

Uncertainty in Executive Compensation and Capital Investment: A Panel Study*

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We test whether uncertainty in the CEO's compensation influences the firm's investment decisions, using panel compensation data and cross-sectional investment data. Given the prospect of bearing extra risk, a rational agent reacts to minimize the impact of such risk. We provide evidence that CEOs with high earnings uncertainty invest less. As expected, the negative impact of permanent earnings uncertainty on firm investment is larger than that of transitory earnings uncertainty. The results are robust to several alternate specifications and lend support to Stultz' over-investment hypothesis. Knowing how investment is tied to the CEO's earnings uncertainty helps in building the correct compensation package.

I. Introduction

This paper tests whether uncertainty in the CEO's compensation affects the firm's investment decisions. Our new approach models and measures the CEO's earnings uncertainty using panel (cross-sectional time-series) compensation data. We pay special attention to decomposing the executives' earnings uncertainty into permanent and transitory components. We then explain capital expenditures and acquisitions (investment henceforth) as a function of uncertainty, as well as firm specific characteristics. We find strong support that the firm's investment growth is negatively related to the CEO's earnings uncertainty.

There has been much work investigating corporate managers' incentive to maximize shareholder wealth, largely motivated by Jensen and Meckling (1976). A subset of this literature examines the determinants of executive compensation and its impact on managerial decision making. There are many methodological issues to be resolved in this area, and many questions about the impact of executive compensation on managerial behavior remained unanswered. Smith and Watts (1992) explain the usefulness of documenting robust empirical relations among firms' investment and compensation policies. Gaver and Gaver (1995) and Mehran (1995) follow with papers that also explore empirical relationships between corporate financial policy variables and executive compensation.

Similar to Smith and Watts, Gaver and Gaver, and Mehran, we present exploratory empirical evidence on the relationship between corporate financial policy variables involving executive compensation; in this case corporate investment and the earnings uncertainty of the CEO. These variables are part of a simultaneous system that determines the firm's value and how that value is allocated to stakeholders. Consequently, the relationships reported are not necessarily causal. Instead the results document empirical regularities between corporate investment and executive compensation that may be useful in determining corporate policy. The paper provides a fresh perspective on why investment rates differ across firms.

Section II of the paper reviews the literature on executive compensation and investment, and develops testable hypotheses of the relationship between compensation and investment. Section III describes the data. Section IV explains the empirical methodology, and Section V presents the empirical results. Section VI offers a summary and conclusions.

II. Executive Compensation and Investment

A. Executive Compensation

Studies that examine the relationship between executive compensation and firm performance have produced conflicting results, rendering the topic prone for further investigation. Baker, Jensen, and Murphy (1988) discuss aspects of optimal contracting where current economic theory and actual practice seem particularly disassociated given the lack of correlation between pay and performance. Jensen and Murphy (1990) argue that how CEOs are paid is more relevant than how much they are paid and find that CEO compensation is largely independent of performance and that the relationship between pay and performance has weakened over time. Gibbons and Murphy (1992) investigate empirically the influence of executive compensation on firms' investment and find conflicting evidence of this influence depending on whether the level or the growth rate of investment is tracked. They find that capital spending increases during the CEOs last years in office and argue that this is puzzling since incentive compensation plans typically are not tied to shareholder value. Rather, the compensation package usually depends on accounting performance which the CEOs should want to keep high in their final years in office. None of these papers explicitly examine the *volatility* of CEO compensation over time, and its influence on the firm's investment.

Several recent studies examine the relationship between the firm's investment opportunity set and the structure of the CEO's compensation package. Lewellen, Loderer, and Martin (1987) find that growth firms use more stock-based compensation, as opposed to salary and bonus, compared to low-growth firms. Smith and Watts (1992) argue that firms with valuable growth opportunities have a high degree of information asymmetry and are expected to utilize incentive compensation to reduce agency costs. They examine industry-level data and find that high-growth

firms utilize long-term incentive compensation more than low-growth firms. Gaver and Gaver (1995) examine the proportions of executive pay derived from salary, bonus, long-term incentive compensation, and stock-based compensation. They find that executives of growth firms receive a larger proportion of their compensation from long-term incentive compensation. Mehran (1995) finds a positive relationship between firm performance and compensation structure. These studies suggest that the structure of executive compensation is related to the firm's investment policy.¹

B. Earnings Uncertainty and Corporate Investment

We utilize panel data on CEO compensation to determine expected earnings and earnings uncertainty, then relate these characteristics investment behavior. We assume that the CEO's expectations about his future earnings level, and earnings uncertainty are important influences on the firm's investment choices.

We develop measures of CEO earnings uncertainty, following methods from the precautionary savings literature². The rational expectations literature shows that economic agents alter current behavior in response to predicted future occurrences. Our forward-looking or rational expectations approach to the problem emphasizes the importance of future expected states of the world. In our application, the relation between corporate investment and earnings of the CEO may be erroneous without the inclusion of a measure of the CEO's earnings uncertainty, as well as the level of expected earnings.³

¹ Gaver and Gaver (1995) discuss the difficulty of determining how executive compensation packages are determined. They point out that although the firm's investment opportunity set is likely to influence compensation policy, the management incentives that arise from the compensation packages undoubtedly influence the investment decisions of managers. Since both decisions arise simultaneously, optimal compensation policies for a given (exogenous) investment opportunity set are difficult to determine. This simultaneity problem is also noted by Smith and Watts (1992) and Mehran (1995), and is an area for future research.

² See Leland (1968) and Kimball (1990) for a theoretical development and Kazarosian (1997) and Lusardi (1992) for empirical work using panel data.

³ Our main results demonstrate that future earnings uncertainty influences capital investment (table 2.) Additional investigation reveals that contemporaneously measured uncertainty and investment also have a statistically significant relationship. We thank an anonymous referee for suggesting that we test the contemporaneous model.

