

Real Estate and Alternative Asset Allocations of U.S. Firms' Defined Benefit Pension Plans

Executive Summary. *This study examines the role of real estate and alternative assets in the investment portfolio of defined benefit (DB) pension plans offered by U.S. firms for the period 2002 to 2010. These plans provide a unique reflection of the confluence of regulatory, accounting, and economic changes that have recently taken place. Results indicate less than a quarter of our sample plans invest in real estate while half invest in alternative assets. Plans that include the assets in their investment strategy tend to have larger market values, lower accumulated pension benefit obligations on a proportional basis, and higher returns.*

by Karen Eilers Lahey*
Aigbe Akhigbe**
Melinda Newman***
T. Leigh Anenson****

In the United States, defined benefit (DB) plans are currently the predominant type of retirement plan provided to government employees in public pension plans and historically, to corporate employees covered by private pension plans. There has been a gradual shift by businesses that offer private pensions to defined contribution (DC) plans in an effort to reduce the liabilities that DB plans create for them. However, there are still many U.S. corporations that offer DB plans to their employees and they are regulated by the federal government (Anenson and Lahey, 2007). It is the investment choices of these private DB pension plans that are the focus of this paper.

A unique confluence of events in the last five years has brought increased attention to the funding status of DB pension plans. First, in response to the default of several large DB pension plans in the early 2000s, the Bush Administration called for pension funding reform. This resulted in passage of the Pension Protection Act of 2006 (PPA, 2006), which represents the most comprehensive change to pension laws since the Employment Retirement Income Security Act of 1974 (ERISA, 1974).¹ Second, Financial Accounting Standards Board's (FASB's) FAS 158 rule became effective September, 2006 and amends FAS 87, 88, 106, and 132(R). In an effort to make DB pension funding status more transparent, this change in accounting rules moves pension reporting from the financial

*The University of Akron, Akron, OH 44325-4803 or klahey@uakron.edu.

**The University of Akron, Akron, OH 44325-4803 or aigbe@uakron.edu

***The University of Akron, Akron, OH 44325-4803 or newmanm@uakron.edu.

****University of Maryland, College Park, MD 20742-1815 or lanenson@rhsmith.umd.edu.

statement footnotes to explicit reporting in the balance sheet and income statement of publicly-traded corporations.

Additionally, the General Accounting Office (GAO) of the federal government issued three guidance reports in 2008 and an additional guidance report in 2010, regarding DB pension investments in private equity and hedge funds.² Though the allocation of DB pension assets to these alternative investments is still relatively small, the proportion of plans making such investments has grown significantly over the past decade, causing rising concern regarding the relative riskiness of these investment vehicles and their unique exemption from federal oversight. Compounding this and the issues noted above, the "Great Recession" of 2008–2009 exposed significant underfunding by both public and private DB pension plans.

Corporate DB plans are funded by yearly contributions from employers and sometimes employees, as well as earning returns on a portfolio that can invest in a wide variety of securities. Investing in traditional debt and equity securities has been altered by the recent phenomenon of investing in real estate and alternative investments. Real estate assets can be in the form of direct equity in property, or investment in mortgages, derivative securities, or real estate investment trusts (REITs). The addition of real estate assets to investment portfolios has been advocated since the early 1980s by numerous authors, including Hartzell, Hekman, and Miles (1986), Webb and Rubens (1987), Firstenberg, Ross, and Zisler (1988), Ziering and McIntosh (1997), Ziobrowski and Ziobrowski (1997), and Mueller and Mueller (2003). These studies rely on a mean variance approach in determining the amount of real estate assets that should be included in a portfolio and are based on the benefits of diversification. A different approach to analyzing the addition of real estate assets to pension plans (an asset-liability framework) is advocated by Chun, Ciochetti, and Shilling (2000) and further analyzed by Craft (2001, 2005). Their results recommend investment in real estate assets as well, but at a much lower percentage of the portfolio than that of the prior studies.

This paper examines the role of real estate assets and alternative investments in the portfolio of DB

plans offered by publicly-traded U.S. firms to their employees. These plans provide a unique reflection of the confluence of regulatory and accounting changes that have recently taken place. Below is a review of the literature that examines recommendations for adding real estate assets to pension plans and asset allocations that have occurred. There is then an explanation of the data and methodology used in this study, followed by a discussion of the results. The paper closes with concluding remarks.

Review of the Literature

Ibbotson and Siegel (1984) provide data on real estate returns (8.33%) compared to stocks (12.42%) and bonds (3.76%) for the period 1947–1982. They find a very low correlation of real estate returns with the returns of stocks and bonds and state that this allows portfolio managers to diversify their assets and provide an inflation hedge. The return to real estate is not explained by either market or inflation risk, but rather by its non-risk characteristics of control, tax benefits, marketability, and information costs. According to Hartzell, Hekman, and Miles (1986), pension funds have over 96% of their investments in stocks and bonds. They obtain data from an open-ended institutional manager of pension fund real estate investments for the period 1973–1983 and support the findings of Ibbotson and Siegel. Real estate assets are negatively correlated with the S&P 500 stocks and bonds and positively correlated with Treasury bills and inflation.

In 1990, 54% of all pension funds owned no real estate assets and DC plans had only 1%, according to Ennis and Burik (1991). Those pension funds that did hold real estate assets had only 3.5% of total assets in this category. Using the Capital Asset Pricing Model (CAPM) to determine the appropriate percentage for real estate assets, the authors find that 10% to 15% should be allocated to these assets in an efficient portfolio. Their explanation for the smaller percentage of real estate in pension funds is that the assumptions of the CAPM are not met by real estate assets.

The percentage of real estate assets that would be expected to be included in pension plans is less

than suggested by a simulation of means and variances with other assets according to Chun, Ciochetti, and Shilling (2000). They argue that the explanation may be that the appropriate model should be based on an asset-liability framework of Sharpe (1990), in which pension fund assets are used to maximize the risk-adjusted future surplus value (assets minus liabilities). Real estate assets' main role in the asset-liability model is to provide a hedge against the risk of inflation in pension liabilities in contrast to the mean-variance model in which real estate assets provide diversification on the asset side of pension funds.

