT}\,N(d_2)$$

$$\text{Value of Put} = -S\,e^{(b-r)T}N(-d_1) + X\,e^{-rT}\,N(-d_2)$$

where:

- S is the stock price of the underlying stock. If we expect the stock to pay specific dividends before the option expires, we should subtract the present value of those dividends from the stock price and use this "adjusted stock price" as the relevant input for this equation.
- X is the exercise, or strike price of the option
- r is the risk-free rate
- b is the "cost of carry," defined as risk-free rate minus the dividend yield (q)
- T is the expected life of the option in years
- σ^2 is the variance of the underlying security
- $d_1 = \dfrac{\ln(\frac{S}{X}) + (b + \frac{s^2}{2})T}{s\sqrt{T}}$
- $d_2 = d_1 - s\sqrt{T}$

These formulae look intimidating, but can be inputted into a spreadsheet for automatic calculation. Note that the function N(parameter) used in the Black-Scholes formula is mathematical notation for the cumulative normal distribution function. It can be represented in Excel using the following formula "=NORMDIST(parameter,0,1,TRUE)."

Using the Black-Scholes Formula

To use the Black-Scholes method, we simply enter the properties of an option into the appropriate formula. For example, say a call option has the following properties:

- The underlying security is worth $50. (S = $50).
- The exercise price is $40 (X = $40).
- The risk free rate is 5%. (r = 0.05).
- The dividend yield is 3%. (q = 0.03).
- The "cost of carry" is 2% (b = r – q = 0.05 - 0.03 = 0.02).
- The option has a maturity of 5 years (T = 5).
- The volatility (σ) of the underlying stock is 30%. (σ = 0.3).
- e is a constant equal to 2.7183.

We can then calculate the Black-Scholes value of this option:

$$d_1 = \frac{\ln(\frac{50}{40}) + (0.02 + \frac{0.3^2}{2})5}{0.3\sqrt{5}} = \frac{\ln(1.25) + 0.3250}{0.6708} = \frac{0.2231 + 0.3250}{0.6708} = 0.8171$$

$$d_2 = d_1 - s\sqrt{T} = 0.8171 - 0.3\sqrt{5} = 0.8171 - 0.6708 = 0.1463$$

$$N(d_1) = N(0.8171) = 0.7931$$

$$N(d_2) = N(0.1463) = 0.5582$$

$$\text{Value of Call} = 50\, e^{(0.02 - 0.05)5}\, 0.7931 - 40\, e^{-0.05\ 5}\ 0.5582 = 34.13 - 17.39 = \$16.74$$

Note that while the option can be immediately exercised for a gain of $10—by paying $40 to exercise an option and receiving a share worth $50—the option will trade in the marketplace at $16.74. This higher value comes from the "time value" of the option—that is, from the possibility that the stock may be worth even more than $50 before the option expires in five years.

Spreadsheet

A spreadsheet with the Black-Scholes call and put option pricing models can be obtained from the authors upon request.

Appendix C — WHY EMPLOYEE STOCK OPTIONS ARE WARRANTS AND PUT WARRANTS ARE OPTIONS—AND WHY THAT MATTERS

Common stock investors often use the terms "options" and "warrants" interchangeably. If a distinction is made, "warrants" are typically described as having a longer life than "options." This distinction is generally valid. However, options and warrants differ in another important aspect that gives them different market values.

The Difference between "Options" and "Warrants"

This difference can best be explained with a simple example. When an investor purchases an "option" on, say, a share of Intel from the Chicago Board Options Exchange, it represents the temporary right to buy that stock at a certain fixed price from *someone who currently owns that existing share*. If the investor decides to exercise the "option," the amount of the fixed price will go to the owner of that share of Intel, and ownership of that share will change hands. Note that this in no way changes either the value of Intel or number of Intel shares outstanding.

A "warrant" is subtly different. The investor who purchases a similar "warrant" from a company obtains the temporary right to pay a fixed price to own *a share that does not currently exist*. The difference is that, unlike an "option," "warrants" are issued not by an independent third party, but by the company itself. Thus, if the investor exercises an Intel "warrant," the company itself receives the proceeds of the exercise price, and issues a new share in return. The exercise of a "warrant," then, has two effects that the exercise of an "option" does not:

1. It raises value the value of the company by the amount of the exercise price, and

2. It lowers the value per share by increasing the number of outstanding shares.

The net effect of (1) and (2) will always result in a lower value for the "warrant" than for a similar "option" with the same terms and condition. Indeed, warrant experts have derived a mathematical formula defining the relationship between a "warrant" and its "option equivalent":[36]

$$\text{Warrant Value} = \frac{1}{\left(1 + \frac{\text{Number of warrants}}{\text{Number of shares}}\right)} \text{ x Value of "Option Equivalent"}$$

Why an ESO Is Really a Warrant

In the Glossary, we offer the following definition of an ESO:

> An employee stock option gives an employee the temporary right—but not the obligation—to exchange a fixed amount of money for *a newly issued share of his company's stock*, no matter how high that stock's share price becomes (italics added).