We develop two competing hypotheses regarding the impact of compensation structure on capital investment. The Over-Investment Hypothesis--many papers argue that managers may over invest in capital projects. Stulz (1990) explains that managers want to maximize investment (even in negative NPV projects) in order to maximize perquisites. Murphy (1985) documents a positive relationship between management compensation and firm size, suggesting that managers have an incentive to invest in projects to make the firm larger. Baker, Jensen, and Murphy (1988) find that compensation is positively related to promotions, which are more plentiful in large firms. Greater compensation, perquisites and promotions are all factors that may lead to over-investment. Managers insulated from outside discipline may be more likely to over-invest, leading to a reduction in firm value (Stulz (1988)). Since the CEO knows the nature of his compensation contract, future compensation provides an unbiased estimate of the CEO's expected future earnings. Managers with high earnings uncertainty, due to being tied to firm performance, will seek to hedge through reducing investments. As a result of managerial risk aversion there may be less over-investment.

A reduction in investment may also be a direct result of a lack of free cash flow.⁴ Yet a lack of cash flow may in turn cause an increase in cash flow volatility. If cash flow volatility and compensation volatility are correlated, then this lack of cash flow could also reduce investment through the increase of compensation volatility. To isolate the impact of risk aversion on investment, we control for growth opportunities, cash flow uncertainty, and free cash flow.⁵

The Under-Investment Hypothesis--Larcker (1983) finds that the adoption of performance plans is associated with an increase in corporate investment. A change in managerial decision making occurs due to a lengthening of the decision-making horizon of the manager. Focusing on longer-term positive cash flows will only make projects more desirable to managers. Managers

⁴ Jensen (1986) argues that firms with high free cash flow may face an agency problem whereby managers may invest these cash flows in diversification strategies that are unprofitable. Firms with low free cash flow may invest less in risk-reducing strategies, leading to further lower investment due to the incentive compensation.

⁵ We thank an anonymous referee for emphasizing the importance of including free cash flow as a separate explanatory variable to sort out these two effects.

with high earnings uncertainty, due to being tied to firm performance, will focus more on long-term cash flows. As a result there may be more capital investment.

We estimate equation 1 below to test the above competing hypotheses. Tables 2 through A2 provide evidence to support the Over-Investment Hypothesis--as the manager's earnings uncertainty rises, the firm's investment falls.

III. Data

Recall that our main question is whether investment is impacted by the CEO's future earnings uncertainty. We use two data sets to investigate this question. First, we compile panel data on CEO compensation for 1988-1994 from annual issues of *Forbes*. We generate three variables from *Forbes*--permanent earnings, earnings uncertainty, and the percentage of stock owned by the CEO. Executive compensation includes salary and bonus payments and is reported each year for the 800 highest paid CEOs. In our empirical model below, we use both salary and bonus to create both permanent earnings and earnings uncertainty. Table 1 lists summary statistics of all variables described here.

We exclude executives from non-manufacturing firms in order to focus on firms where capital investment is a significant corporate policy variable. Our sample includes firms in SIC codes 10 - 49. We exclude firms that had a change in CEO during the 1988-1994 period and firms with less than three years of earnings observations. Our final sample size is 190.

Second, we match the CEO panel data with a cross-section of firm level investment from Compustat. Other firm-specific characteristics representing control variables that may influence investment are also from Compustat. The firm's investment opportunity set may impact its level of investment. Following Smith and Watts (1992) we utilize the firm's market to book ratio to measure investment opportunities. Similar to Smith and Watts and Larker (1983), we use net sales to measure firm size. Firm performance and risk may impact the level of investment. We use return on equity to measure performance, and the coefficient of variation of the firm's cash flow to measure firm risk. In line with Smith and Watts' discussion of the relationship between investment and dividend policies we control for the dividend payout ratio. Since financial leverage

may also impact investment policy we use the debt to equity ratio as a control. Similar to Mehran (1995), we utilize the percentage of shares owned by CEOs to control for managerial ownership. As noted above, free cash flow may impact a firm's ability to over invest in risk reducing projects. We control for free cash flow following Lang, Stulz, and Walkling (1991) and Lehn and Poulsen (1989).

All Compustat variables are for the year ended 1988 unless otherwise noted. Computation of these variables, along with Compustat data-item numbers are listed below. Managerial ownership is from Forbes. The remaining two variables--permanent earnings, and earnings uncertainty are described in detail in the next section.

Capital Investment [Capital Expenditures (128) + Acquisitions (129)]

Investment Opportunities (Market To Book Ratio)

[Total Assets (6) - Common Equity (60) + (Fiscal Year-End Closing Price (199) x Common Shares Outstanding (25))]/Total Assets (6)

Size: Net Sales (12)

Performance (Return on Equity)

Income Before Extraordinary Items (18)/Stockholder's Equity (216)

Dividend Payout Ratio:

[(Dividends per Share--Ex Date (26) x Common Share Outstanding (25)) + Cash Dividends—Preferred (19)] / Income Before Extraordinary Items (18)

Debt to Equity Ratio

[Book Value of Long Term Debt (9) + Debt on Current Liabilities (5)]/ Stockholder's Equity (216)

Firm Risk (Cash Flow Uncertainty):

The coefficient of variation of the Cash Flow, where cash flow is defined as: Income Before Extraordinary Items (18) + Depreciation and Amortization Expense (14). We calculate cash flow uncertainty using various (four through seven) year windows. See below specifications.

Managerial Ownership:

Managerial ownership is the percentage of total shares owned by the CEO, obtained from *Forbes*.

Free Cash Flow:

[Operating Income Before Depreciation (13) - Interest Expense (15) - Income Taxes (16 - 35) - Preferred Dividends (19) - Common Dividends (20)] / Total Assets (6).

To control for possible industry effects (in both our earnings profile regressions, and our final investment regression) we group executives and firms into nine industry categories.

1) Mining/Construction, 2) Food/Tobacco, 3) Textiles/Apparel/Lumber/Furniture, 4) Paper/Printing, 5) Chemical/Petroleum Refining/Rubber/Plastic/Leather, 6) Building Materials/Primary Metals/Fabricated Metals, 7) Non-Electrical Machinery/Electrical Machinery, 8) Transportation Equipment/Measuring Equipment/Manufacturing Miscellaneous, and 9) Utilities/Transportation. In all tables the industry categories are abbreviated, e.g. the Food/Tobacco category is called Food.

