SFAS No. 123 Disclosures and Discounted Cash Flow Valuation

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November 1999

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I am grateful to Larry Revsine, Jim Wahlen (associate editor), and two anonymous referees for their comments on this paper. Financial support from the Accounting Research Center at the J.

L. Kellogg Graduate School of Management, Northwestern University is gratefully acknowledged.

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SYNOPSIS

One of the cornerstones of financial statement analysis is the discounted cash flow valuation. Despite the broad use of this valuation technique, and the economic importance of employee stock options to firm values, there is little guidance on how employee stock options should be incorporated in a valuation. This paper provides a comprehensive approach to doing so, including consideration of the income tax implications of option exercises, the simultaneity of equity and option valuation, and the use of the disclosures that were mandated recently by Statement of Financial Accounting Standards No. 123. The paper provides a comprehensive example using Microsoft's fiscal 1997 financial statements and employee stock option disclosure. This paper should be of interest to academics and practitioners involved in corporate valuation and financial statement analysis.

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INTRODUCTION

Employee stock options (ESOs) have become a common element in many corporation's pay structures. Matsunaga, Shevlin and Shores (1992) report that roughly three-fourths of the respondents to a Conference Board survey had some form of ESO plan in place by 1989. ESO plans are not only common, but also large relative to the number of outstanding shares. For Matsunaga, Shevlin and Shores' sample of 170 firms, the mean ratio of options authorized to shares outstanding was about 13%.

In response to the growing importance of ESOs, as well as the debate surrounding Statement of Financial Accounting Standards (SFAS) No. 123, "Accounting for Stock-Based Compensation,"a literature on ESOs has developed. This literature has focused on how the differences between ESOs and publicly traded options affect their relative values. The context for this literature has generally been to assist accounting rulemakers in setting standards for financial disclosures about ESOs.

Despite the attention to how ESOs should be valued in financial disclosures, there is little guidance on how investors should use these disclosures. This paper seeks to fill that gap by providing a comprehensive framework for incorporating ESOs in a discounted cash flow (DCF) valuation, and explaining how SFAS No. 123 disclosures facilitate the analysis. The paper considers the income tax implications of ESOs and the simultaneous nature of ESO and equity valuation.

The use of ESO disclosures is examined in a valuation context because it is generally accepted that maximizing shareholder wealth is the appropriate goal of management and, as a result, corporate valuation is a critical element of financial analysis. Whether a firm is analyzing alternative operating strategies, a stock issue or repurchase, a potential takeover target, a minority investment in another firm, or any other investment opportunity, valuation is usually a critical component of the decision process. Palepu, Bernard, and Healy (1996) note that "(a)t some level, nearly every business decision involves valuation (at least implicitly)."

The most common approach to corporate valuation is DCF analysis, for which there exists a broad literature. However, just as the ESO literature has not focused on corporate valuation, the valuation literature has not considered in detail the role of ESOs in the valuation.[1] With the wide use of ESOs today, especially in certain industries, ESOs can impact significantly the values obtained under DCF analysis. Thus, failure to consider ESOs can lead to large valuation errors.

Although the methodology provided in this paper eliminates the valuation error inherent in ignoring ESOs, it is still subject to forecasting errors. As the paper shows, when ESOs are considered in a valuation, forecasted ESO grants are an important element of the valuation. The accuracy of this forecast, like any other component of the valuation, will affect the accuracy of the valuation. However, an analysis of the "best" way to forecast transactions, whether they involve ESOs or not, is beyond the scope of this paper.

The methodology described in this paper can be generalized in two ways. First, while the illustration provided in the paper uses the ESO valuation technique adopted by the Financial Accounting Standards Board (FASB), the same approach to incorporating ESOs in a DCF valuation could be applied using any option valuation model. Although other models may be more appropriate theoretically, as the paper discusses, the FASB methodology provides reasonable ESO values. Further, a major advantage of using the FASB methodology is the availability of information. Second, because the DCF and residual income (RI) valuation models, given identical assumptions, produce identical results, the valuation approach described in this paper also can be applied to a RI valuation. At the conclusion of the paper, the illustration is recast using the RI model instead of DCF.

The paper proceeds as follows. First, it examines the ESO literature. Second, it provides an overview of the DCF valuation framework and how both outstanding ESOs and future ESO grants fit into that framework. Third, it describes the income tax consequences of ESOs and how they affect the measurement of the ESO valuation components. The next two sections link the SFAS No. 123 disclosures to the valuation implications of future ESO grants and outstanding ESOs, respectively, and illustrate the use of the disclosures with Microsoft's fiscal 1997 financial statements. Microsoft was chosen because of the magnitude of its ESOs, and because its SFAS No. 123 disclosures are representative. The same analysis is easily applied to other companies. The next section discusses model sensitivities and the applicability of the methodology to a residual income (RI) valuation. The last section summarizes the paper.

VALUATION OF EMPLOYEE STOCK OPTIONS

Obviously, incorporating ESOs in a DCF valuation requires that the ESOs be valued. Therefore, some model of option value is necessary in the analysis. A great deal of research in recent years has been devoted to the question of how to value ESOs because, even though models of publicly traded options have been in existence for about 25 years, these models are not appropriate for ESOs, because of the restrictions placed on them. Among those restrictions are that, in general, employees may not sell or hedge ESOs, and employees who leave the company forfeit any unexercised ESOs they hold. These features, together with employee turnover, risk aversion or liquidity needs, make ESOs likely to be either forfeited or exercised early.[2] (See Huddart (1997).) The possibilities of forfeiture and early exercise reduce the value of an ESO relative to an otherwise similar publicly traded option. (See Jennergren and Naslund (1993), Hemmer, Matsunaga and Shevlin (1994), Huddart (1994) and Kulatilaka and Marcus (1994).)

Sensitive to the fact that ESOs are worth less than traded options, the FASB in SFAS No. 123 accounted for the difference by using a modified Black-Scholes (1973) model to determine the fair values of ESOs. This model uses expected forfeiture and exercise behavior, rather than the actual terms of the options, in the computation of option value. Hemmer et al. argue that the FASB's methodology overstates the value of ESOs. By replacing the actual time to expiration in the Black-Scholes formula with the option's expected life, the FASB method values options as if they all will be exercised or forfeited at the end of the expected life of the options. In fact, the exercises will occur at various points in time before and after the expected date. Because option values are concave in time to expiration, the average value of these options is less than the value obtained using the FASB methodology. Cuny and Jorion (1995), however, note that models that assume employee turnover is uncorrelated with stock price performance, as is the case with the FASB's model, understate option values.

