Uniformity versus Flexibility: Evidence from Pricing of the Pension Obligation

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ABSTRACT: We functionally derive the discretionary component of the pension obligation (PBO) based on deviation of actuarial assumptions—discount rate and compensation growth rate—from their respective industry medians. We then examine the implications of allowing discretion in the choice of pension assumptions on the pricing of the PBO. We find no evidence that discretion—as currently allowed under U.S. GAAP—impairs the value relevance of the PBO. We also find that the discretionary component is incrementally value-relevant beyond the nondiscretionary component. Additional analyses suggest that these results are unlikely attributable to market fixation on reported PBO or measurement error in our discretionary component. Overall, we find that imposing uniformity in the choice of pension assumptions, on average, prevents communication of value-relevant information through the PBO.

Keywords: value relevance; pensions; discretion; flexibility; uniformity; earnings management; managerial opportunism; information communication.

Data Availability: The data used in this study are publicly available from the sources indicated in the text.

I. INTRODUCTION

There is an ongoing debate over "uniformity versus flexibility" in financial accounting. Some argue the flexibility afforded by Generally Accepted Accounting Principles (GAAP) allows managers to opportunistically manipulate financial reports, as evidenced by a large earnings management literature. Others believe flexibility facilitates efficient contracting (e.g., Watts and Zimmerman 1986) and improves private information communication through financial reports (e.g., Healy and Palepu 1993). This tension is best

described by Dye and Verrecchia (1995, 390): ''Whether expanding discretion in accounting choice is desirable appears to depend on whether the prospects for improved communication of the firm's financial condition are more than offset by the effects of managerial opportunism.'' Ultimately, whether flexibility (discretion) improves or impairs the quality of financial accounting information is an empirical question.

In this paper we examine the effects of discretion, as currently allowed under U.S. GAAP, on the value relevance of the pension obligation. The measurement of the projected benefit obligation (PBO)—the pension obligation for defined benefit plans—is a complex process that involves making a number of actuarial assumptions, of which the discount rate and compensation growth rate are the most important. Accordingly, our research question is as follows: Does the discretion currently allowed under U.S. GAAP in the choice of pension (actuarial) assumptions—the discount rate and compensation growth rate—improve or impair the value relevance of the PBO? To address this question, we construct a measure of ''nondiscretionary'' PBO by replacing the firms' discount rate and compensation growth rate assumptions with their respective industry medians. The difference between reported PBO and our measure of nondiscretionary PBO is our estimate of the discretionary component. We then examine the value relevance of the estimated discretionary component of the PBO through price association regressions.

We choose to study the PBO for several reasons. First, prior studies (e.g., Subramanyam 1996) have addressed a similar research question by examining the pricing of discretionary accruals. The inferences from these studies, however, are questionable because discretionary accruals are subject to considerable measurement error (Bernard and Skinner 1996; Guay et al. 1996). The advantage of studying the PBO is that the assumptions used in determining the PBO are disclosed in footnotes; hence, it is possible to estimate a discretionary component that is likely less susceptible to measurement error than discretionary accruals.[1] Second, it is widely accepted that defined benefit pension accounting allows considerable managerial discretion and is a fertile area for manipulation (e.g., Gopalakrishnan and Sugrue 1995). However, variation in pension assumptions also reflects economic differences in pension plans (Blankley and Swanson 1995). Therefore, the PBO provides an ideal setting to examine the trade-off between the costs and benefits of allowing discretion in financial accounting choices. Finally, pension obligations are economically significant for the purpose of this study because they are large in magnitude and are sensitive to actuarial assumptions.

Using a large sample over 1991–2003, we perform both relative and incremental price association tests for evaluating the value relevance of the discretionary PBO component. Our relative price association tests compare the explanatory power of non-nested regressions of market value on pension and nonpension assets and liabilities (and a vector of controls) that alternatively use the reported PBO and our measure of nondiscretionary PBO as the pension liability. Our incremental price association tests examine whether the market incrementally attaches value to the discretionary component of the PBO beyond the nondiscretionary component. We find no difference in explanatory power (or in the pricing coefficient on the pension obligation) across the discretionary and nondiscretionary models in our relative price association regressions. However, we find that the discretionary component is incrementally valued by the market in a similar manner to the nondiscretionary

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[1] Other studies have also used specific accruals to examine the value relevance of the discretionary component. For example, Beaver and Engel (1996) examine the pricing of the discretionary component of loan loss reserves for commercial banks. Discretionary component of specific accruals is arguably less prone to measurement error than discretionary accruals. As we discuss later, our methods have the added advantage that we functionally (rather than statistically) estimate the discretionary component.

component in the incremental price association regressions. Overall, our results suggest that (1) discretion—as currently allowed under U.S. GAAP—does not impair the value relevance of the PBO; and (2) the discretionary component is incrementally value-relevant. Thus, our results are consistent with discretion in the choice of pension assumptions, on average, facilitating the communication of value-relevant information through the reported PBO.

Our results are subject to two alternative explanations: (1) measurement error in our discretionary PBO proxy causes our pricing results to arise spuriously; and (2) the discretionary component of the PBO is priced because the market fixates on reported PBO without appreciating the differential (if any) value relevance of the discretionary and nondiscretionary components. Measurement error in our setting could arise because (1) our estimate of discretionary PBO could reflect the effects of deviations in pension assumptions from their respective industry medians with error; and (2) industry medians are inappropriate benchmarks. Several diagnostic tests suggest that our discretionary PBO proxy reflects the effects of deviation in pension assumptions accurately. However, we are unable to test the appropriateness of industry-based benchmarks, although sensitivity analysis with alternative benchmarks does not alter our inferences. Regarding the market mispricing explanation, Aboody et al. (2002) conclude that market inefficiency does not materially affect inferences in value relevance studies that use a price (levels) specification such as ours. Moreover, our tests of future abnormal returns suggest that there is unlikely any market mispricing related to the discretionary PBO component. Nevertheless, we substitute price with a measure of *ex post* intrinsic value as a proxy for firms' fundamental value and show that our results are qualitatively similar to those using contemporaneous stock price, both for the relative and the incremental analyses.[2]

Our findings contribute to the ongoing debate on "uniformity versus flexibility" in accounting standard setting. We show that allowing flexibility (discretion) in the choice of pension assumptions—as currently allowed under U.S. GAAP—on average improves information communication through the PBO. Our results are consistent with the benefits of allowing discretion, i.e., private information communication, outweighing the costs, i.e., opportunistic manipulation. Thus, our study complements prior research by examining the pricing implications of discretionary choices in a unique setting. Given the importance of the research question and the measurement problems inherent with estimating the discretionary component, our paper contributes to the literature by using an alternative methodology that is likely less susceptible to the measurement error problem.

Our analyses are subject to several caveats. First, while the PBO offers several advantages for examining our research question, its major drawback is that it is a balance sheet item (rather than an income statement item) that is presently not recognized on the financial statements. Although prior research (e.g., Barth 1991) shows that footnote disclosures of pension obligations are priced by the market in a similar manner to other liabilities on the balance sheet, it is possible that market pricing of disclosed items may differ from those recognized on the financial statements. Besides, examining the pricing implications of a balance sheet item does not fit the traditional notion of "earnings" management. Thus, our paper adopts a broader definition of discretion than that adopted by much of the prior

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[2] In the spirit of Aboody et al.'s (2002) suggestion, we measure *ex post* intrinsic values as the present value of three future years of dividends and three-year-ahead market price.

literature, which largely focuses on earnings management.[3] Second, similar to other papers that examine specific accruals choices (e.g., Wahlen 1994), our results may not apply broadly to all accrual choices. This reduces the generality of our inferences. Third, while we perform alternative tests that control for potential market inefficiency, we cannot completely rule out the stock market's functional fixation on reported PBO as an alternative explanation for our results. This is because pension obligations are long-term in nature and it is difficult to control for mispricing that persists over many years. Fourth, our basis for evaluating the benefits of discretion is through association with stock price. Holthausen and Watts (2001) criticize value relevance research that examines standard-setting issues through association with stock price/returns. While acknowledging this criticism, we note that we are not using stock price as the basis for addressing a specific standard-setting issue. Rather, we merely use stock price as a proxy for determining whether economically relevant information is communicated through discretionary choices.

Finally, our inferences are sensitive to our choice of industry-based benchmarks for defining uniformity (or discretion). Specifically, we conclude that imposing uniformity in the selection of pension assumptions impairs information communication through the PBO. However, this inference depends crucially on the particular form of uniform accounting adopted. We define uniformity at the industry level. The choice of industry for determining uniformity appears appropriate based on institutional evidence. One can, however, visualize a richer uniform accounting regime that allows more firm-specific details than that captured at the industry-level. If such a regime can be successfully implemented (without the moral hazard problems that characterize flexible accounting), it is possible that it may be more informative than a regime that allows flexibility such as the U.S. GAAP.

The rest of the paper is organized as follows. Section II motivates our research question. Section III discusses sample, research design, and provides descriptive analysis. Section IV presents our empirical results. Section V explores alternative explanations and Section VI concludes.

II. MOTIVATION AND DISCUSSION

In addition to widespread allegations in the financial press, academic research documents a vast body of evidence relating to opportunistic earnings management. (See Schipper [1989], Healy and Wahlen [1999], and McNichols [2000] for reviews of the earnings management literature.) Even managers admit they routinely manage earnings for opportunistic reasons (Graham et al. 2006). Evidence of managers misusing the discretion allowed by GAAP raises questions about the desirability of allowing flexibility in financial reporting. However, it is not clear whether the alternative, i.e., eliminating flexibility through some form of uniform accounting, will make accounting numbers more informative. Flexible accounting rules allow firms to contract more efficiently (Watts and Zimmerman 1986) and to communicate value-relevant private information through accounting numbers (Schipper 1989; Healy and Palepu 1993; Sankar and Subramanyam 2001). The ongoing ''uniformity versus flexibility'' debate in accounting standard setting, therefore, involves trading off the relative benefits of allowing discretion, i.e., improved private information communication, with its costs, i.e., opportunistic manipulation (Dye and Verrecchia 1995).

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[3] Balance sheet management is recently starting to attract attention from both academics (Gramlich et al. 2001) and practitioners (Lundelius 2003). Research also shows that footnote information is manipulated (Bartov et al. 2004) and in particular the pension obligation (e.g., Asthana 1999). Besides, recent SEC investigations suggest that regulators are specifically concerned about PBO manipulation through discount rate assumptions (Schultz 2004).

Given its importance to standard setting, there are surprisingly few empirical studies that examine whether discretion improves or impairs the quality of financial reporting. Subramanyam (1996) documents that the stock market prices discretionary accruals, which suggests that discretion on average enhances the value relevance of earnings. Hunt et al. (1998) show that income smoothing is associated with higher price-earnings multiples, while Tucker and Zarowin (2006) show that discretionary income smoothing improves the informational efficiency of stock prices. The evidence from these studies, however, is inconclusive because measurement error in the discretionary accruals proxy could spuriously induce discretionary accruals to be priced. For example, Bernard and Skinner (1996) point out that measurement error can induce the discretionary accruals proxy to contain a large nondiscretionary component. Also, Guay et al. (1996) show that models that decompose accruals into discretionary and nondiscretionary components (including the Jones 1991 model and its variants, which are used by most papers in this genre) are subject to such large measurement error that they are indistinguishable from a random decomposition of accruals. In either case, the pricing results of Subramanyam (1996) and others could arise simply through measurement error in the discretionary accruals proxy.