Chun, Ciochetti, and Shilling (2000) use CompuStat data on 938 firms' pension assets and pension benefit obligations (PBOs) from 1988 to 1997. The results of their simulation study indicate that an appropriate asset allocation to equity REITs in a pension fund depends on the funding status of the plan, with overfunded plans tending to hold more real estate than those that are underfunded. They find that plan holdings of real estate assets are positively correlated with plan size, the liability growth rate of the plan, and the size of employers and employee contributions to the plan. With respect to the latter finding, they argue that the larger the contribution level, the greater the cushion of reserves against market volatility, so the greater the risk tolerance of plan investors in making asset allocation decisions. In a separate study, Ciochetti, Sa-Aadu, and Shilling (1999) show that DB pension plan investment in real estate is positively correlated with plan size, firm profitability, and financial slack. However, plan investment in real estate assets is negatively correlated with the number of pension plans within a firm, and with net profit margin, suggesting a smoothing of earnings.

Craft (2005) relies on the asset-liability framework used by Chun, Ciochetti, and Shilling (2000) to explore why there is not a higher percentage of real estate assets in corporate pension funds. His empirical results indicate that for a pension fund that is fully funded, asset allocations to private real estate should be 13% and to REITs, 15%. For pension funds that are underfunded, his results show a smaller percentage for private real estate and the same percentage for REITs.

A different view of real estate allocations in pension funds is suggested by Peyton and Lotito (2006). In particular, they discuss the investment characteristics of commercial real estate that are similar to alternative investments of hedge funds, commodities, and private equity. First, both real estate assets and alternative investments have offered plans stronger returns than stocks and bonds for the period 1996–2005. Second, real estate and alternative investment returns are relatively uncorrelated with stock and bond returns. Notably, they find commercial real estate returns to be uncorrelated with alternative investment returns as well.

Third, real estate and alternative assets are not priced on a daily basis nor are market prices transparent. The authors note that commercial real estate held in REITs is different because REITs are traded daily at market-determined prices. The tradeoff, however, is that REIT returns are more highly correlated with stock market returns, and therefore offer less opportunity for diversification. Hence, in 2004, just 13% of the more than \$3 trillion of investment grade commercial real estate is held by REITs and the rest is in private holdings. Fourth, given the nature of the assets, real estate and alternative investments have less liquidity than stocks and bonds, although the authors argue that commercial real estate is more liquid than private equity. Lastly, neither real estate nor alternative investments are widely available to individual investors.

Though there are many commonalities among the characteristics of real estate and alternative investments, Peyton and Lotito (2006) argue that the differences are equally important, with the most important difference being the valuation of the two types of assets. Real estate has an independent, third party valuation process conducted and indexed by licensed appraisers. This results in the primary index for real estate (the NCREIF-NPI index) being a relatively reliable valuation tool. In contrast, alternative investments rely more often on self-reported valuations and are less transparent, so alternative asset indexes tend to suffer from backfill and survivorship biases. In addition, individual investors can assume either an active or passive role in the management of real estate

assets, whereas alternative investments are largely passive investments.

Given the differences in these asset classes and their uncorrelated returns, the authors consider the optimal allocation of plan assets to real estate assets and private equity to be separate decisions. They show that allocation of plan assets to real estate investments offers the benefits of diversification when combined with stock, bond, and private equity investments. The benefit of allocation to private equity, however, relies on the expert selection of value-enhancing deals on a better than random basis. Peyton and Lotito (2006) conclude that while real estate and alternative investments are each "alternative" investments to stocks and bonds, they are two different asset classes and should be considered as such.

Do assets perform differently when the economy is doing well and when it is doing poorly? Sa-Aadu, Shilling, and Tiwari (2010) find that both real estate assets and alternative investments have gains in a poor economy and/or a volatile economy. Their results indicate that risk-averse investors should overweight real estate, alternative investments, and government bonds in a bad economy because they act as a hedge when there are unexpected shocks to the portfolio. These same asset classes should also be included in portfolios during good economic conditions. They argue that there are differences in returns across these asset classes and that real estate offers different diversification and hedging properties than alternative investments, as suggested by Peyton and Lotito (2006). Therefore, Sa-Aadu, Shilling, and Tiwari (2010) argue that real estate assets appear to be underweighted in portfolios.

The Pension Benefit Guaranty Corporation (PBGC) adopted a new investment policy for regulated funds in February, 2008. The PBGC was established as part of the Employee Retirement Income Security Act of 1974 (ERISA, 1974) and provides corporate pension plan beneficiaries a public insurance plan in the event that their plan is terminated. The PBGC can change the investment policy for regulated funds every four years.

According to Purcell and Kinneen (2009), the justification for the 2008 change in policy is to generate higher returns because expenses have exceeded revenues since 1998. The policy has 45% allocated to equity investments, 45% to fixed-income investments, and 10% to real estate, private equity, and hedge funds. There is also the opportunity to invest in funds of hedge funds and other unregulated funds that offer high returns and high risks. Previous policy in 2004 allocated 15%–25% to equity and 75%–85% to fixed maturity securities. The new policy reflects an asset-liability matching strategy as previously discussed and is used by a majority of pension funds that the PBGC insures.

Purcell and Kinneen (2009) contrast this 2008 policy with the asset allocation of the United Kingdom plan (Pension Protection Fund, PPF) that invests predominately in fixed income assets. It has been suggested by Ciochetti, Sa-Aadu, and Shilling (1999) that the PBGC guarantee may encourage more risk taking by corporate pension plans because the agency will take over the plan assets if the firm fails. They also suggest that underfunded pension plans may want to take on additional risk to increase return and reduce underfunding in much the same way as S&L financial institutions did in the 1980s.

Correspondingly, the GAO study #10-915T (2010) notes that the number of public and private DB pension plans investing in hedge funds and private equity has grown significantly. Over the 2001–2009 period, the proportion of surveyed funds investing in private equity has grown from 71% to 90%, while the proportion investing in hedge funds has increased from 11% to 51%. The study notes that these investments tend to be restricted to large DB plans, and that the average allocation to private equity and hedge funds among surveyed plans was approximately 8% and 5%, respectively.

Finally, Clayton et al. (2007) state that there has been a dramatic change in the last five to ten years in terms of real estate gaining acceptance as an institutional investment vehicle. Part of the explanation is the development of public REITs, the securitization of commercial mortgages, and stronger

integration of private real estate and national and global markets. Factors offered to explain the persistently small percentage investment in real estate assets among corporate pension plans, however, include plan size, the plan's funding status, firm profitability, the percentage of real estate assets of the corporation, the inability to take advantage of tax consequences from holding real estate, and the PBGC guarantee of pension funds.