Taken as a whole, the above research makes it clear that the particular features of ESOs and employees that are modeled, and the parameter values that are assumed, affect the option values obtained. This is problematic because important parameters, like risk aversion, are unobservable, making many of these models difficult to implement. However, Carpenter (1998) shows that the FASB's modified Black-Scholes computation results in ESO values that are very close to those of a more complex model incorporating risk aversion and outside job offers to model forfeitures and exercises. Carpenter's results indicate that while the SFAS No. 123 approach to ESO valuation is imperfect, it provides a reasonable estimate of the value of an ESO. This, together with their ready availability, makes the SFAS No. 123 disclosures a valuable source of information about ESOs that can be used in a corporate valuation.

OVERVIEW OF DISCOUNTED CASH FLOW VALUATION AND EMPLOYEE STOCK OPTIONS

This section lays out a comprehensive approach to incorporating ESOs in a DCF valuation. First, it describes a standard DCF valuation of a firm that does not grant ESOs. Then, it generalizes the DCF valuation approach to include ESOs.

DCF Valuation of Firms without ESOs

A DCF valuation is based on the notion that the combined value of all of a firm's securities is equal to the value of all the net assets to which those securities have a claim. Consider a firm that has operating net assets (e.g., fixed assets, working capital, intangibles) and non-operating assets (e.g., excess cash, marketable securities, investments in other companies), and is financed by a combination of debt, preferred stock, and common equity. The firm does not issue any ESOs. Its valuation takes the following form:

$$OP_0 + NONOP_0 = DEBT_0 + COMEQUITY_0 \ ,$$

where *OP* is the value of operating net assets, *NONOP* is the value of non-operating assets, *DEBT* is the combined value of debt and preferred stock, and *COMEQUITY* is the value of common equity. The subscript "0" refers to the valuation date.

In a DCF framework, operating net assets are valued by taking the present value of the future free cash flows they are expected to generate. Typically, non-operating assets are valued either by appraisal or by observing market value, and debt and preferred stock are valued by observing market value. Common equity, being a residual claim, is estimated by:

$$COMEQUITY_0 = \sum_{t=1}^{\infty} \frac{FCF_t}{(1+k_c)^t} + NONOP_0 - DEBT_0 \ ,$$

where FCF_t is the expected free cash flow in period t and k_c is the weighted-average cost of capital.

FCF_t includes some outflows that are not actually paid in cash, but by issuing a claim on the firm's assets. For example, the expected purchase of a machine is considered an outflow in the free cash flow forecast, even if it is to be paid for by issuing debt. This transaction will actually generate a stream of interest payments (net of tax shields) and principal repayments over the life of the debt. However, this cash flow stream is incorporated in the free cash flow forecast as if it were a lump sum cash outflow on the date the machine is to be purchased, and the amount of the cash flow is the value of the debt on that date. I refer to such amounts as "free cash flow equivalents."

By including free cash flow equivalents in FCF_t and debt that is outstanding at the valuation date in $DEBT_0$, all future debt service is reflected somewhere in the valuation.[3] In other words, all expected principal and interest payments, net of tax benefits, reduce the value of common equity through either $\sum_{t=1}^{\infty} \frac{FCF_t}{(1+k_c)^t}$ (claims expected to be issued) or $DEBT_0$ (existing claims).

DCF Valuation of Firms with ESOs

Consider now a firm that has issued ESOs in the past, some of which are still outstanding, and that expects to issue additional ESOs in the future. In expectation, both the outstanding ESOs and the yet-to-be-issued ESOs will result in outflows of value when the options are exercised in the money.[4] For both sets of options, the amount of the outflow, before considering taxes, will be the difference between the market price of the firm's shares when the options are exercised and the option strike price. A DCF valuation must reflect the current value of both of these sets of expected outflows.

The expected outflows related to ESOs that have not yet been granted can be captured by treating them as cash equivalent outflows on the respective grant dates, the dates these claims on the firm's assets are to be issued. Treating the expected issuances of ESOs to compensate employees as free cash flow equivalents is analogous to the treatment of the expected issuance of debt to pay for a machine. These free cash flow equivalents are then discounted back to the valuation date along with all other forecasted free cash flows.

The expected outflows related to outstanding ESOs, like those related to outstanding debt, must be deducted to determine the value of common equity. This is done by subtracting the fair value of the outstanding ESOs as of the valuation date, similar to the subtraction of the market value of outstanding debt.

Together, these two components capture the current value of the claims related to all ESOs, whether expected to be issued in the future or currently outstanding. Thus, the DCF valuation formula generalizes to:

$$COMEQUITY_0 = \sum_{t=1}^{\infty} \frac{FCF_t^* - GRANT_t}{(1+k_c)^t} + NONOP_0 - DEBT_0 - ESO_0 \ , \quad (1)$$

where FCF_t^* is free cash flow in period t before considering ESO grants, $GRANT_t$ is the grant date value of forecasted option grants in period t, and ESO_0 is the value of outstanding stock options at the valuation date. Thus, incorporating ESOs in a DCF valuation requires a forecast of future ESO grants and an estimate of the value of outstanding ESOs.

There are three factors that complicate the valuation in equation (1). First, the exercise of ESOs may give rise to a tax deduction, so both $GRANT_t$ and ESO_0 must reflect the tax benefits the ESOs will generate. Second, $GRANT_t$ represents the expected grant-date value of options that have not yet been issued. Because the number and terms of these options have not been set, the values of these options cannot be computed with a standard option pricing model, even if it accounts for the differences between publicly traded options and ESOs. Third, ESO_0 depends on, among other things, $COMEQUITY_0$, making equation (1) circular and requiring that it be solved simultaneously with the valuation of the ESOs as a function of equity value. The following section discusses the tax consequences of ESOs and how they impact the measurement of $GRANT_t$ and ESO_0. Estimating $GRANT_t$ and the circularity problem are addressed in the two subsequent sections, respectively.

