Usefulness of expected values in liability valuation: the role of portfolio size

Gary Colbert
University of Colorado Denver

Dennis Murray
University of Colorado Denver

Robert Nieschwietz
Seattle University

Abstract

This study investigates whether the usefulness of expected values to financial statement users depends on portfolio size (N). Given that standard setting boards require some liabilities to be measured at fair value, and given that fair values are often estimated using expected cash flows, the investigation is conducted within the context of liabilities. Expected value is hypothesized to be more useful when N is large because actual cash flow realizations are more centered on their expected value than when N is small. That is, because users will perceive that expected values are more accurate predictors of actual realizations when N is large, valuations assigned to liabilities will be closer to their expected values than when N is small. The results show that when N is large, the valuations assigned by subjects to liabilities are much closer to the expected value of the future cash outflows than when N is small, but users' perceptions of the accuracy of expected values did not appear to influence their valuations. These results suggest that standard setters should give consideration to the effect of portfolio size on the use of expected value in financial reporting.

Keywords: Liability Valuation, Expected Value, Portfolio Size

Introduction

The Financial Accounting Standards Board (FASB) and the International Accounting Standards Board (IASB) have undertaken a joint project to reexamine their respective conceptual frameworks. The Boards hope that this reexamination will result in an improved and common framework. The project's goals include updating the concepts to reflect new business practices and improving parts of the conceptual frameworks, such as the recognition criteria and measurement attributes of financial statement items (FASB 2006).

The initial efforts by the Boards in this project have focused on the objectives of financial reporting and the qualitative characteristics of financial reporting information. The FASB has already published an exposure draft of two chapters addressing these issues (FASB 2008). The Boards are now directing their energies towards the two most fundamental financial statement elements: assets and liabilities. The FASB has issued an *Invitation to Comment* (FASB 2005) that is intended to solicit views regarding the central accounting issues associated with assets and liabilities.

A critical aspect of accounting related to liabilities is the measurement attribute. That is, what measurement attribute should accountants assign to recognized liabilities? Accounting standards recently promulgated by the FASB have tended to require the use of fair value. For example, Statement of Financial Accounting Standard (SFAS) 143, *Accounting for Asset Retirement Obligations* (FASB 2001), and SFAS 146, *Accounting for Costs Associated with Exit or Disposal Activities* (FASB 2002) require that the liabilities addressed by those standards be stated at fair value. Further, SFAS 159, *The Fair Value Option for Financial Assets and Financial Liabilities* (FASB 2007), provides firms the option of valuing any financial liability at fair value. The IASB has taken a similar path. International Accounting Standard (IAS) 37, *Provisions, Contingent Liabilities and Contingent Assets*, (IASB 1998) requires that provisions (i.e., liabilities of uncertain timing or amount) be measured at the amount necessary to settle the liability on the balance sheet date.

The FASB defines fair value as the price that would be paid to transfer a liability in an orderly transaction (FASB 2007). An observable marketplace-determined amount is often used in this regard. When observable marketplace-determined values are not available, the present value of future cash flows may be used. The FASB distinguishes between two types of future cash flow forecasts in Statement of Financial Accounting Concept (SFAC) 7, *Using Cash Flow Information and Present Value in Accounting Measurements* (FASB 2000). *Estimated cash flow* refers to the forecast of a single future cash flow amount and reflects the traditional approach to implementing present value. This amount usually reflects the most likely future cash flow (i.e., the best estimate). *Expected cash flow* refers to the probability-weighted sum of more than one possible forecasted cash flow realization. Given that the expected cash flow approach requires more explicit consideration of different assumptions and scenarios, the FASB has concluded that the use of the expected cash flow approach is preferable in many situations. SFAS 143, for example, states that "the expected cash flow approach will usually be the only appropriate technique for an asset retirement obligation" (FASB 2001, 8). The IASB also requires the use of expected value to measure liabilities in certain circumstances (IAS 37) and the Board is considering expanding the use of expected cash flow (IASB 2005).

An example suggested in SFAC 7 raises an interesting issue related to the use of the expected cash flow approach. Consider a liability with two possible future cash flow realizations: a 90% probability of a $0 cash flow and a 10% probability of a $1,000 cash flow.