One approach to reducing measurement error in the discretionary accruals proxy is modeling specific accrual choices (McNichols 2000). For example, researchers have modeled the discretionary component of loan loss reserves/provisions in commercial banks (e.g., Wahlen 1994; Beaver and Engel 1996; Beaver and Venkatachalam 2003) and loss reserves in property casualty insurance companies (e.g., Petroni et al. 2000; Beaver and McNichols 1998, 2001).[4] While it is difficult to identify a specific accrual that is economically significant for this purpose, the advantage of this approach is that it allows researchers to exploit their knowledge of GAAP and the economic determinants of the specific accrual to model the nondiscretionary component more accurately.

In this paper we examine the value relevance of a specific accrual that is subject to managerial discretion: the projected benefit obligation (PBO) of defined benefit pension plans. We choose the PBO as the target of our analysis for several reasons. First, pension obligations are large in magnitude and often can exceed 50 percent of the total liabilities of a firm. In addition, the PBO is sensitive to changes in underlying actuarial assumptions.[5] Taken together, the average magnitude of the PBO and its sensitivity to assumption choices makes it an economically significant item to study for our purpose.

Second, the PBO provides an ideal setting in which to examine the tension between the costs and benefits of allowing discretion in accounting choice. On the one hand, defined benefit pension accounting allows considerable scope for managerial discretion, and is regarded as a fertile area for manipulation (Buffet and Loomis 2002). For example, managers can exercise discretion in choosing pension assumptions such as discount rates and compensation growth rates, both of which have significant impact on the PBO. Several studies (e.g., Blankley and Swanson 1995; Gopalakrishnan and Sugrue 1995; Godwin et al. 1996;

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[4] The evidence regarding the value relevance of the discretionary component from these ''specific accrual'' studies is mixed. With respect to commercial banks, Wahlen (1994) shows that the discretionary component of loan loss provisions explains future cash flow changes and Beaver and Engel (1996) find that the discretionary component of loan loss reserve is positively associated with prices. Beaver and Venkatachalam (2003) show that market pricing of loan loss reserves and loan fair values depend on signaling or opportunistic motivations of managers. Also, a number of papers have partitioned property casualty insurance companies' loss reserves into discretionary and nondiscretionary components. However, only Petroni et al. (2000) examine pricing implications of discretion in property casualty loss reserves, and find mixed results. Outside the financial sector, Kallapur and Kwan (2004) examine the effect of discretion on the pricing of brand values.

[5] For example, we estimate that a 1 percent (100 basis points) change in the discount rate would, on average, yield an 11 percent change in PBO in our sample.

Asthana 1999) find that pension assumptions vary considerably across firms and that management's pension assumption choices are influenced by reporting incentives associated with agency considerations. Also, regulators (in particular, the SEC) are concerned that pension assumptions are being used to window dress financial statements (Borrus et al. 2004), especially through the use of high discount rates to reduce PBO values (Schultz 2004). On the other hand, discretion in pension assumptions may be exercised by management to reflect real economic differences among pension plans (e.g., Blankley and Swanson 1995). For example, SFAS No. 87 indicates that the selection of discount rates should be based on current prices for settling the pension obligation.[6] Therefore, discount rates can vary across firms for at least two reasons. First, the age of the workforce can differ across firms. Assuming an upward-sloping yield curve, firms with an older workforce should use lower discount rates due to the relatively shorter maturity of their pension obligations. Second, interest rates vary across countries. Thus, firms with international operations should use different discount rates based on the relative exposure of their pension plans in various countries. Similarly, compensation growth rates can vary across firms for economic reasons. For example, labor markets are not perfectly competitive and there can be specific skills required in different companies and industries, thereby creating cross-sectional variation in compensation growth rates.

Finally, the most important advantage of studying the PBO is that we are able to use footnote disclosure to *functionally* derive the discretionary component through manipulating pension assumptions. Past methods, including those using specific accruals, *statistically* estimate the discretionary component as the residual from a regression of the accrual on a vector of likely determinants. For example, Jones (1991) models accruals as a function of PP&E and change in sales, and Beaver and Engel (1996) model loan loss reserves as a function of net loan charge-offs, loans outstanding, nonperforming assets, and one-year-ahead change in nonperforming assets. Under such methods, any unexplained portion of the accrual is automatically classified as discretionary. Therefore, measurement error in the discretionary component can arise merely because the model estimating the accrual is incompletely specified, i.e., there are economic determinants of accruals—unrelated to discretion—that have not been modeled (Bernard and Skinner 1996). In contrast, our discretionary component is estimated deterministically as a function of reported pension assumptions—the discount rate and compensation growth rate—and their respective industry median benchmarks. By functionally deriving the discretionary component rather than estimating it as the residual from a regression, our method is not subject to measurement error arising from incomplete model specification.[7] Of course, our measure of discretionary PBO is not error-free. Measurement error can arise from estimation error and simplifying assumptions in parameters that are used for estimating the discretionary PBO component. However, diagnostic tests (see Section V) suggest that the extent of such measurement error is unlikely material.

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[6] In determining the discount rate, SFAS No. 87 permits consideration of a broad range of factors, including annuity or Pension Benefit Guaranty Corporation (PBGC) interest rates and interest rates on long-term, high-quality, fixed-income investments. In a letter to the EITF in 1993, the SEC specifically suggested using high-quality corporate debt yields as assumed discount rates for pension plans.

[7] For example, analogous to the Jones (1991) model, we could model the discretionary component of PBO as the residual from the following regression: $PBO = a + b*EMP + e$, where *EMP* equals number of employees. When estimated in such a manner, any variation in *PBO* that arises because of factors orthogonal to number of employees—such as wage levels, pension formulae, years of service—will be attributed to the discretionary component. Such a problem does not arise in our methodology that functionally models the discretionary component of the PBO.

While the PBO offers several advantages for examining our research question, its major drawback is that it is a liability (as opposed to an income statement item) that is not recognized on the financial statements.[8] Therefore, our paper does not examine the implications of earnings management in its narrow sense, but rather implications of a broader concept of "accounts" management, which includes management of balance sheet and footnotes.[9] Besides, two problems arise when using a mere disclosed (as opposed to recognized) item to test our research question. First, users may not weight disclosed items similarly as recognized items. Prior research (e.g., Barth 1991), however, shows that PBO footnote disclosures are priced by the market in similar manner to other liabilities on the balance sheet. Second, managers may not be interested in manipulating items that are merely disclosed in footnotes. While this is possible, there is evidence suggesting that managers do manipulate pension assumptions that determine the PBO (e.g., Gopalakrishnan and Sugrue 1995) and the SEC is concerned about PBO management (Schultz 2004).

Finally, our definition of the discretionary component is dependent on the particular form of uniform accounting we propose. Therefore, our methodology does not eliminate measurement error in our discretionary component that arises from inappropriate choice of the benchmark. We choose the industry as our benchmark because the largest economic differences across firms are due to industry factors.[10] Our choice of industry as the basis for uniform accounting may be criticized for being too broad to be meaningful because it does not take into consideration myriad economic differences across firms within an industry. An ideal first-best solution would be a system of uniform accounting that incorporates the rich diversity across firms through a system of complex rules. However, such a system will be practically impossible to codify and implement. Therefore, practically the choice is between two second-best solutions: (1) a GAAP that eliminates discretion but imposes arbitrary one-size-fits-all rules (uniformity); or (2) a GAAP that specifies broader principles and allows managers discretion to choose assumptions that best reflect their idiosyncratic economic reality (flexibility). In a sense, our paper compares the costs and benefits of these two second-best solutions—while arbitrary uniformity will eliminate the moral hazard problem, it will also prevent the richness of the firms' economic reality from being reflected in the accounting numbers (Dye and Verrecchia 1995).

III. SAMPLE, RESEARCH DESIGN, AND DESCRIPTIVE STATISTICS
Sample

Our sample is drawn from all U.S. firms with necessary pension and stock price data available in the Compustat annual industrial, full coverage and research files. We limit our sample to the 1991–2003 time period because data on pension assumptions, such as compensation growth and discount rates, are available in Compustat only after 1990. After excluding all firm-years with sales less than $10 million, our final sample includes 12,567 firm-years comprising of 1,707 unique firms. For the future-returns analysis, we further

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[8] SFAS No. 87 uses a corridor method to smooth the effects of PBO assumption changes (and actual return on plan assets) on reported pension expense. In order to articulate the balance sheet with the income statement, SFAS No. 87 does not recognize the PBO (or the fair value of plan assets) on the balance sheet. What is recognized instead is accrued or prepaid pension cost.

[9] A recent survey paper does refer to "accounts" manipulation, rather than earnings manipulation (Stolowy and Breton 2004). Also, recent papers provide evidence of balance sheet management (e.g., Gramlich et al. 2001) and footnote manipulation (Bartov et al. 2004).

[10] Standard-setters also recognize the industry as the logical basis for setting uniform standards (e.g., AICPA issues SOPs that are largely industry-specific). Also analysts often benchmark on industry averages when performing financial statement analysis.

restrict our sample to firms with three-year-ahead monthly stock returns from CRSP. In our regression analysis, we delete 1 percent of observations with the smallest and the largest values of studentized residuals to remove the effect of outliers.

Distribution of Pension Assumptions

Firms can decrease (increase) the PBO by choosing a higher (lower) discount rate or a lower (higher) compensation growth rate. Under SFAS No. 87, firms are required to disclose these pension assumptions in footnotes. Table 1 reports the distribution of discount rate and compensation growth rate assumptions used by our sample firms over the 1991–2003 period. The mean discount rate (r) over our sample period is 7.45 percent. The mean compensation growth rate (g) is 4.84 percent. The cross-sectional variation in both r and g are fairly substantial throughout the sample period, with the by-year standard deviation of r (g) close to 0.60 percent (0.80 percent). The by-year range of r (g) is greater than 5 percent (6 percent) in each of the 13 years, with the largest single-year range up to 11.00 percent (13.00 percent). In short, there is large cross-sectional variation in both r and g, which is much larger than the variation over time. While this large cross-sectional variation could arise from managerial attempts to manage the reported PBO numbers, it is also possible that the variation reflects economic differences in pension plans across firms.

Computation of Discretionary and Nondiscretionary PBO

As mentioned earlier, we compute the discretionary component of the PBO as the difference between the reported PBO (as disclosed in the pension footnote) and an estimate of nondiscretionary PBO. Our estimate of nondiscretionary PBO is determined by substituting the company's assumed discount rate (r) and compensation growth rate (g) with their respective industry medians for each year. Specifically

$$PBO = \frac{P_{r,L}(KW(1 + g)^N)}{(1 + r)^N} \qquad (1)$$

where $P_{r,L}$ is the present value factor of an L period annuity at a discount rate of r, i.e., $r^{-1}(1 - (1 + r)^{-L})$, L is the employees' post-retirement life expectancy, K is the proportion of the employees' wages that are payable as pension benefits given current service and vesting, W is the current wage, g is the wage (i.e. compensation) growth rate, and N is the number of years to retirement. Conceptually, *PBO* is the present value of the projected pension benefit annuity of $KW(1 + g)^N$ that is expected to be paid annually over an L-year period after the date of retirement. The projected benefit annuity is simply the proportion of current pension wage component, KW, projected as of the retirement date. Our objective is to estimate the change in *PBO* due to changes in the discount rate (r) and the compensation growth rate (g). In order to do this, we need to determine the three unknowns in Equation (1): life expectancy (L), years to retirement (N), and the pension wage component (KW).