TAX CONSEQUENCES OF EMPLOYEE STOCK OPTIONS

This section first summarizes the ESO tax rules that are relevant to DCF valuation. (For a more complete description of the tax rules, see Matsunaga, Shevlin and Shores (1992).) It then discusses the effect these rules have on the measurement of $GRANT_t$ and ESO_0.

Summary of Relevant Tax Rules

There are two types of ESOs for tax purposes. “Incentive stock options” (ISOs) provide employees with tax-favored treatment, while “non-qualified stock options” (NSOs) do not.[5] An option must meet certain requirements to qualify as an ISO, including that it was not in-the-money when granted and that the employee does not sell the shares received for at least one year after exercise. Options that are issued in-the-money or that do not meet one of the other requirements for ISO treatment are NSOs. Further, if an employee exercises an ISO and sells the stock received within one year, the sale is deemed to be a “disqualifying disposition,” which causes the ISO to become an NSO. The tax consequences of ISOs and NSOs are as follows:

Incentive Stock Options (ISOs)

Date	Employee Tax Consequences	Employer Tax Consequences
Grant Date	No income recognized.	No deduction allowed.
Exercise Date	No income recognized.	No deduction allowed.
Sale (if not a disqualifying disposition)	Capital gain or loss for difference between sale price and strike price.	No deduction allowed.
Sale (if considered a disqualifying disposition)	Ordinary income for difference between fair value of stock at exercise and strike price; Capital gain or loss for difference between sale price and fair value of stock at exercise.	Deduction for compensation expense for amount employee recognizes as ordinary income.

Non-Qualified Stock Options (NSOs)

Date	Employee Tax Consequences	Employer Tax Consequences
Grant Date	No income recognized.	No deduction allowed.
Exercise Date	Ordinary income for difference between fair value of stock at exercise and strike price.[6]	Deduction for compensation expense for amount employee recognizes as ordinary income.
Sale	Capital gain or loss for difference between sale price and fair value of stock at exercise.	No deduction allowed.

The company receives a tax deduction for an ISO exercise only if the employee subsequently enters into a disqualifying disposition. In contrast, all NSO exercises result in a tax deduction at the exercise date. In both cases, the amount of the deduction is the amount the option was in-the-money when it was exercised. Assuming only in-the-money options are exercised, the amount and timing of the firm's tax benefits per exercised option are summarized by the following chart:

Tax Benefits Realized by Employer
per Exercised Option

Option Type	Exercise Date	Sale Date
ISO with no disqualifying disposition	0	0
ISO with disqualifying disposition	0	$\tau \cdot (S_E - X)$
NSO	$\tau \cdot (S_E - X)$	0

where τ is the firm's marginal tax rate, S_E is the stock price at the exercise date, and X is the option strike price.

ESO Valuation and Taxes

As the above chart shows, ISO exercises followed by disqualifying dispositions and NSO exercises both result in tax deductions, but potentially at different times. However, this timing difference is likely to be small. By definition, the exercise date and the date of a disqualifying disposition cannot be more than one year apart. More likely, disqualifying dispositions take place even closer to the exercise date. The tax cost an employee would incur by selling the stock she receives before a year has passed is essentially fixed for the year, while the cost she faces by holding the position the remainder of the year is falling throughout the year. For example, one day before a year has passed, the employee would need to incur the market risk and other holding costs for only one more day to avoid the tax cost of a disqualifying disposition. Thus, it is unlikely there would be a disqualifying disposition close to the one-year mark. Immediately after exercise, however, the employee would be facing a full year of holding costs in order to avoid the same tax cost. If the employee is going to have a disqualifying disposition, the optimal timing of it is immediately after exercise. Thus, treating the tax deduction triggered by a disqualifying disposition as if it were realized on the exercise date rather than the sale date should have very little effect on its value, while greatly simplifying the computation. Therefore, for an exercise of either an ISO for which there will be a disqualifying disposition or an NSO, the valuation must incorporate a tax benefit of $\tau \cdot (S_E - X)$ to be received at the exercise date.

If n_E is the number of options exercised and p is the proportion of those options that will generate a tax deduction, then the aggregate tax benefit realized at exercise is

$$TB_E = n_E \cdot (S_E - X) \cdot \tau \cdot p \ . \quad (2)$$

$n_E \cdot (S_E - X)$ is the aggregate amount the exercised options are in the money. Hence, it represents the amount of firm value transferred to employees upon exercise. Thus, the aftertax outflow at exercise is $n_E \cdot (S_E - X) \cdot (1-\tau \cdot p)$. Because this amount is $1-\tau \cdot p$ times the options' aggregate value at exercise, the amount of the free cash flow equivalent at the grant date is

$$GRANT_t = C_{G,t} \cdot (1 - \tau \cdot p) \ , \quad (3)$$

where $C_{G,t}$ is the aggregate fair value of ESOs granted in period t. Similarly, the effect the claims from outstanding ESOs have on equity value is

$$ESO_0 = C_0 \cdot (1 - t \cdot p)\ , \quad (4)$$

where C_0 is the aggregate fair value of outstanding ESOs at the valuation date.

Estimating $GRANT_t$ and ESO_0 requires an estimate of p. A reasonable way to estimate p is to refer to its historical values. Rearranging the tax benefit formula (2) shows that historical values of p can be estimated from information in the financial statements and the ESO footnote:

$$p = \frac{TB_E}{n_E \cdot (S_E - X) \cdot t}\ . \quad (5)$$

Because the cost of ESOs is not recognized as an expense, the tax benefit triggered by an exercise does not reduce income tax expense. Instead, it is credited directly to equity. Thus, TB_E represents a difference between reported income and cash flow, and must be disclosed in the cash flow statement if it is material. SFAS No. 123 also requires the number of options exercised (n_E) and their average strike price (X) to be disclosed. The remaining components of (5), the marginal tax rate (τ) and the average stock price at exercise[7] (S_E), must be estimated.