Based on the commonly-held view of real estate assets and commodities/hedge fund/private equity investments as being "alternatives" to stock and bond investments, this study examines the *actual* allocation of these assets in corporate DB pension plans. However, in light of previous research suggesting these are distinctly different asset classes, we conduct our analysis on each asset class separately as well. We consider the influence of variables on the likelihood of plan investment in each asset class, and on returns from plans' investment in each respective asset class.

Data and Methodology

We collect all data from the Compustat database for the years 2002–2010, which reflects the period for which DB pension asset allocation data are available. Identification of firms with positive, DB pension plan values (*PENSIZE*) results in a total of 19,595 firm-year observations over this time period. For these firms, we collect additional pension plan variables and firm control variables as defined below.

DB Pension Plan Variables

We define *INV_RE* as the percentage of DB pension plan assets invested in real estate assets, as reported by Compustat on an annual basis. Similarly, *INV_EQ* captures the proportional investment in equity securities, while *INV_DEBT* reflects the percentage of pension assets invested in all fixed income securities. *INV_ALT* is the remaining proportion of DB pension plan assets invested in alternative investments, including private equity and hedge funds. Isolation of observations for which pension asset allocation

data are available results in a final sample of 9,899 firm-years over the period 2002–2010.

We define *EMPRCONT* (*EMPECONT*) as the annual employer (employee) dollar contribution to the pension plan, respectively, standardized by the pension market value. $ACCPBO = (\text{The accumulated pension benefit obligation}) / \text{Pension plan market value}$, where the numerator reflects the present value of all benefits earned by employees for services rendered to date. Compustat defines pension funding status (mnemonic PCPPAO) as the pension plan's long-term assets net of the plan's current and long-term liabilities. As a measure of funding status, a negative value indicates the pension is underfunded. Therefore, we define *UNDERFUND* as an indicator variable, assuming a value of one if a data item is negative, and is zero otherwise.³ Compustat also reports the annual change in the market value of pension plan assets, excluding contributions to and payments from the plan (mnemonic PBARAT). To estimate the pension plan's annual raw return (*RETURN*), we standardize this data item by pension plan market value. We then risk-adjust this raw return measure (*RETURNRA*) using the standard deviation of returns for each firm's pension plan.

Firm Control Variables

As a measure of firm size, we report the total asset book value of the firm (*TABV*). *LIQUID* is the book value of cash and short-term investments, and is included as a proxy measure of the firm's general preference for liquidity. *PPE* reflects the book value of the firm's gross property, plant, and equipment, and is included as an estimate of a firm's experience with real estate investment. *LIQUID* and *PPE* are each standardized by *TABV*. Finally, *ROA* is defined as $\text{Net Income} / \text{TABV}$, and is included as a measure of firm profitability.

Methodology

We first attempt to determine the variables that significantly influence the choice of asset allocation in our sample of DB pension plans. To do so, we specify our logit model as follows:

$$\begin{aligned} \Pi = & \alpha + \beta_1 LNPENSIZ E + \beta_2 EMPRCONT \\ & + \beta_3 EMPECONT + \beta_4 ACCPBO \\ & + \beta_5 UNDERFUND + \beta_6 LIQUID \\ & + \beta_7 PPE + \beta_8 ROA + \varepsilon, \end{aligned} \quad (1)$$

where *LNPENSIZ E* is the natural log of *PENSIZ E*, and all other variables are as previously defined. We conduct three separate estimations of the model. In the first estimation, the dependent variable (*Π*), assumes a value of one for firms whose DB pension plans include real estate investments but no alternative investments, and is zero for DB pension plans with alternative investments but no real estate investments. In the second estimation, the dependent variable (*Π*), assumes a value of one if the firm's DB plan invests in both real estate and alternative investments, and is zero if it invests in neither asset type. In the third and final estimation of the model, the dependent variable assumes a value of one if the firm allocates a portion of its DB pension assets to real estate and/or alternative investments, and is zero if the plan invests in neither asset type.

Based on the results of Ciochetti, Sa-Aadu, and Shilling (1999) and Chun, Ciochetti, and Shilling (2000), we expect *LNPENSIZ E* to be positively correlated with the probability of investing in real estate assets. Concurrent with GAO report #10-915T (2010), we expect the same direction of correlation for *LNPENSIZ E* and the probability of investing in alternative assets. For *EMPRCONT* and *EMPECONT*, Chun, Ciochetti, and Shilling (2000) find a positive correlation between the level of employer (employee) contribution and real estate investment, so it may be that *EMPRCONT* and *EMPECONT* each positively influence the likelihood of real estate investment as well.

For alternative investments, it may be that, as suggested by Chun, Ciochetti, and Shilling (2000), the greater the contribution of the firm, the greater the risk tolerance and the desire for relatively high returns. If this is the case, we expect a positive relationship between *EMPRCONT* and the likelihood of alternative investments choices. With respect to *EMPECONT*, it may be that the same

reasoning holds, in which case we expect a positive coefficient estimate for *EMPECONT* as well. Alternatively, it may be that the greater the contribution made by firm employees, the lower the risk exposure desired by the firm in order to remain well within the fiduciary requirements of ERISA. If this is the case, we would expect a negative relationship between *EMPECONT* and the probability of alternative investment allocations.

The greater the firm's accumulated pension benefit obligation is relative to the pension plan's market value (*ACCPBO*), we expect the greater the desire for relatively high returns. Therefore, we expect a positive correlation between *ACCPBO* and the probability of alternative investment choices. If, as suggested by Peyton and Lotito (2006) and Sa-Aadu, Shilling, and Tiwari (2010), the benefit of real estate investment is diversification effects, it is plausible that the correlation of *ACCPBO* with the probability of real estate investment may assume either sign. Based on the findings of Chun, Ciochetti, and Shilling (2000), we expect a negative correlation between *UNDERFUND* and the likelihood of real estate investment, indicating that underfunded (overfunded) firms are less (more) likely to invest in real estate assets. We expect a similar outcome for the likelihood of alternative investments.

To the extent that *LIQUID* is a proxy measure for a firm's general liquidity preferences, we expect a negative correlation with the likelihood of both real estate and alternative investment choices. If, however, a higher measure of *LIQUID* reflects excess cash available for investment, a positive correlation may result. Finally, we expect firm investment in PPE to negatively influence the likelihood of DB plan investment in real estate, but for firm *ROA* to have a positive influence (Ciochetti, Sa-Aadu, and Shilling, 1999). It is plausible that the correlation of the likelihood of pension investments in alternative assets with *PPE* and *ROA*, respectively, may be in either direction.