The expected cash flow is $100.[1] Yet, this amount is not one of the possible future realizations. To what extent is it desirable to measure this liability based on an expected value that does not represent either of the possible realizations?[2] The lack of correspondence in this example between the expected value and future cash flow realizations arises, in part, due to the singular nature of the liability. That is, the example includes only one liability item. As the number of items in the portfolio (N) increases, the distribution of outcomes (i.e., the net result of multiple items) becomes increasingly concentrated around the expected value. As a result of the increased correspondence between the expected value and the realized outcomes, the expected value may prove to be more useful to financial statement users.

Given that much of current GAAP requires, permits or recommends the use of expected cash flows to value liabilities in singular situations (e.g., SFAS 143, SFAS 146 and IAS 37), this paper investigates whether the usefulness of expected values to financial statement users depends on N. The participants in this study were asked to assign a settlement value to a hypothetical environmental contingency. It is hypothesized that the participants will assign a value that is closer to the expected value when N is large. The results show that when N is large, the valuations assigned by participants to liabilities are much closer to the expected value of the future cash outflows than when N is small. A causal model which hypothesizes that participants' perceptions of accuracy intervene between N and the use of expected value is also tested. That is, when N is large expected value will be viewed as being a more accurate indicator of the ultimate cash outflow, and therefore, participants will assign settlement values closer to the expected value than when N is small. The results do not support the intervening role of accuracy perceptions.

The remainder of this paper is organized as follows. The next section provides the motivation and hypotheses. The research method is discussed in the following section and the final two sections describe the results and provide a summary and conclusions.

Motivation and Hypotheses

Psychologists and management scientists have long been interested in studying how individuals make decisions under uncertainty.[3] This work, especially the work of Hogarth and Einhorn (1990) that models how individuals use probability information in risky decision making, is drawn on to formulate the hypotheses.

Liability Portfolio Size

Hogarth and Einhorn's (1990) venture theory (VT) provides a descriptive model of outcomes individuals replace the associated probabilities of the outcomes with decision weights.[4]

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[1] ($0 X .9) + ($1,000 X .1) = $100.

[2] Given that the focus is on the form of the cash flow forecasts, any discounting calculation is dispensed with in the remainder of the paper.

[3] Much of this work was spawned by the seminal work of Kahneman and Tveresky (1979).

[4] VT focuses on how probabilities are translated into decision weights. VT assumes that the associated payoff is transformed based on the value function of prospect theory (Kahneman and Tversky 1979).

While it seems natural to use the probability of an outcome as a decision weight, Hogarth and Einhorn (1990) argue that this hides important psychological matters, particularly the effect of uncertainty. They reason that an individual's intuition of probability is best equated with long-run, multiple-play, situations. Also, in multiple-play situations, because the realized outcome is likely near the expected value, expected value is more reflective of likely outcomes and the use of the stated probability of an outcome as a decision weight therefore corresponds to some reality. In contrast, they reason that when the number of plays is small expected value is less likely, and from a *psychological* point there is greater uncertainty. Hogarth and Einhorn refer to this additional uncertainty as outcome uncertainty.

Hogarth and Einhorn (1990) model the decision process as an anchoring and adjustment process to arrive at decision weights. The initial anchor is the probability of the outcome provided and the adjustment, if any, is the result of a mental simulation that is affected by the presence of outcome uncertainty. The higher the outcome uncertainty the greater the extent of mental simulation and adjustment, increasing the likelihood of choices of decision weights that deviate from the probability provided. VT is used to formulate the hypothesis about the effect of liability portfolio size on individual's valuation judgments. When the liability portfolio is large it is expected that the mental simulation will be less and the adjustment from the stated probability will be small and thus, individuals will be more likely to choose a valuation close to expected value. In contrast, when the portfolio is small, it is expected that outcome uncertainty will be greater, increasing the extent of the mental simulation and the adjustment from the stated probability will be larger and thus, individuals will be more likely to choose valuations that deviate from expected value. This leads to the following hypothesis:

H1: When the contingency portfolio is small individual's valuations will differ more from expected value.