Estimating Microsoft's Historical p

Exhibit 1 estimates Microsoft's historical p in fiscal 1995, 1996 and 1997. The income tax benefits of the stock option exercises (TB_E) were obtained from Microsoft's fiscal 1997 cash flow statement, which is provided in Appendix 1. The number of options exercised (n_E) and the average strike prices of the exercised options (X) were obtained from Microsoft's SFAS No. 123 disclosure, which is provided in Appendix 2.[8] The marginal tax rate (τ) was estimated to be 40% (34% federal statutory rate plus an estimated additional state tax burden). Microsoft does not disclose the average stock price at exercise for the exercised options (S_E). These values were estimated based on Microsoft's stock price range during each year.[9] It was assumed that more options were exercised when the stock price was relatively high. Thus, the estimates of S_E are near the respective annual highs. The reason for this assumption is that when employees exercise early, they forego expected value equal to the option premium, which is the difference between the option's value and the amount the option is in the money. The higher the stock price, the lower the premium on an in-the-money option, and the less costly it is for employees to exercise early. The assumption that more options are exercised when the stock price is higher is consistent with Huddart and Lang's (1996) finding that ESO exercises are positively correlated with lagged stock returns.

The above values result in estimates of the historical p in 1995-1997 of 1.06, 1.14, and 0.95, respectively. The fact that two of these values are above 100% indicates that the estimates in the exhibit are not perfect. Undoubtedly, one or both of τ and S_E are misestimated. Still, these results suggest that virtually all of Microsoft's ESOs generated a tax deduction at exercise. Assuming the mix of NSOs and ISOs does not change in the future, an estimated p of 1 is reasonable for the forecast.

A value of p that is close to 1 is not surprising. As Matsunaga, Shevlin and Shores (1992) show, there was a substantial shift from ISOs to NSOs following the Tax Reform Act of 1986. The respondents to a Conference Board survey indicated that in 1989, 68% of option grants were NSOs, 20% were a combination of NSOs and ISOs, and 12% were ISOs. This compares to 19%, 57% and 24%, respectively in 1985. This shift from ISOs to NSOs occurred due to the increase in the corporate tax rate above the highest marginal rate for individuals, making the corporate deduction generated by NSOs more valuable than the individual's tax cost. The elimination of the preferential treatment for capital gains added to the shift toward NSOs being more attractive than ISOs.[10]

INCORPORATING FUTURE ESO GRANTS IN A VALUATION

Many DCF valuations use historical relationships as a basis for projecting future free cash flows. For any firms that recognize the costs of ESO grants, a forecast based on reported historical results implicitly includes a forecast of future compensation expense related to ESOs.[11] However, virtually no firms recognize the cost of ESOs in the financial statements, as recommended (but not required) by SFAS No. 123. Thus, forecasts based on reported historical results capture free cash flows before considering ESO grants. As a result, ESO grants must be incorporated in the free cash flow forecast explicitly.[12]

By substituting (3) and (4) into (1),

$$COMEQUITY_0 = \sum_{t=1}^{\infty} \frac{FCF_t^*}{(1+k_c)^t} - \sum_{t=1}^{\infty} \frac{C_{G,t} \cdot (1 - t \cdot p)}{(1+k_c)^t} + NONOP_0 - DEBT_0 - C_0 \cdot (1 - t \cdot p) \quad (6)$$

In (6), the value of operating net assets has been decomposed into the value of free cash flow before considering future ESO grants, and the present value of future ESO grants. The first component, $\sum_{t=1}^{\infty} \frac{FCF_t^*}{(1+k_c)^t}$, is the standard DCF valuation, with ESOs ignored in the free cash flow forecast. Valuing the second component, $\sum_{t=1}^{\infty} \frac{C_{G,t} \cdot (1 - t \cdot p)}{(1+k_c)^t}$, is problematic. As of the valuation date, the grant date stock prices, and the number and terms of these options are unknown. As a result, direct use of an option pricing model to determine $C_{G,t}$ is not possible.

The terms of ESOs to be granted are typically determined at the grant date, and generally depend on the market price of the stock at that time. For example, firms commonly issue options exactly at-the-money. If the stock price happens to be up at the grant date, the strike price will be higher. If it is down, the strike price will be lower. Therefore, the sensitivity of the value, as of the valuation date, of these yet-to-be-issued options is less than it would be if the terms of the options were fixed by the valuation date. In addition, the firm likely considers the value of the options being issued when determining the number to issue, further reducing the sensitivity of the value of an expected grant before it is made. This suggests that one method to simplify the difficult problem of forecasting the value of future ESO grants is to estimate the aggregate dollar value of the grants.[13] The SFAS No. 123 disclosure provides the number and weighted-average dollar value of ESO grants for each of the most recent three years. These can be used to compute the aggregate dollar values of prior ESO grants, which can be used as a reference to forecast the aggregate dollar value of future grants.

Estimating the Value of Microsoft's Future Option Grants

To estimate the value of Microsoft's future ESO grants, the values of ESO grants in the past three years are examined. The first table in Microsoft's SFAS No. 123 disclosure indicates that the company granted 44 million ESOs in fiscal 1995, 57 million in fiscal 1996, and 55 million in fiscal 1997. The last paragraph of the footnote indicates that these options had average values of \$10.46, \$17.72 and \$23.43, respectively.[14] Thus, the aggregate values of options granted in the last three fiscal years were \$0.46 billion, \$1.01 billion, and \$1.29 billion, respectively.

The following forecast is used to illustrate the valuation of forecasted ESO grants. No attempt is made here to determine the "best" way to forecast future ESO grants. The specific assumptions that an analyst would use in a particular valuation will undoubtedly vary and be based on his or her knowledge of the particular firm's circumstances. The illustration assumes the aggregate dollar value of ESO grants will grow 3% annually. As a result, the present value will be computed as a simple perpetuity with growth. The marginal tax rate is assumed to be 40%. The cost of capital is assumed to be 12%. This parameter would typically be computed using an asset pricing model such as the capital asset pricing model. Based on the historical values of p, it is assumed that 100% of the options have a disqualifying disposition or are NSOs. Given these assumptions, the present value at June 30, 1997 of the forecasted future option grants, after considering tax benefits, is about \$8.9 billion, computed as follows:

$$\frac{C_{G,1997} \cdot (1+g) \cdot (1-t \cdot p)}{k_c - g} = \frac{\$1.29B \cdot 1.03 \cdot (1-0.4 \cdot 1.0)}{.12-.03} = \$8.9B$$

Internal Consistency of Forecast

Internal consistency is an important characteristic of any forecast. In the context of ESO grants, this has at least two implications. First, for most firms there is likely to be a tradeoff between option grants and other forms of compensation. Thus, it is important for the forecast of future option grants and other compensation amounts to be consistent. For example, if a decrease in option grants is forecasted, the analyst should consider an increase in other forms of forecasted compensation, or have a reasonable basis for forecasting an overall decline in compensation. Second, presumably options have an incentive effect on managers. That is, the presence of an ESO plan is likely to affect the forecast of free cash flows before considering ESO grants, and the forecast should reflect expected cash flows conditional on the forecasted option grants.

