Are disclosures about bank derivatives and employee stock options ‘value-relevant’?

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Abstract

The papers by Venkatachalam (1996) and Aboody (1996) provide some interesting evidence on issues that are important to accounting regulators as well as accounting academics. However, for econometric as well as economic reasons, there are limits to what we can learn from this type of research (cross-sectional ‘levels’ studies). Careful attention to methodological issues in this type of research design can reduce, but likely will not eliminate, these interpretational difficulties.

Key words: Capital markets; Methodology; Derivatives; Disclosure; Employee stock options; Value relevance

JEL classification: M41; C21; G14; G21

1. Introduction

Over the last five to ten years accounting researchers have increasingly addressed disclosure issues of interest to accounting regulators. Much of this research involves assessing the ‘value relevance’ of disclosures mandated by the Financial Accounting Standards Board (FASB) using a cross-sectional ‘levels’ research design. In this type of study the market value of equity is regressed on the book values of balance sheet assets, liabilities, and the disclosed value(s) of the variable(s) of interest. Researchers then assess value relevance by testing whether the coefficient on the variable of interest is of the predicted sign and reliably different from zero. For example, Barth, Beaver, and Landsman (1992) use this design to assess the value relevance of pension disclosures mandated by
SFAS-87. In addition, a number of recent papers use this design to assess the value relevance of financial instrument disclosures mandated by SFAS-107.

The papers by Venkatachalam (1996) and Aboody (1996) continue this research stream and address, respectively, the value relevance of disclosures about bank derivatives and employee stock options. Both issues are clearly of interest to accounting regulators, and are arguably the two most controversial accounting regulations of the 1990s. However, before we draw firm inferences from these studies and pass our conclusions on to accounting regulators, it is appropriate to step back and consider exactly what we can learn from these studies. I will argue, in particular, that what we learn from these studies depends crucially on both econometric issues and our beliefs about the level of sophistication of market participants. Therefore, it is important to consider the effects of both factors before making policy recommendations based on this research. Although I center the discussion on the papers by Venkatachalam (1996) and Aboody (1996), many of the conclusions apply to the value relevance literature in general.

In cross-sectional valuation studies a fundamental challenge facing the researcher is to convince the reader that the results (significant coefficients on the variables of interest) are evidence in favor of the idea that the market is attaching value to the information variables of interest, rather than being due to econometric problems. The most likely alternative explanation is correlated omitted variables and the associated measurement error bias. This bias is problematic because it can take either sign, i.e., it does not automatically bias the coefficient towards zero. To meet this challenge, the researcher ideally would do a number of things:

- Have a well-specified theory that allows definite predictions about the sign and magnitude of the regression coefficients.
- Estimate a valuation model that minimizes the likelihood of a correlated omitted variables problem. Ideally, the reader would be convinced that all other valuation-relevant variables have been included and are measured without error.

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1 For example, Barth, Beaver, and Landsman (1996), Eccher, Ramesh, and Thiagarajan (1996), and Nelson (1996) all examine whether the fair value disclosures required by SFAS-107 are value-relevant, although Nelson uses a somewhat different research design and reaches somewhat different conclusions.

2 Some of these comments have appeared previously in papers by Bernard and Schipper (1994), Holthausen and Palepu (1994), and Holthausen (1994), but bear repeating.

3 This is true in any multiple regression where at least two of the regressors are measured with error and the correlation between these regressors is non-zero. For example, see Maddala (1977, Ch. 13).

4 Bernard (1995) suggests that one way to do this is to utilize the Feltham–Ohlson valuation model, which explicitly models price as a function of book value and future expected abnormal earnings.
• Provide results that are robust to different specifications, time periods, estimation methods, etc. Of particular interest is whether the results are robust to estimating the regression in 'changes' form, since this reduces the likelihood of correlated omitted variable problems.

In addition to the econometric issues, there are limits to what we can learn from these studies because they are fundamentally association studies that cannot tell us a great deal about why stock prices correlate with the variables of interest. I discuss the Venkatashalam and Aboody papers in turn.

