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EQUITY COMPENSATION ISSUE ALERT

How Unrefined Expected Term Approaches Create Audit Risk

Many companies use the Black-Scholes-Merton formula to value their plain vanilla employee stock options, although considerable differences exist as to how they estimate the key input, expected term. In this Equity Compensation Issue Alert, we compare the differences between rigorously developed expected terms and "simplified" or "unrefined" expected terms among a sample of 25 companies. Simplified or unrefined estimates are those developed without analysis as to how historical data should be used in a representative manner, whether different employee groups exhibit distinct exercise patterns, and which expected term estimation technique is most appropriate. Our results illustrate how simplified expected term estimates can differ substantially from estimates produced by expert and judgment-driven analyses, and that this difference can have material financial statement implications. Conducting a rigorous analysis of expected term will result in an estimate that is more robust, compliant, and defensible than the alternative. This has implications for auditors, regulators, and companies estimating expected terms for options as part of their Accounting Standards Codification Topic 718 (ASC 718) compliance process.

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EXECUTIVE SUMMARY

Considerable heterogeneity exists with regard to companies' techniques for estimating the expected term assumption for their employee stock option grants being valued in the Black-Scholes-Merton (BSM) formula. Some companies rely on automated expected term "calculators" generated within their equity administration system (such as the popular "Midpoint Method"). In many cases, however, these simplified approaches produce expected term results that are not reliable for ASC 718 (formerly, Statement of Financial Accounting Standards 123 Revised or "FAS 123R") purposes, because they do not:

1) Test for the possibility that different groups of employees exhibit distinct exercise patterns;
2) Incorporate a process for filtering out records in the historical data that are not representative of the awards being valued in the present; and
3) Give consideration to competing expected term estimation models (techniques) based on the dynamics of the historical data.

For purposes of this paper, an expected term approach is termed "simplified" or "unrefined" if it does not involve formal analysis into one or more of the above three areas. In contrast, an analytical or judgment-driven expected term estimation approach does formally consider each of the above three technical areas.

As public accounting firms, the Securities and Exchange Commission (SEC), and the Public Accounting Oversight Board (PCAOB) continue to refine their expectations concerning employee stock option valuation, this Equity Compensation Issue Alert demonstrates the benefit of conducting a rigorous expected term analysis to decrease the inherent imprecision or bias present in simplified expected term calculations.

First, we provide a summary of the relevant accounting guidance on expected term discussed in ASC 718. Next, we present the results of a study performed by Equity Methods, which leverages comprehensive historical data of 25 companies. This study quantifies the difference between simplified expected term calculations and more rigorously developed expected term estimates that involve testing for differences in exercise behavior across employee groups, excluding non-representative historical data, and selecting an expected term estimation model that best fits the dynamics in the historical data.[1] The research illustrates how performing rigorous analyses can materially affect the expected term assumption, which directly affects compensation expense recognized in the financial statements. Our focus is on the three aforementioned estimation topics and their materiality/relevance.

Our results suggest it is not appropriate to merely run all historical data through a simplified "expected term calculator," even if that calculator includes a generally accepted technique such as the "Midpoint Method." Whereas auditors historically focused on testing for the partial life cycle bias (addressed by the Midpoint Method), we expect the next area of audit scrutiny to include the manner in which historical data are used and analyzed. This is especially likely in cases where recipient pools have changed substantially over time, cases where a wide variety of award characteristics (e.g., multiple vesting schedules) are reflected in the historical data, cases where current grants are not similar to historical grants, and cases where non-representative exercise and cancellation activity are known to be present in the data. We believe companies should conduct rigorous analyses on expected term to mitigate the associated audit and financial statement risks that could result from reliance on simplified expected term estimates.

[1] In the current study, tests were conducted using the popular "Midpoint Method" as the expected term technique. The Midpoint Method is a common estimation technique because it formally incorporates unexercised options, thus addressing the partial life cycle bias. The time between grant and settlement is calculated on settled options and then combined (using a weighted average) with an expected time between grant and settlement on unsettled options. The expected settlement date on unsettled options is generally computed as the midpoint between the valuation date and option expiration date. While likely to remain a popular estimation technique, it is certainly not optimal in all cases.

TOPIC INTRODUCTION – WHAT ASC 718 SAYS ABOUT EXPECTED TERM ESTIMATION

As noted above, at least three areas of best practice related to development of the expected term assumption are missing from simplified expected term calculators utilized by many companies in their employee stock option valuation processes. These areas of best practice include:

1) *Groups Analysis* which involves testing for the possibility that different groups of employees exhibit distinct exercise patterns;
2) *Exclusions Analysis* which involves isolating and removing records in the historical data that are not representative of expected future behavior; and
3) *Methodology Analysis* which involves consideration of competing expected term methodologies and selection of the most appropriate method based on relevant information and circumstances.

In this section, we summarize the guidance in ASC 718 on expected term estimation and explain how each of these best practices on expected term flow naturally from the accounting guidance.[2]

Groups Analysis

Often the simplest of the three practices noted above is the need to statistically test whether separate homogeneous employee groups exhibit different exercise patterns. For example, published academic research identifies a common trend of executives holding their options longer than non-executives.[3] ASC 718 specifically mentions the importance of testing for such differences in exercise behavior:

ASC 718-10-55, Paragraphs 33-34

> Estimating the fair value of an option based on a single expected term that effectively averages the differing exercise and post-vesting employment termination behaviors of identifiable groups of employees will potentially misstate the value of the entire award.
>
> Aggregating individual awards into relatively homogenous groups with respect to exercise and post-vesting employment termination behaviors and estimating the fair value of the options granted to each group separately reduces such potential misstatement. An entity shall aggregate individual awards into relatively homogenous groups with respect to exercise and post-vesting employment termination behaviors regardless of the valuation technique or model used to estimate the fair value.

[2] This Issue Alert is not meant to serve as a comprehensive guide to companies on how to conduct a rigorous expected term analysis. The particular analyses discussed in this section are presented because they are often not a part of the process of developing software-based expected term estimates. Thus, they illustrate the main points of divergence between simplified and rigorous expected term estimation processes. A comprehensive expected term analysis would potentially involve other analyses and consideration of additional relevant information points as well.

[3] A study by S. Huddart cited in SAB 107 found that executives and senior managers hold their options for significantly longer periods than their more junior counterparts. See S. Huddart, "Patterns of stock options exercise in the United States," in J. Carpenter and D. Yermack, eds., Executive Compensation and Shareholder Value: Theory and Evidence (Kluwer, Boston, MA, 1999), pp. 115-142. See also S. Huddart and M. Lang, "Employee stock option exercises: An empirical analysis," Journal of Accounting and Economics, 1996, pp. 5-43.

Of course, many companies will run such a test and find that exercise behavior is generally constant across their employee base. SEC Staff Accounting Bulletin (SAB) 107, Page 33 notes that it is acceptable to have only one employee group and thus one expected term assumption, but only after an analysis has been conducted to validate that differences across groups are not present. Thus, the best practice is not to force multiple expected term assumptions for multiple employee groups, but rather, statistically test whether material exercise behavior differences exist. In the event they do, it is of course then necessary to assign different expected term assumptions to each employee group.[4]

Exclusions Analysis

A second critical component often overlooked in the development of unrefined expected term estimates is the careful removal of non-representative historical data from the expected term calculation process. Equity Methods refers to this as *exclusions analysis.* Our policy position based on experience and knowledge of the accounting guidance suggests it is not appropriate to upload all historical exercise and cancellation data to a system, "push a button," and leverage the resulting expected term output without performing this type of intermediary analysis. In our opinion, the prudent and correct approach is to comb through the historical data to determine which historical grants (and their corresponding exercise behavior) are representative of those grants being valued. For instance, if present-day grants have a 5-year contractual term but historical grants had a 10-year contractual term, it is necessary to either exclude those historical grants altogether or apply some type of adjustment to the historical data. Quite simply, *more* data does not always mean *better* data, and just because data are available does not necessarily mean they are representative for assumption development purposes.[5]

Although not as principles-oriented as its cousin IFRS 2, ASC 718 shies away from providing bright-line tests when discussing expected term estimation, and instead emphasizes how judgment should be applied when analyzing historical data to ensure the data faithfully represent the present-day valuation for which the data are being leveraged:

ASC 718-10-55, Paragraph 24
Historical experience is generally the starting point for developing expectations about the future. Expectations based on historical experience shall be modified to reflect ways in which currently available information indicates that the future is reasonably expected to differ from the past. The appropriate weight to place on historical experience is a matter of judgment, based on relevant facts and circumstances.