IV. Empirical Implementation

A. Relating Capital Spending and Earnings Uncertainty

In light of the above discussion (Section II), an empirical analysis of a firm's corporate investment policy should incorporate earnings uncertainty and permanent earnings. We perform the estimation in two stages. The first exploits the *Forbes* panel data to create measures of permanent earnings and earnings uncertainty for each executive, following the models detailed below. We estimate a panel equation for individual earnings profiles to impute permanent earnings for each executive. We then calculate earnings uncertainty (our key explanatory variable) from each executive's earnings profile residual.

The second stage (our main estimating equation) is a cross-sectional regression that explains the log of investment as a proportion of net sales using the uncertainty and permanent earnings proxies as our two key regressors.⁶ We also include a standard vector of firm characteristics typically used to describe capital investment such as firm size, leverage, investment opportunities, industry dummies and others described above (section 3) and in the results.

⁶ We measure the dependent variable in natural logs to measure variations in investment *growth rate* among firms. Our results section and appendix describes our investigation of many variations of this specification. One variation includes the dependent variable measured in levels rather than the natural log, for which the qualitative results do not change.

The general form of the investment equation is,

$$\frac{I_i}{NS_i} = f(U_i, Y_i^P, \mathbf{X}_i) + e_i \quad (1)$$

I_i is capital spending for firm i , NS_i is net sales, U_i is future earnings uncertainty of the executive of firm i , Y_i^P is permanent earnings of executive i (both U_i , and Y_i^P are described in detail below) and \mathbf{X}_i is a vector of firm and CEO characteristics that is assumed to influence investment. The error term $e_i \sim N(0, \sigma_\varepsilon^2)$

Table 1 contains descriptive statistics of all variables used in equation (1). Tables 2, 3 and appendices contain results from various specifications of regression equation (1).

B. Construction of Permanent Earnings

Intuition

In this section we describe our empirical model of permanent earnings, following King and Dicks-Mireaux (1982) and our earnings uncertainty model following Kazarosian (1997). Our hypothesis is that executives' earnings uncertainty (both permanent and transitory) will influence the capital investment decision that executives make. A necessary first step is to construct a measure of expected (permanent) earnings, around which uncertainty can be carefully measured. This permanent earnings is also a key regressor in our investment equation, since any claim that earnings uncertainty impacts investment must control for the level of the earnings.⁷

Investment is measured in 1988, while permanent earnings is calculated using 1988-1994 data. An example of permanent earnings is what the executive expects to receive from a contract next year. An example of a permanent earnings shock is a raise, while an example of a transitory earnings shock is a one time bonus payment--it is not expected to continue. These shocks generate uncertainty associated with each type of earnings, which we model and calculate below. The

⁷ As well as avoiding omitted variable bias by including permanent income as a regressor, we also control for any possible correlation between permanent earnings and earnings uncertainty by implicitly scaling the uncertainty proxy by the level of permanent earnings. Since we estimate a log-earnings profile rather than an earnings profile, the standard deviation of the log-earnings profile residual is a coefficient of variation.

strength of our proxies for both permanent earnings, and earnings uncertainty is that we use time-series data to estimate them.

Each executive in our sample has between three, and seven annual earnings observations (1988-1994). Our empirical implementation of the permanent earnings model reflects the buffer-stock idea that a saver considers a short term future earnings stream rather than her lifetime earnings stream.⁸

To estimate permanent earnings we pool all executives' time-series earnings data within each of nine industries, and express the executive's log-earnings as a cubic in age. We then estimate earnings with nine separate industry-specific random effects models. Each industry has as many earnings profiles as there are executives in that industry. Within each industry, each log-earnings profile has the same slope reflecting the same expected growth rate of earnings. Across industries, the executives are assumed to expect different earnings growth, and therefore the slopes are allowed to differ. The individual-specific nature of the permanent earnings measure comes from the profile's intercept--each executive's profile intercept is unique. It would be possible, yet impractical to allow both the slope and intercept to be executive-specific since the earnings profile is a cubic in age, and we have only five (on average) earnings values per person.

One advantage of this profile estimation technique is that it incorporates executive-specific earnings determinants, such as ability or luck. Another advantage is that it helps to eliminate transitory earnings since the profile is derived from each executive's time-series earnings rather than a single cross-sectional observation. Also, by using a panel we can directly measure uncertainty around the executive-specific earnings profiles. This idiosyncratic uncertainty measure is impossible without time-series earnings data.

⁸ Carroll (1991) argues that the correct interpretation of Friedman's permanent earnings is roughly expected earnings (earnings in the absence of transitory shocks) or the expected value of a probability distribution. This expected earnings, rather than the annuity value of total lifetime resources, is closer to the permanent earnings concept that Friedman described. Our panel estimate of permanent earnings below closely follows Carroll's interpretation.

Model

The formal permanent earnings model begins with:

$$Y_i^P = \mathbf{Z}_i\beta + \delta_i \quad (2)$$

where permanent earnings (Y_i^P) is annual earnings with no transitory component, evaluated at the same age for everyone. \mathbf{Z}_i is a vector of observable characteristics, with the parameter vector β . $\delta_i = N(0, \sigma_\delta^2)$ is the time constant executive-specific error.

Current and permanent earnings differ by virtue of the executive's position on his age-earnings profile $g(AG_{it})$, and by a transitory earnings component. Current earnings E_{it} in any particular year for executive i , in terms of permanent earnings is:

$$E_{it} = Y_i^P + g(AG_{it}) + \mu_{it} \quad (3)$$

where μ_{it} is the current, observation-specific error, assumed to have an arbitrary covariance structure that is constant across executives, and is uncorrelated with the executive-specific error δ_i .

The observation-specific error μ_{it} includes both permanent and transitory shocks, because in estimation the profile's slope is not updated over time. An ideal measure of permanent earnings would include only the permanent component of μ_{it} . Although we cannot decompose μ_{it} into its permanent and transitory components, we can isolate the standard deviation of the components which serve as proxies for permanent and transitory earnings uncertainty.