We assume that life expectancy after retirement is 15 years, i.e. $L = 15$.[11] We estimate N by inverting the following relation between *PBO* and *ABO* (see Subramanyam and Zhang 2001):

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[11] The life expectancy for age 65 males during the mid 1990s was between 15 and 16 years. We round it down to 15 years. See the Centers for Medicare and Medicaid Services website: http://www.cms.hhs.gov.

TABLE 1
Distribution of Discount Rate and Compensation Growth Rate Assumptions

Discount Rate (r)

%	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Total
Mean	8.32	8.15	7.43	8.14	7.43	7.57	7.25	6.82	7.48	7.49	7.15	6.66	6.12	7.45
Std. Dev.	0.63	0.61	0.51	0.62	0.58	0.53	0.56	0.59	0.67	0.63	0.62	0.66	0.56	0.83
Minimum	4.50	4.50	5.00	5.00	4.00	3.50	3.50	3.00	3.00	3.00	2.50	2.00	2.00	2.00
1st Percentile	6.50	5.75	5.75	6.00	5.50	4.50	4.50	5.00	5.10	5.75	5.00	3.75	2.70	5.40
5th Percentile	7.25	7.00	7.00	7.00	7.00	7.00	6.75	6.00	6.50	6.56	6.10	6.00	5.60	6.15
25th Percentile	8.00	8.00	7.10	8.00	7.25	7.50	7.00	6.75	7.25	7.50	7.00	6.50	6.00	7.00
50th Percentile	8.50	8.20	7.50	8.25	7.50	7.50	7.25	6.75	7.50	7.50	7.25	6.75	6.25	7.50
75th Percentile	8.75	8.50	7.50	8.50	7.50	7.75	7.50	7.00	7.75	7.75	7.35	6.75	6.25	8.00
95th Percentile	9.00	9.00	8.50	8.80	8.30	8.00	8.00	7.50	8.00	8.00	7.60	7.25	6.50	8.75
99th Percentile	9.50	9.50	9.00	9.00	9.00	8.50	8.50	8.00	8.25	8.25	8.00	7.50	7.00	9.00
Maximum	10.75	10.00	11.00	14.00	13.00	12.00	12.00	12.50	13.00	13.00	13.00	13.00	11.00	14.00
No. of Obs.	1,048	1,131	1,145	1,132	1,116	1,087	1,056	930	885	806	732	762	737	12,567

Compensation Growth Rate (g)

%	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	Total
Mean	5.73	5.54	5.05	5.05	4.86	4.79	4.68	4.55	4.60	4.57	4.46	4.22	4.10	4.84
Std. Dev.	0.84	0.80	0.84	0.80	0.87	0.78	0.78	0.82	0.79	0.74	0.71	0.77	0.79	0.91
Minimum	1.00	1.00	1.00	2.00	2.00	2.00	1.30	1.50	2.00	1.20	2.00	0.30	0.20	0.20
1st Percentile	4.00	3.00	3.00	3.00	3.00	3.00	2.50	2.50	2.90	2.50	2.50	2.00	1.90	2.75
5th Percentile	4.50	4.25	4.00	4.00	3.50	3.50	3.50	3.50	3.50	3.50	3.25	3.00	3.00	3.50
25th Percentile	5.00	5.00	4.50	4.50	4.50	4.50	4.00	4.00	4.00	4.00	4.00	4.00	3.74	4.25
50th Percentile	6.00	5.50	5.00	5.00	5.00	5.00	4.75	4.50	4.50	4.50	4.50	4.12	4.00	5.00
75th Percentile	6.00	6.00	5.50	5.50	5.10	5.00	5.00	5.00	5.00	5.00	5.00	4.63	4.50	5.50
95th Percentile	7.00	6.70	6.25	6.25	6.00	6.00	6.00	5.80	5.75	5.50	5.50	5.40	5.13	6.00
99th Percentile	8.50	8.00	7.50	7.50	7.00	6.50	6.50	7.00	6.50	6.00	6.00	6.00	6.00	7.50
Maximum	9.11	8.50	10.00	8.10	15.00	10.00	10.00	10.00	9.00	9.00	9.50	9.50	9.00	15.00
No. of Obs.	1,048	1,131	1,145	1,132	1,116	1,087	1,056	930	885	806	732	762	737	12,567

$$PBO = ABO(1 + g)^N \tag{2}$$

and solving for *N*:

$$\hat{N} = \frac{Ln(PBO/ABO)}{Ln(1 + g)} \tag{3}$$

where *ABO* is the accumulated benefit obligation disclosed in footnotes. ABO disclosures were discontinued under SFAS No. 132, which became effective in 1998. Therefore, for firm-years after 1997 we extrapolate *N* by using the firm-specific median over the 1991–1997 period.[12]

Note that our measure of *N* is derived from information reflected in the *PBO* and the *ABO*. Therefore, it is a composite measure that reflects the effects of assumptions regarding employee turnover and early retirement frequency in addition to the proportion of retirees and the weighted average years to retirement. In other words, it is essentially a measure of the weighted average expected remaining years of service within the organization. As Table 2, Panel B reports, the mean (median) *N* is 4.2 (3.7) years and a quarter of our sample firm-years have *N* below 2.3. The low values of *N* largely reflect the high proportion of retirees in the pension plans and to a lesser extent the effect of employee turnover. Therefore, while our estimate of *N* is appropriate for measuring the effects of compensation growth, it has measurement error when estimating the effects of discount rates on the *PBO*.

Using each firm's reported *g* and *r* from financial statement footnotes, along with our estimates of *L* and *N*, we determine *KW* as follows:

$$\widehat{KW} = \frac{PBO(1 + r)^{\hat{N}}}{P_{r,15}(1 + g)^{\hat{N}}} \tag{4}$$

With an estimate of *KW*, we can generate estimates of *PBO* under various discount and compensation growth rate assumptions by substituting various values for *r* and *g* in Equation (1). In our case, we substitute *r* and *g* with their respective annual industry medians (where industry is defined based on Fama and French's [1997]) industry classifications) to estimate our measure of nondiscretionary *PBO*:

$$PBO\text{-}X = \frac{P_{r^*,15}(\widehat{KW}(1 + g^*)^{\hat{N}})}{(1 + r^*)^{\hat{N}}} \tag{5}$$

where *r** and *g** represent industry median discount and compensation growth rates. Finally, the discretionary component of the *PBO* is determined by subtracting the nondiscretionary component from the reported *PBO*:

$$PBO\text{-}D = PBO - PBO\text{-}X. \tag{6}$$

Descriptive Statistics

Table 2, Panel A provides descriptive statistics of general sample characteristics. The mean total assets and market capitalization are $9.010 and $4.231 billion (median $1.195

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[12] While measurement error can arise from such extrapolation, we find our estimates of *N* are fairly stable over time for each firm and, thus, we do not expect such measurement error to be significant.

TABLE 2
Descriptive Statistics[a]

	Mean	Std. Dev.	25th Percentile	Median	75th Percentile
Panel A: Sample Characteristics					
Total Assets ($ million)	9,010.061	38,753.088	307.051	1,195.000	5,058.836
Market Capitalization ($ million)	4,231.182	15,409.114	161.201	699.266	2,652.320
Market-to-Book	3.182	60.213	1.230	1.753	2.651
Panel B: Measures of Price Association Regressions					
NPTA	2.495	3.388	0.744	1.141	2.386
NPTL	1.934	3.206	0.396	0.726	1.567
PA	0.182	0.200	0.058	0.122	0.238
NI	0.047	0.135	0.016	0.049	0.092
SALEGRW	0.105	0.466	0.009	0.063	0.134
R&D	0.011	0.032	0.000	0.000	0.008
EMP (thousands)	14.682	32.805	1.276	4.000	13.000
PBO	0.175	0.180	0.062	0.123	0.231
PBO-X	0.175	0.180	0.062	0.123	0.230
PBO-D	0.000	0.014	−0.003	0.000	0.003
N (years)	4.227	2.948	2.287	3.716	5.407

[a] Our sample consists of 12,567 firm-years from 1991–2003. All variables in Panel B except for *SALEGRW* and *EMP* are deflated by current-year sales.
Variable Definitions:
  NPTA = nonpension assets, measured as total assets;
  NPTL = nonpension liabilities, measured as total liabilities adjusted for accrued (prepaid) pension cost;
  PA = fair-value of pension assets;
  NI = income before extraordinary items;
  SALEGRW = average sales growth over the previous three years;
  R&D = research and development expense;
  EMP = number of employees in thousands;
  PBO = projected benefit obligation as disclosed in the pension footnote;
  PBO-X = nondiscretionary component of *PBO*, estimated using industry-medians of assumed discount rate and compensation growth rate;
  PBO-D = discretionary component of projected benefit obligation, i.e., the difference between *PBO-X* and *PBO*; and
  N = estimated average number of years to retirement, calculated as $ln(PBO/ABO) \div ln(1 + g)$, where *ABO* is the accumulated benefit obligation and *g* is the compensation growth rate disclosed in footnotes.

and $0.699 billion), respectively. Mean market-to-book ratio for our sample is 3.182 (median 1.753). These statistics reveal that our firms are generally larger than average with somewhat lower market-to-book ratios, which is consistent with the nature of firms with defined benefit pension plans.[13] Overall, our descriptive data are comparable to those of earlier papers studying pension accounting (e.g., Barth 1991). Panel B of Table 2 provides descriptive statistics for measures used in our price association regressions, with most variables deflated by current-year sales revenue. The mean and median *PBO-X* (0.175 and

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[13] For comparison, the mean total assets, market capitalization, and market-to-book ratio for all firm-years in Compustat during the same sample period are $2.8 billion, $1.4 billion, and 6.56, respectively.

0.123) are identical to that of the PBO, suggesting that the average *PBO-D* is close to zero. Also, the standard deviation of the discretionary component (*PBO-D*) is more than an order of magnitude smaller than that of the nondiscretionary component (*PBO-X*), which suggests that much of the variation in PBO is attributable to industry-wide factors over which the manager has no discretion.

IV. RESULTS
Stock Price Association Tests
We assess the value relevance of the discretionary component of the PBO through price association regressions, where the market value of equity is regressed on contemporaneous accounting measures. We adopt a levels (price) rather than a changes (returns) specification because it is economically better specified (Kothari and Zimmerman 1995), consistent with prior pension research (Landsman 1986; Barth 1991; Barth et al. 1992) and appropriate for our research question, which examines the value relevance of a balance sheet item. However, the price specification suffers from econometric problems, especially heteroscedasticity (Kothari and Zimmerman 1995), and inferences from R^2s can be problematic due to scale bias (Brown et al. 1999). To mitigate these problems, we report results from a sales-deflated version of our model.[14]

We examine both relative and incremental value relevance of the discretionary component of PBO. For the relative value-relevance tests, we compare the explanatory power (and coefficients) across two models where PBO is measured with and without discretion. For the incremental value-relevance tests, we include both the discretionary and nondiscretionary components of PBO in the same model and examine the sign and significance of the coefficient on the discretionary component.