[4] The effects of calculating a separate expected term in a case where the ratio of grants for two separate groups has changed dramatically is illustrated in the following example. Consider a company that has been issuing options under two separate plans since inception, and each plan has a different vesting schedule. Plan 1 uses 1-year cliff vesting, while Plan 2 uses 4-year graded vesting. Historically, each plan has accounted for 50% of the options granted. Using the Midpoint Method, an expected term of 3.90 years is calculated for the 1-year vesting group, and an expected term of is 5.80 years is calculated for the 4-year vesting group. Since the historical data includes 50% of the options for each group, the Midpoint Method with no groups equals the weighted average of the two groups, or 4.85 years. The need for the company to value these two plans separately becomes apparent when Company B decides to issue 90% of their grants under Plan 1, and 10% under Plan 2, a ratio that is not reflected in their historical data. If Company B used the historical data with no groups to calculate an expected term, they would be using a 4.85-year expected term for both option plans, when in reality 90% of the grants should have an expected term of 5.80 years, and 10 percent of the grants should have an expected term of 3.90 years. The expected term would be drastically underestimated for 90% of the grants, and would be overstated for 10% of the grants.

[5] While the focus of this Issue Alert is on illustrating the imprecision or bias of software-based expected term estimates, it should be noted that the basic argument for the need for a rigorous analysis of historical data (including groups and exclusions analyses) applies to the development of forfeiture rate estimates as well.

Equity Methods' interpretation is that this paragraph directs companies to perform an exclusions analysis on their data before using it for expected term calculations. Otherwise, historical data are constituting the "ending point" and not the "starting point," as directed in the guidance above. After the exclusions process is complete, Equity Methods refers to the filtered dataset as an "Inference Dataset," because it represents that subset of the full historical data from which reliable *inferences* can be drawn about future settlement behavior. Filtering historical data allows for the removal or adjustment of awards which are not representative of those currently being granted or expected to be granted in the future.

Examples of records in the data that may require exclusion or special handling include awards assumed through a business acquisition, cancellations from a large, one-time reduction in force, awards with irregular and significantly different vesting schedules, and awards with substantially different contractual terms. With that said, considerable best practices have arisen with regard to the types of exclusions that are appropriate. For example, a consensus exists that it is generally not acceptable to exclude time periods involving intense market volatility, such as the economic meltdown in 2008. Although the scope of this paper does not delve deeply into such topics, it is important to note how the accounting firms and other subject-matter experts have informally arrived at a general consensus with regard to the types of awards/circumstances that should and should not be excluded.

Methodology Analysis

Expected term estimates are highly sensitive to the methodology that is used to compute them. The third best practice that is typically not addressed within simplified or unrefined approaches is analysis to determine the calculation methodology that is most appropriate given the dynamics in the historical data. Numerous calculation methodologies exist for expected term, such as holding periods from vesting instances, the aforementioned Midpoint Method,[6] various actuarial-based approaches, and even lattice-based approaches. Estimates produced by these methods using the same inference dataset can vary widely, yet all meet the basic criteria: incorporating exercises and post-vesting cancellations, as well as some estimate regarding expected settlement behavior on outstanding awards. ASC 718 indicates that companies should generate assumption estimates that are reasonable and supportable:

ASC 718-10-55, Paragraph 19
Regardless of the valuation technique or model selected, an entity shall develop reasonable and supportable estimates for each assumption used in the model, including the employee share option or similar instrument's expected term…

Companies should perform an analysis to establish which expected term methodology is most appropriate based on all relevant information available at the time of a new option grant. As noted in SAB 107, page 31, the expected term estimate should be based on the facts and circumstances available in each particular case.

Circumstances Where the Midpoint Method is Not Appropriate

Equity compensation valuation subject-matter experts in the accounting firms spent 2006 to 2009 identifying companies relying on expected term estimation methods that failed to estimate the future settlement behavior of outstanding awards (and thus were susceptible to the partial life-cycle bias). As a result, many companies employ the Midpoint Method

[6] Numerous other methods exist as well. Usually these methods produce expected terms based on weighted averages, although it should be noted that the use of a *weighted* average methodology can in some cases produce unreasonable expected term estimates, depending on how the weights of settlement activity in the data for different recipient pools correspond to current granting practices and recipient pools.

(described above), which we agree is a generally robust means of estimating expected term in some cases because it applies a simple and yet reasonable assumption as to the expected timing in which outstanding options will be settled. This methodology for calculating expected term is now available in some administration software systems and third-party software products.

Unfortunately, circumstances exist in which the Midpoint Method is not the most appropriate means of modeling settlement behavior for purposes of generating an expected term estimate. The Midpoint Method adjusts a weighted-average historical holding period calculation on settled awards by factoring in currently outstanding awards. A few instances in which the Midpoint Method may yield biased or incorrect results include the following:

- Historical Holding Period estimates are expected to be non-reliable for reasons other than the presence of outstanding options;
- Vesting of current grants is longer than the vesting of most grants in the historical data;
- Vesting of current grants is shorter than the vesting of most grants in the historical data;
- A wide variety of vesting schedules are contained in the historical data;
- Grants are made to executives or officers of the company, who may be reasonably expected to hold their options past the midpoint date.

In short, the Midpoint Method makes a number of assumptions, which may not hold true:

- Vesting schedules on historical grants are identical or similar to vesting schedules on current grants; and
- Employees do not have an observable back-loaded or front-loaded exercise strategy.

Elaborating on the second assumption, it is often empirically observable that employees deliberately hold their options until 6 months before they expire—in this case, the straight-line settlement assumption contained in the Midpoint Method would downward bias the expected term estimate. Alternatively, it is sometimes also observable that employees have a "surge" of exercise activity near the time that their awards vest, thus suggesting exercise may be front-loaded (to the extent the awards are in-the-money at the time of vesting).

In these and other cases, the Midpoint Method can yield biased expected term results. Companies should thus perform an analysis as to what the most appropriate expected term methodology is, given the characteristics of past grants and settlement activity in the historical data as well as the characteristics of current grants, recipient pools, and other available information. Since much of ASC 718 is principles-driven (versus rules-driven through the application of strict bright-line tests), it is particularly important that *de facto* rules do not emerge on the question of methodology and crowd-out case-specific judgment and analysis.

How a Rigorous Analysis Fits into the Accounting Framework

Taken together, the three best practices described above point to the value that a rigorous analysis of the data and circumstances facing companies at the time of a new grant can provide in determining reasonable, compliant expected term estimates. We find consistency between the tone in ASC 718 of applying judgment to the use of historical data and broader framework issues contemplated in Statement of Financial Accounting Concepts No. 2 (CON 2)[7]. The fundamental

[7] Note that although the Statements of Financial Accounting Concepts were not codified under the Accounting Standards Codification initiative (ASC), this initiative was not intended to undo or change GAAP. Thus, we believe it remains appropriate to appeal to the Statements of Financial Accounting Concepts when trying to understand how specific decisions should be made in light of the accounting framework.

goal in ASC 718 is the generation of a *reliable* grant-date fair value, given information available at the time the valuation is being performed. CON 2 defines reliability as one of the two primary qualities that make accounting information useful for decision making (Page 6):

CON 2, Page 6
The reliability of a measure rests on the faithfulness with which it represents what it purports to represent, coupled with an assurance for the user that it has that representational quality.