2. Venkatashalam (1996) on the fair value of banks' derivatives disclosures

The objective of SFAS-119, issued in 1994, is to improve the quality of firms' disclosures about financial derivatives, many of which are not currently given recognition in financial statements. In particular, Venkatashalam exploits the fact that under SFAS-119 bank footnotes provide information on the fair value of derivatives held for purposes 'other than trading', which represent off-balance sheet assets and liabilities. Venkatashalam asks three research questions:

1. Are the SFAS-119 fair value derivatives disclosures value-relevant?
2. Does information on the notional amounts of the derivatives have incremental value relevance over derivative fair values?
3. Can the SFAS-119 disclosures be used to understand banks' risk-management activities?

2.1. Are the SFAS-119 fair value derivatives disclosures value-relevant?

To address whether the fair value derivatives disclosures are value-relevant, Venkatashalam regresses the market value of equity on the fair values of on-balance sheet assets and liabilities, on the fair value of off-balance sheet derivatives, and on the fair value of other off-balance sheet financial instruments. He finds that the coefficients on the balance sheet assets and liabilities are all close to one and that the coefficient on the fair value of off-balance sheet derivatives is also reliably positive and close to one, as expected if these disclosures are 'value-relevant'.

5 Under SFAS-119, firms must separate derivatives into those held for trading purposes and those held for purposes 'other than trading'. Derivative securities in the trading category are included on banks' balance sheets and are marked-to-market at the end of each period.
Although Venkatachalam's evidence indicates that the FASB disclosures are associated with stock prices in a plausible way, notice what it does not tell you. First, the evidence does not say anything about the source of market participants' information about derivative fair values. It is conceivable, for example, that these numbers are available to market participants from sources other than footnotes, so that the SFAS-119 disclosures do not convey new information to the market. In other words, asking the association question does not tell us anything about the information content of the disclosures or whether financial statement disclosures are the most cost-effective source of these data, both of which are likely to be important questions for accounting regulators.6

Second, to interpret this type of evidence we have to make assumptions about the level of sophistication of market participants. To see this consider what we would have concluded had the author found that the coefficient on the fair value disclosures was not reliably different from zero. One interpretation would be that the market is sophisticated but that the disclosures are not useful to market participants, a conclusion that might cause FASB to rethink its disclosure policy. However, an alternative explanation would be that market participants, for whatever reason, could not properly process and impound the information (perhaps because of its complexity). Or it may be, as Bernard and Schipper (1994) point out, that market participants believe that footnote information is less reliable than information in the body of the financial statements (because it is not recognized), and so appropriately discount these numbers. For example, some argue that derivatives' fair values are difficult to measure reliably. In short, the results in these studies are often open to a number of interpretations that depend on our priors about the quality of the information and how efficiently market participants process and impound the information.

Alternative explanations for these results are less likely in the Venkatachalam paper than in some other papers for two reasons. First, Venkatachalam makes predictions about both the sign and the magnitude of the regression coefficient: he predicts that the coefficient on derivative fair values should be one. When the results bear this prediction out we can be more confident about the author's interpretation because alternative explanations then require a very specific form of market inefficiency to be plausible. Second, Venkatachalam estimates the regression in changes as well as levels, and finds that the changes results are

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6 In fact, as is common in these types of levels studies, Venkatachalam measures stock price at the banks' December 31 fiscal year-end, several months before the financial statements are available to market participants, so the tests assume that the information is impounded in price before it is disclosed.
consistent with those from the levels regression (the coefficient on derivative fair values is reliably positive in the changes specification as well). Since changes regressions are less susceptible to correlated omitted variables problems, this also increases our confidence in the results.

2.2. *Does information on the notional amounts of the derivatives have incremental value relevance over the fair value of derivatives?*

Venkatachalam next addresses whether the notional amounts of derivatives provide information to market participants beyond derivative fair values. To the extent that market participants are only interested in assessing the market value of the firm's derivative positions, notional amounts are less useful than fair values because they are not directly related to the value of these securities. So, to be *incrementally* informative, notional amounts must tell market participants something beyond the securities' fair values. For example, it may be that notional amounts provide information about a bank's level of involvement in derivatives and so (depending on one's view about whether derivatives are used to increase or decrease risk) something about the bank's managers' views about risk management. In any event, it is hard to be sure *ex ante* why these amounts might be incrementally informative. Therefore, Venkatachalam estimates the regression including the notional amounts of derivatives, but does not make a prediction about the sign or magnitude of the coefficient on this variable.