We first examine the *relative* value relevance of the pension liability with discretion (i.e., *PBO*) and without discretion (i.e., *PBO-X*) by comparing the following two models (subscripts i and t represent firm and year):

$$P_{it} = a_0 + \sum_{t=1992}^{2003} a_t I_t + b_1 NPTA_{it} + b_2 NPTL_{it} + b_3 PA_{it} + b_4 PBO_{it} + c_1 NI_{it}$$
$$+ c_2 SALEGRW_{it} + c_3 R\&D_{it} + c_4 EMP_{it} + e_{it} \tag{7}$$

$$P_{it} = a_0 + \sum_{t=1992}^{2003} a_t I_t + b_1 NPTA_{it} + b_2 NPTL_{it} + b_3 PA_{it} + b_4 PBO\text{-}X_{it} + c_1 NI_{it}$$
$$+ c_2 SALEGRW_{it} + c_3 R\&D_{it} + c_4 EMP_{it} + e_{it} \tag{8}$$

where P_{it} is market capitalization at current fiscal year-end; I_t is a dummy variable for each year from 1992 through 2003; $NPTA_{it}$ and $NPTL_{it}$ are nonpension assets and liabilities; PA_{it} is fair value of pension assets; PBO_{it} is the projected benefit obligation disclosed in the pension footnote; and $PBO\text{-}X_{it}$ is the nondiscretionary portion of pension obligation (as defined in Section III). As noted earlier, all variables (with the exception of *SALEGRW* and *EMP*) are deflated by sales.

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[14] As a sensitivity check, we also estimate our models on undeflated and per-share basis and find qualitatively similar results.

In addition to the variables of interest, we include a vector of control variables: NI_{it} is income before extraordinary items; $SALEGRW_{it}$ is the average sales growth over the previous three years;[15] $R\&D_{it}$ is research and development expense; and EMP_{it} is number of employees in thousands. We include NI_{it} because Ohlson (1995) shows that, when income is neither perfectly persistent nor transitory, the correct specification of the price association model is one that includes both the book value of equity and income. $SALEGRW_{it}$ is included to control for growth opportunities not reflected in the financial statements. Finally, we include EMP_{it} and $R\&D_{it}$ as control variables to mitigate the effects of the service cost anomaly.[16] Although service cost is never featured as a separate explanatory variable in any of our models, it is embedded in our measures of the pension liability and thus may affect our inferences in the absence of these control variables. Generally, the coefficients on our control variables are in the predicted direction and statistically significant for most specifications.

Panel A of Table 3 reports the regression results of Models (7) (with discretion) and (8) (without discretion). The adjusted R^2 (56.8 percent) of Model (7) is the same as that of Model (8), and the coefficient weight on PBO_{it} (-0.601) is slightly larger than that on $PBO\text{-}X_{it}$ (-0.540), although the difference is not statistically significant. These results suggest that allowing discretion in PBO at least does not impair the value relevance of reported pension obligation.

Next, we perform *incremental* association tests using the following model:

$$P_{it} = a_0 + \sum_{t=1992}^{2003} a_t I_t + b_1 NPTA_{it} + b_2 NPTL_{it} + b_3 PA_{it} + b_4 PBO\text{-}X_{it}$$
$$+ b_5 PBO\text{-}D_{it} + c_1 NI_{it} + c_2 SALEGRW_{it} + c_3 R\&D_{it} + c_4 EMP_{it} + e_{it} \qquad (9)$$

where $PBO\text{-}D_{it}$ is the discretionary component of PBO and all other variables are as defined earlier. The results are reported in Panel B of Table 3. The pricing coefficient of $PBO\text{-}D_{it}$ is negative and significant (p = 0.02, two-tailed). The magnitude of the coefficient of $PBO\text{-}D_{it}$ (-1.068) is larger than that of $PBO\text{-}X_{it}$ (-0.600), although F-test for equality suggests the two coefficients are not statistically different at conventional levels of significance.[17]

In summary, our price association tests suggest that (1) discretion does not impair the relative value relevance of the PBO; and (2) the discretionary component of the pension liability is incrementally priced by the market in a manner similar to the nondiscretionary component. This suggests that discretionary choices made by managers in selecting pension assumptions provide valuable information to the market about the underlying economics of the pension obligation.

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[15] When sales growth data are unavailable for the three previous years, we use either two- or one-year average sales growth as a substitute to maximize the number of usable observations.

[16] The service cost anomaly refers to the anomalous positive relation between service cost (an expense) and stock price, which was first reported by Barth et al. (1992). Subramanyam and Zhang (2001) argue that the positive relation between service cost and price occurs because service cost proxies for value created by human capital. They control for this effect by adding the number of employees and research and development expense in the regression and show that the coefficient on service cost becomes negative (which is theoretically correct) after inclusion of these control variables.

[17] Inability to reject the null that the coefficients on *PBO-X* and *PBO-D* are equal is not equivalent to *accepting* the null of no difference between the coefficients. Following Chung and Kallapur (2003) and Greenwald (1975), we examine the confidence intervals of the coefficient differences to ascertain whether the null is likely to be true. The 95 percent confidence limits of the coefficient differences are -0.861 and 0.275, which are economically significant, suggesting that the null of equality in the coefficient estimates is unlikely to be true. Statistically, we cannot accept the null of equality of coefficients, although neither can we reject this null.

TABLE 3
Market Value Association Tests[a,b]

	NPTA	NPTL	PA	PBO/ PBO-X	PBO-D	NI	SALE GRW	R&D	EMP	Adj. R²
Panel A: Relative Association Tests										

Models: $P_{it} = a_0 + \sum_{t=1992}^{2003} a_t I_t + b_1 NPTA_{it} + b_2 NPTL_{it} + b_3 PA_{it} + b_4 PBO + c_1 NI_{it} + c_2 SALEGRW_{it} + c_3 R\&D_{it} + c_4 EMP_{it} + e_{it}$

$P_{it} = a_0 + \sum_{t=1992}^{2003} a_t I_t + b_1 NPTA_{it} + b_2 NPTL_{it} + b_3 PA_{it} + b_4 PBO\text{-}X + c_1 NI_{it} + c_2 SALEGRW_{it} + c_3 R\&D_{it} + c_4 EMP_{it} + e_{it}$

	NPTA	NPTL	PA	PBO/ PBO-X	PBO-D	NI	SALE GRW	R&D	EMP	Adj. R²
With Discretion	1.351	−1.333	0.501	−0.601		2.197	0.126	10.752	0.001	56.8%
	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	
Without Discretion	1.349	−1.332	0.448	−0.540		2.201	0.127	10.726	0.001	56.8%
	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	
Difference	0.002	−0.002	0.053	−0.061		−0.004	−0.001	0.026	0.000	0.0%
	(0.97)	(0.97)	(0.71)	(0.72)		(0.99)	(0.99)	(0.97)	(0.96)	(0.12)

Panel B: Incremental Association Tests

Model: $P_{it} = a_0 + \sum_{t=1992}^{2003} a_t I_t + b_1 NPTA_{it} + b_2 NPTL_{it} + b_3 PA_{it} + b_4 PBO\text{-}X_{it} + b_5 PBO\text{-}D_{it} + c_1 NI_{it} + c_2 SALEGRW_{it} + c_3 R\&D_{it} + c_4 EMP_{it} + e_{it}$

	NPTA	NPTL	PA	PBO/ PBO-X	PBO-D	NI	SALE GRW	R&D	EMP	Adj. R²
	1.351	−1.335	0.501	−0.600	−1.068	2.197	0.126	10.741	0.001	56.8%
	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)	
F-Test $b_4 = b_5$					(0.27)					

[a] Our sample consists of 12,567 firm-years from 1991–2003. We delete 1 percent of observations with the smallest and the largest values of studentized residuals to remove the effect of outliers. The dependent variable in all regressions is market capitalization at current fiscal year-end. All variables except for *SALEGRW* and *EMP* are deflated by current-year sales.

[b] I_t is a dummy variable for each year from 1992 through 2003; p-values for coefficient estimates and their differences are two-sided and White (1980) adjusted; p-values for R² differences are based on Vuong's (1989) test statistic.

All independent variables (*NPTA*, *NPTL*, *PA*, *PBO*, *PBO-X*, *PBO-D*, *NI*, *SALEGRW*, *R&D*, and *EMP*) are defined in Table 2.

Time-Series and Cross-Sectional Variation

While our results suggest that, on average, discretion improves the value relevance of the PBO, we do not imply that managers never engage in opportunistic management of PBO assumptions. Prior research has shown that managers' choice of pension assumptions are consistent with opportunistic incentives related to capital market considerations, debt contracting, and legal requirements (e.g., Feldstein and Morck 1983; Gopalakrishnan and Sugrue 1995; Godwin et al. 1996; Asthana 1999). We therefore emphasize that while *on average* pension assumption choices likely reflect economic characteristics of the pension plans, certain firms undoubtedly do manage assumptions opportunistically. Accordingly, in this section we examine whether the *PBO-D* varies with factors related to agency considerations and whether this causes a variation in its pricing coefficient. Since the funded status of the pension plan has most consistently been shown to be associated with pension assumption management (e.g., Asthana 1999), we examine time-series and cross-sectional variation in our results with respect to the funded status.

Time-Series Variation

Corporate pension plans in the U.S. were well funded in the 1990s, but have experienced a reversal of fortune since 2000 because of a significant drop in stock valuations and declining interest rates.[18] In our sample, the mean (median) funded status, which was 5.0 percent (1.5 percent) of PBO during 1991–2000, declined to −16.3 percent (−19.1 percent) of PBO during 2001–2003 (results not tabulated). The deterioration in funded status suggests that there might be greater incentives to manipulate pension assumptions during 2001–2003, which could result in the stock market attaching relatively lower weight on the *PBO-D* during this period. Accordingly, we examine whether the pricing coefficient on *PBO-D* differs across these two periods by estimating the following regression:

$$P_{it} = a_0 + \sum_{t=1992}^{2003} a_t I_t + b_1 NPTA_{it} + b_2 NPTL_{it} + b_3 PA_{it} + b_4 PBO\text{-}X_{it}$$
$$+ b_5 PBO\text{-}D_{it} + b_6 PBO\text{-}D_{it} * Post2000 + c_1 NI_{it} + c_2 SALEGRW_{it}$$
$$+ c_3 R\&D_{it} + c_4 EMP_{it} + e_{it} \tag{10}$$

where *Post2000* is a dummy variable taking the value of 1 for years 2001–2003, and 0 for years 1991–2000. All other variables are previously defined.

Table 4, Panel A reports results of estimating Equation (10). The estimated pricing coefficient on *PBO-D* (which represents the pricing coefficient on *PBO-D* for the 1991–2000 period) is −0.907 and marginally significantly negative (at p = 0.10, two-tailed). The coefficient on *PBO-D * Post2000* (−0.293) is not significant at conventional levels. The sum of the coefficients on *PBO-D* and *PBO-D * Post2000* (which represents the pricing coefficient on *PBO-D* for the period 2001–2003) is −1.199 and marginally significantly negative (at p = 0.10, two-tailed). Overall, there is no evidence suggesting that the pricing coefficient on *PBO-D* was lower in magnitude during 2001–2003 than during 1991–2000.

Cross-Sectional Variation

We also examine cross-sectional variation in *PBO-D* and its pricing coefficient with respect to funded status. We define the extent of underfunding as nondiscretionary pension

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[18] For example, defined benefit plans in the S&P 500 companies were roughly $300 billion overfunded in 1999 and became underfunded by $340 billion in mid-2003 (Morgan Stanley 2003).