Substituting equation (3) into equation (2) yields:

$$E_{it} = \mathbf{Z}_i\beta + g(AG_{it}) + \delta_i + \mu_{it} \quad (4)$$

Equation (A2.3) shows the components of current earnings and its associated errors.

μ_{it} and δ_i must be separated in estimation to identify the executive-specific component $\hat{\delta}_i$ of each intercept ($\bar{\beta} + \hat{\delta}_i$). This separation is possible only with panel data.⁹

⁹ Cross-sectional studies that separate these error terms must use outside panel estimates to weigh the unobserved individual-specific trait embodied by the lone earnings observation in the cross section (e.g. Cox, 1990).

To distinguish permanent from current earnings using panel data, we estimate

$$\ln E_{it} = \sum_{k=1}^9 \bar{\beta}_1 J_k + \sum_{k=1}^9 \bar{\beta}_{2k} J_k g(AG_{it}) + \delta_i + \mu_{it}. \quad (5)$$

$\ln E_{it}$ is the log of current earnings for person i in year t , J_k are occupation dummies, and $g(AG_{it})$ is a cubic in age. The log specification ensures that our earnings uncertainty measure--the standard deviation of the log-earnings profile residual--is not necessarily proportional to the level of permanent earnings.

We estimate (5) using a random effects model. The executive-specific profiles are defined by between three and seven observations per executive, and distinguished by a unique random intercept $\hat{\beta}_{1i} = \bar{\beta}_1 J_k + \hat{\delta}_i$, with mean $\bar{\beta}_1$ and variance $\hat{\sigma}_\delta^2$. The predicted value doesn't include either permanent or transitory earnings shocks. Both shocks are embodied in the residuals μ_{it} of each profile.¹⁰

Estimated *permanent earnings* Y_i^P is the annual average of the present discounted value of expected (predicted) earnings, from the executive-specific profile (equation (5)), within a standardized age bracket (55-59).¹¹ This earnings proxy helps to control for Life-Cycle behavior in our capital investment regressions.

C. Construction of Earnings Uncertainty

Intuition

Earnings uncertainty is unobservable. Yet in the Forbes data, executives' earnings over time is observable. Under reasonable assumptions outlined above, we construct a measure of permanent (expected) earnings from the executives' time-series earnings process. As observed

¹⁰ We account for possible serial correlation in μ_{it} by imposing no restrictions on its process and by treating the random effects regression as a seemingly unrelated regression system (SUR)--one equation for each time period--following Chamberlain (1982). If the μ_{it} are correlated, SUR will yield efficient estimates.

¹¹ We chose this age bracket to be in line with the average age of the executives in our sample. In the first year of our panel (1988) the executives' average age is 55.

earnings become more errant around expected earnings, we assume uncertainty increases. The standard deviation of each executives' log-earnings profile residual is our total uncertainty proxy.¹²

There are important advantages to this uncertainty proxy. First, since the earnings profile incorporates predictable growth, the proxy is desirably void of expected changes in human capital. Because of this, uncertainty will be less likely overstated. Second, since the proxy comes from up to seven earnings observations over ten years, its value incorporates the degree of persistence in the earnings generating process that is specific to each executive. Kimball and Mankiw (1989) and Caballero (1990) indicate that the magnitude of precautionary saving effects in a multiperiod context depends critically on the persistence of earnings shocks.

Using panel data is only a necessary first step in capturing the different magnitude of precautionary saving effects predicted by permanent and temporary shocks. The observation-specific log-earnings profile's residual must be dissected into its permanent σ_{η} and transitory σ_{τ} standard deviation (uncertainty) components. To isolate these components of total uncertainty, our model below describes our application of the decomposition technique developed by Hall and Mishkin (1982) and Carroll (1992).

Model

Earnings are assumed to be more uncertain the more erratic the variation around an expected trend. We use two related methods to proxy earnings uncertainty. Each is generated from the current, observation-specific residuals of the executive's profile ($\hat{\mu}_{it}$) and is therefore less likely to confound the effects of predictable earnings growth and uncertainty. The residuals $\hat{\mu}_{it}$ contain both permanent and transitory shocks because the profile's slope is not updated over time.

The first uncertainty proxy, which includes both shocks, is simply the standard deviation of each executive's earnings profile residuals $\sigma_{\hat{\mu}_{it}}$. The second uncertainty proxy isolates the transitory and permanent components that compose total uncertainty. The uncertainty

¹² Since earnings are in log form, the uncertainty measure is measured relative to earnings size (i.e. the coefficient of variation).

decomposition complements our method of measuring executive-specific profiles, in creating a unique value for both permanent and transitory uncertainty, measured directly from time series residuals of each profile.

Carroll (1992) shows that if the permanent shock η and the transitory shock τ are i.i.d. and uncorrelated, then

$$\text{Var}(r(d)) = \text{Var}(\ln E_{it+d} - \ln E_{it}) = d\sigma_{\eta}^2 + 2\sigma_{\tau}^2 \quad (6)$$

where d is the number of years between earnings observations.¹³ First we identify predictable Life-Cycle earnings changes using equation (5) estimates, then apply (6) to decompose the variance of the remaining time-series change $\hat{\mu}_{it+d}$.¹⁴ Equation (6) shows that permanent shocks are cumulative whereas transitory shocks are not. Current earnings in any year E_{it+d} consists of permanent earnings in year t , all past permanent shocks, growth, and the current transitory shock. Two or more d values solves (5) for each executive, because if the mean of $r(d) = 0$, then $[r(d)]^2$ provides an unbiased estimate of (5). Although this sample's mean $\hat{\mu}_{it}$ is close to zero ($<.01$), an F-test can not reject executive-specific earnings growth rates.

D. Summary

We estimate the panel equation for individual earnings profiles (equation (4)) to impute permanent earnings for each executive. We then calculate total earnings uncertainty from each executive's profile residual. Finally we estimate the decomposed permanent and transitory earnings uncertainty using equation 5 above. After we create these regressors, we estimate equation (1) above to investigate the variation of capital expenditures.