An ESO, then, is clearly a warrant because exercising an ESO causes (1) the value of the firm to increase by the amount of the exercise price and (2) the firm to issue a new share to the employee. Thus, when valuing ESOs, we should calculate the value of its "option equivalent," and then multiple it by the "warrant conversion factor" described in the equation above. Not doing so will result in an overstatement of the ESO's value.

Why a Put Warrant is Really a Put Option

Companies such as Microsoft and Dell routinely sell so-called "put warrants" to third parties, which provide a partial hedge against share price appreciation. In exchange for a premium for the sale of the put warrant—which under current laws is tax-free corporate income—the company assumes a liability. [37] Specifically, the owner of a put warrant can sell a share of stock back to the company at the warrant's exercise price—no matter how low the underlying stock's market price falls. In this scenario, the company buys a share of stock from the owner of a put warrant. This is the opposite of a traditional "warrant," in which the company issues a new share.

Thus, the word "warrant" in "put warrant" simply reflects the fact that the company is one of the counterparties in the transaction—and does not imply that we need to adjust the calculated Black-Scholes value for possible dilution resulting from share issuance. Indeed, the value of a put warrant liability is simply the calculated Black-Scholes value of a regular put option. As with ESOs, put warrants represent an economic liability that must be subtracted from corporate value before calculating shareholder value.

Appendix D A RECIPE FOR VALUING OUTSTANDING STOCK OPTIONS

We can value the economic liability created by outstanding stock options for any U.S. company. In order to perform this analysis, we need to estimate a number of parameters. This Appendix walks through this calculation, using Microsoft as a case study.

The first step in this analysis is to value the ESOs using the Black-Scholes option pricing method (see Appendix A and B for more information on this model). The company gives us detailed information on options in five "tranches"—each with its own range of exercise prices. To calculate the Black-Scholes value, we must combine this information with our estimates of the following six parameters for each tranche:

1. *Stock price*: Microsoft closed at 105 $^{7}/_{16}$ on October 27, 1998.

2. *Weighted average exercise price*. The annual report and 10-K SEC filing give this information for each tranche of outstanding options.

3. *Expected life of option*. Microsoft reports the "remaining life (in years)" for each tranche of outstanding options. We use this number to value the company's ESOs; using the usually shorter "vesting period" of options will result in understating the options value.

4. *Risk-free rate*. The appropriate risk-free rate is the rate associated with the risk-free zero-coupon security with the same maturity as the option. The preferrable choice is to obtain this information from a data vendor such as Bloomberg for each tranche.[38]

Another common practice is to use the risk-free rate assumed by the company. While this may be an acceptable shortcut, it will tend to understate the value of ESOs when rates drop or if the company picks a lower risk-free rate than is appropriate.

5. *Volatility (*σ*)*. This parameter refers to the expected volatility—technically, the standard deviation—of the underlying stock. Investors can use one of three approaches to estimate this parameter.

- First, the company discloses its own estimate of the volatility that it uses to value annual stock option grants. As with risk-free rates, companies have an incentive to choose a lower volatility level, so using a company's estimate may result in understating the value of outstanding options.

- The second approach is to use the stock's historical volatility levels as a proxy for expected volatility. A rule of thumb is to measure the volatility over the same number of historical days as the option's expected life. Thus, to estimate the volatility of a one-year option, use the historical volatility of the stock over the last year.

- The final approach is to impute the volatility embedded in a listed option with terms similar to that of the option that is being valued. This is accomplished by entering the market price of an option as an input into the Black-Scholes formula, along with the four non-volatility inputs, and then imputing what the market expects the volatility to be. This is the most computation-intensive approach, but is likely to provide the most accurate answer.

- *Dividend yield (q)*. This equals next year's expected dividend per share divided by the share price. Note that this assumes that the company has a constant dividend yield over the option's life. Alternatively, this assumption can be relaxed by assuming the dividend yield is zero and lowering the stock price by the present value of future dividend payments expected during the life of the option.