TABLE 4
Time-Series and Cross-Sectional Analyses[a,b]

Panel A: Time-Series Variation

Model: $P_{it} = a_0 + \sum_{t=1992}^{2003} a_t I_t + b_1 NPTA_{it} + b_2 NPTL_{it} + b_3 PA_{it} + b_4 PBO\text{-}X_{it} + b_5 PBO\text{-}D_{it} + b_6 PBO\text{-}D_{it}*Post2000 + c_1 NI_{it}$

$+ c_2 SALEGRW_{it} + c_3 R\&D_{it} + c_4 EMP_{it} + e_{it}$

NPTA	NPTL	PA	PBO-X	PBO-D	PBO-D *Post2000	NI	SALE-GRW	R&D	EMP	Adj. R²	$b_5 + b_6$
1.351	−1.334	0.499	−0.599	−0.907	−0.293	2.202	0.126	10.730	0.001	56.8%	−1.199
(0.00)	(0.00)	(0.00)	(0.00)	(0.10)	(0.74)	(0.00)	(0.00)	(0.00)	(0.00)		(0.10)

Panel B: Cross-Sectional Variation

Model: $P_{it} = a_0 + \sum_{t=1992}^{2003} a_t I_t + b_1 NPTA_{it} + b_2 NPTL_{it} + b_3 PA_{it} + b_4 PBO\text{-}X_{it} + b_5 PBO\text{-}D_{it} + b_6 PBO\text{-}D_{it}*UFUND + c_1 NI_{it}$

$+ c_2 SALEGRW_{it} + c_3 R\&D_{it} + c_4 EMP_{it} + c_5 UFUND + e_{it}$

NPTA	NPTL	PA	PBO-X	PBO-D	PBO-D *UFUND	NI	SALE-GRW	R&D	EMP	UFUND	Adj. R²	$b_5 + b_6$
1.352	−1.335	0.457	−0.554	−1.415	0.623	2.195	0.126	10.742	0.001	−0.012	56.8%	−0.791
(0.00)	(0.00)	(0.00)	(0.00)	(0.06)	(0.49)	(0.00)	(0.00)	(0.00)	(0.00)	(0.39)		(0.15)

[a] Our sample consists of 12,567 firm-years from 1991–2003. We delete 1 percent of observations with the smallest and the largest values of studentized residuals to remove the effect of outliers. The dependent variable in all regressions is market capitalization at current fiscal year-end. All variables except for *SALEGRW*, *EMP*, *Post2000*, and *UFUND* are deflated by current-year sales.

[b] I_t is the dummy variable for each year from 1992 through 2003; p-values for coefficient estimates and their differences are two-sided and White (1980) adjusted; p-values for R^2 differences are based on Vuong's (1989) test statistic.

Variable Definitions:

Post2000 = indicator variable taking the value of 1 for years 2001–2003, and 0 otherwise; and

UFUND = indicator variable taking the value of 1 when the extent of underfunding is above the median and 0 otherwise, where the extent of underfunding is defined as nondiscretionary pension liability (*PBO-X*) minus the fair value of pension assets (*PA*), divided by reported pension liability (*PBO*).

All other independent variables (*NPTA*, *NPTL*, *PA*, *PBO-X*, *PBO-D*, *NI*, *SALEGRW*, *R&D*, and *EMP*) are defined in Table 2.

liability (*PBO-X*) minus the fair value of pension assets (*PA*), divided by reported pension liability (*PBO*). We find (not tabulated) that *PBO-D* is negatively correlated with the extent of underfunding (Pearson/Spearman correlation of $-0.128/-0.137$), which is consistent with firms with underfunded plans reducing reported *PBO* numbers through assumptions choices. We next examine cross-sectional variation in the pricing coefficient on *PBO-D* through the following equation:

$$P_{it} = a_0 + \sum_{t=1992}^{2003} a_t I_t + b_1 NPTA_{it} + b_2 NPTL_{it} + b_3 PA_{it} + b_4 PBO\text{-}X_{it}$$
$$+ b_5 PBO\text{-}D_{it} + b_6 PBO\text{-}D_{it} * UFUND + c_1 NI_{it} + c_2 SALEGRW_{it}$$
$$+ c_3 R\&D_{it} + c_4 EMP_{it} + c_5 UFUND + e_{it} \tag{11}$$

where *UFUND* is an indicator variable that takes the value of 1 when the extent of underfunding is above the median, and 0 otherwise; and all other variables are previously defined.[19]

Results of estimating Equation (11) are reported in Panel B of Table 4. The pricing coefficient on *PBO-D* (-1.415), which represents the coefficient for the *least* underfunded firms, is significantly negative (p = 0.06, two-tailed). The coefficient on *PBO-D * UFUND* (0.623) is positive, but insignificant (p = 0.49, two-tailed). The sum of the coefficients on *PBO-D* and *PBO-D * UFUND* (-0.791), which represents the coefficient for the *most* underfunded firms, is negative and insignificant (p = 0.15, two-tailed). Although the relative magnitudes for the coefficients on the least and most unfunded plans are in the predicted direction, the difference is not statistically significant.

V. ALTERNATIVE EXPLANATIONS

In the previous section, we show that the stock market prices the discretionary component of the PBO in a similar manner to the nondiscretionary component. One interpretation of this result is that value-relevant information is communicated through the discretionary component. However, there are two potential alternative explanations: (1) measurement error in the decomposition of the PBO into discretionary and nondiscretionary components makes their pricing coefficients arise mechanically; and (2) the stock market fixates on reported PBO numbers without considering the differential value relevance of the discretionary and nondiscretionary components. In this section, we address each of these alternative explanations in order.

Measurement Error

Guay et al. (1996) show that similar pricing coefficients on the discretionary and nondiscretionary accruals' components is consistent with significant measurement error such as that arising from a random decomposition of accruals. Our pricing results are consistent with a random decomposition of the PBO, suggesting measurement error in our discretionary component is a plausible alternative explanation. Because we functionally derive the discretionary component (*PBO-D*), we argue that the *PBO-D* is less susceptible to measurement error than earlier methods such as the Jones (1991) model, especially to error arising from incomplete model specification (see Section II). However, we do not claim that the *PBO-D* is free of measurement problems. Measurement problems can arise under

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[19] We also examine rank specifications where we partition the sample into four, five, and ten portfolios based on the extent of underfunding and find qualitatively similar results.

our methodology for at least two reasons. First, *PBO-D* could estimate the effects of deviations in pension assumptions from their benchmarks with error, i.e., there could be error in our functional derivation of *PBO-D*. Second, inappropriate choice of benchmarks could affect what we define as discretionary and, thus, spuriously lead us to conclude that the discretionary component is priced. In the following two subsections we explore separately each of these two measurement problems and report results of diagnostic tests and sensitivity analyses that we perform to rule out the measurement error explanation for our results.

Does PBO-D Accurately Reflect Deviations in Pension Assumptions?

In this subsection, we evaluate the representational faithfulness of *PBO-D* in measuring the effects on the *PBO* of deviations in the reported pension assumptions (r and g) from their respective researcher-imposed benchmarks (r^* and g^*). We discuss the appropriateness of the benchmarks in the next subsection.

Measurement error could arise from our functional derivation of *PBO-D* if there is error in estimating the functional parameters, such as post-retirement life expectancy (L) or remaining service life (N). For example, we assume employee post-retirement life expectancy (L) is 15 years for all firms. To the extent that there is cross-sectional variation in this measure, our discretionary component is measured with error. In particular, our assumption of $L = 15$ may overstate life expectancy for firms that have a large proportion of retirees in the pension plans. Measurement error can also arise in our estimate of N. Since N measures the average remaining service life, it measures the average years to retirement with error, particularly for plans with large proportion of retirees or high employee turnover.

Before we test the extent of measurement error in *PBO-D*, we first examine the materiality of measurement error in L and N on the measurement of the *PBO-D*. To do this, we estimate two alternative measures of *PBO-D* by respectively substituting our current assumptions (or estimates) for L and N in Equation (5) with randomized values selected from uniform distributions respectively over the range of $(5,20)$ and $(0,50)$.[20] We then examine how our original *PBO-D* measure correlates with these two alternative measures of *PBO-D*. Panel A of Table 5 reports these correlations. We find that randomizing L has a negligible effect on the computation of *PBO-D* (both Pearson and Spearman correlations between the original *PBO-D* measure and that using randomized L are approximately 0.99). While randomizing N has a larger effect on the *PBO-D* computation than L (Pearson/Spearman correlation is 0.73/0.84), its effect is also not economically significant. In contrast, when we estimate *PBO-D* by randomly decomposing *PBO* a la Guay et al. (1996), its correlation with our original *PBO-D* measure is close to zero. These preliminary diagnostics suggest that estimation error in parameters determining PBO—such as L and N—are unlikely to have material effects on the computation of *PBO-D*.

We next perform two tests to directly evaluate the representational faithfulness of our *PBO-D* measure in capturing the effects of deviations in pension assumptions from their industry benchmarks. First, we examine the extent of variation in *PBO-D* that is explained by the two discretionary choices being manipulated, namely the discount rate (r) and compensation growth rate (g). Specifically, we estimate the following regression:

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[20] We use alternative ranges for the distributions and find qualitatively similar results.

TABLE 5
Tests of Measurement Error

Panel A: Correlation between Our Original and Various Randomly Generated Measures of *PBO-D*[a]

Correlation	Randomized L	Randomized N	Random Decomposition
Pearson	0.989 (0.00)	0.733 (0.00)	0.007 (0.48)
Spearman	0.992 (0.00)	0.843 (0.00)	0.007 (0.45)

Panel B: Regressing Various Measures of *PBO-D* on Deviations of *r* and *g* from Their Respective Industry Benchmarks[a]

Model: $$\frac{PBO\text{-}D_{it}}{PBO_{it}} = a + b_1(r_{it} - r_{it}^*) + b_2(g_{it} - g_{it}^*) + e_{it}$$

PBO-D Measures	Intercept	$r_{it} - r_{it}^*$	$g_{it} - g_{it}^*$	Adj. R^2
Our Measure	−0.001 (0.00)	−9.853 (0.00)	3.698 (0.00)	91.6%
Randomized L	0.000 (0.02)	−8.934 (0.00)	3.747 (0.00)	88.1%
Randomized N	−0.025 (0.00)	−27.433 (0.00)	23.559 (0.00)	77.4%
Random Decomposition	−0.001 (0.26)	−0.008 (0.94)	−0.055 (0.49)	−0.0%

(*continued on next page*)

TABLE 5 (Continued)

Panel C: Regression of Actuarial Gain/Loss on Changes in *PBO* Due to Changes in *r* and *g*[b]

Model: $\dfrac{ACTGL_{it}}{PBO_{it}} = a + b\,\dfrac{PBO\text{-}Z_{it}^{t-1}}{PBO_{it}} + e_{it}$

Alternative	Full Sample			Firm-Years with *g* Unchanged		
Measures of *PBO-D*	Intercept	$\dfrac{PBO\text{-}Z_{it}^{t-1}}{PBO_{it}}$	Adj. R^2	Intercept	$\dfrac{PBO\text{-}Z_{it}^{t-1}}{PBO_{it}}$	Adj. R^2
Our Measure	0.013 (0.00)	1.121 (0.00)	53.0%	0.010 (0.00)	1.182 (0.00)	64.5%
Randomized *L*	0.014 (0.00)	1.180 (0.00)	50.9%	0.011 (0.00)	1.241 (0.00)	62.6%
Randomized *N*	0.024 (0.00)	0.250 (0.00)	33.8%	0.020 (0.00)	0.309 (0.00)	52.3%
Random Decomposition	0.022 (0.00)	−0.064 (0.71)	−0.0%	0.021 (0.00)	−0.305 (0.31)	0.0%

Panel D: Market Value Incremental Association Tests with *PBO-X* and *PBO-D* Calculated Using Alternative Benchmarks for *r* and *g*[a]

Model: $P_{it} = a_0 + \sum\limits_{t=1992}^{2003} a_t I_t + b_1 NPTA_{it} + b_2 NPTL_{it} + b_3 PA_{it} + b_4 PBO\text{-}X_{it} + b_5 PBO\text{-}D_{it} + c_1 NI_{it} + c_2 SALEGRW_{it} + c_3 R\&D_{it} + c_4 EMP_{it} + e_{it}$

Alternative Benchmarks	NPTA	NPTL	PA	PBO-X	PBO-D	NI	SALE-GRW	R&D	EMP	Adj. R^2
Industry Median *r** and *g**	1.352 (0.00)	−1.335 (0.00)	0.501 (0.00)	−0.600 (0.00)	−1.068 (0.02)	2.197 (0.00)	0.126 (0.00)	10.741 (0.00)	0.001 (0.00)	56.8%
F-Test $b_4 = b_5$					(0.27)					
Random *r** and *g**	1.351 (0.00)	−1.334 (0.00)	0.505 (0.00)	−0.602 (0.00)	−0.509 (0.00)	2.199 (0.00)	0.126 (0.00)	10.745 (0.00)	0.001 (0.00)	56.8%
F-Test $b_4 = b_5$					(0.41)					

TABLE 5 (Continued)

AA-Rate for $r*$, Industry Median for $g*$	1.353	−1.336	0.502	−0.596	−1.197	2.197	0.126	10.747	0.001	56.8%
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	
F-Test $b_4 = b_5$					(0.15)					
AA-Rate for $r*$, Population Median for $g*$	1.350	−1.333	0.498	−0.598	−0.520	2.198	0.126	10.723	0.001	56.8%
	(0.00)	(0.00)	(0.00)	(0.00)	(0.25)	(0.00)	(0.00)	(0.00)	(0.00)	
F-Test $b_4 = b_5$					(0.85)					

[a] Our sample consists of 12,567 firm-years from 1991–2003. We delete 1 percent of observations with the smallest and the largest values of studentized residuals to remove the effect of outliers.