Accuracy as a Mediator Variable

The FASB views relevance and faithful representation[5] as the two most important qualities that determine the usefulness of information (FASB 2008). Faithful representation requires that the depiction of an item be "complete, neutral and free from material error" (FASB 2008, QC7). The aspect of this definition that is most germane to this study is "free from material error." The FASB has elaborated on this component of faithful representation: "some minimum level of accuracy … is necessary for an estimate to be a faithful representation of an economic phenomenon" (FASB 2008, QC11). Accordingly, the FASB views the accuracy of future cash flow forecasts to be an important aspect of faithful representation, and consequently, an important determinant of decision usefulness.

It is theorized that the liability portfolio size (N) will impact users' perceptions of accuracy. As discussed above, when N is small outcome uncertainty is higher. This will lead individuals to perceive that expected value information is a less accurate measurement of the future outcome, and as a consequence individuals will decrease the weight they place on this information. Combining the role of accuracy described here and the expectations from VT above, the following causal sequence is posited: when the liability portfolio size is small individuals will perceive that expected value information is less accurate, which in turn will lead

[5] The Boards have proposed to replace the term reliability with the term faithful representation.

individuals to increasingly choose valuations of the liability that differ more from expected value. Figure 1 provides an illustration of the causal model. This leads to the following hypothesis:

H2: When the contingency portfolio is small individuals will perceive that expected value information is less accurate; the reduced accuracy will lead individuals to arrive at valuations that differ more from expected value.

Insert Figure 1 about here

Research Method

Participants were asked to make judgments about a contingent liability set in the context of a hypothetical company held as an investment. Each participant was asked to recommend a valuation to resolve the contingent liability, and to judge how accurately expected value information represented the cash flow consequences of the contingent liability. Participants received identical case materials except for the manipulated experimental treatments of the liability portfolio size.

Participants

MBA graduates participated as subjects in the study. MBAs were used in this study for at least two reasons. First, MBAs are likely investors and hence potential users of the financial statements of publicly held corporations. Second, MBAs are also likely to be reasonably well informed about financial statements. Therefore, the reactions of the participants should be of interest to accounting standard setters such as the FASB and the IASB.

MBA graduates were identified from the records of a Midwest university's executive MBA program. 370 graduates were contacted by email and asked to participate in this online study. 70 individuals agreed to participate by completing an online survey, yielding a 19% response rate. Due to incomplete or inappropriate responses 56 surveys were usable. Non-response bias was examined by comparing the replies of early and late responders; no significant differences were noted on the demographic and dependent variables.

Materials

An email to potential participants explained the general purpose of the research and requested they complete the online survey identified by an electronic link. The survey was patterned after similar prior studies, principally Kennedy et al (1998). It included a brief introduction, a description of the hypothetical company, summary financial statement information and calculated financial ratios for one year, information about the contingent liability, and a questionnaire. The summary financial statements were modeled after a publicly traded energy company that operates retail gas outlets. Environmental lawsuits were chosen as

the contingent liability in question.[6] Minor adjustments were made to the initial survey based on a pilot test. Panel A of the Appendix contains the context and description of the company provided.

Independent Variable

Portfolio size is used as the independent variable (N). To capture the concept of liability portfolio size, the number of lawsuits was manipulated as being 100 (retail gas stations) or one (a regional storage facility). Panel B of the Appendix contains the contingent liability information provided to subjects for the large portfolio size (N=100) condition.

Dependent Variable

Participants were asked to recommend a valuation to resolve the contingent liability. Panel C of the Appendix contains the valuation question asked. The dependent variable stated in the hypotheses concerns variation from expected value. This variable, variation from expected value (ABSVAR), is measured as the absolute value of the difference between the participant's valuation and the expected value (potential payout multiplied by associated probability).[7]

Mediating Variable

The questionnaire asked participants how accurate was the expected value information associated with the environmental lawsuit. An 11-point scale anchored on 0 (Not reliable) and 10 (Very reliable) was used. The response to this question serves as the mediating variable (ACCURACY) in the causal model in hypothesis 2. This question was seeded among other questions related to the company and the contingent liability such as "How likely is it that the company will be able to meet its debts as they become due?" and "Based on the limited data provided, rate the riskiness of the Company's environmental lawsuits."