Our experience suggests the compliant response to ASC 718's characterization of historical data as the "starting point" is an estimation framework predicated on representational faithfulness. This framework hinges on a rigorous analysis of the historical data so as to identify potential groups in the data, identify and exclude / adjust those grants that are not representative of present-day grants, and select a methodology for expected term that is appropriate given all relevant facts and circumstances. The research study that follows in this Equity Compensation Issue Alert demonstrates the value-relevance of both group's analysis and exclusions analysis (Inference Dataset creation), in the context of the often-used Midpoint Method.

Empirical Study: Do Simplified, Software-Based Expected Terms Differ From Analysis-based Expected Terms?

Although we believe the guidance is sufficiently clear that the best practice areas discussed above should always be applied, there is a natural curiosity as to their financial statement materiality. In other words, just because there is appeal *in theory* to performing rigorous analyses, will such analyses yield different assumptions *in practice*? What is the financial statement impact of bypassing the added effort of the analyses described above and, instead, merely pushing data through a calculator? To answer this question, we performed a study on 25 companies' data to investigate the difference between simplified expected term estimates and more rigorously developed expected term estimates, as explained in the prior section.

Our research is based on proprietary data containing comprehensive stock option grant, vesting, exercise, and cancellation information for the 25 companies included. The companies in the study represent full valuation engagements conducted by Equity Methods in the past, and offer a range of different expected term and grouping recommendations. All have been successfully presented and defended in the external audit process. For each company, we simulated simplified (unrefined) expected term results by eliminating all forms of analysis and simply pushed all the historical data through a plain Midpoint Method algorithm.

The companies included in the study span different market capitalizations and industries; summary statistics on their composition are provided in Figures 1 and 2 below. In general, the cross-section of firms studied provides a representative sample of the broad market.

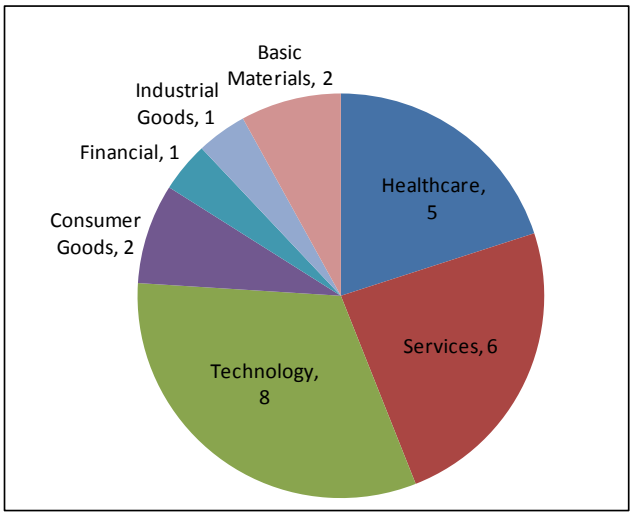

Figure 1: Sector Composition of Companies in Study

Market Capitalization	
Min	$31 MM
Max	$43.7 B
Mean	$6.5 B
Median	$1.0 B

Figure 2: Market Capitalizations

For each firm in the sample, we first compiled several competing expected term estimates. The first estimate formed was a basic Midpoint Method calculation using an unadjusted full dataset with no exclusions and no separation of the calculations into employee groups. We refer to this as the "Simplified Calculation without Groups." The second calculation uses the Midpoint Method without a grouping scheme but with an Inference Dataset that removes non-representative grants. We call this the "Analysis-based Calculation without Groups." Finally, the third calculation uses the Midpoint Method with a grouping scheme (where appropriate) and an Inference Dataset. We refer to this as the "Analysis-based Calculation with Groups."

In other words, "Simplified" calculations for purposes of this study are those that involve no exclusions analysis and "Analysis-based" calculations involve an exclusions analysis. We performed a multitude of tests to determine whether some or all of the best practice principles described above materially impact expected term estimates. The four different scenarios are depicted in Figure 3 below.

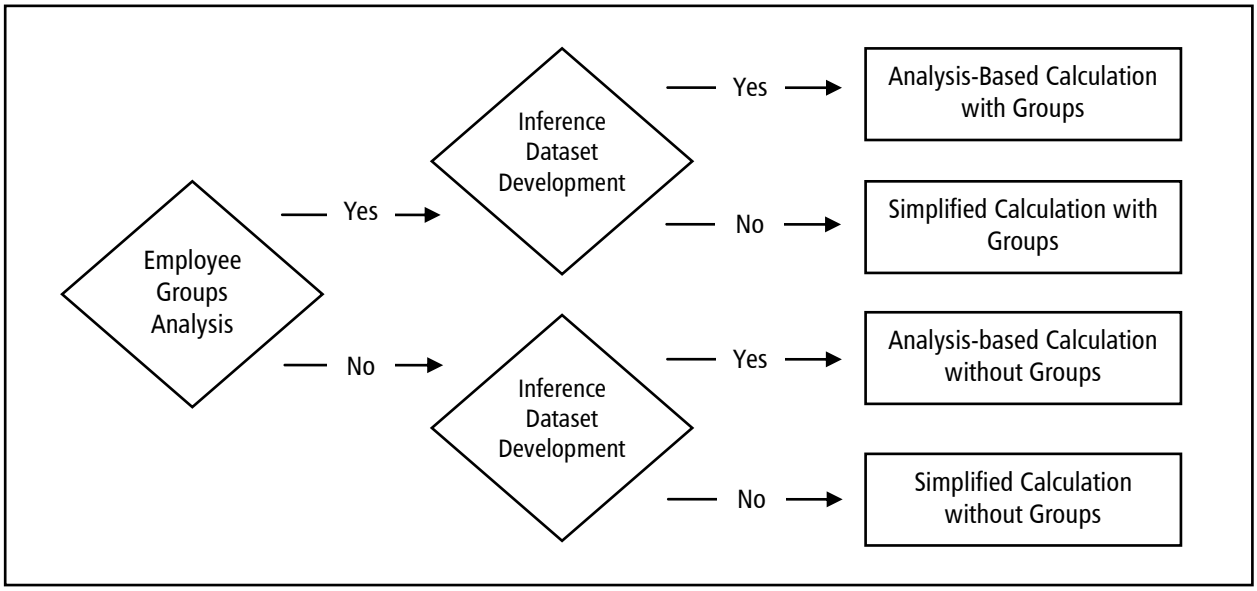

Figure 3: Graphical Depiction of Research Design

Our opinion, based on the guidance of ASC 718 described above and interaction with both auditors and regulators, is that an Analysis-based calculation (with testing for Groups) is necessary.[8] The purpose of this study is to determine whether this particular approach yields materially different results than simplified approaches. Said differently, we investigate whether material differences exist in expected term estimates derived from unrefined applications of the Midpoint Method and estimates produced by rigorous analyses that test whether homogeneous employee groups exhibit distinct exercise patterns and isolate non-representative historical grants for exclusion. Steps were taken to carefully isolate each variable. The following comparison tests were performed:

Test Case	Expected Term 1		Expected Term 2
1	Analysis-based without Groups	*Compared to*	Analysis-based with Groups
2	Simplified without Groups	*Compared to*	Analysis-based without Groups
3	Simplified without Groups	*Compared to*	Analysis-based with Groups

Table 1: Expected Term Comparison Test Case Descriptions

The first test case compares an Analysis-based expected term including a Groups Analysis to an Analysis-based expected term without a Groups Analysis, therefore isolating and demonstrating the impact of Groups Analysis on expected term estimates in cases where an exclusions analysis has already been performed. The second test case demonstrates the benefit of exclusions analysis by isolating the effect of evaluating the historical settlement data for non-representative grants in order to formulate an Inference Dataset. The third test case combines the effects of testing for groups as well as performing an exclusions analysis on the data. This test case, the most important of the three test cases in our study, reflects the impact of performing a comprehensive expected term analysis (including both groups and exclusions) on the expected term estimate. In each test case, the expected term methodology was controlled by using the Midpoint Method in every analysis.