Using these six inputs, we can calculate the value of each "tranche" of Microsoft's employee stock options.

To illustrate this methodology, the remainder of this Appendix will focus on how to value Microsoft's most recently issued tranche of outstanding ESOs, with exercise prices between $59.61 and $87.25.

There are four main steps:

1. *Black-Scholes valuation*. Microsoft's 10-K filing shows that the company had approximately 61 million of these ESOs outstanding. The company also discloses the inputs it uses to calculate the Black-Scholes value of its annual option grants. For the purposes of this exercise, we have valued Microsoft's outstanding ESOs using these same estimates (see Table 9).

Table 9
Characteristics of Microsoft's ESOs with Exercise Prices between $59.61 and $87.25, FY98

Range of Exercise Prices	Weighted Average Exercise Price	Expected Life of Option	Risk Free Rate	Volatility (σ)	Dividend Yield	Value of Call Option Equivalent
59.61 - 87.25	$ 64.00	6.5	5.7%	32.0%	0.0%	$ 65.58

Source: SEC filings and CSFBC analysis.

The Black-Scholes formula tells us that a call option with these characteristics has a value of $65.58. At first glance, it seems we should multiply this value times the number of outstanding warrants and have our answer. However, we must make a number of potentially major adjustments:

2. *Employees leaving before their options vest*. Most firms use ESOs as a tool to retain valuable employees. Thus, options are typically structured so that an employee who leaves the firm has to forfeit any unvested options. While losing a valuable employee does not help a company, shareholders do benefit in part from this forfeiture. To value this effect, we estimate how long each option tranche has before it becomes fully vested. Then, using our estimate of how frequently employees leave the firm, we estimate how many of the ESOs in a particular tranche will exist at expiration date. We then multiply this number—the expected number of options at expiration date—by the company's estimate of each option's Black-Scholes value to get a preliminary estimate of those ESOs' value.

We applied this technique to our case study of Microsoft's ESOs with exercise prices between $59.61 and $87.25. These ESOs have an expected life of 6.5 years. Our next step is to estimate the vesting period of the typical Microsoft option.

Microsoft's Annual Report states that:

> Options granted during and after 1995 generally vest over four and one-half years and expire seven years from the date of grant, while certain options vest over seven and one-half years and expire after ten years.

This estimate tends to be somewhat subjective, as the company gives us a range of between 4 ½ to 7 years for the vesting schedule of its ESOs. We would lean toward the lower end of the range at five years since the text implies that the majority of the options are of the kind that vest in 4 ½ years. Using this estimate, and assuming that most options expire in 10 years, only an option that has less than 5 years to expiration will be fully vested. Thus, we can infer that these options with a $6^1/_2$ year contractual life have $1^1/_2$ years before they will be fully vested.

The next step is to estimate the number of options that Microsoft employees forfeit annually. Fortunately, Microsoft discloses the number of options outstanding, along with annual option grants, cancellations, and exercises. Using this information, we can divide the number of options cancelled annually by the balance of options at the beginning of the year to calculate what we call the "option churn rate" (see Table 11).

Table 11
Estimate of Microsoft's Annual "Option Churn"

Year	Number of Options	Annual Cancellations	Option Churn Rate
June-94	456	18	**3.9%**
June-95	456	14	**3.1%**
June-96	476	18	**3.8%**
June-97	478	13	**2.7%**
		Average	3.4%

Source: Company SEC filings and CSFBC analysis.

We can see that Microsoft employees typically forfeit between 2.7% and 3.9% of total outstanding options annually. Taking a simple average of this tight range, we arrive at a estimate of approximately 3.4% for Microsoft's annual option churn. In the absence of an "option reload"—in which management cancels all options with exercise prices above a certain price and replaces them with options with a lower exercise price—we can use this number as a proxy for the percentage of options cancelled annually.

We can then use this estimate to infer how many of these options will actually exist when they become fully vested. To do this, we use the following formula:

$$\text{Vested Options Expected} = \text{Actual Options} \times (100\% - \text{Churn Rate})^{\text{Years until vesting}}$$

We can apply this formula to our tranche of options:

$$\text{Vested Options Expected} = 61 \times (100\% - 3.4\%)^{1.5 \text{ years}} = 61 \times (96.6\%)^{1.5} = 57.9$$

With a Black-Scholes value of $65.58 per option, we estimate that the tranche has an expected pretax "option equivalent" value of $3.985 billion. Thus, the estimated churn reduces the value of the tranche by approximately 5%.