[b] Initial sample consists of 12,567 firm-years from 1991–2003; data limitation on actuarial gain/loss reduces the final sample size to the following: "full sample" consists of 8,590 firm-observations, and "firm-years with g unchanged" consists of 3,777 firm-observations. We delete 1 percent of observations with the smallest and the largest values of studentized residuals to remove the effect of outliers.

Panel A reports the correlation between our original measure of *PBO-D* and various alternative measures of *PBO-D*. *PBO-D* is the discretionary component of projected benefit obligation. Our measure of *PBO-D* is estimated from our original model described in Section III, using industry-medians of discount rate and compensation growth rate and assuming an employee post-retirement life expectancy (L) of 15 years. *PBO-D* with "randomized L" is estimated using the original model with L randomly drawn from a uniform distribution over [5,20] years. *PBO-D* with "randomized N" is estimated using the original model with N randomly drawn from a uniform distribution over [0,50] years. We construct the "Random decomposition" measure of *PBO-D* a la Guay et al. (1996) by randomly decomposing *PBO* into a discretionary component and a nondiscretionary component as follows: we first obtain measure of (undeflated) randomized nondiscretionary *PBO* which is equal to $PBO*e$, where e is randomly drawn from a uniform distribution over [0.88,1.12]. The range of distribution is chosen based on the standard deviation of undeflated *PBO* and *PBO-D*. The randomized measure of *PBO-D* is then measured as the difference between *PBO* and *RPBO-X*, deflated by *PBO*.

Panel B reports results from regressing various measures of *PBO-D* on deviations of r and g from their respective benchmarks. Measures of *PBO-D* are as defined in Panel A. r and g are assumed discount rate and compensation growth rate, respectively. $r*$ and $g*$ are industry medians of r and g, respectively. p-values for coefficient estimates are two-sided.

Panel C reports results from regression of actuarial gain/loss on changes in *PBO* due to changes in r and g. $ACTGL_{it}$ is estimated as the difference between fair-value pension expense and the sum of service cost, interest cost, and actual return on plan assets. Fair-value pension expense is measured as the difference between employer contributions and changes in the funded status. $PBO\text{-}Z_{it}^{t-1}$ is the difference between PBO_{it} and $PBO\text{-}X_{it}^{t-1}$, and $PBO\text{-}X_{it}^{t-1}$ is the estimate of PBO_{it} using year $t-1$ assumptions for r and g. Alternative measures of PBO_{it} and $PBO\text{-}X_{it}^{t-1}$ are used: "our measure" is constructed based on the assumptions employed in our original model; "randomized L" assumes an L that is randomly drawn from a uniform distribution over [5,20] years; "randomized N" assumes an N that is randomly drawn from a uniform distribution over [0,50] years; "random decomposition" corresponds to a randomized $PBO\text{-}Z_{it}^{t-1}$ that randomly deviates from *PBO* by 1 percent. The 1 percent deviation is chosen such that the variability in the randomized $PBO\text{-}Z_{it}^{t-1}$ (deflated by *PBO*) is comparable to that of our original measure. p-values for coefficient estimates are two-sided.

Panel D reports results from market value incremental association tests using alternative measures of *PBO-X* and *PBO-D*. The dependent variable is market capitalization at current fiscal year-end. All variables except for *SALEGRW* and *EMP* are deflated by current-year sales. I_t is the dummy variable for each year from 1992 through 2003. Independent variables *NPTA*, *NPTL*, *PA*, *PBO-X*, *PBO-D*, *NI*, *SALEGRW*, *R&D*, and *EMP* are defined in Table 2. Various benchmarks are used to calculate *PBO-X* and *PBO-D*: "Industry median" means that *PBO-X* and *PBO-D* are our original measures as described in Panel A. *PBO-X* and *PBO-D* with "randomized $r*$ and $g*$" are estimated using a randomized $r*$ and $g*$, where $r*$ is randomly drawn from a uniform distribution over [2%,13%] and $g*$ is randomly drawn from a uniform distribution over [1%,15%]. *PBO-X* and *PBO-D* with "population median" are estimated using the annual population medians of r and g. *PBO-X* and *PBO-D* with "AA-rate for r" are estimated using the AA corporate bond yield. p-values for coefficient estimates and their differences are two-sided and White (1980) adjusted.

$$\frac{PBO\text{-}D_{it}}{PBO_{it}} = a_1 + b_1(r_{it} - r^*_{it}) + b_2(g_{it} - g^*_{it}) + e_{it} \tag{12}$$

where all variables are as defined previously. The dependent variable measures the proportion of the PBO that we partition as discretionary, and the explanatory variables are the two discretionary assumption choices we study, i.e., the deviation of reported discount rate and compensation growth rate from their respective industry medians. If there is considerable measurement error in *PBO-D*, then we should observe that the discretionary assumption choices do not explain much of the variation in the dependent variable. In particular, a random decomposition of *PBO* would result in an R^2 of close to zero. On the other hand, if the explanatory power of the regression modeled in Equation (12) is high, then it is unlikely that our measure of *PBO-D* has substantial measurement error.

Panel B of Table 5 shows that coefficients on both explanatory variables are significant in the predicted direction (at $p \leq 0.01$, two-tailed). More importantly, the adjusted R^2 of the regression is 91.6 percent. This suggests that a substantial portion of the variation in *PBO-D* is explained by the two discretionary assumption choices we study. Additionally we note that the explanatory power of the above regression is understated because we fit a linear specification to an essentially nonlinear relation.[21]

We also estimate Equation (12) with *PBO-D* measured with randomized *L* and *N*. As expected, the R^2s from regressions using the randomized benchmarks (88.1 percent for randomized *L* and 77.4 percent for randomized *N*) are lower than that using our original measure. Further, when we generate *PBO-D* by randomly decomposing *PBO* a la Guay et al. (1996), the R^2 is close to zero. These sensitivity results establish the validity of our diagnostic test and suggest that our estimate of *PBO-D* is not significantly affected by measurement error.

As an additional diagnostic test, we apply our estimation methods in an alternative setting where we are able to compare our estimates with certain footnote disclosures. Specifically, SFAS No. 87 requires that companies report *actuarial gain/loss*, which are actuarial estimates of changes to PBO during the year arising from changes in pension assumptions—primarily, but not limited to, discount rate and compensation growth rate. We estimate changes in PBO arising from movements in discount rate and compensation growth rate during the year, *using our estimation methods,* and then compare these estimates with

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[21] There are two issues with respect to Equation (12) that require clarification. First, we demonstrate that Equation (12) is not a tautology, i.e., even after assuming linearity we do not necessarily get a 100 percent R^2 for the regression specified in Equation (12). Hypothetically, one can generate a measure of *PBO-D* that is an arbitrary function of $(r - r^*)$ and $(g - g^*)$ and produces a perfect fit for Equation (12). For example, $PBO\text{-}D = [(r - r^*) + (g - g^*)]*PBO$ will generate an R^2 of 100 percent. However, it is important to note that we estimate *PBO-D* as the *difference* between *PBO* and *PBO-X*, where *PBO-X* is modeled as a function of r^* and g^*, rather than estimate *PBO-D* *directly* as some function of $r - r^*$ and $g - g^*$. That is, we estimate $PBO\text{-}D = PBO - PBO\text{-}X = f_0(r, g) - f_1(r^*, g^*)$, rather than $PBO\text{-}D = f_2(r - r^*, g - g^*)$. Because of this, the regression specified in Equation (12) will produce a 100 percent R^2 (assuming linearity) *only* if our estimation procedure (f_1) accurately reflects the actual functional relation between PBO and r/g that is embedded in the reported PBO (f_0), i.e., $f_1 \rightarrow f_0$. On the contrary, if we had directly estimated *PBO-D* as a function of $r - r^*$ and $g - g^*$, then our tests would have been tautological and produced an R^2 of 100 percent (assuming linearity). In other words, since we measure *PBO-D* as the difference between reported PBO and our estimate of *PBO-X*, we will get a good fit for the regression specified in Equation (12) only if we accurately model the relation between PBO and r/g that is implicit in the reported PBO. Second, we need to carefully consider the effect of deflating *PBO-D* by PBO in Equation (12). Because of such deflation, the dependent variable in Equation (12) is equivalent to $PBO\text{-}D/PBO = [f_0(r, g) - f_1(r^*, g^*)]/f_0(r, g) = 1 - f_1(r^*, g^*)/f_0(r, g)$. Therefore, the correct specification of Equation (12) should be one where the explanatory variables are in ratio form. As a sensitivity test, we estimate Equation (12) with the independent variables specified in ratio form and find qualitatively similar results.

the actuarial gain/loss reported by the company. Specifically, we estimate the following regression:

$$\frac{ACTGL_{it}}{PBO_{it}} = a + b \frac{PBO\text{-}Z_{it}^{t-1}}{PBO_{it}} + e_{it} \qquad (13)$$

where $ACTGL_{it}$ is reported actuarial gain/loss, $PBO\text{-}Z_{it}^{t-1}$ is PBO_{it} minus $PBO\text{-}X_{it}^{t-1}$, and $PBO\text{-}X_{it}^{t-1}$ is the estimate of PBO_{it} (based on our estimation methods) using year $t-1$ assumptions for r and g. In other words, $PBO\text{-}Z_{it}^{t-1}$ measures the change in PBO that our method estimates would have occurred in year t given the actual changes in interest rate and compensation growth rate assumptions. Therefore, by comparing our calibrated values ($PBO\text{-}Z_{it}^{t-1}$) with the reported actuarial gain/loss ($ACTGL_{it}$), we can assess the extent to which our estimation methods accurately capture the effects of r and g on PBO.