Test Case 1: Impact of Groups Analysis

The first test conducted isolates and quantifies the impact of a Groups Analysis on the expected term assumption.[9] To do this, we used 15 companies in our 25-company sample that were recommended the Midpoint Method with separate groups in a past Equity Methods analysis. To ensure that the impact of a Groups Analysis was properly isolated, both test cases utilized an Inference Dataset that had exclusions applied to remove any non-representative grants. As noted above, ASC 718 requires that a company test whether a variance in exercise behavior exists among multiple grouping categories. If diversity between groups is present, the guidance states that the options should be valued separately using different assumptions (ASC 718-10-55, Paragraphs 33-34).[10]

[8] For clarity, we are not suggesting every firm must establish separate expected term groups, but rather, every firm should statistically test whether such a bifurcation is optimal given the historical exercise and post-vesting trends observed.

[9] It is well known that executives often have a tendency to hold on to their options for significantly longer periods than their more junior counterparts, and this gap often increases when the recipient pool includes entry-level employees. Other grouping variables worth investigating include country of residence, tenure with the firm, and option plans with significantly different vesting conditions.

[10] The guidance does not explicitly state at what point two separate groups should be considered different enough to separate and value separately. Obviously, these decisions should always be investigated on a case-by-case basis. Aside from the current study, the importance of the grouping exercise is demonstrated by the example of a recent expected term analysis conducted by Equity Methods for one of its' clients. The company had historically granted options to both executives and rank & file employees, and therefore had large amounts of data representing both groups. In 2010, the client changed their compensation strategy to only issue stock options to executives. An Analysis-based calculation without groups yielded an expected term of 4.81 years. Separately, an Analysis-based calculation with groups was performed for the two different groups (executive and rank & file): executives held their options, on average, 7.33 years, whereas rank & file employees held their options, on average, 4.19 years. The expected term for executives is, in fact, 52% longer than that of the entire population. With all other variables held constant, the Black-Scholes Merton valuation was 22% higher when using the executive expected term result instead of the entire population's aggregate result.

In order to test the data for separate homogeneous groups, Equity Methods combined human resources data and descriptive statistics with the grant, exercises, and vesting datasets to search and test for patterns. The groups identified in the analyses varied by company, but the most common groups that showed significant variance were different vesting schedules and several variations of grouping by officers, directors, or senior executive teams. The full listing of grouping fields is illustrated in Table 2 below.

Group 1	Group 2	Frequency
Officers	Non-Officers	3
Board of Directors	Employees	2
Senior Executive Team	All Others	4
Section 16 Insiders	All Others	1
Vesting Type One	Vesting Type Two	5

Table 2: Grouping Schemes Represented in the Sample for Test Case 1

A separate Midpoint expected term was calculated for the Analysis-based Calculation without Groups and for the Analysis-based Calculation with Groups in order to reveal the effect that the Groups Analysis had on the assumption. On average, the expected term for each separate group differed from the expected term without groups by 0.8 years. In the most extreme case we investigated, one of the group's expected terms differed from the "no groups" calculation by 4.4 years.

Statistics for the expected term assumptions calculated with and without groups for these companies are shown in Table 3 below. The most important statistic in Table 3 is the mean and maximum difference in expected term estimates, as they are an indicator of possible variances between the two calculations.

Expected Term Statistic	Analysis-based Calculation without Groups	Analysis-based Calculation with Groups	Difference in Expected Term Estimates
Min	3.4 years	3.4 years	0.0 years
Max	6.6 years	9.8 years	4.4 years
Median	5.0 years	5.5 years	0.4 years
Mean	5.1 years	5.6 years	0.8 years
Company Count	15	15	15

Table 3: Summary Statistics on Expected Terms Analyzed in Groups Analysis Test Case

It is important to note that not all companies will find that their data are comprised of separate homogeneous groups. In fact, in our sample of 25 companies, Equity Methods recommended groups for 15 of the 25 companies that we also recommended use of the Midpoint Method to, and we determined that homogeneous groups did not exist for the remaining 10 companies. The reason the test is important is that many companies have at some point in their history implemented broad changes to their option granting practices with a large focus on the depth of the plan throughout the organization. While equity compensation remains a growing and prolific compensation vehicle, the mix of equity award types has usually changed to include more or fewer options (relative to restricted stock) being targeted at certain groups. *For these companies which have implemented broad changes to the recipient pool or issue grants with materially different vesting characteristics, it is particularly important to test for groups to ensure compliance with ASC 718.*

Because the calculation of a single expected term without groups is based on the weighted average shares of various recipient pools in the historical dataset, testing for groups becomes even more important when the weight of each recipient pool in the historical data differs from the weighting reflected in present-day grant practices. If the amount of shares granted to each separate group is not represented by the weights in the historical data, the risk of misestimating the expected term for each separate group becomes larger, especially if each group behaves differently.

In order to determine if the differences in Test 1 were statistically significant and could be consistently expected, we conducted a paired *t* test and tested the null hypothesis that the mean of the differences is zero. In this test, we compared the expected term results from the Analysis-based Calculation without Groups to the Analysis-based Calculation with Groups, in order to isolate the Groups variable.

Paired *t* Test (Null Hypothesis: Mean Difference = 0)	**Group 1 Results**	**Group 2 Results**[11]
Average	0.9 years	0.8 years
Standard Deviation	0.8483	1.1991
N	15	13
Degrees of Freedom	14	12
Test Stat	**4.1656**	**2.2814**
Probability that Mean Difference = 0	**0.0476%**	**2.0787%**

Table 4: Paired *t* Test Results for Differences in Simplified and Analysis-Based Expected Terms

The results in Table 4 above indicate that the possibility of the null hypothesis being true is extremely small, with a 0.048% possibility of Group 1 being the same as the no-group result, and a 2.079% possibility of Group 2 being the same as the no-group result. Therefore, we reject the null hypothesis and conclude that the mean of the differences in the expected term estimates is not zero. This means that groups analysis is important: if a company does in fact have separate homogeneous groups present in the data, then it is likely to see different expected term results for each of its groups.

Test Case 2: Impact of Exclusions Analysis

The second analysis we performed tests the impact of excluding or modifying grants that are not representative of future expectations. This analysis is the most difficult to implement without a thorough analysis and understanding of the historical data; simplified or unrefined approaches, by definition, involve mechanically "herding" all the historical data through a calculator without consideration as to the representational faithfulness of the various components comprising the data. As introduced earlier, one of the first steps a company should take when using historical data to predict future settlement behavior is to determine what portions of the data are, in fact, representative of present-day grants and settlement expectations on these grants. The departure point in ASC 718 for building an Inference Dataset is the notion that "expectations based on historical experience shall be modified to reflect ways in which currently available information indicates that the future is reasonably expected to differ from the past."[12]

In our professional practice, we carefully scrutinize historical data to ensure that only representationally faithful components are included in the analysis. The process depicted in Figure 4 below identifies and removes non-representative grants to create an Inference Dataset that is better positioned to provide accurate expected term estimates. In this phase, Equity Methods uses powerful statistical techniques to identify and summarize grant characteristics such as contractual terms, vesting descriptions, award types, award classes, recipient pools, and cancellation reasons as well as granting and exercise patterns. These summary statistics allow us to compare the historical grant data with the anticipated grant characteristics and recipients. Thus, characteristics that match are retained in the inference dataset, while characteristics that are not representative are removed to prevent possible bias and skewing of the results.

[11] Group 2 has two less observations because in these cases, Equity Methods recommended separating groups, but the second group was a group that was no longer receiving awards in the future, and therefore was not recommended going forward.