INCORPORATING OUTSTANDING ESOs IN A VALUATION

Recall equation (6) was

$$COMEQUITY_0 = \sum_{t=1}^{\infty} \frac{FCF_t^*}{(1+k_c)^t} - \sum_{t=1}^{\infty} \frac{GRANT_t}{(1+k_c)^t} + NONOP_0 - DEBT_0 - C_0 \cdot (1 - t \cdot p) \quad (6)$$

C_0 is the value of outstanding ESOs, before considering tax effects, so

$$C_0 = CALL(COMEQUITY_0) \quad (7)$$

where $CALL(\cdot)$ is the value of a call option as a function of the underlying equity value.[15] Carpenter's results, discussed earlier, suggest that the effect of restrictions generally placed on ESOs can be approximated by using the expected average time to exercise in place of the time to expiration in a modified Black-Scholes model to evaluate C_0. Although the SFAS No. 123 disclosures do not include the value of outstanding options, they provide information that can be used to estimate the value of outstanding ESOs with such a model.[16]

In a valuation, the value of the company's stock is not given, but is determined endogenously. So, (6) and (7) comprise a simultaneous equation system. It is not possible to invert typical option pricing formulae, such as Black-Scholes, algebraically. Thus, these equations cannot be solved directly. Instead, an iterative technique must be used to obtain option and equity values that satisfy both equations. One such technique is illustrated below.

Estimating Consistent Values of Microsoft's Common Equity and Outstanding ESOs

The following illustration's focus is the valuation effect of the options, so a complete free cash flow forecast is not provided. Rather, a value of the free cash flows before considering ESO grants is assumed, and the remainder of the valuation is shown explicitly. The valuation uses the Black-Scholes model with expected time to exercise substituted for actual time to expiration to estimate the value of the outstanding ESOs.[17]

The following assumptions are used in the valuation:

- The present value of forecasted free cash flow, before considering future ESO grants, is $180 billion.
- Excess cash at the valuation date is $8 billion.
- Equity investments are worth their book value - about $2.3 billion.
- There is no debt outstanding.
- The book value of the preferred stock - $1.0 billion - approximates the market value at the valuation date.
- The Black-Scholes parameters are as given in the Microsoft disclosure.

Exhibit 2 is a valuation of Microsoft's equity. For the first iteration, in panel A, the value of Microsoft's outstanding ESOs is not known. As a first approximation, a value of zero is used. This results in a per share common equity value of $150.33 ($180.4B/1.2B shares). The $150.33 per share value can then be used to estimate the value of the outstanding ESOs as of the valuation date. Each of the four columns in the option valuation section represents a set of outstanding ESOs at June 30, 1997, and is based on information obtained from the ESO footnote. For example, there were 65 million options outstanding having strike prices between $2.24 and $17.00, and an average strike price of $9.64. An average time to expiration of two years was used, rather than the actual average time to expiration, to reflect the likelihood of early exercises. Using the Microsoft provided 30% standard deviation of returns and 6.5% risk-free interest rate, and the previously estimated $150.33 per share value of stock, these options are worth $141.87 each. Assuming $p = 1$ and $\tau = .40$, the value of each option after considering tax benefits is $85.12. Thus, these 65 million options have an aggregate aftertax value of $5.5 billion. The same computation for the other three sets of outstanding options shows that when the equity value is $150.33 per share, the outstanding options have an aggregate aftertax value of $18.1 billion. This is inconsistent with the initial assumption that the options were worth zero, so it is not a solution.

In the second iteration in panel B, the estimated aftertax option value from the first iteration is used instead of the original estimate of zero. If the options are worth $18.1 billion, then the equity is worth $135.23 per share, significantly less than in the first iteration. The revised equity value implies the options are worth only $16.0 billion aftertax. This is still not a solution, but the $2.2 billion error is considerably smaller than the $18.1 billion error in the first iteration.

The process is repeated, and with each iteration the error will be smaller. Eventually, it will be trivial, and the process is stopped. Exhibit 3 shows the result after repeated iterations. In it, the options are worth $16.3 billion after taxes, or about 10% of the value of the common equity of $164.1 billion ($136.79 per share).

ESOs are a significant portion of Microsoft's capital structure. As a result, several iterations were necessary to find consistent equity and option values. Exhibit 4 shows how eventually that process led to consistent values for Microsoft's common equity and ESOs. For companies with few ESOs relative to the number of shares outstanding, two iterations are likely to be sufficient. Even for Microsoft, the $2.2 billion error after the second iteration is only about 1.3% of common equity value.

Note that this 1.3% error is the result of not computing more than two valuations. That is, it is the error induced by using the option value implied by the first pass at equity valuation, and then adjusting the equity for the option value. This does not mean that ESOs can be ignored altogether without a large error. Indeed, ignoring Microsoft's options would have induced two major valuation errors. First, free cash flow would have been valued $8.9 billion too high due to the exclusion of the cost of future ESO grants. Second, no value would have been allocated to the 239 million outstanding options. The resulting common equity value would have been about $157.75 per share [($180.4B+$8.9B)/1.2B], rather than $136.79, an overvaluation of about 15%.

SENSITIVITIES AND OTHER VALUATION METHODOLOGIES

Sensitivities

Exhibit 5 provides sensitivities of $\sum_{t=1}^{\infty} \frac{GRANT_t}{(1+k_c)^t}$, ESO_0, and common equity per share to key assumptions about future ESO grants and outstanding ESOs. Panel A shows that a one percentage point change in the growth rate in the value of future option grants affects the present value of those grants (after taxes) by about $1 billion. Because this affects the combined value of common equity and outstanding ESOs, it has an indirect impact on the value of the outstanding ESOs. The impact on common equity is less than $1 per share (0.6%). Panel B shows the sensitivity of the valuation to *p*, which affects both the future ESO grants and the outstanding ESOs directly. As *p* is reduced from the 1.00 used in the illustration to 0.90, the value of common equity falls by about $1 per share (0.9%). In the most extreme (and unlikely) case where *p*=0.00, the value of common equity falls by $11.64 per share (8.5%).