3. Dilutive effect of employee stock options. As we discussed in Appendix C, an ESO will always be worth slightly less than its "option equivalent"—a regular option with similar characteristics. This is because an ESO forces the company to issue a dilutive share. Option experts have derived a formula to calculate this effect:

$$\text{ESO Value} = \frac{1}{\left(1 + \frac{\text{Number of ESOs}}{\text{Number of shares}}\right)} \text{ x Value of "Option Equivalent"}$$

We can use the "warrant conversion factor" to calculate just how much each ESO is worth. First, however, we need to estimate the dilution that occurs when employees exercise the options in each tranche of ESOs. Indeed, for this tranche of options, we need to calculate how many shares will exist when employees exercise all vested options with lower exercise prices (see Table 12).

Table 12
Dilution from Exercise of Vested Options

Range of Exercise Prices	Estimated Number of Options at Vesting Period End	Number of Basic Shares
$1.12 - $8.50	85	2,432
8.51 - 11.94	100	2,517
11.95 - 27.25	97	2,617
27.26 - 59.60	98	2,714
59.61 - 87.25	61	2,812

Source: Company SEC filings and CSFBC analysis.

If employees exercise all ESOs with lower exercise prices, 2.812 billion shares will be outstanding. Since there are 61 million ESOs expected to be fully vested, we can use these two numbers to infer the "warrant conversion factor" and value how much the ESOs will actually be worth:

$$\text{ESO Value} = \frac{1}{\left(1 + \frac{61\,\text{million}}{2.812\,\text{billion}}\right)} \text{ x } \$65.58 = 97.9\% \text{ x } \$65.58 = \$64.21$$

Each ESO is worth only 97.9% of the calculated Black-Scholes value of $65.58, or $64.21. Thus, the unadjusted value of this warrant tranche is 61 million ESOs times $64.21, or approximately $3.9 billion (see Table 13).

Table 13
Pre-Tax Value of Microsoft's ESOs with Exercise Prices between $59.61 and 87.25, FY98

Range of Exercise Prices	Value of Call Option Equivalent	Estimated Number of Options at Vesting Period End	Fair Market Value Of Each Warrant	Expected Pre-Tax ESO Value
59.61 - 87.25	$ 65.58	61	$ 64.20	$ 3,901

Source: SEC filings and CSFBC analysis.

4. *Tax deductibility of an ESO's intrinsic value at exercise date*. Finally, we must take into account the benefit that the company will reap from tax savings. The IRS allows companies to deduct the intrinsic value of any option from pretax income during the year in which the employee owner of that ESO exercises it. This lowers the cost of the option to the company by the calculated Black-Scholes value times the marginal tax rate. Thus, to calculate the expected after-tax value of Microsoft's options, we multiply the expected pretax ESO value by the quantity one minus 35%. This reduces the value of this tranche from $3.9 billion to $2.5 billion.

If we repeat this exercise for all five tranches of Microsoft's ESOs, we come up with a total expected after-tax value of approximately $22.1 billion.

Appendix E A RECIPE FOR VALUING ANNUAL STOCK OPTION GRANTS

Estimating the Value of *Historical* Annual Stock Option Grants

The disclosures mandated by Statement of Financial Accounting Standards (SFAS) 123 allow us calculate the value of annual stock option grants. This Appendix details the specific steps needed to perform this analysis. Continuing our case study of Microsoft, this Appendix applies our methodology to value Microsoft's annual stock option grants. Because this analysis has many similarities to the valuation of outstanding ESOs, it may be helpful to first read Appendix D.

1. *Black-Scholes valuation*. SFAS 123 requires that every company calculate the Black-Scholes per-option value of its annual stock option grants since 1995. It also requires disclosure of the inputs into the Black-Scholes formula. As a good corporate citizen, Microsoft also discloses this information. For example, in its 1998 10-K SEC filing, Microsoft states that its 1998 annual stock option grant had a Black-Scholes per-option value of $23.62.

As with outstanding options, we can use disclosed information with several assumptions to calculate the Black-Scholes value of option grants (see Appendix B). Because we are going along with Microsoft's assumptions here, we can accept the company's valuation of its annual stock option grants.