Turning our attention to plan returns, we subsequently specify the following cross-sectional model as:

Pension Plan Return Measure

$$\begin{aligned}
 &= \alpha + \beta_1 \text{INDICATOR} + \beta_2 \text{LNPNESIZE} \\
 &+ \beta_3 \text{EMPRCONT} + \beta_4 \text{EMPECONT} \\
 &+ \beta_5 \text{ACCPBO} + \beta_6 \text{UNDERFUND} \\
 &+ \beta_7 \text{LIQUID} + \beta_8 \text{PPE} + \beta_9 \text{ROA} + \varepsilon, \quad (2)
 \end{aligned}$$

and develop regression estimates using *RETURN* as the dependent variable. Similar to our logit regressions, we estimate the model for three different samples. In the first sample, the variable *INDICATOR* assumes a value of one for firms whose DB pension plans include real estate investments but no alternative investments, and is zero for DB pension plans with alternative investments but no real estate investments. As such, a positive (negative) coefficient estimate for *INDICATOR* suggests that investment in real estate assets is associated with greater (lower) plan returns than for those plans choosing to instead make alternative investments.

For the second sample, *INDICATOR* assumes a value of one if the firm's DB plan invests in real estate and alternative investments, and is zero if it invests in neither. A positive (negative) coefficient estimate for *INDICATOR* reflects a greater (lower) return for plans investing in real estate and alternative investments than for plans that refrain from making either type of investment. In the third sample, *INDICATOR* assumes a value of one if the firm's DB plan invests in real estate and/or alternative investments, and is zero if it invests in neither. Therefore, a positive (negative) coefficient estimate for *INDICATOR* in this sample reflects a greater (lower) return for plans investing in either real estate or alternative investments, as opposed to those plans that refrain from making either type of investment.

Finally, we re-estimate the model for each of the above-noted samples using risk-adjusted return (*RETURNRA*) as the dependent variable. All other variables in the model are as previously defined. Because our sample is comprised of observations for many of the same firms over multiple years, we use a random effects panel data model in our cross-

sectional analysis.⁴ Based on the studies of Purcell and Kinneen (2009) and Sa-Aadu, Shilling, and Tiwari (2010), we expect returns to be higher for plans investing in either real estate or alternative assets, as opposed to plans invested in neither asset type. It is an empirical question, however, in regard to the relative returns between plans investing in either real estate or alternative assets.

Results

Descriptive Statistics

Panel A of Exhibit 1 reflects summary statistics for firms whose DB pension plans include real estate investments and no alternative investments versus those firm plans that invest in alternative assets but not in real estate. Consistent with prior research, there are relatively few sample plans that invest in real estate. There are a total of 715 firm-year observations in the real estate sample and 3,739 firm-year observations for those pension plans in the alternative investment sample. As expected, the median market value of the pension plans containing real estate assets (\$324.0 million) is larger than the median measure for those that do not (\$141.6 million), and is statistically different at a 1% level of significance (Chun, Ciochetti, and Shilling, 2000; GAO, 2010).

Reflecting the differences in plan size, plans invested in real estate rather than alternative investments invest significantly more in equity and debt than those plans that opt for alternative investments rather than real estate. When considered on a proportional basis, our real estate sample allocates a median (mean) of 5% (6.4%) investment to real estate assets. This relatively small amount is consistent with the findings of Ennis and Burik (1991). Note that the alternative asset pension plans invest a median (mean) proportion of 5.4% (11.3%) of plan assets in these alternative investments, which is consistent with the findings of GAO report 10-915T. The median proportional investment in equity is larger for the real estate sample (63.0%) than the alternative investment sample (60.0%) and is statistically significant at the 1% level. Median proportional investment in

Exhibit 1
Descriptive Statistics for Firms with DB Pension Plans

Panel A	Real Estate/No Alternative Investments		Alternative/No Real Estate Investments	
	Mean	Median	Mean	Median
Pension				
<i>PENSIZE</i> (\$m)	1,802.06	324.00	889.09***	141.60***
<i>DINV_RE</i> (\$m)	107.04	15.95	0.00***	0.00***
<i>DINV_ALT</i> (\$m)	0.00	0.00	362.36	6.55***
<i>DINV_EQ</i> (\$m)	1,124.52	192.78	967.09	78.20***
<i>DINV_DEBT</i> (\$m)	568.62	91.65	2,385.66	40.49***
<i>INV_RE</i>	0.0638	0.0500	0.0000***	0.0000***
<i>INV_ALT</i>	0.0000	0.0000	0.1127***	0.0540***
<i>INV_EQ</i>	0.6098	0.6300	0.5696***	0.6000***
<i>INV_DEBT</i>	0.3262	0.3100	0.3177	0.3134
<i>DEMPCONT</i> (\$m)	80.54	12.60	48.01***	6.30***
<i>DEMPCONT</i> (\$m)	1.54	0.00	1.70	0.00
<i>DACCPBO</i> (\$m)	2,042.84	425.19	1,036.59	184.17***
<i>DUNDERFUND</i> (\$m)	5.45	-12.15	-99.83	-6.61**
<i>EMPCONT</i>	0.0703	0.0482	0.3710	0.0603***
<i>EMPECONT</i>	0.0017	0.0000	0.0021	0.0000
<i>ACCPBO</i>	1.1763	1.1333	1.6658***	1.1577**
<i>UNDERFUND</i>	0.6713	1.0000	0.6676*	1.0000
<i>RETURN</i>	0.0441	0.0944	0.2075	0.0892**
<i>RETURNRA</i>	0.0095	0.0204	0.0448	0.0193**
Firm				
<i>TABV</i> (\$m)	28,132.83	3,237.90	23,251.97	2,617.65***
<i>LIQUID</i>	0.0871	0.0495	0.0921	0.0553***
<i>PPE</i>	0.6411	0.5878	0.5819***	0.5142***
<i>ROA</i>	0.0453	0.0382	0.0268***	0.0291***
Return Data Obs.	691		3,589	
Other Data Obs.	715		3,739	
Panel B				
	Real Estate and Alternative Investments		No Real Estate/No Alternative Investments	
Variable	Mean	Median	Mean	Median
Pension				
<i>PENSIZE</i> (\$m)	4,761.33	679.51	473.89***	67.68***
<i>DINV_RE</i> (\$m)	266.61	24.90	0.00***	0.00***
<i>DINV_ALT</i> (\$m)	488.76	41.70	0.00***	0.00***
<i>DINV_EQ</i> (\$m)	2,446.72	354.11	313.24***	40.25***
<i>DINV_DEBT</i> (\$m)	1,609.73	193.77	160.45***	24.51***
<i>INV_RE</i>	0.0536	0.0500	0.0000***	0.0000***
<i>INV_ALT</i>	0.1057	0.0619	0.0000***	0.0000***
<i>INV_EQ</i>	0.5376	0.5700	0.6024***	0.6300***
<i>INV_DEBT</i>	0.3134	0.3000	0.3972***	0.3700***
<i>DEMPCONT</i> (\$m)	159.65	22.08	28.20***	3.20***
<i>DEMPCONT</i> (\$m)	6.40	0.00	0.87***	0.00***
<i>DACCPBO</i> (\$m)	5,020.44	855.86	591.63***	93.00***
<i>DUNDERFUND</i> (\$m)	117.94	-15.00	-42.80**	-4.38***
<i>EMPCONT</i>	0.0558	0.0400	0.1040***	0.0622***
<i>EMPECONT</i>	0.0037	0.0000	0.0018***	0.0000***
<i>ACCPBO</i>	1.1561	1.1130	1.3441***	1.1684***
<i>UNDERFUND</i>	0.6205	1.0000	0.7044***	1.0000***
<i>RETURN</i>	0.0607	0.0997	0.0515**	0.0878***
<i>RETURNRA</i>	0.0131	0.0215	0.0111**	0.0190***
Firm				
<i>TABV</i> (\$m)	69,478.37	6,979.00	9,634.40***	1,663.46***
<i>LIQUID</i>	0.0953	0.0670	0.0925	0.0525***
<i>PPE</i>	0.6015	0.5081	0.6144	0.5805***
<i>ROA</i>	0.0401	0.0350	0.0299	0.0275***
Return Data Obs.	1,235		3,994	
Other Data Obs.	1,291		4,154	