Experimental Design

A one by two experimental design is used in the study. The total number of observations used was 56; the number of observations were 29 for the large liability portfolio (N = 100) and 27 for the small liability portfolio size (N = 1).

Participants' Demographics

[6] In all cases participants were informed that in accordance with generally accepted accounting principles the Company had not recorded a liability for the contingency.

[7] Expected value (potential payout multiplied by its associated probability) was provided in both experimental conditions. This was achieved by varying the size of the potential payout. The potential payout and expected value was set so as to be material to the financial statements. As an example, Panel B of the Appendix contains the additional information on the contingent liability provided the participants in the condition where the portfolio size was 100.

Participants were asked whether they currently owned stock investments, years of business experience and years of financial related work experience. A large majority (94%) reported they currently (or recently) own stock investments and that they have considerable business and financial experience. Participants reported having an average of almost 20 years of business experience and over 8 years of financial experience.[8] Taken together the demographics suggest that the participants are well suited as subjects for the study.

Results

Manipulation Checks

A manipulation check was used to assess if the participants attended to the independent variables. Participants were asked to recall, without looking back at the case, the number of lawsuits that were pending against the company. Ten respondents failed the check. The analysis reported in the paper below includes these respondents. The analysis is also repeated deleting the ten responses. The results and conclusions are substantially unchanged from those reported below.

Tests of Hypotheses

Hypothesis 1 is tested using a single factor ANOVA model. Descriptive statistics and the ANOVA model are reported in Table 1. Hypothesis 1 states that when N is small individual's valuations will differ more from expected value. The means reported in Panel A are consistent with the hypothesis; when N is small ABSVAR is higher. The ANOVA model in panel B shows that the hypothesized effect of N is statistically significant (f-value = 5.70; p-value = .02). It is concluded that the size of the liability portfolio strongly influences valuation judgments.

Insert Table 1 about here

Hypothesis 2 states that ACCURACY is a mediator variable in the effect of the independent variable, N, on the dependent variable, ABSVAR. Baron and Kenny (1986) provide an approach to testing models that involve moderator and mediator variables. Following from Baron and Kenny (1986) three conditions are necessary to demonstrate mediation here: (1) the independent variable, N, is associated with the dependent variable, ABSVAR; (2) the independent variable is associated with the mediator variable, ACCURACY; (3) the mediator variable is associated with the dependent variable after controlling for the effect of the independent variable. The ANOVA model reported in Table 1 shows that the independent variable, N, is associated with the dependent variable ABSVAR. Thus, condition (1) is met.

Table 2 reports the two regression models used to test conditions (2) and (3). In Panel A the coefficient on N is positive and is statistically associated (p-value = .10) with ACCURACY,

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[8] The possibility of demographic differences across the groups was analyzed using one-way ANOVAs. No significant differences were found.

which is weakly consistent with condition (2). However ACCURACY is not statistically significant in the regression model reported in Panel B. In contrast, consistent with hypothesis 1 and the ANOVA model results in Table 1, N is statistically significant in the multiple regression model (p-value = .03). It is concluded that the liability portfolio size influences perceptions of accuracy and strongly influences valuation judgments; however the results do not support the hypothesized causal model.

Insert Table 2 about here

Summary and Conclusions

Standard setters are increasingly requiring the use of fair value measurement for liabilities. In the absence of observable marketplace-determined amounts, the present value of future cash flows is often used. Future cash flows are estimated using either a single point estimate of the most likely future cash flow or the probability-weighted sum of more than one possible forecasted cash flow realization (i.e., an expected value). In the latter situation, when facing only one case (e.g., a single loan guarantee), the calculated expected cash flow frequently differs from any of the possible realizations. This paper investigates the usefulness of expected values to financial statement readers when the number of cases was small (N = 1) versus large (N = 100). The results show that users' liability valuations were much closer to the expected value when N equaled 100 than when N equaled 1, implying that portfolio size strongly affects the usefulness of expected value. Standard setters have rarely conditioned the use of expected value on portfolio size. The results of this study suggest that standard setters should consider portfolio size when utilizing expected value in financial reporting.