¹³ Carroll's permanent and current earnings (in logs) are $Y_{t+1}^P = g + Y_t^P + \eta_{t+1}$, and $E_t = Y_t^P + \tau_t$ where g is predictable Life-Cycle growth. These definitions and recursive methods yield $r(d) = dg + \eta_{t+1} + \dots + \eta_{t+d} + \tau_{t+d} - \tau_t$, which in turn yield equation 6 above.

¹⁴ In year t if one expects \hat{E}_{it+d} , then after removing the predictable Life-Cycle element, $r(d) = \hat{\mu}_{it+d}$. If instead one expects \hat{E}_{it} plus the predicted growth rate, then $r(d) = \hat{\mu}_{it+d} - \hat{\mu}_{it}$. Our specifications below adopt the first interpretation.

V. Empirical Results

A. Main Results

Table 2 contains estimates of equation (1) above which addresses our main question--does uncertainty in the CEOs compensation influence the firm's investment decisions? In specifications 1 and 2 (both a and b) we find that the impact of *future* compensation uncertainty on the *current* investment to sales ratio is highly significant, negative and large. The evidence conforms to theoretical predictions that rising earnings uncertainty (from pay-for-performance contracts) causes executives to invest less. In other words, our results support the over investment hypothesis (Stultz 1988) described in section II. These results are robust in light of our broad set of control variables, and alternate specifications.

We control for two key executive-specific characteristics--permanent earnings and managerial ownership. Including these controls eliminates the possibility that our earnings uncertainty coefficient embodies the influence of these two variables--likely positively correlated to uncertainty. Our firm-specific controls are firm risk (cash flow uncertainty), financial leverage (debt to equity ratio), investment opportunity (market to book ratio), firm size (sales), firm performance (return on equity), dividend payout ratio, free cash flow, and nine industry dummies. The firm controls are typical capital expenditure explanatory variables, without which, we could not have confidence in our strong earnings uncertainty result.

The total earnings uncertainty coefficient of -1.4 is significant at the 1% level (specification 1 (a)). At sample means, doubling earnings uncertainty reduces investment's share of total sales by 22 percent. This elasticity translates into an approximate \$137 million decline in capital investment spending. The adjusted *R*-squared is 0.24 and the *F*-statistic shows that the overall regression is significant at the 1% level. This negative, and significant coefficient for executive earnings risk indicates that even after accounting for the influence of expected firm risk (and the executive's expected future earnings) the *riskiness* of the CEO's earnings matters for the firm's investment.

Specifications 1 (a) and 2 (a) are identical except that both the executive's earnings uncertainty and the firm's cash-flow uncertainty measures are calculated using data five years hence for specification 1 (a) versus using data four years hence for specification 2 (a). The earnings uncertainty coefficient remains statistically significant for the five year window, yet the estimates' size falls as the length of the window increases. This supports the standard intuitive interpretation of the Life-Cycle hypothesis that people consider a short term future in making economic decisions.¹⁵

B. Additional Results

Sub-specifications (a) and (b) of table 2 differ by virtue of the uncertainty variables used--(b) uses the permanent and transitory components separately. Permanent uncertainty isolates the persistent component of the earning's shock. It is important to dissect the shocks, because we expect permanent shocks to have a larger influence on economic behavior. Since permanent shocks are expected to persist (e.g. a raise) and transitory shocks (a bonus) are not long lasting, we expect larger coefficients on permanent uncertainty.¹⁶

Indeed when executives are looking ahead four years (Specification 1 (b)), permanent shocks have a larger influence (31%) on the investment to sales ratio, than have transitory shocks.¹⁷ Yet Specification 2 (b) shows that when earnings uncertainty is perceived five years hence, the point estimates indicate that transitory shocks significantly influence investment while permanent shocks do not. This result may reflect the reduced ability of the executive to predict permanent earnings (and permanent shocks) as the forward looking window is extended.

¹⁵ The coefficient on earnings uncertainty is statistically significant for the regression using earnings data six years hence, yet becomes insignificant using data seven years hence. As expected, the coefficient's size falls as the length of the window increases (-0.819 and -0.645 for seven years respectively.) Please see Appendix Table A1 available from the author for the complete regression results from the extended windows. Appendix table A2 addresses an additional possible objection to the main specification. We substitute the dependent variable measured in levels rather than logs and find the same statistically significant qualitative results as in Table 2. Also, not included in appendix, we substitute the dependent variable measured as the difference from the industry (level) mean--same statistically significant qualitative results as Table 2.

¹⁶ See Skinner (1988) and Blanchard and Mankiw (1988) for theoretical background.

¹⁷ Carroll and Samwick (1992) and Kazarosian (1997) find that permanent shocks are larger than their transitory counterparts in precautionary savings studies.

Table 3 addresses a possible objection to the above forward looking model. We abandon the rational expectations (forward looking) specifications of tables 2 and instead substitute *average* annual capital investments relative to *average* sales from 1988-1991 as our dependent variable (contemporaneous model.) We also substitute average values (1988-1991) for our control variables--managerial ownership, debt to equity ratio, market to book ratio, sales, return on equity, dividend payout ratio and the level of free cash flow. We find that our main results are robust. An increase in the executive's earnings uncertainty squelches contemporaneously measured firm investment. This is true for the impact of total earnings uncertainty on investment (Specification 1), as well as for both permanent and transitory uncertainty (Specification 2). Consistent with our forward looking model, we also find that permanent shocks impact investment more strongly than temporary shocks. A notable difference in results of this contemporaneous model is that the coefficients of the debt-to-equity ratio and the free cash flow is now statistically significant at the 1% level (Specifications 1 and 2)

VI. Conclusion

Our findings indicate that uncertainty in CEO compensation has a statistically significant negative effect on a firm's investment. This result is robust under various. Increasing the time over which uncertainty is calculated (up to six years), aggregating investments, using a level rather than a log specification, or using a difference from the mean specification all produce the same qualitative results. Decomposing the future earnings uncertainty into permanent and transitory components reveal that both components affect investments negatively. As expected, the negative impact of the CEO's expected permanent earnings uncertainty on firm investment is larger than the impact of transitory uncertainty.