2. *Employees leaving before their options vest*. In Appendix D, we estimated that Microsoft employees tend to forfeit about 3.4% of outstanding options annually. Applying this churn rate to the number of ESOs granted annually, we can estimate how many options we expect will actually exist when they become fully vested. Using our estimate of a five-year vesting period and 10-year option life, we follow the same method as outlined in Appendix D to arrive at the following estimates:

Table 14
Microsoft's Estimated Number of ESOs Expected at Vesting Period End, 1995-98
in millions

Year	Number of Options Granted	Estimate of Annual Employee Churn	Vesting Period of Granted Options	Estimated Number of Options at Vesting Period End
1998	69	3.4%	5	58
1997	110	3.4%	5	92
1996	114	3.4%	5	95
1995	88	3.4%	5	74

Source: SEC filings and CSFBC analysis.

3. *Dilutive effect of employee stock options*. Next, we estimate the dilutive effects of the annual ESO option grants, following the same procedure as outlined in Appendix D. To do this, we must calculate the "warrant conversion factor" formula:

$$\text{ESO Value} = \frac{1}{\left(1 + \frac{\text{Number of ESOs}}{\text{Number of shares}}\right)} \text{ x Value of "Option Equivalent"}$$

The only major change is that we must estimate the number of shares that will exist when employees exercise a particular year's ESOs. For example, looking at the 1998 ESO grants, we must assume that all outstanding options will be exercised before the employees exercise the ESOs freshly granted in 1998. After employees exercise all 441 million of the ESOs expected to be vested and exercised, the expected share count will rise from the basic share count of 2.432 billion to 2.873 billion. With 58 million options from the 1998 grant expected to be vested, we can calculate the warrant conversion factor for 1998:

$$\text{Warrant conversion factor} = \frac{1}{\left(1 + \frac{58\,\text{million}}{2.873\,\text{billion}}\right)} = 98.0\%$$

With a Black-Scholes calculated "option equivalent" value of $23.62, this translates into an expected pretax ESO value of $23.62 times 98.0%, or $23.15 per ESO.

4. *Tax deductibility of an ESO's intrinsic value at exercise date*. Finally, we adjust this value for the tax deductibility of the ESO's intrinsic value at exercise. This lowers the cost of the option to the company by the amount of the marginal tax rate. At a tax rate of 35%, this translates into a value of $23.15 times 65%, or $15.05. With 58 million options expected to be vested, we can value the after-tax value expected economic value of the 1998 option grant at 58 million times $15.05, or $872.9 million.

Repeating this exercise for past years, we arrive at the following estimates for the value of the grants from 1995 to 1998:

Table 15
Microsoft's Expected After-Tax Economic Value Imparted to Employees, 1995-98
in millions

Year	Weighted Average Black-Scholes Value	Estimated Number of Options at Vesting Period End	Warrant Conversion Factor [1/(1+q)]	Marginal Tax Rate	Expected After-Tax Economic Value Imparted to Employees
1998	$ 23.62	58	98%	35%	$ 873
1997	$ 11.72	93	98%	35%	$ 690
1996	$ 8.86	96	98%	35%	$ 541
1995	$ 5.23	74	98%	35%	$ 247

Source: SEC filings and CSFBC analysis.
Note: These calculations assume that Microsoft's warrant conversion factor from 1995 to 1997 equals the 1998 level.

Estimating the Value of *Future* Annual Stock Option Grants

After estimating the *historical* cost of annual ESO grants, we can then attempt to place a value on *future* annual ESO grants. This estimate depends on many factors, such as changes in business fundamentals, trend analysis, and the scalability of a company's business model.

To estimate Microsoft's future annual ESO grants, we first analyzed the company's historical option cost as a percent of revenues—including both revenues and changes in deferred revenues. Over the last four fiscal years, this percentage was fairly stable between 4.1% and 5.6% (see Table 16).

Table 16
Microsoft's After-Tax Option Cost as a Percent of Sales, 1995-98
in millions

Year	Revenue	Expected After-Tax Economic Value Imparted to Employees	Option Cost as a Percent of Sales
1998	$ 17,752	$ 873	4.9%
1997	$ 12,959	$ 690	5.3%
1996	$ 9,654	$ 541	5.6%
1995	$ 6,006	$ 247	4.1%

Source: SEC filings and CSFBC analysis.

If we assume that Microsoft's after-tax ESO cost will continue at approximately 5.0% of sales, we can apply this percentage to our forecast of future sales to arrive at an annual estimate of ESO's going forward.