Exhibit 1 (continued)
Descriptive Statistics for Firms with DB Pension Plans

Panel C Variable	Real Estate and/or Alternative Investments		No Real Estate/No Alternative Investments	
	Mean	Median	Mean	Median
Pension				
PENSIZE (\$m)	1,872.87	207.85	473.89***	67.68***
DINV_RE (\$m)	76.32	0.00	0.00***	0.00***
DINV_ALT (\$m)	345.66	6.44	0.00*	0.00***
DINV_EQ (\$m)	1,318.61	118.18	313.24***	40.25***
DINV_DEBT (\$m)	1,980.64	59.44	160.45	24.51***
INV_RE	0.0200	0.0000	0.0000***	0.0000***
INV_ALT	0.0971	0.0500	0.0000***	0.0000***
INV_EQ	0.5675	0.6000	0.6024***	0.6300***
INV_DEBT	0.3178	0.3100	0.3972***	0.3700***
DEMPCONT (\$m)	77.26	8.98	28.20***	3.20***
DEMPECONT (\$m)	2.73	0.00	0.87***	0.00***
DACCPBO (\$m)	2,107.50	269.39	591.63***	93.00***
DUNDERFUND (\$m)	-377.64	-7.89	-42.80	-4.38***
EMPCONT	0.2622	0.0536	0.1040	0.0622***
EMPECONT	0.0024	0.0000	0.0018**	0.0000***
ACCPBO	1.4813	1.1431	1.3441	1.1684***
UNDERFUND	0.6574	1.0000	0.7044***	1.0000***
RETURN	0.1541	0.0926	0.0515	0.0878***
RETURNRA	0.0333	0.0200	0.0111	0.0190***
Firm				
TABV (\$m)	34,247.29	3,076.81	9,634.40***	1,663.46***
LIQUID	0.0922	0.0571	0.0925	0.0525**
PPE	0.5945	0.5258	0.6144***	0.5805**
ROA	0.0321	0.0317	0.0299	0.0275***
Return Data Obs.	5,517		3,994	
Other Data Obs.	5,745		4,154	

Notes: A total of 9,899 firm years comprise the data sample for which the pension variable data are available from the Compustat database for the period 2002–2010. Panel A reflects summary statistics for firms whose DB pension plans include real estate investments but no alternative investments versus DB pension plans that include alternative investments but no real estate investments. Panel B reflects summary statistics for DB pension plans invested in real estate and alternative investments as opposed to DB pension plans that make neither type of investment. Panel C reflects summary statistics for DB pension plans invested in real estate and/or alternative investments as opposed to DB pension plans that make neither type of investment. PENSIZE is pension market value. The DINV_* variables reflect the plan assets invested in real estate (RE) assets, alternative (ALT) assets, equity (EQ) investments, and debt (DEBT) instruments, respectively, in \$millions (\$m). The INV_* variables reflect the corresponding investments in % format. DEMPCONT (DEMPECONT) is the employer (employee) contribution dollar amount, respectively, while DACCPBO is the accumulated pension benefit obligation dollar amount. The % form of each of these variables is standardized by PENSIZE. DUNDERFUND is the annual pension funding status (Compustat data item #A290), where a negative value indicates the pension is underfunded. UNDERFUND assumes a value of one (zero) if DUNDERFUND is negative (positive). RETURN is the annual raw return of plan assets while the risk-adjusted return, RETURNRA, is RETURN standardized by the standard deviation of returns for each firm pension plan. TABV is the total asset book value of the firm; LIQUID is (the book value of cash and short-term investments)/TABV. PPE is (the book value of the firm's gross property, plant, and equipment)/TABV and ROA is NI/TABV.

* Differences in means (medians) between the two groups are statistically significant at the 1% level.
 ** Differences in means (medians) between the two groups are statistically significant at the 5% level.
 *** Differences in means (medians) between the two groups are statistically significant at the 10% level.

debt, however, is not statistically significantly different between the two samples of DB plans.

On a percentage basis, the median employer plan contribution (EMPCONT) is lower for the real estate sample (4.8%), and statistically significant

in its difference from the median of the comparative firms (6.0%). Similar results hold for the accumulated pension benefit obligation results.

Note that for both samples, the summary measures of ACCPBO are greater than one, indicating that the accumulated PBO is, on average, greater



than the pension market value for our sample firms.

Corresponding with the *ACCPBO* results, the median measure of the pension funding status (*DUNDERFUND*) is -\$12.2 million for the real estate sample and -\$6.6 million for alternative investment plans, reflecting an overall level of underfunding for our sample of firm-years. The measures are statistically different at a 5% level of significance, indicating that the real estate sample is significantly more underfunded than the comparative firms. The means of the *UNDERFUND* indicator variable show that, on average, a larger proportion of the plans investing in real estate are underfunded (67.1%), as opposed to the sample of comparable firms (66.8%), although the difference is statistically significant at just the 10% level.