This investigation brings together two important (and largely independent) strands of research – the effect of labor earnings uncertainty on consumer behavior and the findings that agency costs influence firm level investment. While there is substantial evidence that the desire to hedge labor earnings uncertainty affects an individual's saving behavior, research on the affect of earnings uncertainty on CEO's actions are non existent. Our findings indicate that this new

channel of influence – a CEO's desires to hedge labor earnings risk – may influence a firm's investment behavior. A natural direction for future research is to investigate more specific models that explore particular factors associated with earnings variability and then re-estimate a similar investment model. Given the importance of stock options in CEO's compensation and the increase in the CEO's future earnings uncertainty, additional research is needed to investigate the corporate policy implication of such changes. Specifically, uncertainties associated with incentive pay may affect the CEO's desire to hedge and consequently influence a firm's investments decision.

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Table 1

| Summary Descriptive Statistics* | | | | |
|--|----------|--------------------|-----------|-----------|
| | Mean | Standard Deviation | Minimum | Maximum |
| Panel A: Dependent Variable | | | | |
| Investment Divided by net sales in 1988 | 0.126 | 0.095 | 0.015 | 0.680 |
| Log of Investment Divided by net sales in 1988 | -2.316 | 0.706 | -4.201 | -0.385 |
| Panel B: Uncertainty variables (4-year window) | | | | |
| Total Earnings Uncertainty | 0.158 | 0.123 | 0.008 | 0.875 |
| Permanent Earnings Uncertainty | 0.041 | 0.073 | 0.000 | 0.703 |
| Transitory Earnings Uncertainty | 0.087 | 0.090 | 0.000 | 0.484 |
| Cash Flow Uncertainty | 30.764 | 42.393 | 1.699 | 337.058 |
| Panel C: Uncertainty variables (5-year window) | | | | |
| Total Earnings Uncertainty | 0.171 | 0.122 | 0.016 | 0.919 |
| Permanent Earnings Uncertainty | 0.038 | 0.059 | 0.000 | 0.473 |
| Transitory Earnings Uncertainty | 0.100 | 0.094 | 0.000 | 0.476 |
| Cash Flow Uncertainty | 32.041 | 44.484 | 1.508 | 410.957 |
| Panel D: Other Independent variables (in 1988) | | | | |
| Permanent Earnings (in thousands of 1986\$) | 889.538 | 681.978 | 20.780 | 7216.154 |
| Managerial Ownership (in %) | 1.373 | 5.191 | 0.000 | 37.380 |
| Debt to Equity Ratio | 0.690 | 2.012 | -23.175 | 6.845 |
| Market to Book Ratio | 1.718 | 3.152 | -37.973 | 6.418 |
| Sales (in millions of 1986\$) | 4985.890 | 8702.900 | 345.565 | 59681.000 |
| Return on Equity | 12.859 | 26.732 | -317.376 | 48.916 |
| Dividend Payout Ratio | 31.064 | 103.992 | -1106.220 | 487.500 |
| Free Cash Flow | 0.083 | 0.046 | -0.070 | 0.234 |
| Panel E: Other Independent variables (average over 4 -year window) | | | | |
| Managerial Ownership (in %) | 1.601 | 5.798 | 0.000 | 37.058 |
| Debt to Equity Ratio | 0.936 | 1.065 | -1.212 | 9.072 |
| Market to Book Ratio | 2.269 | 1.689 | 0.589 | 16.125 |
| Sales (in millions of 1986\$) | 4983.859 | 8545.503 | 363.483 | 57812.888 |
| Return on Equity | 13.530 | 10.188 | -19.222 | 53.170 |
| Dividend Payout Ratio | 43.454 | 66.547 | -315.876 | 478.000 |
| Free Cash Flow | 0.076 | 0.038 | -0.029 | 0.208 |

* Number of observations equals 190.