Table 17
Microsoft's Adjusted NOPAT and FCF Calculation, 1999-2002
in millions

Year	1999E	2000E	2001E	2002E
Revenues	17,500	21,613	26,691	32,297
NOPAT	6,319	7,476	8,876	10,755
Estimated After-Tax Option Cost	875	1,081	1,335	1,615
Adjusted NOPAT	5,444	6,395	7,541	9,140
Investment	550	520	520	1,079
Adjusted FCF	4,894	5,875	7,021	8,061

Note: Revenues include changes in deferred revenues.
Source: Value Line Forecasts, SEC filings, and CSFBC analysis.

Appendix F THE IRS AND EMPLOYEE STOCK OPTION TAXATION

To understand the cash economics of stock options, we must understand how the government taxes options. This Appendix explains the relevant U.S. Internal Revenue Service (IRS) regulations on stock option taxation, and how those regulations affect shareholder value.[39]

The government takes the simplest approach possible to options: the IRS will take note of an option as a taxable event only if it can be clearly valued. For example, if the company grants an ESO with an intrinsic value below the price of the underlying stock, the employee will have to recognize the difference as gross income to be taxed at the ordinary tax rate. However, since most companies grant at-the-money ESOs, the IRS usually does not tax the option at all at the grant date, even when it has considerable economic value.

The IRS will then wait until an employee exercises an option before noting it as a taxable event. Only then does the employee have to recognize the intrinsic value of the option—the difference between the market value of the underlying share and the exercise price of the option—as ordinary income.[40]

The IRS has a symmetrical policy toward employers: during the same year in which an employee recognizes ESO-related gross income, the employer can deduct the same amount from its taxable income.[41]

Table 18
Chronology of Taxable Events Related to Option Grant and Exercise

	ESO Granted	ESO Exercised	Stock Sold
Employer	Difference between market price and ESO's exercise price deducted from taxable income in that year	ESO's intrinsic value deducted from taxable income in that year	Nothing happens
Employee	Difference between market price and ESO's exercise price added to gross income in that year	ESO's intrinsic value added to gross income in that year	Employee pays normal capital gains tax

Source: Section 83 of the United States Internal Revenue Code.

We advocate that investor subtract the cost of an ESO—as calculated by the Black-Scholes method—from net operating profit after taxes (NOPAT). It is important, however, to account properly for the tax deductibility of the intrinsic value of the option upon exercise.

The question of the tax treatment of options can be answered by adopting the binomial option pricing model, outlined by Cox, Ross, and Rubinstein in a classic 1979 paper.[42] This method demonstrates that the after-tax cost of an ESO to the issuing firm will equal the calculated Black-Scholes value times the quanity one minus the marginal tax rate.[43] We have followed this approach through this paper.

Appendix G GLOSSARY OF TERMS

Agency Costs are the costs—such as the wasting of free cash flow on value-destructive projects and perquisites—that would be avoided if managers properly acted as the "agents" of shareholders.

An ***American option*** can be exercised at any time during the option's life. This makes it more valuable than a European option that can be exercised only at the end of the option's life.

Asymmetric information occurs when one party in a contract has more knowledge than its counterparties. Economists often use "asymmetric information" as a euphemism for "inside information."

An ***at-the-money*** option is an option that has an exercise price exactly equal to the market price of the underlying stock.

The ***Cumulative Abnormal Return (CAR)*** is the cumulative risk-weighted outperformance or underperformance of a stock during a certain period surrounding an event.

An ***employee stock option*** (ESO) gives an employee the temporary right—but not the obligation—to exchange a fixed amount of money—called the "exercise price"—for a newly issued share of a company's stock, no matter how high that stock's share price becomes.

A ***European option*** can be exercised only at the end of the option's life. This makes it less valuable than an American option that can be exercised at any time during the option's life.

An ***in-the-money*** option refers to an option that can immediately be profitably exercised because its exercise price is below the market price of the underlying stock. A ***deep in-the-money*** option has an exercise price that is significantly above the market price of the underlying stock.

An ***out-of-the-money*** (also called an ***underwater*** or ***premium strike price***) option refers to an option that cannot be immediately exercised at a profit because its exercise price is above the current stock's market price. A ***deep out-of-the-money*** option has an exercise price that is significantly below the market price of the underlying stock.

An option's ***intrinsic value*** equals the profit that would be realized if an employee immediately exercised it. It is the difference between the underlying stock's market price and the exercise price of the option.

An option's ***time value*** equals the value of an option associated with the possibility of *future* price appreciation. It is the difference between an option's total value and its intrinsic value.

An option ***repricing*** or ***reload*** occurs when a company lowers the exercise price of its ESOs, usually to the current market price of the stock.