Note that the median raw return (*RETURN*) and risk-adjusted return (*RETURNRA*) are 9.4% and 2.0%, respectively, for our real estate sample, and are larger than the median measures of 8.9% and 1.9% for the alternative investment sample. In each case, the return measure is statistically significant in its difference between the samples at the 5% level, although the economic difference in returns is perhaps surprisingly small.

For our control variables, firms with DB plan investments in real estate but no alternative assets are significantly larger than firms whose DB plans that hold no real estate but do make alternative investments. Based on the median measures of *LIQUID* and *ROA*, the level of liquidity is lower, while firm profitability is higher (Ciocchetti, Sa-Aadu, and Shilling, 1999) for the former sample as well. Note that the median measure of *PPE* is higher for the DB plans of firms investing in real estate assets (58.8%) than for firms whose plans invest in alternative investments (55.3%). This may reflect a level of familiarity with real estate investment translating from the firm's capital investment structure to that of the plan's investment structure. The differences in median measures for all of the firm control variables are statistically significant at the 1% level.

Panel B of Exhibit 1 reflects summary statistics for firms whose DB pension plans include both real

estate and alternative investments versus those plans that invest in neither. There are a total of 1,291 firm-year observations for those investing in both, while 4,154 firm-year observations reflect no investment in real estate or alternative assets. Similar to the results of Panel A, DB pension plans that invest in real estate and alternative investments are significantly larger than those that do not. Correspondingly, the former plans invest significantly more in equity and debt than the latter, but significantly less on a proportional basis, as expected. At the median, alternative investment holdings are 6.2% for the former sample and are consistent with the findings of GAO report 10-915T. As indicated by the median (mean) of *INV_RE*, plans investing in both types of investments hold 5.0% (5.4%) allocation in real estate assets (Ennis and Burik, 1991).

Comparable to the results in Panel A of Exhibit 1, the median percentage employer contribution (*EMPRCONT*) is lower for the real estate/alternative asset sample (4.0%), and statistically significant in its difference from the median of the comparative firms (6.2%). However, employees contribute a higher percentage (*EMPECONT*) to the real estate/alternative asset plans than do employees of debt/equity plans. Following the logic of Chun, Ciocchetti, and Shilling (2000), this may reflect a larger contribution level, creating a greater cushion against market volatility, and therefore a greater risk tolerance of plan investors in making asset allocation decisions.

As in Panel A of Exhibit 1, the accumulated pension benefit obligation results (*ACCPBO*) are smaller for the real estate/alternative asset sample, but are greater than one for both samples, indicating that the accumulated PBO is, on average, greater than the pension market value for our sample firms. Plans investing in real estate and alternative assets have greater underfunding (*DUNDERFUND*) than comparative firms, as reflected by the median measures of -\$15.0 million and -\$4.4 million, respectively. As reflected in the means of *UNDERFUND* however, a smaller percentage of the real estate/alternative investment plans are underfunded (62.1%) than are the comparative plans (70.4%), with a statistically significant difference at the 1% level.



The median raw return (*RETURN*) and risk-adjusted return (*RETURNRA*) are 9.97% and 2.2%, respectively, for our real estate/alternative investment sample, and are larger than the median measures of 8.8% and 1.9% for the sample plans investing in only debt and equity. In each case, the return measure is statistically significant in its difference between the samples at the 1% level. The summary results for the remaining control variables also reflect patterns similar to those of Panel A in Exhibit 1. The exception is that the median measure of *PPE* is significantly lower for our real estate/alternative investment plans (50.8%) than for plans investing in debt and equity (58.1%).

Finally, Panel C of Exhibit 1 reflects summary statistics for firms whose DB pension plans include either real estate or alternative investments as opposed to firms whose DB pension plans hold neither type of investment. Consistent with the GAO report 10-915T, there are more firm-year observations (5,745) in the prior sample than in the latter sample (4,154). As expected, the results track those of Panel A, and to a greater extent, those of Panel B. Plans investing in either real estate or alternative investments have greater market value, greater returns, lower percentage contributions by employers, and greater percentage contributions by employees. Median risk-adjusted returns are economically comparable, however, with the prior sample's risk-adjusted return registering 2.0%, while the latter sample's is 1.9%.

The mean proportion of underfunded plans is again smaller for the prior sample (65.7%) than for the latter sample (70.4%), while the median level of underfunding is greater for the sample plans invested in real estate and/or alternative assets (-\$7.9 million) than it is for plans that are not (-\$4.4 million). As reflected in the median measure of *ACCPBO*, the median pension benefit obligation exceeds the pension market value for both samples. All differences in medians are statistically significant at the 1% level.

Logit Analysis

The first column of Exhibit 2 shows the logistic regression results when the dependent variable assumes a value of one if the firm allocates a portion

of its DB pension plan investment to real estate assets but no alternative assets and is zero for DB plans with alternative investment but no real estate investments. Consistent with the summary statistics, the coefficient estimate for *LNPENSIZE* is positive and statistically significant at the 1% level, indicating that larger DB pension plans have a greater likelihood of investing in real estate assets (Ciocchetti, Sa-Aadu, and Shilling, 1999; Chun, Ciocchetti, and Shilling, 2000). Also consistent with the summary statistic results are the positive coefficient estimates for *PPE* and *ROA*, indicating that they are more capital intensive and firms that are more profitable are more likely to invest plan assets in real estate. Each coefficient estimate is statistically significant at the 1% level.