Panel C shows the sensitivity of the valuation of the outstanding ESOs to assumptions about the time to maturity. The most extreme possible cases are shown, with time to expiration used in the computation of option value ranging from immediate to the actual times to expiration. The difference in common equity in these two extreme cases is only $1.15 per share (0.8%). Finally, panels D and E show the sensitivities to standard deviation of returns and risk-free interest rate, respectively. Like the time to maturity, these sensitivities are very small. The reason for the small sensitivities in panels C, D and E is that the outstanding Microsoft ESOs are very deep in the money. Thus, their values are very close to the amounts they are in the money and depend very little on the t, σ and r. For another company whose options are not as deep in the money, the sensitivities to these three variables will be higher.

Valuation using Other Methods

This paper has focused on DCF analysis. However, the same approach can be used in conjunction with any equivalent methodology. For example, given consistent assumptions, a RI valuation will produce the same result as DCF. Exhibit 6 shows the Microsoft valuation summary (similar to exhibit 3) under the RI approach. If ESOs were ignored, the total value of equity in the DCF valuation would have been $180.0B + 10.3B - 1.0B = $189.3B. A RI valuation also would produce that amount, consisting of $9.8B of book value and $179.5B for the present value of the residual income. The present value of future ESO grants is $8.9B, so the combined value of common equity and outstanding ESOs is still $180.4 billion. An iterative process identical to the one used in the DCF case produces an aftertax ESO value of $16.3B.

SUMMARY

The principles of DCF valuation can be applied to ESOs. The same principles that lead one to deduct debt from firm value to estimate equity value imply that outstanding ESOs at the valuation date also must be deducted. Unlike debt repayments, however, ESO exercises may trigger tax deductions, which reduce the value of the firm's obligation. It is the aftertax ESO value that is deducted in the valuation. Similarly, just as the issuance of debt to finance a forecasted operating cost is treated as a free cash flow equivalent, the expected issuance of ESOs as employee compensation, net of expected tax benefits, also must be included in the free cash flow forecast.

The footnote disclosures mandated by SFAS No. 123 are extremely useful in incorporating ESOs in a DCF valuation. In particular, information about outstanding ESOs can be used to estimate the value of those options, while information about past grants can be used to forecast the aggregate values of future option grants. The cash flow statement disclosure of the tax benefits realized from option exercises can be used to estimate the tax effects related to both of the ESO components of the valuation.

Finally, consistent values of ESOs and common equity must be determined using an iterative process. For most firms, two iterations are sufficient. These consist of (a) a valuation of the firm's equity assuming the outstanding ESOs are worthless, (b) a valuation of the outstanding ESOs (net of tax) given the equity value determined in (a), and (c) a re-estimate of the equity value after deducting the ESO value determined in (b). For a firm having a substantial portion of its capital derived from ESOs, as Microsoft does, several iterations may be necessary to achieve consistent equity and option values.

NOTES

[1] Some valuation texts discuss outstanding ESOs. However, they generally do not address the valuation implications of forecasted future ESO grants or ESO-related income tax deductions, or the need to value ESOs and common equity simultaneously. See, for example, Copeland, Koller and Murrin (1994) and Palepu, Bernard and Healy (1996).

[2] For example, Huddart and Lang (1996) find the mean (median) proportion of elapsed ESO life at exercise to be 74% (82%).

[3] Debt expected to be issued for cash, in a debt-equity swap, or in any other purely financing transaction is ignored in the valuation. However, assuming that these transactions are fairly priced, they have no effect on the company's equity value.

[4] An "in-the-money" option is one where the option's strike price is below the market value of the underlying stock.

[5] While employees receive more favorable tax treatment for ISOs, employers receive more favorable treatment for NSOs.

[6] If the option can be sold on an organized exchange, then the employee recognizes income at the grant date for the amount the option is in-the-money at that time. The employer gets a deduction for the same amount. In that case, there are no tax consequences to either party at the exercise date, and the employee's basis to compute the capital gain or loss is the fair value at the grant date rather than at the exercise date. In most cases, however, ESOs are restricted and cannot be sold on an exchange.

[7] Although SFAS 123 does not require this amount to be disclosed, some firms do so. For example, General Electric includes the average stock price at time of exercise in its reconciliation of outstanding options. When available, this information can be used to make estimates of p more precise.

[8] Microsoft split its stock two-for-one in fiscal 1998 and again in fiscal 1999. The number of shares, number of options and per share amounts in the illustration were not adjusted for these splits, so that the illustration would be on a consistent basis with the fiscal 1997 financial statements. As a result, the per share value is not on a consistent basis with Microsoft's current stock price.

[9] Quarterly stock price data can also be used to better guage stock price activity during the year.

[10] Matsunaga, Shevlin and Shores (1992) suggest that the impact of the removal of the preferential treatment for capital gains may be mitigated by the possibility that such treatment could be reinstated in the future. It in fact was subsequently reinstated by the Taxpayer Relief Act of 1997.

[11] The expense recognized in a particular year under the accounting encouraged by SFAS 123 is not the value of the grants made in that year, because grant costs are capitalized and amortized. For the few firms that follow the recommended accounting, it is necessary to adjust the expense to the value of the grant.

[12] Theoretically, it would be equivalent to incorporate the value outflow as of the exercise date rather than the grant date. However, this approach would be much more complicated. It would involve forecasting the distribution of possible stock prices at the exercise date, and using an option pricing formula to bring the possible option values back to the grant date. Then, the value as of the grant date would have to be discounted back to the valuation date. However, the value as of the grant date of this distribution of future option values is just the fair value of the options at the grant date, which presumably would be used to derive the exercise date distributions. Thus, it is much simpler to incorporate the value of the eventual outflow as of the grant date rather than the exercise date.

[13] An analyst who wished to do so, could use <u>any</u> method desired to forecast future option grants without changing any of the other conclusions of this paper.

[14] As the ESO footnote states, these values are based on an expected life for the options, rather than the actual time to expiration.

[15] The option value is also a function of other parameters, all of which are exogenous to (6).

[16] Even if the SFAS 123 disclosure included the value of outstanding ESOs, the value would undoubtedly be based on the trading price of the underlying stock at the balance sheet date. Thus, the ESO value would not necessarily be consistent with the valuation.