The problem with including variables in the regression without strong priors is that interpreting the estimated coefficients becomes difficult – there is a danger that the researcher's interpretation is an *ex post* rationalization for the observed findings. Since cross-sectional levels regressions are susceptible to correlated omitted variables problems (especially as we add more variables), and since different assumptions about the sophistication of market participants lead to different interpretations, it is difficult to rely on one story over another.

Venkatachalam finds that the coefficient on notional values is small but reliably negative. He interprets this as evidence that notional amounts measure the credit risk of the derivatives. However, it is not clear why derivative notional amounts should measure their credit risk, or how this evidence rules out other explanations. For example, perhaps market participants believe that bank managers are using derivatives to hedge risk, but view hedging as an overly costly and hence a value-reducing activity. Or it could be that market participants don't trust managers to use the derivatives to reduce risk, or that they don't understand how derivatives are used and react negatively to derivatives usage *per se* (perhaps because of the negative publicity). Or it could just be that the result is attributable to measurement error. The point is that, without
a theory to generate clear predictions, it is difficult to differentiate alternative explanations based on the data.\textsuperscript{7}

2.3. \textit{Can the SFAS-119 disclosures be used to understand banks' risk-management activities?}

The evidence in the association part of the paper indicates that market participants view derivative fair value disclosures as value-relevant. This may not be too surprising since derivative securities, like other financial instruments, are financial assets (liabilities) whose value should be reflected in the market value of the firm on a one-for-one basis. The more interesting (and controversial) economic issue is how derivative securities are used by banks. As Venkatachalam notes, most bank managers claim that derivatives held for purposes 'other than trading' are used for asset-liability management purposes (hedging). However, there is little outside investors can do to verify this and mitigate their concerns that managers might be using the derivatives to 'take a view' on future interest rates or foreign exchange rates. Indeed, this is one of the principal reasons FASB is addressing the hedging/derivatives question. Thus Venkatachalam investigates whether the SFAS-119 disclosures can be used to determine how bank managers use derivatives.

If banks are using derivative securities for hedging purposes, one would expect that, through time for a given bank, gains (losses) on the derivatives positions would, if the hedge were perfect, exactly offset losses (gains) on the banks' underlying exposures. That is, there should be a perfect negative correlation in time-series. Of course, if banks choose, as is likely given transactions costs and other considerations, to be less than perfectly hedged, we expect to observe a less than perfect negative correlation. In addition, the \textit{observed} relation may be less than perfect because there are likely to be timing differences between when gains and losses on these instruments occur and when they are recognized for accounting purposes.\textsuperscript{8} Finally, another problem with testing this hypothesis is that the SFAS-119 data are currently available only for one year. As a result of this constraint, Venkatachalam is forced to assess banks' 'hedging

\textsuperscript{7} Of course, it is even more troubling when regression coefficients take a sign that is \textit{opposite} to what researchers predict. For example, in Barth, Beaver, and Landsman (1992) the coefficient on the service cost component of the pension expense is \textit{positively} related to market value, opposite in sign to what the authors predict. Since this component of the expense is relatively easy to measure and understand, the fact that this coefficient takes the 'wrong' sign makes it more difficult to interpret the other results in the paper: if market participants can't correctly assess the implications of the service cost component, is it reasonable to expect them to correctly interpret the more complex components of pension expense?

\textsuperscript{8} This problem is mitigated to the extent that bank managers hedge accounting rather than economic exposures.
effectiveness' using cross-sectional data, which may make it more difficult to interpret the evidence.\(^9\)

The results of the hedging effectiveness tests indicate that there is a negative cross-sectional relation between gains (losses) on derivatives and gains (losses) on balance sheet items. However, this relation is small in economic terms – the regression \(R^2\) is only 4\%. Moreover, if banks are hedging, we not only expect a negative relation but also that the observations fall in the northwest and southeast quadrants of Figs. 1 and 2 in the paper [so that gains (losses) on derivatives offset losses (gains) on balance sheet items]. However, as is clear from Figs. 1 and 2 in the paper, many of the observations fall in the southwest quadrant, indicating that derivatives losses are associated with losses on balance sheet items, which seems inconsistent with hedging. In addition, Venkatachalam reports that only 47\% of the observations fall in the predicted (hedging) quadrants, so that over half of the observations fall into quadrants that seem inconsistent with hedging. So it is difficult to interpret these results as being consistent with hedging, although more powerful tests will have to wait until time-series data are available [it is hard to interpret cross-sectional tests like these because they assess correlations at a single point in time (or for a relatively short period) whereas hedging operates through time for a given firm].\(^{10}\)