[12] ASC 718-10-55-55 states: "Historical experience is generally the starting point for developing expectations about the future. Expectations based on historical experience shall be modified to reflect ways in which currently available information indicates that the future is reasonably expected to differ from the past. The appropriate weight to place on historical experience is a matter of judgment, based on relevant facts and circumstances."

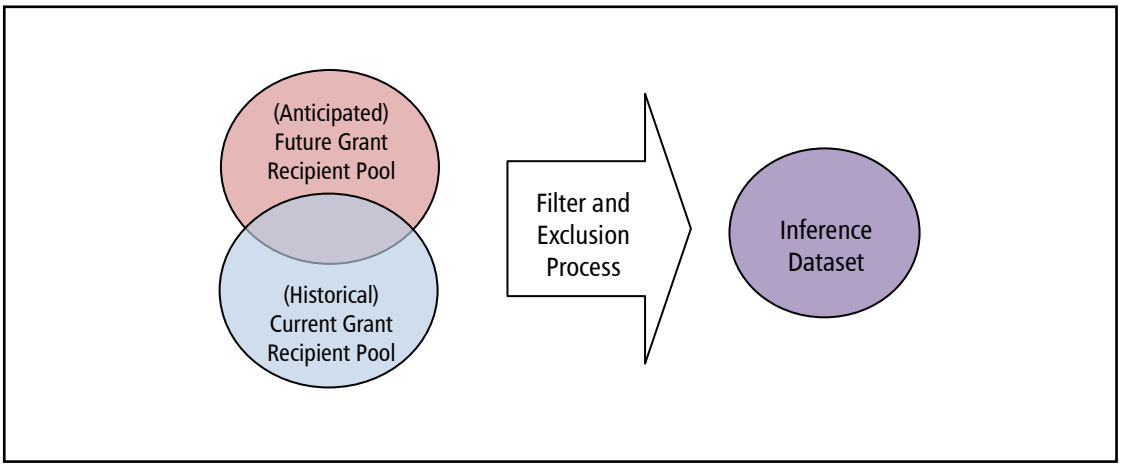

Figure 4: Creation of Inference Dataset

Examples of grants that are commonly excluded are:

- Option plans from business acquisitions,
- One-time reductions in workforce that are not expected in the future,
- One-time cancellation events due to a spinoff,
- One-time cancellation events due to an options exchange or re-pricing,
- Grants with significantly different vesting or contractual term characteristics, and
- Grants with unexplainable logical data errors.

Data errors are more common than many expect, especially when dealing with large datasets which include grants issued over a decade ago, as these companies are often more likely to have merged datasets or undergone a change in administration systems. Best practice also suggests using data that are over 10-years old in order to reduce the impact of the partial life cycle bias.

In order to test for the effects of exclusions, we selected 10 companies out of our sample set of 25 companies for which we recommended the Midpoint Method but did not recommend separating the valuation by groups. This process ensured that all other variables were controlled and any difference in expected term would be the direct cause of the exclusions process. We then calculated a Midpoint Method expected term for each company twice: once without exclusions and once with exclusions. After the expected terms were calculated under each scenario for all 10 companies, we were able to compare the results for the Simplified Calculation without Groups to the Analysis-based Calculation without Groups.

The results depicted in Table 5 below reveal that the average expected term for the 10 companies using the Simplified Calculation without Groups was 4.7 years, while the Analysis-based Calculation with Groups was 5.1 years. The average variance in expected term was 0.4 years, while the maximum variance was 0.8 years.

Expected Term Statistic	Simplified Calculation without Groups	Analysis-based Calculation without Groups	Difference in Expected Term Estimates
Min	3.2 years	4.0 years	0.1 years
Max	6.7 years	7.1 years	0.8 years
Median	4.5 years	4.7 years	0.4 years
Mean	4.7 years	5.1 years	0.4 years
Company Count	10	10	10

Table 5: Summary Statistics on Expected Terms Analyzed in Exclusions Analysis Test Case

As expected, the results of excluding non-representative grants on the expected term varied greatly by company, from 0.1 years to 0.8 years. Companies with large one-time cancellation events or unique one-off grants can expect to see the greatest variance after applying exclusions. Regardless, it is important that a company undergo the exercise in order to better understand the impact and ensure that the expected term calculation is informed by relevant and representative data. An expected term calculated on the full historical dataset may be representative of past granting patterns, but may not be representative of future expectations.

Once again, in order to determine if the differences in Test 2 were statistically significant and could be consistently expected, we conducted a paired *t* test and tested the null hypothesis that the mean of the differences in expected terms is zero. In this test, we compared the expected term results from the Simple Calculation without Groups to the Analysis-based Calculation without Groups, therefore isolating the effect of excluding non-representative grants.

Paired *t* Test (Null Hypothesis: Mean Difference = 0)	**Test Results**
Average	0.4 years
Standard Deviation	0.2322
N	10
Degrees of Freedom	9
Test Stat	**5.6793**
Probability that Mean Difference = 0	**0.0151%**

Table 6: Paired *t* Test Results for Differences in Simplified and Analysis-based Expected Terms

The results in Table 6 above indicate that the possibility of the null hypothesis being true is extremely small, with a 0.015% possibility that the results would end up the same. Therefore, we reject the null hypothesis and conclude that the mean of the differences in Analysis-based and Simplified expected terms is not zero. This means that a company should expect to see different results from an expected term calculated on an unadjusted dataset as compared to an expected term calculated on an exclusion-adjusted inference dataset.

Test Case 3: Combined Effect of Separating Heterogeneous Groups and Excluding Non-Representative Grants

The third and final analysis we performed involves comparison of the basic Simplified Calculation without Groups to the Analysis-based Calculation with Groups, which reflects the comprehensive analysis typically conducted by Equity Methods. This test combines both Test 1 and Test 2 to understand the overall effects of both separating homogeneous groups and removing non-representative grants.

In order to control for expected term methodologies in our analysis, we once again only used firms for which we recommended the Midpoint Method. Of the 25 companies in the study, 13 companies met the criteria of utilizing the Equity Methods recommended Midpoint Method based on an Inference Dataset with separate groups. Once the companies were selected, we calculated two expected term assumptions for each company. The first calculation once again intended to replicate the simplified Midpoint Method Calculation without Groups that can be estimated in various software applications, and the second calculation represented a full analysis conducted by Equity Methods. As expected, the combination of separating homogeneous groups and removing non-representative grants from the dataset yielded the greatest difference when compared to the Simplified Calculation without Groups.

When we compared each group in the Analysis-based Calculation to the expected term from the Simplified Calculation without Groups, the mean variance was the highest of the three tests, at 1.2 years. However, the most alarming result was the maximum difference of 5.8 years. This was a case in which the company issued drastically different grants to a small subset of the recipient pool. The expected term for this group was calculated at 9.8 years; had they not separated this group, they would have valued the options using an expected term of 4.0 years, drastically underestimating the

expected term. Table 7 below illustrates the summary statistics of Test 3 conducted on the 13 companies, with the column on the right showing the differences between the two calculations.

Expected Term Statistic	Simplified Calculation without Groups	Analysis-based Calculation with Groups	Difference in Expected Term Estimates
Min	3.5 years	3.4 years	0.1 years
Max	6.9 years	9.8 years	5.8 years
Median	4.8 years	5.7 years	0.8 years
Mean	4.8 years	5.6 years	1.2 years
Company Count	13	13	13

Table 7: Summary Statistics on Expected Terms Analyzed in Groups and Exclusions Analysis Test Case

In order to determine if the differences in expected terms in Test Case 3 were statistically significant and could be consistently expected, we conducted a paired t test and tested the null hypothesis that the mean of the differences is zero. In this test, we compared the expected term results without groups to each separate group recommended. The results in Table 8 below indicate that the possibility of the null hypothesis being true is extremely small, with a nearly 0% possibility of Group 1 being the same as the no-group result, and a 1.4% possibility of expected terms for Group 2 being the same. Therefore, we reject the null hypothesis and conclude that the differences in expected term are not zero. This means that a company should expect to see statistically different results when conducting a comprehensive expected term analysis.