[17] The Black-Scholes model is $CALL(S) = S \cdot N(d_1) - X \cdot exp(-r \cdot t) \cdot N(d_2)$, where:
$CALL(S)$ = value of a call option

S = per share value of the firm's equity
X = strike price on the option
t = time to expiration
σ = expected standard deviation of returns on the underlying stock
r = risk-free interest rate
$N(\cdot)$ = cumulative normal distribution function
$d = [\log(S/X) + r \cdot t] / (\sigma \cdot \sqrt{t})$
$d_1 = d + \sigma \cdot \sqrt{t} / 2$
$d_2 = d - \sigma \cdot \sqrt{t} / 2$

Although the computation uses the Black-Scholes model, any option valuation model formula could be used. In particular, for firms that pay dividends, the option pricing model employed should consider that fact. For example, the Black-Scholes model adjusted for dividends could be employed instead.

Appendix 1

Microsoft Corporation Cash Flows Statements

(In millions)

	Year ended June 30		
	1995	1996	**1997**
Cash flows from operations			
Net income	$ 1,453	$ 2,195	**$ 3,454**
Depreciation and amortization	269	480	**557**
Unearned revenue	69	983	**1,601**
Recognition of unearned revenue from prior periods	(54)	(477)	**(743)**
Other current liabilities	404	584	**321**
Accounts receivable	(91)	(71)	**(336)**
Other current assets	(60)	25	**(165)**
Net cash from operations	1,990	3,719	**4,689**
Cash flows used for financing			
Common stock issued	332	504	**744**
Common stock repurchased	(698)	(1,385)	**(3,101)**
Put warrant proceeds	49	124	**95**
Preferred stock issued			**980**
Preferred stock dividends			**(15)**
Stock option income tax benefits	179	352	**796**
Net cash used for financing	(138)	(405)	**(501)**
Cash flows used for investments			
Additions to property, plant, and equipment	(495)	(494)	**(499)**
Equity investments and other	(230)	(625)	**(1,669)**
Short-term investments	(651)	(1,551)	**(921)**
Net cash used for investments	(1,376)	(2,670)	**(3,089)**
Net change in cash and equivalents	476	644	**1,099**
Effect of exchange rates on cash and equivalents	9	(5)	**6**
Cash and equivalents, beginning of year	1,477	1,962	**2,601**
Cash and equivalents, end of year	1,962	2,601	**3,706**
Short-term investments	2,788	4,339	**5,260**
Cash and short-term investments	$ 4,750	$ 6,940	**$ 8,966**

See accompanying notes.

Appendix 2
Microsoft Employee Stock Option Footnote

Stock option plans The Company has stock option plans for directors, officers, and all employees, which provide for nonqualified and incentive stock options. The option exercise price is the fair market value at the date of grant. Options granted prior to 1995 generally vest over four and one-half years and expire 10 years from the date of grant. 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 10 years. At June 30, 1997, options for 113 million shares were vested and 290 million shares were available for future grants under the plans.
Stock options outstanding were as follows:

	Shares	Price Range		Weighted Average
Balance, June 30, 1994	228	$ 0.16 -	$ 25.07	$ 11.65
Granted	44	23.88 -	41.57	25.25
Exercised	(35)	0.16 -	23.88	7.91
Canceled	(9)	2.56 -	37.50	17.70
Balance, June 30, 1995	228	0.77 -	41.57	14.56
Granted	57	40.10 -	58.94	44.99
Exercised	(40)	0.77 -	45.25	10.75
Canceled	(7)	2.59 -	55.44	27.85
Balance, June 30, 1996	238	1.10 -	58.94	22.07
Granted	**55**	**55.31 -**	**119.19**	**58.29**
Exercised	**(45)**	**1.10 -**	**58.94**	**13.27**
Canceled	**(9)**	**17.00 -**	**97.13**	**38.83**
Balance, June 30, 1997	**239**	**2.24 -**	**119.19**	**31.43**

For various price ranges, weighted average characteristics of outstanding stock options at June 30, 1997 were as follows:

		Outstanding options			Exercisable options	
Range of exercisable prices		Shares	Remaining life (years)	Weighted average price	Shares	Weighted average price
$ 2.24 -	$ 17.00	65	3.5	$ 9.64	64	$ 9.63
17.01 -	24.00	65	5.4	20.81	39	20.10
24.01 -	55.00	56	5.8	43.13	10	41.02
55.01 -	119.19	53	6.6	58.47	-	-

The Company follows APB Opinion 25, Accounting for Stock Issued to Employees, to account for stock option and employee stock purchase plans. 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. Had compensation cost for these plans been determined based on the Black-Scholes value at the grant dates for awards as prescribed by SFAS Statement 123, Accounting for Stock-Based Compensation, pro forma net income and earnings per share would have been:

Year ended June 30	1995	1996	**1997**
Pro forma net income	$ 1,243	$ 1,902	**$ 3,053**
Pro forma earnings per share	$ 0.99	$ 1.48	**$ 2.32**

The pro forma disclosures above include the amortization of the fair value of all options vested during 1995, 1996, and 1997. If only options granted during 1996 and 1997 were valued, as prescribed by SFAS 123, pro forma net income would have been $2,073 million and $3,179 million, and earnings per share would have been $1.62 and $2.42 for 1996 and 1997.

The weighted average Black-Scholes value of options granted under the stock option plans during 1995, 1996, and 1997 was $10.46, $17.72, and $23.43. Value was estimated using an expected life of five years, no dividends, volatility of .30, and risk-free interest rates of 7.0%, 6.0%, and 6.5% in 1995, 1996, and 1997.