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3. **Aboody (1996) on the market valuation of employee stock options**

The paper by Aboody is potentially important because it addresses how the market prices data on employee stock options (ESO), an issue clearly of interest to accounting regulators given the recent debate over accounting for these instruments. In addition, the Aboody paper is unusual in this literature because it precedes the relevant accounting pronouncement, and so potentially provides regulators with evidence before they make their final decisions. However, notice that the paper, like other association studies, cannot address the key question in the ESO debate, that of disclosure vs. recognition (Bernard and Schipper, 1994). In addition, the paper cannot address the 'economic consequences' arguments often raised by corporate executives in the ESO debate; this requires an 'event

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\(^9\)For example, in any given year all banks are exposed to the same interest rate shocks and so, to the extent that their hedging strategies are similar, we may not have a great deal of variation in the variables of interest.

\(^{10}\)Time-series data would help mitigate both the timing problem (gains and losses on the hedging instruments may not be recognized in earnings in the same period as the corresponding gains and losses on the underlying exposures) and the problem that there is limited variation in the underlying economic variables in any given year.
study' approach along the lines of those done for other accounting pronouncements.\textsuperscript{11}

3.1. Does the market price ESO values?

The basic issue in the paper is whether the estimated value of ESOs is reflected in stock prices. Because the study predates SFAS-123, the author uses data that firms provide in footnotes and proxy statements under APB-25 to estimate the value of ESOs, an exercise that the author presumes investors also undertake. Information on the value of ESOs potentially affects stock prices in two countervailing ways:

- **Dilution effect:** Issuing ESOs dilutes the value of existing stockholders' claims on the firm, implying that ESO value is inversely related to stock price.
- **Incentive effect:** Issuing ESOs more strongly aligns employees' incentives with those of stockholders, helps reduce employee turnover, etc., implying that ESO value is positively related to stock price.

Because the relative strength of these two effects is unclear, the author does not make a prediction about magnitude or the sign of the coefficient on the ESO variable. For example, if ESO value equals the value of the employee's contribution to the firm, then we would expect the coefficient to be zero. In addition to the relative strength of the two effects, the expected magnitude of the coefficient will be affected by the relative timing of the two effects (e.g., how soon do the incentive benefits accrue to the firm?), by how quickly the incentive benefits are recognized in accounting earnings and by how quickly market participants recognize these benefits. All of these ambiguities complicate our interpretation of the author's results.

Despite these ambiguities, the author is able to predict (plausibly) that as time passes after the grant date, the incentive effect will be increasingly impounded into the firm's earnings and book value, so that the dilution effect will have a increasingly strong influence on the value of the ESO coefficient (i.e., he predicts that the coefficient will become more negative through time).

To assess how the market values ESOs, Aboody regresses stock price on the net book value of balance sheet assets and liabilities, on net income for the period, and on his estimate of ESO value. This specification is motivated by reference to Ohlson, although it only very loosely fits the Feltham–Ohlson framework. In that model stock price equals book value plus the present value of future expected abnormal earnings. In Aboody’s specification, the present value of future expected abnormal earnings is represented by current earnings.

\footnote{Dechow, Sloan, and Sweeney (1996) recently conducted such a study for the ESO issue.}
This is an important simplification that ignores future growth in earnings and book values. Nevertheless, this specification is often used in cross-sectional levels studies, the most obvious problem being that the firm’s future growth prospects becomes a potentially important omitted variable. The question then becomes one of assessing whether future earnings growth is a correlated omitted variable.

An additional step in the Aboody paper, compared to papers that assess the value relevance of footnote disclosures already mandated by FASB, is that Aboody has to estimate the value of the ESOs. There are two types of problems in doing this, both of which likely cause measurement error in Aboody’s estimates of ESO values. First, it is not obvious which option pricing model to use, or how the parameters of the model should be adjusted to reflect the unique characteristics of ESOs. For example, the formulae must be adjusted to reflect features like employee turnover and the nontransferability of employee stock options. Second, data on several important inputs to the option pricing formula are not directly available from financial statements. For example, in 60% of cases firms only disclose a range of exercise prices for their ESOs, so Aboody estimates the exercise price as the midpoint of this range.