Paired t Test (Null Hypothesis: Mean Difference = 0)	Group 1 Results	Group 2 Results
Average	1.3 years	1.1 years
Standard Deviation	0.7288	1.5340
N	13	13
Degree of Freedom	12	12
Test Stat	**6.3203**	**2.5008**
Probability that Mean Difference = 0	**0.0019%**	**1.3936%**

Table 8: Paired t Test Results for Difference in Simplified and Analysis Based Expected Terms

Since Test Case 3 quantified the difference in expected term between a simplified (unrefined) calculation and a comprehensive analysis, we conducted one additional statistical test to determine the significance of the differences in expected term results. The following Wilcoxon Signed Rank Tests in Tables 9 and 10 determine the probability that the Simplified Calculation without Groups would yield similar results to that of the Analysis-based Calculation with Groups. In other words, a small probability result in this test would mean that a company should not expect the values of the two calculations to be the same, meaning that the Analysis-based Calculation with Groups will in fact yield a different expected term result.

Simplified Calculation without Groups	Analysis-based Calculation with Groups (Group 1)	A - B	|A - B|	Rank	+	-
5.0 years	3.9 years	1.05	1.05	6	6	0
4.8 years	7.0 years	-2.23	2.23	12	0	12
5.5 years	6.2 years	-0.73	0.73	3	0	3
5.8 years	6.6 years	-0.76	0.76	4	0	4
5.0 years	7.0 years	-2.01	2.01	10	0	10
3.9 years	6.0 years	-2.15	2.15	11	0	11
4.8 years	7.3 years	-2.56	2.56	13	0	13
4.0 years	5.3 years	-1.32	1.32	9	0	9
6.9 years	6.4 years	0.52	0.52	2	2	0
4.5 years	3.7 years	0.78	0.78	5	5	0
4.8 years	5.1 years	-0.26	0.26	1	0	1
4.0 years	5.1 years	-1.15	1.15	8	0	8
3.5 years	4.6 years	-1.09	1.09	7	0	7
Wilcoxon Signed Rank Test (Null Hypothesis: There is no difference between the two populations)			**Totals**		13	78
			T		13	
			N		13	
			μ_T		45.50	
			σ_T^2		204.75	
			Test Stat		**-2.27128**	
			Probability		**0.01156**	

Table 9: Wilcoxon Signed Rank Test (Group 1): Simplified Expected Term without Groups vs. Analysis-based Calculation with Groups

Simplified Calculation without Groups	Analysis-based Calculation with Groups (Group 2)	A - B	|A - B|	Rank	+	-
5.0 years	5.8 years	-0.79	0.79	8	0	8
4.8 years	5.8 years	-1.01	1.01	10	0	10
5.5 years	5.4 years	0.09	0.09	2	2	0
5.8 years	5.7 years	0.11	0.11	3	3	0
5.0 years	4.1 years	0.87	0.87	9	9	0
3.9 years	4.0 years	-0.17	0.17	4	0	4
4.8 years	4.2 years	0.58	0.58	6	6	0
4.0 years	9.8 years	-5.80	5.80	13	0	13
6.9 years	6.9 years	0.07	0.07	1	1	0
4.5 years	6.1 years	-1.62	1.62	11	0	11
4.8 years	6.7 years	-1.83	1.83	12	0	12
4.0 years	4.7 years	-0.72	0.72	7	0	7
3.5 years	3.4 years	0.17	0.17	4	4	0
Wilcoxon Signed Rank Test (Null Hypothesis: There is no difference between the two populations)			**Totals**		25	65
			T		25	
			N		13	
			μ_T		45.50	
			σ_T^2		204.75	
			Test Stat		**-1.43266**	
			Probability		**0.07598**	

Table 10: Wilcoxon Signed Rank Test (Group 2): Simplified Expected Term without Groups vs. Analysis-based Expected Term with Groups

Table 9 compares the Simplified Calculation without Groups to one of the groups in the Analysis-based Calculation, and Table 10 compares the same Simplified Calculation without Groups to the second group in the Analysis-based Calculation. Unlike the paired *t* test above, the nonparametric methods in the Wilcoxon Signed Rank Test do not assume that the sample population (of expected terms) has a given distribution. The Wilcoxon Signed Rank Test is a nonparametric hypothesis test for the case of two related samples.

In the tests above, the null hypothesis states that there is no difference between the two expected term approaches. The test statistics indicate that the probability of this hypothesis being true is very small, 1.16% in Group 1, and 7.60% in Group 2, as seen in the tables above. Therefore, we would reject the null hypothesis and conclude once again that the two expected terms are statistically different, giving validity to conducting a full analysis involving both groups and exclusions when estimating expected term. While not all companies should expect a large difference, overall, the probability of a company having very similar results in a simple calculation compared to an analysis-based calculation is very small, proving that these analyses improve expected term estimates.

FINANCIAL STATEMENT IMPLICATIONS

While the statistical tests performed as part of our study prove that the decision to conduct a rigorous analysis (versus an unrefined calculation) is likely to yield different results, natural questions to ask are: how this impacts financial statement values and is the magnitude of such a difference large enough to care about? Before addressing the specific numerical implications of a misstated expected term assumption, it is important to recall the auditing standards concerning materiality.

Auditing Standards on Materiality

The danger on issues like that covered in this Issue Alert is that the impact of a misstated expected term may not materially affect the financial statements on an aggregate basis—and for this reason, the relevance may be dismissed. Unfortunately, this is not consistent with the AICPA's professional auditing standards, as captured in AU Section 312, *Audit Risk and Materiality in Conducting an Audit*.

A key question in AU 312 is how misstatement of an entry or balance is evaluated from a materiality perspective, and how this misstatement potentially influences the economic decisions of users of financial statements. AU 312 introduces the possibility of misstatement as arising from factors such as the following:

AU 312, Paragraph 07

a. An inaccuracy in gathering or processing data from which financial statements are prepared
b. A difference between the amount, classification, or presentation of a reported financial statement element, account, or item and the amount, classification, or presentation that would have been reported under generally accepted accounting principles
c. The omission of a financial statement element, account, or item
d. A financial statement disclosure that is not presented in conformity with generally accepted accounting principles
e. The omission of information required to be disclosed in conformity with generally accepted accounting principles
f. An incorrect accounting estimate arising, for example, from an oversight or misinterpretation of facts; and
g. Management's judgments concerning an accounting estimate or the selection or application of accounting policies that the auditor may consider unreasonable or inappropriate.

Points a, b, f, and g are all potentially at play when simplified expected term approaches are utilized in lieu of rigorous analyses. This begs the question as to the relevance of an account-level misstatement in the context of the overall financial statements. The key principle in AU 312 and adopted by auditors is to not analyze materiality on a standalone basis. Misstatements at a de minimis level can be disregarded endlessly, but transactions that are not de minimis yet not so large to be "material" to the overall financial statements need to be formally understood and tracked. Otherwise, the auditor runs the risk of disregarding a handful of non-material misstated transactions that aggregate to a material amount—and suddenly, the overall financial statements are materially misstated. This is explained as follows:

AU 312, Paragraph 20
At the account balance, class of transactions, relevant assertion, or disclosure level, audit risk (AR) consists of (a) the risk (consisting of inherent risk and control risk) that the relevant assertions related to balances, classes, or disclosures contain misstatements (whether caused by error or fraud) that could be material to the financial statements when aggregated with misstatements in other relevant assertions related to balances, classes, or disclosures and (b) the risk (detection risk) that the auditor will not detect such misstatements. These components of audit risk may be assessed in quantitative terms, such as percentages, or in nonquantitative terms such as high, medium, or low risk. The way the auditor should consider these component risks and combines them involves professional judgment and depends on the auditor's approach or methodology.