In Exhibit 2, Column 2 reflects the logistic regression results when the dependent variable assumes a value of one if the firm's DB pension plan invests in both alternative assets and real estate and is zero if it invests in neither. Consistent with the summary statistics, the coefficient estimate for *LNPENSIZE* is again positive and significant at the 1% level, indicating a greater likelihood that the largest of the DB plans will make investments in both alternative assets and real estate. Also consistent with the univariate results are the coefficient estimates for *EMPRCONT* and *EMPECONT*, with the former assuming a negative estimate value while the latter's estimate value is positive. These results suggest that the higher the proportional contribution commitment of the firm (employees), the lower (greater) the likelihood of seeking returns from real estate and alternative investments. Both results are statistically significant at the 1% level. Finally, departing from our summary statistics, the coefficient estimate for *ROA* is negative and significant at the 1% level, suggesting that more profitable firms are less likely to invest plan assets in real estate and alternative investments.⁵

The third column of Exhibit 2 reflects the logistic regression results when the dependent variable assumes a value of one if the firm allocates a portion of its DB pension assets to either real estate or alternative investments, and is zero for plans investing in only debt and equity. Not surprisingly,

Exhibit 2
Logit Models of DB Pension Asset Allocation Selections

Variable	Real Estate/No Alternative Investments	Real Estate and Alternative Investments	Real Estate and/or Alternative Investments
	Coefficient Estimates	Coefficient Estimates	Coefficient Estimates
Intercept	-2.3386 (0.000)***	-3.3069 (0.000)***	-0.7647 (0.000)***
<i>LNPENSIZ</i> E	0.1534 (0.000)***	0.4777 (0.000)***	0.2499 (0.000)***
<i>EMPRCONT</i>	-1.1254 (0.106)	-3.4776 (0.000)***	0.0100 (0.687)
<i>EMPECONT</i>	2.4313 (0.773)	9.2583 (0.001)***	2.6116 (0.192)
<i>ACCPBO</i>	-0.1141 (0.368)	-0.0326 (0.505)	0.0068 (0.217)
<i>UNDERFUND</i>	0.0471 (0.661)	-0.1250 (0.161)	-0.1269 (0.028)**
<i>LIQUID</i>	-0.4005 (0.424)	0.6570 (0.121)	0.1613 (0.510)
<i>PPE</i>	0.3580 (0.003)***	0.0262 (0.807)	-0.0279 (0.669)
<i>ROA</i>	0.0107 (0.007)***	-0.0116 (0.003)***	-0.0066 (0.002)***

Notes: A total of 9,899 firm years comprise the data sample for which the pension variable data are available from the Compustat database for the period 2002–2010. In the first column of coefficient estimates, the dependent variable assumes a value of one for firms whose DB pension plans include real estate investments but no alternative investments, and is zero for DB pension plans with alternative investments but no real estate investments. In the second column of estimates, the dependent variable takes a value of one if the firm's DB plan invests in real estate and alternative investments, and is zero if it invests in neither. In the third column of estimates, the dependent variable takes a value of 1 if the firm's DB plan invests in real estate and/or alternative investments, and is zero if it invests in neither. *LNPENSIZ*E is $\ln(\text{pension market value})$. *EMPRCONT* (*EMPECONT*) is the employer (employee) contribution amount, respectively, standardized by *PENSIZ*E. *ACCPBO* is (The accumulated pension benefit obligation) / *PENSIZ*E. *UNDERFUND* assumes a value of one (zero) if the annual pension funding status (Compustat data item #A290) is negative (positive). As a measure of funding status, a value of one indicates the pension is underfunded. *LIQUID* is (the book value of cash and short-term investments) / *TABV*. *PPE* is (the book value of the firm's gross property, plant, and equipment) / *TABV* and *ROA* = $NI / TABV$. *P*-values based on the chi-square statistic are reported in parentheses. In column 2, for $N = 1$, the number of observations is 585; for $N = 0$, the number of observations is 2,489; % correctly classified is 81.0. In column 3, for $N = 1$, the number of observations is 1,056; for $N = 0$, the number of observations is 2,741; % correctly classified is 72.3. In column 4, for $N = 1$, the number of observations is 4,260; for $N = 0$, the number of observations is 2,741; % correctly classified is 40.0.

* Statistically significant at the 1% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 10% level.

the quality of the model's fit declines when allowing for an either/or qualification. The result continues to hold for *LNPENSIZ*E, and in this test, the coefficient estimate of *UNDERFUND* is negative and significant at the 5% level. This indicates that underfunded DB pension plans are less likely to invest in either real estate or alternative assets. This result is consistent with the findings for *UNDERFUND* in our summary statistics, where the real estate/alternative investment sample reflected a lower proportion of firm plans being underfunded.

Panel Data Analysis

The first two columns of Exhibit 3 reflect the cross-sectional, panel data results for the regression of raw return (*RETURN*) and risk-adjusted return (*RETURNRA*) on the explanatory variables of Equation 2. For these results, the variable *INDICATOR* assumes a value of one for firms whose DB pension plans include real estate investments but no alternative investments, and is zero for DB pension plans with alternative investments but no real estate investments. Most notable among the results is the positive coefficient



Exhibit 3
Panel Data Models of DB Pension Plan Returns

Dependent Variable	Real Estate/No Alternative Investments		Real Estate and Alternative Investments		Real Estate and/or Alternative Investments	
	RETURN	RETURNRA	RETURN	RETURNRA	RETURN	RETURNRA
Intercept	-1.5959 (0.000)***	-0.3449 (0.000)***	-0.0816 (0.184)	-0.0176 (0.184)	-0.9179 (0.000)***	-0.1984 (0.000)***
INDICATOR	0.1705 (0.061)*	0.0368 (0.061)*	0.0019 (0.888)	0.0004 (0.888)	-0.0281 (0.241)	-0.0061 (0.241)
LNPENSIZ	0.2967 (0.000)***	0.0641 (0.000)***	0.0303 (0.000)***	0.0066 (0.000)***	0.1761 (0.000)***	0.0381 (0.000)***
EMPRCONT	0.6089 (0.000)***	0.1316 (0.000)***	-0.0186 (0.576)	-0.0040 (0.575)	0.6081 (0.000)***	0.1314 (0.000)***
EMPECONT	3.0162 (0.565)	0.6516 (0.565)	-0.1369 (0.583)	-0.0297 (0.582)	0.0042 (0.997)	0.0009 (0.997)
ACCPBO	-0.0355 (0.000)***	-0.0077 (0.000)***	-0.0193 (0.000)***	-0.0042 (0.000)***	-0.0352 (0.000)***	-0.0076 (0.000)***
UNDERFUND	-0.0158 (0.727)	-0.0034 (0.727)	-0.0400 (0.000)***	-0.0087 (0.000)***	0.0202 (0.340)	0.0044 (0.339)
LIQUID	-0.0477 (0.868)	-0.0103 (0.869)	0.0923 (0.015)**	0.0199 (0.015)**	0.0625 (0.626)	0.0135 (0.626)
PPE	-0.0561 (0.705)	-0.0121 (0.705)	0.0060 (0.745)	0.0013 (0.745)	0.0230 (0.706)	0.0050 (0.706)
ROA	-0.0009 (0.711)	-0.0002 (0.711)	0.0011 (0.000)***	0.0002 (0.000)***	-0.0002 (0.845)	-0.0000 (0.845)
F-Test	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***