Before we report the results of this exercise, it is important to highlight certain caveats regarding the measurement of $ACTGL_{it}$. First, because of data limitations in Compustat we are able to only indirectly estimate $ACTGL_{it}$, such that it includes plan amendments and prior service cost effects in addition to actuarial gain/loss. While prior service cost and plan amendments arise less often than actuarial gain/loss, their effects on the PBO can be substantial during the years that they arise. Therefore, the inability to separate these effects can induce measurement error in $ACTGL_{it}$. Second, actuarial gain/loss can arise for reasons other than changes in r or g. These include changes in other assumptions such as employee turnover rates and life expectancy as well as adjustments based on actual experience. Therefore, even if we are able to measure actuarial gain/loss accurately (i.e., without inclusion of plan amendments and prior service cost), $ACTGL_{it}$ can still have considerable measurement error in terms of measuring the effects of r and g on the PBO.[22]

Because of measurement error with the dependent variable ($ACTGL_{it}$), we caution that R^2 from estimating Equation (13) may be biased downward. However, since measurement error in the dependent variables does not bias the coefficient, we emphasize the estimated coefficient on $PBO\text{-}Z_{it}^{t-1}$. Since the coefficient should be equal to 1 in the absence of measurement error, we can evaluate the economic significance of the measurement error by examining how the estimated coefficient values deviate from 1. Further, we also separately estimate Equation (13) for the subsample without change in g because prior service cost and plan amendments, which cause measurement error in $ACTGL_{it}$, are more likely to be nonzero when there is change in g.

Results of estimating Equation (13) are reported in Panel C of Table 5. For the full sample, the estimated coefficient on $PBO\text{-}Z_{it}^{t-1}$ (using our original estimation methods) is 1.121 (significant at $p \leq 0.01$, two-tailed). Also, the adjusted R^2 is 53.0 percent, which is surprisingly high given the measurement problems with $ACTGL_{it}$. When we exclude firm-years with change in g, the regression coefficient on $PBO\text{-}Z_{it}^{t-1}$ is 1.182 (significant at $p \leq 0.01$, two-tailed) and consistent with our conjecture, the adjusted R^2 is higher (64.5

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[22] The second measurement problem with $ACTGL$ is well illustrated by examining Alaska Air Group's 2001 pension footnote, which separately reports the following two components of $ACTGL$: (1) gain/loss from changes in pension assumptions: $16.4 million; and (2) other actuarial loss: $6.2 million. The first component likely reflects gain/loss from changes in r and g, and the second component can include both gain/loss from changes in other pension assumptions or gain/loss resulting from deviations from actual experience, which in this case, is a substantial portion of the total actuarial gain/loss. Since most companies, unlike Alaska Air Group, do not separately report these two components in their footnotes, it is difficult to determine the amount of gain/loss arising only from changes in r and g.

percent). These results suggest that every dollar of change in *PBO* that we estimate using our method is on average associated with \$1.12 to \$1.18 of actuarial gain/loss, which is consistent with high representational faithfulness of our *PBO-D* measure.

We next estimate Equation (13) where $PBO\text{-}Z_{it}^{t-1}$ is generated with randomized *L* and *N*. As expected, randomizing *L* has negligible effect on our results since *L* does not have a material effect on *PBO-D*. When we randomize *N*, the ability of $PBO\text{-}Z_{it}^{t-1}$ to explain changes in $ACTGL_{it}$ diminishes substantially—the coefficients drop to around a quarter of that using our original estimation methods. Given that randomizing *N* does not have a substantial effect on the measurement of *PBO-D*, these results illustrate the power of our diagnostic test. Finally, when we use a measure of $PBO\text{-}Z_{it}^{t-1}$ that is consistent with the Guay et al. (1996) random decomposition, both the R^2s and coefficients are indistinguishable from zero.

In conclusion, these diagnostic tests suggest that our estimate of *PBO-D* captures the effects of deviations in pension assumptions from industry medians in a sufficiently reliable manner. In particular, it is unlikely that our partitioning of PBO into discretionary and nondiscretionary components is similar to that of a random decomposition in the spirit of Guay et al. (1996).

Appropriateness of Industry Benchmarks

Our tests in the previous subsection establish the representational faithfulness of our estimated *PBO-D*, i.e., that our functional derivation of *PBO-D* accurately captures the deviation in pension assumptions. However, it must be noted that these diagnostics are merely tests of internal validity, i.e., they tell us how well the experimental manipulation of conditions (i.e., pension assumptions) are reflected in the experimental output—the discretionary component (*PBO-D*). They do not evaluate external validity, i.e., they do not tell us whether the experimental manipulation of the conditions (i.e., *our* choice of pension assumption benchmarks) is itself valid. In other words, our diagnostic tests do not examine the appropriateness of using industry medians as benchmarks.

Choice of appropriate benchmarks is crucial for drawing correct inferences. Inappropriate benchmarks will result in incorrect specification of the discretionary and nondiscretionary components, which could lead us to spuriously conclude that the discretionary component (i.e., *PBO-D*) is priced by the market. For example, if we naïvely assume that the benchmarks for *r* and *g* (i.e., *r** and *g**) are equal to zero, then all variation in the PBO will be classified as discretionary and obviously *PBO-D* will be priced by the market. To illustrate this point further, we estimate *PBO-D* using randomly generated benchmarks for *r* and *g*. Table 5, Panel D reveals that the coefficients on *PBO-X* and *PBO-D* using random *r** and *g** are qualitatively similar to those using industry medians in our incremental price association tests.[23] These results do not imply that our original pricing results using industry medians are spurious. Rather, these results merely suggest that use of random benchmarks causes economically relevant information in the firm's assumptions to be randomly embedded in both *PBO-X* and *PBO-D*.

In sum, it is difficult to formulate effective empirical tests for determining the appropriateness of the industry benchmarks. However, our results are unlikely spurious if the benchmarks are appropriately chosen. Appropriateness is largely determined by judging

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[23] Unreported results show that the Pearson (Spearman) correlation between *PBO-D* using industry median benchmarks (our measure) and that using randomized *r** and *g** are 0.349 (0.193), suggesting that randomizing *r** and *g** has a material effect on the measurement of *PBO-D*. Thus, the similarity in pricing results is not due to lack of material differences in the estimation of *PBO-D*.

whether the choice of the benchmark has economic rationale, is descriptively valid and whether it is interesting that deviations from the benchmark are priced. Our choice of industry medians for benchmarks is consistent with institutional evidence. For example, analysts benchmark on industry averages when performing financial statement analysis and accounting standards specify uniform benchmarks within industries (e.g., AICPA issues SOPs that are largely industry-specific). For these reasons, it is interesting that deviations from industry benchmarks are priced by the market.

One drawback with using industry benchmarks is that it does not capture earnings management that occurs on average in the entire industry. Accordingly, in sensitivity tests we measure *PBO-D* using alternative benchmarks for *r* and *g* and report the results in Table 5, Panel D. Specifically, we measure *PBO-D* using AA corporate bond rates as the benchmark for *r* and alternatively use industry medians and population median as the benchmarks for *g*. We find qualitatively similar results to that using our original measure of *PBO-D*.[24]

In conclusion, we can reliably state that the PBO component attributable to deviation in pension assumptions from industry medians is priced by the stock market. Whether deviations from industry benchmarks can be construed as discretionary depends on the particular form of uniform accounting that is proposed. We acknowledge that one can visualize a complex uniform accounting regime that incorporates more idiosyncratic economic information than merely industry averages, and it is possible that deviations from these richer benchmarks are not informative. However, as discussed earlier, such a system is difficult to implement and will practically suffer from the moral hazard problems that characterize a flexible accounting system such as the U.S. GAAP.

Functional Fixation

It is possible that the stock market fixates on reported PBO numbers without properly distinguishing the differential (if any) value relevance of the discretionary and nondiscretionary components. If this were the case, then our pricing results may be attributable to market mispricing rather than the value relevance of the discretionary component. *A priori*, it is unlikely that our results are attributable to market inefficiency. For example, Aboody et al. (2002) examine the implications of market inefficiency for value relevance studies and conclude that the economic significance of any bias that may arise from market mispricing for a price (i.e., levels) specification, such as ours, is unlikely to be material. Nevertheless, in this section, we explore the market mispricing explanation for our results.

Returns to Discretionary PBO Portfolios

We first examine whether there is significant market mispricing associated with the discretionary component of PBO (i.e., *PBO-D*). For this purpose, we design trading strategies based on the sign and magnitude of *PBO-D*. If *PBO-D* is value-irrelevant but the stock market attaches significant weight to it, then a trading strategy of buying firms with positive (or high) *PBO-D* and shorting firms with negative (or low) *PBO-D* should yield significant positive abnormal returns (note that positive *PBO-D* implies a liability). We examine returns to such a trading strategy by computing portfolio returns beginning three months after the end of the fiscal year and extending for durations of one and three years, where the portfolios are formed on the sign and magnitude of *PBO-D* at the end of the

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[24] When we use population median for *g*, the *PBO-D* coefficient is not significantly negative (p-value = 0.25). While we use two-sided tests for testing significance of the *PBO-D* coefficient (largely to maintain consistency across all our tests), a one-sided test is more appropriate since we cannot hypothesize a positive coefficient on *PBO-D* under any circumstance. The above coefficient is marginally significant using a one-sided test.

fiscal year. We compute cumulative abnormal returns (*CAR*) as $\sum_{t=t0}^{T} R_t^i - \sum_{t=t0}^{T} ER_t^i$, where R_t^i is monthly cum-dividend return for stock i, ER_t^i is the corresponding expected return for that stock, and $t0$ and T represent the first and last months in our respective accumulation windows ($T = 12$ and 36). We compute two sets of *CAR*s based on CAPM and the three-factor Fama and French (FF) model.[25]

Panel A of Table 6 summarizes the results of the *PBO-D* portfolio strategies. We group our sample firms into quintile portfolios, both by year and for the pooled sample, based on *PBO-D* deflated by sales. Because the results are qualitatively similar across the two panels, we focus our discussion on the by-year portfolio results. The trading strategy that goes long (short) in firms with *PBO-D* ≥ 0 (*PBO-D* < 0) yields insignificant one-year and three-year *CAR*s for both abnormal returns benchmarks (i.e., CAPM and FF). Similarly, we do not find any positive and significant abnormal returns for the trading strategy that goes long (short) in firms with the highest (lowest) *PBO-D* portfolio (i.e., Portfolio 5 − Portfolio 1). Overall, our results suggest that there is unlikely significant mispricing associated with the discretionary component of the PBO.

Ex Post Intrinsic Value Association Tests

In this subsection, we adopt an alternative approach that is in the spirit of the remedy proposed by Aboody et al. (2002) to overcome market inefficiency-related bias in value relevance studies. Specifically, we replicate our pricing results after replacing stock price with a measure of *ex post* intrinsic value (*IV$_{it}$*):

$$IV_{it} = \sum_{\tau=1}^{3} \frac{d_{t+\tau}}{(1 + r)^{\tau}} + \frac{P_{t+3}}{(1 + r)^3} \tag{14}$$

where $d_{t+\tau}$ is dividend realization for year $t+\tau$; r is the discount rate, which we set to a constant 10 percent; and P_{t+3} is stock price at the end of year $t+3$. Conceptually, *ex post* intrinsic value is the present value of *ex post* future dividends. Practically, we use a three-year horizon for dividends and use market price at the end of the third year as terminal value. To the extent that mispricing of current accounting information is reversed within three years, the use of our *ex post* intrinsic value measure in place of current stock price will ameliorate any bias arising from market inefficiency.[26]

We replicate our price association tests by replacing current price with our measure of *ex post* intrinsic value. Table 6, Panel B reports results from the relative association tests. Similar to our price regressions, the adjusted R^2 of the regression with *PBO* (i.e., with discretion) is not significantly different from that of the regression with *PBO-X* (i.e., without

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[25] Under CAPM: $ER_t^i = RF_t + b_t^i(MktRF_t)$ where RF_t = one-month T-bill return; $MktRF_t$ = excess return on a value-weighted aggregate market proxy. We estimate b_t^i during a hold-out period $[t-36,t-1]$ by regressing monthly stock excess return on the market excess return for each stock: $R_t^i - RF_t = a_i + b_i(MktRF_t) + e_{it}$.