Table 2
Least Squares Regression Results of Equation (1)--Forward Looking Model

| Independent Variable | Estimated Coefficient (t-value) | | | |
|--|--|--------------------------------------|--|--------------------------------------|
| | Specification 1 ^a (4-year window) | | Specification 2 ^b (5-year window) | |
| | (a) | (b) | (a) | (b) |
| <u>Uncertainty</u> | | | | |
| Total Earnings Uncertainty | -1.387 ***(-3.494) | - - | -1.227 ***(-2.939) | - - |
| Permanent Earnings Uncertainty | - - | -1.881 ***(-2.538) | - - | -1.206 (-1.368) |
| Transitory Earnings Uncertainty | - - | -1.445 ***(-2.625) | - - | -1.345 ***(-2.529) |
| Cash Flow Uncertainty | -0.015 (-1.242) | -0.002 (-1.308) | -0.001 (-0.852) | -0.001 (-0.933) |
| <u>Industry Dummies</u> | | | | |
| Food | -1.678 ***(-4.445) | -1.169 ***(-4.403) | -1.145 ***(-4.274) | -1.138 ***(-4.201) |
| Textiles | -1.098 ***(-3.243) | -1.095 ***(-3.209) | -1.087 ***(-3.176) | -1.088 ***(-3.148) |
| Paper | -0.591 **(-2.475) | -0.597 **(-2.467) | -0.553 **(-2.295) | -0.558 **(-2.292) |
| Chemicals | -0.773 ***(-3.469) | -0.773 ***(-3.441) | -0.740 ***(-3.287) | -0.748 ***(-3.291) |
| Building Materials | -0.795 ***(-3.006) | -0.818 ***(-3.038) | -0.805 ***(-3.019) | -0.793 ***(-2.943) |
| Machinery | -0.820 ***(-3.613) | -0.842 ***(-3.652) | -0.784 ***(-3.415) | -0.805 ***(-3.478) |
| Transportation Equipment | -1.227 ***(-5.128) | -1.232 ***(-5.086) | -1.199 ***(-4.951) | -1.196 ***(-4.893) |
| Utilities | -0.508 **(-2.342) | -0.497 **(-2.275) | -0.493 **(-2.245) | -0.495 **(-2.232) |
| <u>Other Control Variables:</u> | | | | |
| Permanent Earnings | 4.484x10 ⁻⁹ (0.064) | 1.888x10 ⁻⁸ (0.252) | -1.844x10 ⁻⁸ (-0.159) | -1.934x10 ⁻⁸ (-0.161) |
| Managerial Ownership | -0.006 (-0.648) | -0.007 (-0.705) | -0.007 (-0.684) | -0.008 (-0.844) |
| Debt to Equity Ratio | 0.125 **(2.216) | 0.128 **(2.248) | 0.109 *(1.888) | 0.112 *(1.918) |
| Market to Book Ratio | -0.117 ***(-2.616) | -0.123 ***(-2.687) | -0.113 ***(-2.480) | -0.110 **(-2.376) |
| Sales | -9.063x10 ⁻¹³ (-0.158) | -1.848x10 ⁻¹² (-0.314) | -3.077x10 ⁻⁷ (-0.051) | -6.954x10 ⁻¹³ (-0.113) |
| Return on Equity | 0.006 (1.362) | 0.006 (1.417) | 0.007 (1.411) | 0.006 (1.278) |
| Dividend Payout Ratio | -3.115x10 ⁻⁵ (-0.071) | -4.344x10 ⁻⁵ (-0.098) | -1.437x10 ^{-5.4} (-0.032) | 1.407x10 ⁻⁵ (0.031) |
| Free Cash Flow | 0.820 (0.656) | 0.914 (0.720) | 0.604 (0.481) | 0.651 (0.512) |
| Constant | -1.337 ***(-6.184) | -1.358 ***(-6.245) | -1.350 ***(-5.950) | -1.372 ***(-6.014) |
| Adjusted R-squared | 0.242 | 0.230 | 0.224 | 0.212 |
| F-statistic | ***4.348 | ***3.977 | ***4.033 | ***3.680 |
| Number of Observations | 190 | 190 | 190 | 190 |

Dependent Variable: Log of capital expenditures + acquisitions in 1988 divided by Net Sales in 1988: $\ln(I_i/NS)$.
Dependent Variable referred to in the text as "investment." Industry reference category is Mining/Construction.
All control variables are measured in 1988.

^a Specification 1 (a) and 2 (a)--Investment response to total earnings uncertainty.

^b Specification 1(b) and 2 (b)--Investment response to permanent and transitory earnings uncertainty.

Uncertainty (both earnings and cash flow) calculated with a *four* year, and *five* year forward looking window beginning in 1988 for specifications 1 and 2 respectively. Significance shown for the 1 (***) , 5 (**) and 10 (*) percent levels.

Table 3
Least Squares Regression Results of Equation (1)
Average Model

| Independent Variable | Estimated Coefficient (t-value) | |
|--|--------------------------------------|--------------------------------------|
| | Specification 1 ^a | Specification 2 ^b |
| <u>Uncertainty</u> | | |
| Total Earnings Uncertainty | -1.268 ***(4.105) | - - |
| Permanent Earnings Uncertainty | - - | -1.506 ***(-2.632) |
| Transitory Earnings Uncertainty | - - | -1.378 ***(-3.164) |
| Cash Flow Uncertainty | -3.120x10 ⁻⁴ (-0.286) | -3.490x10 ⁻⁴ (-0.315) |
| <u>Industry Dummies</u> | | |
| Food | -1.178 ***(-5.596) | -1.178 ***(-5.502) |
| Textiles | -0.991 ***(-3.626) | -0.980 ***(-3.546) |
| Paper | -0.497 ***(-2.635) | -0.491 **(-2.569) |
| Chemicals | -0.762 ***(-4.267) | -0.763 ***(-4.219) |
| Building Materials | -0.886 ***(-4.279) | -0.890 ***(-4.231) |
| Machinery | -0.757 ***(-4.046) | -0.767 ***(-4.027) |
| Transportation Equipment | -1.116 ***(-5.823) | -1.113 ***(-5.708) |
| Utilities | -0.411 **(-2.424) | -0.397 **(-2.314) |
| <u>Other Control Variables:</u> | | |
| Permanent Earnings | -5.340x10 ⁻⁸ (-0.941) | -5.109x10 ⁻⁸ (-0.849) |
| Managerial Ownership | -0.008 (-1.252) | -0.009 (-1.311) |
| Debt to Equity Ratio | 0.182 ***(4.460) | 0.184 ***(4.452) |
| Market to Book Ratio | -0.076 **(-2.316) | -0.076 **(-2.280) |
| Sales | -2.867x10 ⁻¹³ (-0.064) | -6.361x10 ⁻¹³ (-0.140) |
| Return on Equity | 0.005 (0.789) | 0.005 (0.810) |
| Dividend Payout Ratio | -1.060x10 ⁻⁴ (-0.189) | -9.803x10 ⁻⁵ (-0.172) |
| Free Cash Flow | 3.207 **(2.517) | 3.296 (2.544) |
| Constant | -1.617 ***(-8.160) | -1.649 ***(-8.256) |
| Adjusted R-squared | 0.368 | 0.353 |
| F-statistic | ***7.123 | ***6.431 |
| Number of Observations | 190 | 190 |

Dependent Variable: Log of capital expenditures + acquisitions (average 1988-1991) divided by Net Sales (average 1988-1991): $\ln(I_i/NS)$. Dependent Variable referred to in the text as "investment." All "Other Control Variables" also averages from 1988-1991. Industry reference category is Mining/Construction.

^a Specification 1 (a)--Investment response to total earnings uncertainty.

^b Specification 1 (b)--Investment response to permanent and transitory earnings uncertainty.

Significance shown for the 1 (***) , 5 (**) and 10 (*) percent levels.