Notes: A total of 9,899 firm years comprise the data sample for which the pension variable data are available from the Compustat database for the period 2002–2010. This table reflects random effects panel data regression results for three samples. In the first sample, *INDICATOR* assumes a value of one for firms whose DB pension plans include real estate investments but no alternative investments, and is zero for DB pension plans with alternative investments but no real estate investments. In the second sample, *INDICATOR* assumes a value of one if the firm's DB plan invests in real estate and alternative investments, and is zero if it invests in neither. In the third sample, *INDICATOR* assumes a value of one if the firm's DB plan invests in real estate and/or alternative investments, and is zero if it invests in neither. The first run for each sample employs the annual raw return of plan assets (*RETURN*) as the dependent variable, while the second run uses the risk-adjusted return (*RETURNRA*), defined as *RETURN* standardized by the standard deviation of returns for each firm pension plan. *LNPENSIZ* is $\ln(\text{pension market value})$. *EMPRCONT* (*EMPECONT*) is the employer (employee) contribution amount, respectively, standardized by *PENSIZ*. *ACCPBO* is $(\text{The accumulated pension benefit obligation}) / \text{PENSIZ}$. *UNDERFUND* assumes a value of one (zero) if the annual pension funding status (Compustat data item #A290) is negative (positive). As a measure of funding status, a value of one indicates the pension is underfunded. *LIQUID* is $(\text{the book value of cash and short-term investments}) / \text{TABV}$. *PPE* is $(\text{the book value of the firm's gross property, plant, and equipment}) / \text{TABV}$ and $\text{ROA} = \text{NI} / \text{TABV}$. *P*-values for the adjusted *t*-statistics are reported in parentheses. The F test shows the *P*-value results for testing the hypothesis that the independent variables are jointly equal to zero.

* Statistically significant at the 1% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 10% level.

estimate of *INDICATOR*, suggesting that plans investing in real estate assets are associated with greater returns than for those plans choosing to instead make alternative investments. The estimate is statistically significant at the 10% level.

As expected, the coefficient estimate for *LNPENSIZ* is positive and statistically significant, reflecting that the larger DB plans of this

sample are associated with greater plan returns. The positive and statistically significant coefficient estimate for *EMPRCONT* indicates that, controlling for other variables, the greater the proportional contribution of firm employers to the DB plan, the greater the plan's return (Chun, Ciochetti, and Shilling, 2000). Finally, the negative and statistically significant coefficient estimate for *ACCPBO* indicates that the lower the accumulated

PBO relative to the plan's market value, the greater the plan's return.

For Columns 2 and 3 of Exhibit 3, *INDICATOR* assumes a value of one for firms whose DB pension plans include real estate and alternative investments and is zero for DB pension plans investing in only debt and equity instruments. The coefficient estimate for *LNPENSIZE* is positive and statistically significant, reflecting that the large DB plans of this sample are again associated with greater plan returns, while the negative and statistically significant coefficient estimate for *ACCPBO* indicates that the lower the accumulated PBO relative to the plan's market value, the greater the plan's return. For this sample, the coefficient estimate of *UNDERFUND* is also negative and statistically significant at the 1% level, indicating that underfunded plans are associated with lower returns. Finally, the coefficient estimates of *LIQUID* and *ROA* are positive and significant, suggesting that controlling for other variables, more liquid and more profitable firms are associated with higher plan returns as well.

In the final two columns of Exhibit 3, *INDICATOR* assumes a value of one for firms whose DB pension plans include real estate and/or alternative investments and is zero for DB pension plans investing in only debt and equity instruments. The behavior and interpretation of the results is similar to that for the regression of plans that do not invest in alternative investments versus plans that do not invest in real estate, with the coefficient estimates of *LNPENSIZE*, *EMPRCONT*, and *ACCPBO* each having the same direction and statistical significance at the 1% level.

Conclusion

Our examination of DB pension plans held by U.S. firms indicates that, of our 9,899 sample firm-years, 20.3% hold real estate investments, while 50.8% invest in alternative assets. While a slightly greater percentage of our sample DB plans appear to subscribe to these investment strategies than not, the percentage of assets committed to real estate assets and alternative investments remains relatively small compared to traditional equity and

debt investments. Among those that hold real estate investments, the median asset allocation is 5%, while the median allocation for those that hold alternative investments is about 5%–6%.

Our empirical results suggest that large, more underfunded DB pension plans are willing to bear the risk of real estate and/or alternative investments in an effort to garner higher returns. Interestingly, for our sample of plans over the 2002–2010 period, the returns for plans opting to invest in real estate but shunning alternative investments are greater than those that follow an opposite strategy. Also of note is that while the returns are higher for plans investing in real estate and/or alternative investments than for plans investing in only debt or equity, the economic difference in percentage returns is relatively small. Plan size and capital intensity are the factors that most significantly influence the likelihood of investing in real estate, while employer and employee contribution levels affect the likelihood of investing in alternative investments. Finally, pension size and the relative level of accumulated pension benefit obligation are the factors that most consistently influence the level of plan returns. Larger pensions and lower accumulated PBO are associated with greater investment in real estate and/or alternative investments, and subsequently, with higher returns.

Endnotes

1. See Kraft, Fosbre, and Davila-Aponte (2007) for an overview.
2. See GAO, Defined Benefit Pension Plans: Plans Face Valuation and Other Challenges When Investing in Hedge Funds and Private Equity, GAO-10-915T (Washington D.C., July 20, 2010) for an overview.
3. We choose an indicator variable format for *UNDERFUND* to avoid significant correlation with the other pension-related, explanatory variables. Measures of correlation are omitted from the paper, but are available from the authors upon request.
4. In order to capture a possible shift in effects from changes in federal regulation and FASB reporting requirements occurring in 2006, we include in our model dummy year variables. The coefficient estimates for these variables are not statistically significant and are therefore suppressed in the reported results, but are available from the authors upon request.
5. The standard deviation of *ROA* for this sample is 32% on a mean of 4%. The volatility of this variable corresponds to a very small standard error of .00395 in the logit regression,

suggesting instability in the ROA results. We substitute return on equity (ROE) as an alternative measure of profitability and repeat all tests, but find the results to have even greater instability than ROA. We also repeat the tests omitting a profitability measure and find the remaining results to be qualitatively the same.

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We gratefully acknowledge financial support from the Herberich and Moyer endowments at The University of Akron.