Under the three-factor Fama and French model: $ER_t^i = RF_t + b_t^i(MktRF_t) + s_t^i(SMB_t) + h_t^i(HML_t)$, where SMB_t = returns on factor-mimicking portfolio for size; HML_t = returns on factor-mimicking portfolio for book-to-market equity. We estimate b_t^i, s_t^i, h_t^i during a hold-out period $[t-36,t-1]$ by regressing monthly stock excess return on the market excess return and two factor-mimicking portfolio returns for each stock: $R_t^i - RF_t = a_i + b_i(MktRF_t) + s_i(SMB_t) + h_i(HML_t) + e_{it}$. We require that at least six observations are available for each regression estimation. In cases where less than six observations are available, we discard the factor loadings for month t and set three-factor abnormal return to missing for the period that includes month t.

[26] Since *ex post* intrinsic value is derived from future realizations of dividends and price, it contains information that is not yet available in year t. However, Aboody et al. (2002) argue that while unanticipated future information causes measurement error in the intrinsic value proxy, it is unlikely to cause bias in the coefficients.

TABLE 6
Additional Analysis on Future Returns and *ex post* Intrinsic Value

Panel A: Returns to Discretionary PBO Portfolios

| | Sorted by *PBO-D*: By Year | | | | | Sorted by *PBO-D*: Pooled Sample | | | | |
| | | 1-Year Returns | | 3-Year Returns | | | 1-Year Returns | | 3-Year Returns | |
Portfolio	*PBO-D*	CAPM	FF	CAPM	FF	*PBO-D*	CAPM	FF	CAPM	FF
1	−0.012	0.017	0.016	0.012	0.001	−0.012	0.026	0.014	0.013	0.002
2	−0.003	0.001	−0.008	−0.018	−0.036	−0.003	−0.004	−0.010	−0.034	−0.043
3	0.000	−0.030	−0.020	−0.103	−0.085	0.000	−0.032	−0.014	−0.094	−0.078
4	0.002	−0.015	−0.008	−0.035	−0.034	0.002	−0.020	−0.013	−0.049	−0.043
5	0.012	−0.004	−0.014	0.000	−0.029	0.012	−0.002	−0.011	0.018	−0.021
Portfolio 5 minus 1		−0.021	−0.030	−0.011	−0.030		−0.029	−0.025	0.004	−0.023
(p-values)		(0.14)	(0.04)	(0.65)	(0.23)		(0.04)	(0.08)	(0.86)	(0.35)
Long *PBO-D* ≥ 0 and Short *PBO-D* < 0		−0.013	−0.010	0.006	−0.004					
(p-values)		(0.15)	(0.27)	(0.73)	(0.79)					

Panel B: Intrinsic Value—Relative Association Tests

	NPTA	*NPTL*	*PA*	*PBO/PBO-X*	*PBO-D*	*NI*	*SALE GRW*	*R&D*	*EMP*	Adj. R²

Models:
$$IV_{it} = a_0 + \sum_{t=1992}^{2000} a_t I_t + b_1 NPTA_{it} + b_2 NPTL_{it} + b_3 PA_{it} + b_4 PBO + c_1 NI_{it} + c_2 SALEGRW_{it} + c_3 R\&D_{it} + c_4 EMP_{it} + e_{it}$$

$$IV_{it} = a_0 + \sum_{t=1992}^{2000} a_t I_t + b_1 NPTA_{it} + b_2 NPTL_{it} + b_3 PA_{it} + b_4 PBO\text{-}X + c_1 NI_{it} + c_2 SALEGRW_{it} + c_3 R\&D_{it} + c_4 EMP_{it} + e_{it}$$

	NPTA	*NPTL*	*PA*	*PBO/PBO-X*	*PBO-D*	*NI*	*SALE GRW*	*R&D*	*EMP*	Adj. R²
With Discretion	1.309	−1.234	0.584	−1.131		2.944	−0.040	17.276	0.001	46.2%
	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.21)	(0.00)	(0.00)	
Without Discretion	1.306	−1.231	0.495	−1.024		2.951	−0.039	17.222	0.001	46.2%
	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.22)	(0.00)	(0.00)	
Difference	0.003	−0.003	0.090	−0.107		−0.007	0.000	0.054	0.000	0.0%
	(0.97)	(0.97)	(0.71)	(0.73)		(0.99)	(0.99)	(0.99)	(0.94)	(0.20)

TABLE 6 (Continued)

Panel C: Intrinsic Value—Incremental Association Tests

Model: $IV_{it} = a_0 + \sum_{t=1992}^{2000} a_t I_t + b_1 NPTA_{it} + b_2 NPTL_{it} + b_3 PA_{it} + b_4 PBO\text{-}X_{it} + b_5 PBO\text{-}D_{it} + c_1 NI_{it} + c_2 SALEGRW_{it} + c_3 R\&D_{it} + c_4 EMP_{it} + e_{it}$

1.310	−1.235	0.563	−1.111	−1.778	2.945	−0.040	17.218	0.001	46.2%
(0.00)	(0.00)	(0.00)	(0.00)	(0.06)	(0.00)	(0.21)	(0.00)	(0.00)	

F-Test $b_4 = b_5$ (0.44)

Panel A: This table reports future excess returns over a one-year and a three-year window to a strategy based on *PBO-D*, the discretionary component of the projected benefit obligation. The initial sample is drawn from all Compustat firms with non-missing pension and share price data from 1991 through 2000. We further restrict the initial sample to firms with three-year-ahead monthly returns available in CRSP. Due to other data requirement described below, the final sample has 5,858 firm-year observations. Portfolios are formed by sorting *PBO-D* (deflated by sales) into quintiles. The column labeled *PBO-D* reports the mean of *PBO-D* deflated by sales for each portfolio. The panel labeled ''Sorted by *PBO-D*: Pooled Sample'' reports abnormal returns on portfolios formed by sorting the pooled sample into *PBO-D* quintiles. The panel labeled ''Sorted by *PBO-D*: By Year'' reports abnormal returns on portfolios formed by sorting the sample into PBO-D quintiles by year. Returns are accumulated starting three months after the fiscal year-end. Cumulative abnormal returns (CAR) are computed as $\sum_{t=t0}^{T} R_t^i - \sum_{t=t0}^{T} ER_t^i$, where R_t^i is monthly cum-dividend return for stock i, ER_t^i is the corresponding expected return for that stock, and $t0$ and T represent the first and last months in our respective accumulation windows. The columns labeled CAPM reports CARs where expected returns are specified by the one-factor model: $ER_t^i = RF_t + b_i^i(MktRF_t)$, where RF_t is one-month T-bill return, and $MktRF_t$ is excess return on a value-weighted aggregate market proxy. *RF*, *MktRF*, *SMB*, and *HML* are obtained from Kenneth French's website (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/). We estimate b_t^i during a hold-out period $[t-36,t-1]$ by regressing monthly stock excess return on the market excess return for each stock: $R_t^i - RF_t = a_i + b_i(MktRF_t) + e_{it}$. The columns labeled FF reports CARs where expected returns are specified by the three-factor Fama and French model: $ER_t^i = RF_t + b_i^i(MktRF_t) + s_i^i(SMB_t) + h_i^i(HML_t)$, where SMB_t is returns on zero-investment factor-mimicking portfolio for size; HML_t is returns on zero-investment factor-mimicking portfolio for book-to-market equity. We estimate b_t^i, s_t^i, h_t^i during a hold-out period $[t-36,t-1]$ by regressing monthly stock excess return on the market excess return and two factor-mimicking portfolio returns for each stock: $R_t^i - RF_t = a_i + b_i(MktRF_t) + s_i(SMB_t) + h_i(HML_t) + e_{it}$. Panels B and C: The sample is drawn from all Compustat firms with non-missing pension and share price data from 1991 through 2000. The number of firm-year observations for all regressions is 8,187. We delete 1 percent of observations with the smallest and the largest values of studentized residuals to remove the effect of outliers. The dependent variable in all regressions is ''*ex post* intrinsic value'' at current fiscal year-end, which is calculated from the following equation:

$IV_{it} = \sum_{\tau=1}^{3} \frac{d_{t+\tau}}{(1+r)^{\tau}} + \frac{P_{t+3}}{(1+r)^3}$, where d is dividend, r is discount rate, and P is market capitalization. All variables except for *SALEGRW* and *EMP* are deflated by current-year sales. I_t is the dummy variable for each year from 1992 through 2000. Independent variables *NPTA*, *NPTL*, *PA*, *PBO-X*, *PBO-D*, *NI*, *SALEGRW*, *R&D*, and *EMP* are defined in Table 2. p-values for coefficient estimates and their differences are two-sided and White (1980) adjusted. p-values for R^2 differences are based on Vuong's (1989) test statistic.

discretion in *PBO*). Further, the coefficient on *PBO* (-1.131) is higher than that on *PBO-X* (-1.024), although the difference is not statistically significant. Panel C reports results from the incremental association tests. Similar to our pricing results, we find that coefficient on *PBO-D* is negative and significant and statistically indistinguishable from the coefficient on *PBO-X*. Overall, the results from the *ex post* intrinsic value regressions are qualitatively similar to those from the price regressions, although the magnitudes of the coefficients on both *PBO* components are higher for the intrinsic value regressions.

In summary, evidence presented in this section suggests that market inefficiency is unlikely to explain our primary pricing results. However, we caution that our tests lack power to detect and control mispricing that is corrected over the long run, i.e., beyond the three-year horizon employed in our tests. Since pension obligations are notoriously long term in nature, there is some concern that our pricing results may arise from market mispricing that is reversed only over the long run. However, recent evidence (Franzoni and Marin 2005) suggests that the stock market corrects for mispricing related to pension funded status even over the short run, such as the three-year horizon used in our tests.[27] Although indirect, this evidence does suggest that our tests likely have the power to detect mispricing related to the discretionary PBO component.

VI. CONCLUSION

U.S. and International Accounting Standards are going through major changes as a result of the recent waves of accounting scandals. One of the issues that is at the heart of the debate is the degree of flexibility that should be allowed under GAAP. While many criticize that the flexibility accorded under GAAP allows managers to opportunistically manipulate accounting numbers, others believe that it allows managers to better communicate private information to financial statement users. Whether flexibility (discretion) improves or impairs the value relevance of financial statements is ultimately an empirical question. In this study, we examine this issue in the context of pension obligations. Specifically, we examine whether discretion in choosing pension assumptions—as currently allowed under U.S. GAAP—improves or impairs the value relevance of the pension obligation (PBO).

Our results show that allowing discretion does not impair the value relevance of the PBO. We also show that the discretionary component of pension liability, on average, is priced by the stock market in a similar manner to the nondiscretionary component. Overall, our results are consistent with discretion in the choice of pension obligations, on average, improving the communication of value-relevant information through the PBO. Our results have implications for the recent debate on principles-based versus rules-based standards (e.g., FASB 2004).

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[27] Franzoni and Marin (2005) examine returns related to portfolios formed on pension-funded status over a five-year horizon. However, much of the excess returns from their strategy arise over the first three years after portfolio formation. Specifically, the annualized return differential between the most underfunded and the least underfunded deciles are 6.57 percent over a three-year horizon and 7.98 percent over a five-year horizon.

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