Table A1

Least Squares Regression Results of Equation (1)
Forward Looking Model--Extended Horizon

| Independent Variable | Estimated Coefficient (t-value) | |
|--|--|--|
| | Specification 1A ^a (6-year window) | Specification 2A ^b (7-year window) |
| <u>Uncertainty</u> | | |
| Total Earnings Uncertainty | -0.819 *(-1.922) | -0.645 (-1.507) |
| Cash Flow Uncertainty | -4.640x10 ⁻⁴ (-0.352) | -3.640x10 ⁻⁴ (-0.253) |
| <u>Industry Dummies</u> | | |
| Food | -1.051 ***(-3.861) | -1.005 ***(-3.718) |
| Textiles | -1.071 ***(-3.077) | -1.066 ***(-3.053) |
| Paper | -0.529 **(-2.160) | -0.512 **(-2.092) |
| Chemicals | -0.730 ***(-3.196) | -0.734 ***(-3.197) |
| Building Materials | -0.816 ***(-3.010) | -0.780 ***(-2.954) |
| Machinery | -0.767 ***(-3.291) | -0.761 ***(-3.246) |
| Transportation Equipment | -1.170 ***(-4.771) | -1.161 ***(-4.730) |
| Utilities | -0.471 **(-2.110) | -0.459 **(-2.047) |
| <u>Other Control Variables:</u> | | |
| Permanent Earnings | -1.080x10 ⁻⁷ (-0.798) | -1.250x10 ⁻⁷ (-1.007) |
| Managerial Ownership | -0.010 (-0.995) | -0.011 (-1.124) |
| Debt to Equity Ratio | 0.095 (1.607) | 0.092 (1.612) |
| Market to Book Ratio | -0.108 **(-2.331) | -0.104 **(-2.236) |
| Sales | 1.055x10 ⁻¹² (0.167) | 1.367x10 ⁻¹² (0.219) |
| Return on Equity | 0.007 (1.469) | 0.067 (1.457) |
| Dividend Payout Ratio | 1.033x10 ⁻⁶ (0.002) | 1.930x10 ⁻⁵ (0.349) |
| Free Cash Flow | 0.505 (0.396) | 0.446 (0.349) |
| Constant | -1.374 ***(-5.859) | -1.396 ***(-5.959) |
| Adjusted R-squared | 0.203 | 0.197 |
| F-statistic | ***3.666 | ***3.583 |
| Number of Observations | 190 | 190 |

Dependent Variable: Log of capital expenditures + acquisitions in 1988 divided by Net Sales in 1988: $\ln(I_i/NS)$.
Dependent Variable referred to in the text as "investment." Industry reference category is Mining/Construction.
All control variables are measured in 1988.

^a Specification 1A and 2A--Investment response to total earnings uncertainty.

Uncertainty (both earnings and cash flow) calculated with a six year, and seven year forward looking window beginning in 1988 for specifications 1A and 2A respectively. Significance shown for the 1 (***) , 5 (**) and 10 (*) percent levels.

Table A2
Least Squares Regression Results of Equation (1)
Dependent Variable in Levels Rather than Logs

| Independent Variable | Estimated Coefficient (t-value) | |
|--|--------------------------------------|--------------------------------------|
| | Specification 3A (4-year window) | Specification 4A (5-year window) |
| <u>Uncertainty</u> | | |
| Total Earnings Uncertainty | -0.131 **(-2.429) | -0.110 *(-1.951) |
| Cash Flow Uncertainty | -1.410x10 ⁻⁴ (-0.844) | -5.045x10 ⁻⁵ (-0.305) |
| <u>Industry Dummies</u> | | |
| Food | -0.184 ***(-5.162) | -0.180 ***(-4.972) |
| Textiles | -0.197 ***(-4.292) | -0.196 ***(-4.223) |
| Paper | -0.149 ***(-4.590) | -0.145 ***(-4.439) |
| Chemicals | -0.168 ***(-5.541) | -0.164 ***(-5.378) |
| Building Materials | -0.163 ***(-4.534) | -0.164 ***(-4.555) |
| Machinery | -0.158 ***(-5.114) | -0.153 ***(-4.957) |
| Transportation Equipment | -0.204 ***(-6.272) | -0.200 ***(-6.103) |
| Utilities | -0.135 ***(-4.597) | -0.133 ***(-4.469) |
| <u>Other Control Variables:</u> | | |
| Permanent Earnings | 1.711x10 ⁻⁹ (0.179) | -1.803x10 ⁻⁹ (-0.115) |
| Managerial Ownership | -3.770x10 ⁻⁴ (-0.301) | 4.690x10 ⁻⁴ (-0.366) |
| Debt to Equity Ratio | 0.010 (1.391) | 0.008 (1.076) |
| Market to Book Ratio | -0.014 **(-2.340) | -0.014 **(-2.256) |
| Sales | -5.192x10 ⁻¹³ (-0.666) | -4.336x10 ⁻¹³ (-0.530) |
| Return on Equity | 9.270x10 ⁻⁴ (1.533) | 0.001 (1.650) |
| Dividend Payout Ratio | -9.606x10 ⁻⁶ (-0.161) | 8.228x10 ⁻⁶ (-0.137) |
| Free Cash Flow | -0.191 (-1.125) | -0.214 (-1.258) |
| Constant | 0.325 ***(11.072) | 0.322 ***(10.488) |
| Adjusted R-squared | 0.235 | 0.223 |
| F-statistic | ***4.223 | ***4.015 |
| Number of Observations | 190 | 190 |

Dependent Variable: *Level* of capital expenditures + acquisitions in 1988 divided by Net Sales in 1988: I_i/NS.

Dependent Variable referred to in the text as "investment." Industry reference category is Mining/Construction.

All control variables are measured in 1988.

^a Specification 1 (a) and 2 (a)--Investment response to total earnings uncertainty.

^b Specification 1 (b) and 2 (b)--Investment response to permanent and transitory earnings uncertainty.

Uncertainty (both earnings and cash flow) calculated with a *four* year, and *five* year forward looking window beginning in 1988 for specifications 1 and 2 respectively. Significance shown for the 1 (***), 5 (***) and 10 (*) percent levels.