The auditing guidance goes on to discuss drivers of risk and a framework for evaluating aggregate risk. For purposes of this Issue Alert, and the topic of this section, is that if a simplified expected term estimate generates a misstated expected term that is beyond a de minimis level, then it is sufficiently important to reassess the estimation process. From a cost-benefit perspective, the cost of implementing more rigorous analysis-based expected term estimation techniques is quite low, and yet the impact to financial statement reliability can be high.

Hypothetical Materiality Test

Given the above summary of the professional auditing guidance, this section provides insight on how the expected term input affects the overall Black-Scholes-Merton fair value calculation, and on a hypothetical basis, why this may be material. Figure 5 below illustrates how slight imprecision in the expected term can impact the overall dollar value of an option grant:

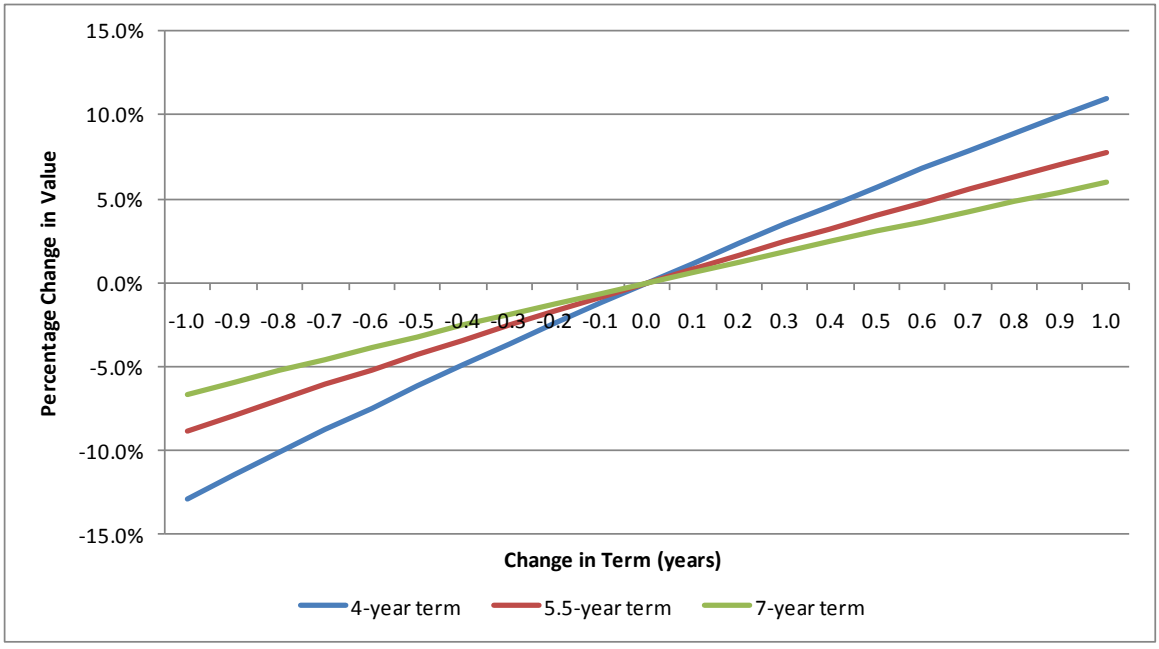

Figure 5: Effect of Expected Term Variance on Option Values

Consider now a hypothetical case (using Test Case 3 from above) illustrating the difference in aggregate compensation expense based on whether a simplified or analysis-based expected term approach is used. This hypothetical example is developed using the following inputs to the Black-Scholes-Merton formula:

- Grant Size: 1.5 million shares
- Stock Price: $25
- Strike Price: $25
- Base Expected Term: 5.2 years (mean of the weighted average group of companies in Test 3)
- Volatility: 50%
- Risk-free Rate: 1.66%
- Dividend Yield: 0%

Using the above inputs, the average company grant would be valued at $17,094,344. Increasing the expected term input by 1.2 years, the mean variance in Test Case 3, would increase the expense of the grant by $1,644,966, or 9.6%, as can be seen in Table 11 below. Decreasing the expected term by 1.2 years in the same scenario would cause a negative variance of $1,914,438, or -11.2%. In the worst case scenario, a company in the sample study had a variance of 5.8 years in expected term, which would cause a $6,507,774 financial impact, a difference of 38.1%. On top of this, an increase in stock price, shares granted, volatility, or risk-free rate would further increase the financial impact and could lead to very material changes and external audit complications.

Shares Granted	Change In Expected Term	Effect on Expense	Percent Change
1,500,000	Increase 1.2 years	$1,644,966	9.6%
1,500,000	Decrease 1.2 years	(1,914,438)	-11.2%
1,500,000	Increase 5.8 years	$6,507,774	38.1%

Table 11: Financial Statement Implications of Mis-Estimating Expected Term

These calculations illustrate why the expected term input is important and how slight imprecision in the value can materially affect overall valuations and compensation cost recognized. However, a further and more interesting test involves measuring expected term imprecision (resulting from the use of an unrefined expected term estimate) in the context of actual company data. This involves simulating compensation expense amounts under both a rigorous analysis-based expected term approach and a simplified approach, and then determining how net income (or other financial data) is affected by the use of one expected term approach over another.

The following case studies are based on the data of two individual firms. These case studies are provided in the context of the AICPA auditing guidance discussed above. The first case study involves a situation in which the misstatement of stock-based compensation expense probably does not cause the overall financial statements to be misstated, but were it considered alongside other individual misstatements, could easily result in overall financial statement misstatement. In the second case, misstatement of the expected term would actually result in misstatement of the aggregate financial statements.

Case Study Methodology

To develop the case studies, the following methodology was used:

- Expected term assumptions were generated both via a Simplified Calculation without Groups and an Analysis-based Calculation with Groups.
- For the Analysis-based Calculation with Groups, the total amount of shares issued to each separate employee group (e.g., executives vs. non-executives) in a full calendar year was determined.
    - Based on this amount, annual compensation cost was calculated for each group.

- For the Simplified Calculation without Groups, annual compensation cost was computed by multiplying the fair value times the total number of shares issued during the most recent calendar year.
- The total difference in annual expense between the two valuations was computed, which would have been caused by the selection of an unrefined expected term in lieu of one developed through a rigorous analysis.

While in reality the compensation cost in any given year is a function of not only current-year awards but also prior-year awards, a reasonable simplifying assumption involves using the total value of the current year's awards as a proxy. This assumption is reasonable because grant values are usually held constant over time, and the test is intended to cover the impact of applying a simplified expected term approach to all grants.

Case Study 1

As noted, the first case study involves a large firm in which the standalone impact of misstating the expected term is probably not material to the overall financial statements, but is sufficiently large that it should be considered alongside other potential misstatements. Combined with other potential misstatements, the result could easily be misstatement of the overall financial statements. The results of this case study are illustrated in Table 12 below[13]:

Case	Total Annual Grant Value ($)		Stock Comp Total Variance ($)	Stock Comp Total Variance (%)	Variance as a % of Annual Net Income
	Simplified without Groups	Analysis-based with Groups			
Company 1	$65,250,000	$71,100,000	$5,850,000	8.97%	1.04%

Table 12: Case Study 1 Financial Statement Misstatement Results

For Company #1, the difference between the total annual grant expense generated using a Simplified Calculation without Groups compared to an Analysis-based Calculation with Groups was large, at nearly 6 million dollars. Annual stock-based compensation expense, if based on the simplified approach, would be misstated by 8.97% relative to the more rigorous approach. On a standalone basis, this misstatement would affect net income by approximately 1%, but as suggested in AU 312, this would be the wrong yardstick. Misstatements that do not materially affect the overall financial statements but are clearly not de minimis should be combined with other potential adjustments and analyzed in aggregate.