An ESO ***vests*** when its owner becomes legally able to exercise the potentially valuable option. An employee typically loses all unvested ESOs upon leaving a firm.

[1] In this paper, we generally use the word "option" to refer to "call options," which give its owner the temporary right to buy a security at a fixed price. A call option increases in value when the value of its underlying stock goes up. The other major type of option is the put option, which gives its owner the temporary right to *sell* a security at a fixed price. A put option increases in value only when the price of that stock falls. Call options are the most often used securities in equity-linked executive stock option packages. Indeed, most countries severely restrict an executive's ability to purchase put options on the companies for which they work.

[2] Brian Arthur, "Increasing Returns and the New World of Business," *Harvard Business Review* 74 (July-August 1996): 103.

[3] Karl Marx, *Das Kapital, A Critique of Political Economy* (Washington, DC: Regnery Publishing, 1996): 347.

[4] The exemplar of this school of thought is Frederick Taylor's "Scientific Management," which proposed that managers do all the thinking and the workers continually repeat tasks at their assembly line workstations. Indeed, "Taylorism" recommended that managers use "time and motion" studies to time employees at their tasks and assure that they were arranged in the most efficient manner. Robert Kanigel, *The One Best Way: Frederick Winslow Taylor and the Enigma of Efficiency* (New York: Viking Press, 1997).

[5] Note that the lack of government anti-monopoly laws and enforcement and the lack of a personal income tax greatly tilted the rankings towards Industrial Revolution-era businessmen. Michael Klepper and Robert Gunther, *The Wealthy 100*, (Carol Publishing Group, 1996).

[6] "Reflections on Jared Diamond's Talk; Bill Gates on Jared Diamond's 'Why Did Human History Unfold Differently on Different Continents for the Last 13,000 Years?' Submitted: 4-15-98. http://www.edge.org/discourse/index.cgi?OPTION=VIEW&THREAD=jared-diamond/5-12-97/reflectionsondiamond.

[7] We inferred this amount using a simple calculation. Microsoft reported that it enjoyed a tax break of $1.553 billion in 1998 owing to "stock option income taxes benefits." Section 83 of the Internal Revenue Code states that an employer can deduct the intrinsic value of options in the year in which an employee exercises the option. Using the company's reported tax rate of 35%, we can divide $1.553 billion by 0.35 to infer that employees exercised options with a cumulative intrinsic value of $4.437 billion in 1998. We then divide this amount by the number of Microsoft full-time employees—27,055 people on June 30, 1998—to infer the per employee value of ESOs. Note that this calculation will only give us the intrinsic value of so-called Non-Statutory ESOs. If the company granted its ESOs in the form of so-called Incentive Stock Options (ISOs)—which are a form of non-tax-deductible ESOs—our estimate would be understated.

[8] Brian J. Hall and Jeffrey B. Liebman, "Are CEOs Really Paid Like Bureaucrats?" *National Bureau of Economic Research Working Paper* 6213 (October 1997).

[9] The Revenue Reconciliation Act of 1993 created this restriction by adding Section 162(m) to the Internal Revenue Code.

[10] Financial Accounting Standards Board, *Financial Interpretation Number 28*, "Accounting for Stock Appreciation Rights and Other Variable Stock Option or Award Plans, An Interpretation of Accounting Principles Board Opinions No. 15 and 25."

[11] Pearl Meyer & Partners.

[12] In our experience, it is extremely difficult to determine if a company is timing its use of ESOs to inflate reported earnings. Since option grants often are not reported until SEC filings require disclosure three months after the close of the fiscal year, a company could use ESOs to "make one more quarter" with relative ease.

[13] Michael C. Jensen, "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers," *American Economic Review* 76, no. 2 (1980): 323-329.

[14] David Yermack, "Good Timing: CEO Stock Option Awards and Company News Announcements," *Journal of Finance* 52, no. 2, (June 1997): 449-476.

[15] Mean cumulative abnormal stock returns (CARs) for Fortune 500 companies awarding stock options to their CEOs between 1992 and 1994. CARs are calculated for an event period around the dates of 620 CEO stock option awards.

[16] This approach was outlined by the Financial Accounting Standards Board (FASB) in two of its official accounting rulings, the Statement of Financial Accounting Standard (SFAS) 128, *Earnings Per Share* (1997), and Accounting Principal Board (APB) Opinion 25, *Accounting for Stock Issued for Employees* (1972).