Several limitations of this study suggest avenues for future research. First, the basic case presented to the participants included only two possible cash flow realizations. This design feature ensured that, in the single case condition, the expected value would not equal either of the realizations. However, in many other distributions of cash flows (e.g., any symmetric distribution), the expected value may well equal one of the possible cash flow realizations. Future research could examine the distributional characteristics that impact the usefulness of expected value. Second, in this study participants were tasked with identifying a settlement amount for the liability. The impact of portfolio size on other decisions, such as investment decisions and risk assessment should be examined. Finally, the experimental nature of the study limits its external validity; other research modes might be helpful in ascertaining the usefulness of expected value in real-world settings.

Figure 1
Causal Model

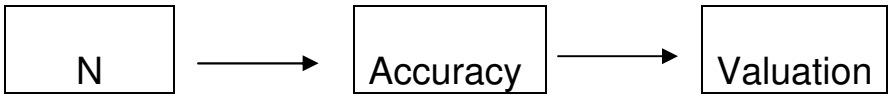

Table 1
Descriptive Statistics and ANOVA Model

Panel A: Descriptive Statistics

ABSVAR Cell Means (Std Dev)
$s in 000s

N = 100	N = 1
4,408	8,453
(4,625)	(9,638)

Panel B: ANOVA Model

Independent Variable	F-Value	Pr>F
N	5.70	0.02

ABSVAR = absolute value of the difference between the participant's valuation and the expected value (potential payout multiplied by associated probability)

N = liability portfolio size (100, 1)

Table 2
Analysis of Mediator Causal Model

Panel A: Regression model: ACCURACY = a + b_1N + e

Independent Variable	Coefficient	t -statistic
N	0.715	1.30*

Panel B: Regression model: ABSVAR = a + b_1N + b_2 ACCURACY +e

Independent Variable	Parameter Estimate	t -statistic
N	-4,130,332	-2.19**
ACCURACY	-409,732	-.089

* Significant at the .10 level
** Significant at the .05 level

ABSVAR = absolute value of the difference between the participant's valuation and the expected value (potential payout multiplied by associated probability)

N = liability portfolio size (100,1)

ACCURACY = response to question: "How accurately does the expected value information represent the cash flow consequences of the lawsuit?"

Appendix

Panel A: Context and Description of the Company

Assume that you have inherited from a family member a small number of equity investments. You are reviewing the investment portfolio that you have inherited. Selected financial statement information for the most recent fiscal year is summarized below for one of the companies you now hold as an investment. Please read the information carefully.

The company owns and operates approximately 200 retail gasoline outlets in the western United States where it sells fuel (gas and diesel) products and convenience store merchandise. To assure an adequate supply of fuel for its retail outlets it owns and operates two regional fuel storage facilities.

Panel B: Example of Additional Information on the Contingent Liability

During the past year, the Company has been named as a defendant in approximately 100 environmental lawsuits concerning some of its retail gas stations. Each lawsuit focuses on one station and alleges that the station's holding tanks are leaking gasoline into the surrounding ground soil. Environmental consultants estimate that if an individual lawsuit is decided against the Company, the Company would bear approximately $1,000,000 in environmental remediation costs. If a lawsuit is decided in favor of the Company, the cost would be $0. Thus, across all lawsuits, the minimum cost is $0, and the maximum cost is $100,000,000. The consultants believe that the outcome for each station is independent of the outcomes for the other stations, and they estimate that the probability of an adverse judgment for a given station is 15%. Therefore, the total expected cost of the lawsuits is $15,000,000.

In accordance with generally accepted accounting principles, the Company has not recorded a liability for this contingency in its financial statements.

Panel C: Question on Valuation of the Contingent Liability

The Company has the opportunity to resolve its liability for the environmental lawsuit by contracting with a bonded third-party company to indemnify itself from all losses associated with the clean-up of the sites. If the Company contracts with this third party, what amount do you think it should be willing to pay to resolve its environmental lawsuit?

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