In addition to these estimation issues, the fact that Aboody is working with data not actually reported in footnotes means that we have to make even stronger assumptions about the role of market participants than usual in association studies. Specifically, to interpret the association tests we have to assume that market participants can and do calculate the value of ESOs in the same way as Aboody. That is, we have to assume that market participants behave as if the ESO data are already reported in footnotes. Moreover, because the author does not have access to the actual disclosures proposed by FASB, and must rely on data available under previous accounting pronouncements, it is difficult for him to make strong statements about the efficacy of FASB’s proposed disclosures.

A final complication in Aboody’s study is that causality runs both from stock prices to ESO value (because option prices depend on the price of the underlying stock) and from ESO value to stock prices (this is the informational issue being addressed). To address this simultaneity issue, Aboody uses a two-stage instrumental variables approach to estimate the relation between stock price levels and estimated ESO values.

The results of the cross-sectional regressions indicate that, on average, the coefficient on estimated ESO value is reliably negative and not significantly different from −1. The author interprets this as evidence that the dilution effect dominates the incentive effect. However, as usual, there are other explanations for the result, and we cannot conclude that ESOs do not have incentive effects. For example, it may be that measurement error plays a role in this regression. As noted above, the ESO variable is likely to be measured with error. In addition, the coefficient on book value is less than one, 0.7, suggesting that, as we might expect, the book value of equity measures the net market value of on-balance
sheet assets and liabilities with error. These facts, combined with the fact that we
know the regression excludes important determinants of value (such as future
expected growth), make measurement error explanations more likely. In
addition, we once again have to make assumptions about the level of sophistica-
tion of market participants. And here the assumption is even stronger because
we have to accept that market participants are sophisticated enough to perform
the same valuation calculations done, at some cost, by the author.

Finally, even without these problems, it is still difficult to conclude from the
author's evidence that incentive effects of ESOs are 'small' or nonexistent. This
follows because the incentive effects of ESO plans may be picked up in stock
prices, earnings, and hence book values even before options are actually granted
to employees. For example, stock price may impound the incentive benefits of
ESO plans at the time the firm's first ESO plan is announced, and many of the
incentive effects may also take place before options are actually granted (if, for
example, employees are less likely to leave the firm once an ESO plan is put in
place). If this is the case we would expect the coefficient on ESO value to be
even with strong incentive effects because the incentive effects are
already captured by the earnings and book value variables.

These interpretational concerns are only partially mitigated by estimating the
regressions in changes form and by including proxies for growth. First, the
changes specification yields only marginally significant results on the ESO
variable (p-value of 0.13), although we expect this specification to be less
powerful. Second, as is often done in these studies, Aboody addresses the
correlated omitted variables problem in an ad-hoc fashion by including several
'growth' proxies, such as past earnings growth, advertising expense, R&D
expense, etc., and reporting (in a footnote) that the results are not affected by
including these variables. This is not a satisfactory way of implementing the
Feltham–Ohlson model, since these variables will only roughly relate to the
present value of abnormal future earnings. For example, past earnings growth
rates do not translate into future earnings growth rates very well. In addition,
these variables do not capture the likely period of a firm's future earnings
growth, or the extent to which its future expected ROE exceeds the cost of
capital. And notice that omitting growth potential may be important here if, as
seems likely, the relative value of ESOs is larger for smaller, 'high-tech' firms that
have more growth opportunities (indeed, this is why so many Silicon Valley
companies prefer this form of compensation).

12 If, as seems likely, ESO value is positively related to future growth opportunities, excluding
growth from the regression would bias the estimated coefficient on ESO value upwards, and so
cannot explain why the coefficient is negative. This explanation may, however, be important for
smaller sample firms (for which growth may be relatively more important) and may explain why the
coefficient on ESO value is less negative for these firms.
3.2. How does the basic result vary across sample partitions?