Case Study 2

The second case study pertains to a smaller company with much lower net income. In this case, the expected misstatement is likely material to the overall financial statements. The results of this case are as follows:

Case	Total Annual Grant Value ($)		Stock Comp Total Variance ($)	Stock Comp Total Variance (%)	Variance as a % of Annual Net Income
	Simplified without Groups	Analysis-based with Groups			
Company 2	$5,000,000	$5,450,000	$450,000	9.00%	4.47%

Table 13: Case Study 2 Financial Statement Misstatement Results

In this second case study, if Company #2 had generated expected term values using the Simplified Calculation without Groups instead of the Analysis-based Calculation with Groups, it would have misstated the value of its total annual grant by $450,000, or 9%. In this case, however, the impact of a 9% expected term misstatement is actually a 4.47% misstatement of net income. Company #2 has a market capitalization of approximately $500 million, and thus is neither a

[13] Slight adjustments to actual results are implemented to ensure anonymity.

mega nor micro cap firm. The reason the misstatement represents such a large portion of annual income is that Company #2 issues option awards as a large percent of overall employee compensation. To make things worse, since net income was down significantly in the given year, the total value of equity compensation was nearly 50% as large as the total net income reported. It becomes immediately apparent that in cases where a company issues large equity grants that even a small misstatement of total equity compensation expense could have a significant impact on net income, especially in years where net income is lower.

Taking these cases together, it is useful to reference guidance from the Public Company Accounting Oversight Board (PCAOB) on how an auditor should evaluate a company's process for estimating fair value of employee stock option grants:

PCAOB – Auditing the Fair Value of Share Options Granted to Employees, Pgs. 3-4
An auditor is required to obtain an understanding of the company's process for determining fair value measurements and disclosures and of the relevant controls sufficient to develop an effective audit approach. Based on the auditor's assessment of the risk of material misstatement, the auditor should test the entity's fair value measurements and disclosures.

The research and case studies provided in this Issue Alert demonstrate how in many cases the risk of material misstatement of the financial statements could be present due to the use of simplified expected term estimation approaches.

CONCLUSION

This Equity Compensation Issue Alert identifies several risks faced by companies that rely on a simplified expected term estimate approach, including expected term bias that is due to not testing for homogenous groups, not removing non-representative grants, and not conducting an analysis to determine which expected term methodology is most appropriate. While the relevant accounting guidance is very clear as to the importance of conducting a rigorous analysis related to these three topic areas, this is not merely a question of applying GAAP correctly. Research performed by Equity Methods also demonstrates the financial statement materiality of failing to conduct a rigorous expected term analysis.

The financial statement implications noted in this Issue Alert are based on an Equity Methods study of actual company data. The results of this study suggest that rigorously developed expected terms are significantly different from simplified expected term estimates calculated within software applications. The risk of financial statement misstatement is high for any company that relies heavily on equity compensation. Even companies with large net incomes can face audit risk, because as long as they issue large quantities of equity awards, the potential expected term misstatement can be considered material when analyzed alongside other similar potential misstatements of the financials.

As auditors continue to hone their skills in working with large sets of employee stock option data, Equity Methods expects they will move their focus away from the basic mechanics of competing expected term calculations and towards the more advanced issues discussed in this document. Auditors are becoming adept at understanding the implications of large changes in optionee recipient pools and award designs, and are fully aware of the impact these changes may have on the expected term assumption. Thus, the audit risk associated with simplified, software-driven expected term calculations will intensify as time progresses. Companies whose historical grant characteristics and recipient pools do not match future award characteristics and /or recipient pools are at an elevated risk. Conducting a rigorous expected term analysis is the only way to ensure a correct and relevant expected term assumption is used in the Black-Scholes-Merton formula when calculating stock option values.

Equity Methods' experience and expertise in conducting ASC 718-compliant expected term analyses ensures compliant and accurate valuations in even the most complex cases. Equity Methods' experts leverage complex statistical programming tools to conduct rigorous analyses on our clients' historical datasets, enabling Equity Methods to recommend and defend appropriate expected term estimates that exhibit representational faithfulness. Through the analyses performed, Equity Methods is able to help clients reduce external audit risk and the risk of financial statement misstatement.

For more information on the financial reporting challenges associated with equity compensation, or to ask questions about the content of this Issue Alert, please contact your Equity Methods relationship manager.

APPENDIX

Tables 14 and 15 below display the effect of overestimating or underestimating the expected term input by 1.2 years on the total expense over a variety of stock prices and number of shares granted. The tables below use the following inputs to inform the Black-Scholes-Merton formula:

- Base Expected Term: 5.2 years (mean of the weighted average group of companies in Test 3)
- Volatility: 50%
- Risk-free Rate: 1.66%
- Dividend Yield: 0%

	Shares Granted					
Grant Price	**500,000**	**1,000,000**	**2,000,000**	**5,000,000**	**10,000,000**	**15,000,000**
$5	$109,664	$219,329	$438,658	$1,096,644	$2,193,288	$3,289,932
$10	$219,329	$438,658	$877,315	$2,193,288	$4,386,576	$6,579,863
$20	$438,658	$877,315	$1,754,630	$4,386,576	$8,773,151	$13,159,727
$30	$657,986	$1,315,973	$2,631,945	$6,579,863	$13,159,727	$19,739,590
$40	$877,315	$1,754,630	$3,509,260	$8,773,151	$17,546,302	$26,319,453
$50	$1,096,644	$2,193,288	$4,386,576	$10,966,439	$21,932,878	$32,899,317
$75	$1,644,966	$3,289,932	$6,579,863	$16,449,658	$32,899,317	$49,348,975
$100	$2,193,288	$4,386,576	$8,773,151	$21,932,878	$43,865,755	$65,798,633
$150	$3,289,932	$6,579,863	$13,159,727	$32,899,317	$65,798,633	$98,697,950
$200	$4,386,576	$8,773,151	$17,546,302	$43,865,755	$87,731,511	$131,597,266
$250	$5,483,219	$10,966,439	$21,932,878	$54,832,194	$109,664,388	$164,496,583
$300	$6,579,863	$13,159,727	$26,319,453	$65,798,633	$131,597,266	$197,395,899

Table 14: Effect on Total Expense of Overestimating Expected Term by 1.2 years

	Shares Granted					
Grant Price	**500,000**	**1,000,000**	**2,000,000**	**5,000,000**	**10,000,000**	**15,000,000**
$5	($127,629)	($255,258)	($510,517)	($1,276,292)	($2,552,584)	($3,828,876)
$10	($255,258)	($510,517)	($1,021,034)	($2,552,584)	($5,105,168)	($7,657,752)
$20	($510,517)	($1,021,034)	($2,042,067)	($5,105,168)	($10,210,336)	($15,315,503)
$30	($765,775)	($1,531,550)	($3,063,101)	($7,657,752)	($15,315,503)	($22,973,255)
$40	($1,021,034)	($2,042,067)	($4,084,134)	($10,210,336)	($20,420,671)	($30,631,007)
$50	($1,276,292)	($2,552,584)	($5,105,168)	($12,762,920)	($25,525,839)	($38,288,759)
$75	($1,914,438)	($3,828,876)	($7,657,752)	($19,144,379)	($38,288,759)	($57,433,138)
$100	($2,552,584)	($5,105,168)	($10,210,336)	($25,525,839)	($51,051,678)	($76,577,517)
$150	($3,828,876)	($7,657,752)	($15,315,503)	($38,288,759)	($76,577,517)	($114,866,276)
$200	($5,105,168)	($10,210,336)	($20,420,671)	($51,051,678)	($102,103,357)	($153,155,035)
$250	($6,381,460)	($12,762,920)	($25,525,839)	($63,814,598)	($127,629,196)	($191,443,794)
$300	($7,657,752)	($15,315,503)	($30,631,007)	($76,577,517)	($153,155,035)	($229,732,552)

Table 15: Effect on Total Expense of Underestimating Expected Term by 1.2 years