Exhibit 1

Proportion of Options Triggering Tax Deductions - Historical Analysis

		1995	1996	1997
Stock option income tax benefits ($ millions)	TB_E	179	352	796
Number of options exercised (millions)	n_E	35	40	45
Average stock price at exercise ($)	S_E	20	30	60
Average strike price of exercised options ($)	X	7.91	10.75	13.27
Assumed marginal tax rate	τ	.40	.40	.40
Proportion of exercised options triggering deduction*	p	1.06	1.14	0.95

$*p = TB_E \,/\, [n_E \times (S_E - X) \cdot \tau]$

Exhibit 2 - Valuation of Microsoft

	Panel A - Iteration 1	Panel B - Iteration 2
Value of free cash flow before future ESO grants	180.0	180.0
Value of future ESO grants	-8.9	-8.9
Present value of future free cash flow	171.1	171.1
Excess cash and equity investments	10.3	10.3
Debt	-0.0	-0.0
Preferred stock	-1.0	-1.0
Value of common equity and ESOs	180.4	180.4
Assumed value of ESOs	0.0	18.1
Equity value	180.4	162.3
Shares outstanding	1.2	1.2
Value per share	150.33	135.23

Computed value of existing options at above share value:

	Panel A				Panel B			
Range of exercisable prices	2.24- 17.00	17.01- 24.00	24.01- 55.00	55.01- 119.19	2.24- 17.00	17.01- 24.00	24.01- 55.00	55.01- 119.19
Number of options (millions)	65	65	56	53	65	65	56	53
Average exercise price (dollars)	9.64	20.81	43.13	58.47	9.64	20.81	43.13	58.47
Time to expiration (years)	2	3	4	5	2	3	4	5
Standard Deviation of returns	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Risk-free interest rate	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065
Black-Scholes value per option (dollars)	141.87	133.21	117.16	108.66	126.77	118.11	102.09	93.76
Tax rate	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Proportion with disqualifying disposition or NSO	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
After-tax option value per option (dollars)	85.12	79.93	70.29	65.20	76.06	70.87	61.26	56.26
After-tax option value (billions of dollars)	5.5	5.2	3.9	3.5	4.9	4.6	3.4	3.0
Total after-tax value of all options (billions of dollars)	18.1				16.0			
Error (Assumed ESO value - computed ESO value) (billions of dollars)	-18.1				2.2			

Exhibit 3

Valuation of Microsoft - Consistent Equity and Option Values

Value of free cash flow before future ESO grants	180.0
Value of future ESO grants	-8.9
Present value of future free cash flow	171.1
Excess cash and equity investments	10.3
Debt	-0.0
Preferred stock	-1.0
Value of common equity and ESOs	180.4
Assumed value of ESOs	16.3
Equity value	164.1
Shares outstanding	1.2
Value per share	136.79

Computed value of existing options at above share value:

Range of exercisable prices	2.24- 17.00	17.01- 24.00	24.01- 55.00	55.01- 119.19
Number of options (millions)	65	65	56	53
Average exercise price (dollars)	9.64	20.81	43.13	58.47
Time to expiration (years)	2	3	4	5
Standard Deviation of returns	0.3	0.3	0.3	0.3
Risk-free interest rate	0.07	0.07	0.07	0.07
Black-Scholes value per option (dollars)	128.41	119.92	104.30	96.30
Tax rate	0.4	0.4	0.4	0.4
Proportion with disqualifying disposition or NSO	1.0	1.0	1.0	1.0
After-tax option value per option (dollars)	77.05	71.95	62.58	57.78
After-tax option value (billions of dollars)	5.0	4.7	3.5	3.1
Total after-tax value of all options (billions of dollars)	16.3			
Error (Assumed ESO value - computed ESO value) (billions of dollars)	0.0			

Exhibit 4

Valuation of Microsoft - Summary of Iterations

Iteration	Aggregate Option Value ($ billions)	Per Share Stock Price ($)
1	$0.0	$150.33
2	$18.1	$135.23
3	$16.0	
.		
.		
.		
n	$16.3	$136.79
n+1	$16.3	

Exhibit 5

Sensitivities of Microsoft Valuation

Panel A: Growth rate in ESO grants

g	0.02	**0.03**	0.04
$\sum_{t=1}^{\infty} \frac{C_{G,t} \cdot (1 - t \cdot p)}{(1+k_c)^t}$	$7.9 B	**$8.9 B**	$10.1 B
ESO_0	$16.4 B	**$16.3 B**	$16.1 B
Common equity per share	$137.54	**$136.79**	$135.90

Panel B: Proportion of ESOs Triggering a Tax Deduction

p	0.00	0.90	**1.00**
$\sum_{t=1}^{\infty} \frac{C_{G,t} \cdot (1 - t \cdot p)}{(1+k_c)^t}$	$14.8 B	$9.4 B	**$8.9 B**
ESO_0	$24.3 B	$17.2 B	**$16.3 B**
Common equity per share	$125.15	$135.62	**$136.79**

Panel C: Time to Expiration of Outstanding ESOs (in years)

t	0,0,0,0	**2,3,4,5**	3.5, 5.4, 5.8, 6.6
ESO_0	$15.2 B	**$16.3 B**	$16.6 B
Common equity per share	$137.63	**$136.79**	$136.48

Panel D: Standard Deviation of Returns

s	0.20	**0.30**	0.40
ESO_0	$16.2 B	**$16.3 B**	$16.3 B
Common equity per share	$136.81	**$136.79**	$136.73

Panel E: Risk-Free Interest Rate

r	0.06	**0.07**	0.08
ESO_0	$16.1 B	**$16.3 B**	$16.4 B
Common equity per share	$136.89	**$136.79**	$136.70

Exhibit 6

Valuation of Microsoft - Residual Income Approach

Book value of common equity	9.8
Value of residual income ignoring ESOs	179.5
Value of future ESO grants	-8.9
Value of common equity and ESOs	180.4
Assumed value of ESOs	16.3
Equity value	164.1
Shares outstanding	1.2
Value per share	136.79

Computed value of existing options at above share value:

Range of exercisable prices	2.24-17.00	17.01-24.00	24.01-55.00	55.01-119.19
Number of options (millions)	65	65	56	53
Average exercise price (dollars)	9.64	20.81	43.13	58.47
Time to expiration (years)	2	3	4	5
Standard Deviation of returns	0.3	0.3	0.3	0.3
Risk-free interest rate	0.07	0.07	0.07	0.07
Black-Scholes value per option (dollars)	128.41	119.92	104.30	96.30
Tax rate	0.4	0.4	0.4	0.4
Proportion with disqualifying disposition or NSO	1.0	1.0	1.0	1.0
After-tax option value per option (dollars)	77.05	71.95	62.58	57.78
After-tax option value (billions of dollars)	5.0	4.7	3.5	3.1
Total after-tax value of all options (billions of dollars)	16.3			
Error (Assumed ESO value - computed ESO value) (billions of dollars)	0.0			

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