To provide some additional insights into the basic result, Aboody reestimates the regressions after partitioning the sample in several ways. First, Aboody partitions the sample according to the vesting stage of the options. He finds that the coefficient on ESO value is positive (but not significant) for options early in the vesting period and becomes negative (and significantly so) as ESOs move further and further into the vesting period. If more of the benefits associated with the options' incentive effects get impounded in earnings and book value as the options move later into the vesting period, this result reinforces the author's interpretation of the results. That is, we would expect the coefficient on ESO value to become more negative as more of the incentive effect gets captured by the earnings and book value variables and less gets captured by ESO values. In the limit we expect the coefficient on ESO value to be $-1$ once all of the incentive benefits are captured in earnings and book value. So this evidence helps support the author's interpretation.

The author next partitions the sample according to the extent to which ESO value is due to intrinsic vs. time value, and finds that the negative coefficient on ESO value is largely driven by the intrinsic value of ESOs. Since an option's intrinsic value (the extent to which the option is 'in-the-money') is easier to measure than its time value, and since intrinsic value becomes relatively more important as options get closer to maturity, the vesting period result may be due to the fact that the options' relative intrinsic value gets larger later in the vesting period. This is true as long as ESOs, on average, move into-the-money over time, which seems likely. This points toward another related explanation for the author's findings. Perhaps it is the case that market participants focus on the dilutive effects of ESOs (which are relatively easy to calculate and so potentially more visible) and underestimate the incentive benefits (which are harder to measure and so less visible). In other words, there may be differential measurement-error problems for the dilution and incentive effects. Once again we are left with some interpretational difficulties.

The author's final partition is based on firm size. He finds that the negative coefficient on ESO value holds for large sample firms but not for small sample firms. For small sample firms the coefficient on ESO value is not reliably different from zero. Once again, there are several potential explanations for this result. One possibility is that incentive effects are relatively more important for smaller sample firms (perhaps because these firms are more 'hard-nosed' about issuing ESOs) so that the incentive effects offset the dilution effects for small firms but not for large firms. This raises the interesting possibility that large firms use ESOs as employee rewards while smaller firms use them more for incentivizing their employees. Another alternative, discussed by the author, is that small firms may be followed by less sophisticated investors than large firms, and these less sophisticated investors are unable to appreciate the value
implications of ESOs. Although this explanation may be true, it seems inconsistent for the author to invoke the view that the market is inefficient for this particular subset of the sample when the results turn out unexpectedly, while adhering to a strong efficiency assumption in the rest of the paper.

3.3. Is FASB's proposed expense incrementally informative?

Finally, Aboody examines whether FASB's proposed ESO expense number has incremental explanatory power in a regression that also includes estimated ESO value along with the other independent variables. He finds that the coefficient on the estimated FASB expense is insignificantly different from zero, and concludes that FASB's method for recognizing the expense will not increase (and may even reduce) the informativeness of reported earnings. This conclusion is too strong, since other explanations seem equally likely. For example, we know that FASB's expense is based on the value of new ESOs granted in a particular year and (from the author's previous results) that the coefficient on ESO value is close to zero for options early in their vesting period. Since options vest either at the grant date or in later years, we expect the coefficient on newly granted ESOs to be close to zero. Alternatively, it may be that measurement error in estimating FASB's expense biases the coefficient on that variable towards zero. This is plausible because the value of newly-issued options largely depends on their time value, which is more difficult to estimate. Or, FASB may have produced the correct number (the 'true' ESO expense) but market participants may have difficulty estimating, processing, and understanding this number. Finally, it could be that, because FASB has not yet instituted its proposal, market participants place less weight on the numbers – perhaps if FASB were to mandate the proposal market participants would respond differently to the information. The bottom-line is that it is difficult to make any strong statements about the informativeness of FASB's proposed expense based on the evidence presented here.

4. Conclusion

Overall, the papers by Venkatachalam and Aboody provide some interesting evidence on issues that are important to accounting regulators as well as accounting academics. However, for econometric as well as economic reasons,

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13 This is the expense that the FASB proposed in their June 1993 Exposure Draft, but dropped in the final statement.

14 ESOs are often issued at-the-money, so their intrinsic value is zero.
there are limits to what we can learn from this type of research (cross-sectional 'levels' studies). Careful attention to methodological issues in this type of research design can reduce, but likely will not eliminate, these interpretational difficulties.

References

Bernard, V. and K. Schipper, 1994, Recognition and disclosure in financial reporting, Unpublished paper (University of Michigan, Ann Arbor, MI).