[17] To avoid confusion, note that "basic" and "diluted" earnings per share calculation outlined by *SFAS 128* represents a change from the "treasury stock method" prescribed by APB Opinion 15 (1971).

[18] To be precise, SFAS 128 assumes that all "in-the-money" options will be exercised.

[19] SFAS 128 specifies that net income should be adjusted when accounting for dilution of equity from the assumed conversion of convertible bonds. Specifically, the interest expense from convertible bonds should be added back to net income when conversion of the bonds into common shares is assumed.

[20] To be specific, the company is allowed to amortize the after-tax cost of an ESO—as valued by the Black-Scholes method—over the vesting period of the option.

[21] "Gretchen Morgenson, "Stock Options Are Not a Free Lunch," *Fortune Magazine*, 216.

[22] Even SFAS 123, however, does not mandate quarterly disclosures of the pro forma effects of option costs.

[23] Because ESOs eventually convert into shares, the value of outstanding ESOs cannot be greater than the value of ordinary equity. However, if there are enough ESOs, the value of currently outstanding shares can approach zero.
[24] "Berkshire Hathaway's Interview with Warren Buffet and Charlie Munger," *Outstanding Investor Digest* 13, No. 3 and 4, (September 24, 1998): 1, 36-57.
[25] Since companies only calculate and report the value of annual ESO grants from fiscal year 1995 to the present, we estimated the cost of Microsoft's annual ESO grants as 5% of sales in 1993 and 1994 for this calculation.
[26] Gretchen Morgenson, "Trimming Stock Options' Sails." *New York Times*.
[27] P. Jane Saly. "Repricing Executive Stock Options in a Down Market," *Journal of Accounting & Economics* 18 (1994): 325-356.
[28] Don Chance, Raman Kumar and Rebecca Todd, "The 'Repricing' of Executive Stock Options," *Virginia Polytechnical Institute Working Paper Series* 97-1 (March 27, 1998).
[29] Professors Chance, Kumar, and Todd value a "repriceable" option by modeling it as a combination of a "down-and-out" and a "down-and-in" strike-step options. A "down-and-out" strike-step option is an option that terminates with no value upon the underlying stock hitting a value that is a certain percentage less than the exercise price. A "down-and-out" strike-step option is an option that springs to life only if the underlying stock hits a value that is a certain percentage less than the exercise price.
[30] Financial Accounting Standards Board. *Emerging Issues Task Force* 87-33.
[31] Gretchen Morgenson, "Trimming Stock Options' Sails." *New York Times*.
[32] Black, F., and M. Scholes (1973): "The Pricing of Options and Corporate Liabilities," Journal of Political Economy, 81, 637-654.
[33] Espen Gaarder Haug. *The Complete Guide to Option Pricing Formulas*. (New York: McGraw-Hill 1998): 3.
[34] Robert Merton, "Theory of Rational Option Pricing," *Bell Journal of Economics and Management Science* 4, (1973):141-183.
[35] For a clear exposition of the derivation of the Black-Scholes formula, see John Hull. *Options, Futures, and Other Derivatives*, 3rd ed. (New York: Prentice Hall Press, 1998): 237-239.
[36] Richard Brealey and Stewart Myers, *Principles of Corporate Finance*, 5th ed. (New York: McGraw-Hill, 1996), 621.
[37] Jeffrey M. Laderman, "Share Buybacks That Pay Back in Spades," *Business Week* (February 23, 1998).
[38] For example, to use Bloomberg to obtain the yield of a zero-coupon Treasury Bill expiring in a year, type "B mm <GOVT>" and hit the <GO> button. Note that "mm" stands for the month of the T-bill's expiration.
[39] This Appendix represents our understanding of Section 83 of the Internal Revenue Code, which governs the taxation of "Non-Statutory Options." However, please obtain independent tax advice before acting on any information in this Appendix.
[40] If the employee keeps the shares obtained by exercising his option, the IRS will tax any capital gains on the eventual sale of those shares assuming a tax basis equal to the market price at option exercise.
[41] To be specific, the employer's fiscal year must include the last day of the employee's fiscal year. Note also that since the option is taxed at the exercise date (and not the grant date), the option's time value at the date of grant is irrelevant.
[42] The Cox-Ross-Rubinstein binomial option pricing model was outlined in J. C. Cox, S. A. Ross, and M. Rubinstein, "Option Pricing: A Simplified Approach," *Journal of Financial Economics* 7 (1979): 229-263. This model is flexible enough to value both American and European options, although it is computationally intensive.
[43] This demonstration is available from the authors upon request.