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Studies in Income, Investment, and Stock Returns: The Permanent Income Hypothesis and the Overinvestment Puzzle

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STUDIES IN INCOME, INVESTMENT, AND STOCK RETURNS: THE PERMANENT INCOME HYPOTHESIS AND THE OVERINVESTMENT PUZZLE

ABSTRACT

Increased sales drive earnings; increased earnings drive investment; and increased investment drives higher stock returns. In this dissertation, I studied the relationship of sales income, firm investment increase and stock returns. The first paper, titled "Permanent Income and Investment", investigates the relationship between changes in sales income and levels of investment. When firms experience increases in sales that they consider to be permanent, the present value of expected profits also increase, leading to increases in the firms' investments. Firm's investment behavior is primarily explained by permanent changes in sales incomes and not by transitory change. The second paper, titled "Firm Investment and Stock Return", investigates the relationship between investment and future returns of the firm. Recent dominant theory has considered the relationship between corporate investment and stock returns as negative due to overinvestment concerns, that is, the market initially under reacts to the possibility of overinvestment. This *paper is the first full-scale empirical study that finds* a positive relationship between corporate investment and stock returns if the investment increase/decrease is observed within a multiple-year framework rather than as a one year event. *If* firms continually increase investment, the investment/return relationship becomes positive. My explanation for this positive relationship is that investors prefer stocks with expected higher profit or growth potential, signaled by continued investment increase.

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Dissertation

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This dissertation consists of two essays: The first essay investigates the relationship between permanent changes in sales and levels of investment. The second essay deals with the relationship between corporate investment and stock returns.

Chapter One: PERMANENT SALES INCOME INCREASE AND INVESTMENT

Abstract

When firms experience increases in sales that they consider to be permanent, the present value of expected profits also increase, leading to increases in the firms' investments. This study investigates the permanent income hypothesis (PIH) of firms' investment; it examines whether investment decisions are influenced by changes in the permanent, in contrast to transitory, component of income increases proxied here by sales increases. Using the co-integration test and the structural vector auto-regression (SVAR) framework, this paper finds strong support for the hypothesis that investment behavior is primarily explained by permanent changes in sales incomes. Empirical multiple time series regression results also confirm that investments are a function of a number of past yearly sales changes. This paper's results show that larger, more liquid, and lower debt ratio firms follow PIH more closely than smaller, less liquid, higher debt ratio firms. Recent studies on corporate investment (i.e., Fazzari, Hubbard, and Petersen (1988) have argued that the higher the dependence on the internal source of funding of the investment, the stronger the severity of financing constraints. This study shows the more dependent on the permanent cumulative increase of internal source of funding a firm's funding on investment, the less financially constrained firms.

1.1. Introduction

This study considers the extent to which a firm's investment increase is determined by a permanent increase in sales. This paper's hypothesis, termed in this paper the Permanent Income Hypothesis (PIH) of investment, postulates that there is a significant effect between investment and permanent changes in sales. This concept gained attention through Milton Friedman's permanent income theory, according to which spending increases with household income and the extent to which consumption is correlated with "income" depend on the passage of time. Applied to company investment, the theory states that a permanent increase in a company's sales leads to increased investment spending. A temporary increase in sales, during one financial quarter, for example, cannot be expected to have the same effect on investment spending as an increase over several quarters. Because investment must be undertaken on the basis of expected profitability over long periods of time, firms may be cautious in altering their rates of investment in response to relatively short-term fluctuations in increase in sales.

Investment decisions are made based on the profitability of the project, and also based on the availability and costs of external and internal financing. According to the pecking-order theory, higher external financing costs make internal financing more attractive to managers (Fazzari, Hubbard, and Petersen (1988)). If managers decide to use internal financing, their perception of the current sales increase as either transitory or permanent affects their investment decisions. When firms are faced with an increase in sales, whether they believe to be permanent or continuous, present value of expected profits increases. This, in turn, should lead to an increase in investment. This hypothesis, the PIH on investment, is also motivated by previous studies that suggest that dividend changes are influenced by permanent earnings (Lee (1996); Kao and Wu (1992); Nakamura and Nakamura (1985);Watts (1973); Fama and Babiak (1968); Lintner (1956), etc.). Two major components of a company's spending are dividend payouts and investment. If dividends are influenced by the permanent component of earnings, I can reason that the decision to increase investment is influenced by the same earnings component.

There are some similarities between dividend and investment decisions. The decision to increase dividends has a certain non-reversibility associated with it because firms have a strong reluctance to decrease dividends once they are established. On the other hand, increases in investment also have similar non-reversibility. Studies have shown that increases in investment give the same positive signals to the market as dividend increases (Roll, Schwartz and

Subrahmanyam (2007)). Blose and Shieh (1997) find when a firm makes surprise announcements of increases in capital expense spending, the greater the q-ratio, the greater the positive abnormal returns will occur, and vice versa. In discussing their reversibility of investment, Dixit and Pindyck (1994) claim that investment is often irreversible because the initial cost of investment is completely or partially a sunk cost. Thus, firms are reluctant to invest when projects are irreversible and the future is uncertain. If an investment is perceived to be irreversible, managers desire some certainty about the future in order to make their investment decision. Hence, managers generally prefer to rely on permanent income increases over transitory income increases for greater certainty. The primary aim of this paper is to investigate the extent to which managers respond to a permanent increase in earnings over one that is perceived to be temporary.

Sales can be used as the proxy for the company earnings since sales are the principal driver of company earnings. The correlation coefficients between sales and net income is about 80%. Earning is measured as either income before extraordinary items or net income in recent finance and accounting papers (Fama and Babiak (1968);Ryan and Zarowin (2003); Lev and Nissim (2004), etc.,) However, income before extraordinary items does not always exclude extraordinary items. Firms are reluctant to exclude them as extraordinary items in general, since it reduces the firms' earnings from a shareholder's perspective. Most of the extraordinary items are missing from our downloaded data. When I include net income and sales as independent variables in the regression on capital investment, sales increases have far more significant effect on the capital investment. The effect of net income becomes much less significant.

There is a relative dearth of inquiry regarding the PIH and company investment. The PIH dates back to the work of Eisner (1960) and Cowler (1963). Eisner's findings were based on a series of questionnaires administered to corporate managers regarding corporate investment policy. This article utilizes the ideas in Eisner (1960) and Cowler (1963) regarding the relationship between the investment decision and permanent income increase, as the essence of the PIH. Abel and Blanchard (1986) studied the relationship between investment and the expected present value of marginal profits. They found that although the present value of marginal profits is significantly related to investment, a large, serially correlated fraction was still left unexplained. Ohlson (1999), Ahsan (2008), Pan (2007), Moore and Schaller (2002), and Easton, Shroff and Taylor (2000) explored two components of earnings: permanent and transitory. These studies differ in their methodologies. Easton, Shroff and Taylor (2000) and Ahsan (2008) used an empirical model, whereas Pan (2007), Tsay andTiao (1990), Meghir and Pistaferri (2004)andLee (1996)used a co-integration model. Ohlson (1999) and Moore and Schaller (2002) used a formal proof model. Among these studies, Meghir and Pistaferri's (2004) and Lee's (1998) papers are the most relevant to this paper. They separate income shocks into idiosyncratic transitory and permanent components using the cointegration method. Pan (2001) defines permanent earnings as long run sustainable earnings. Easton, Shroff and Taylor (2000) define permanent earnings as expected earnings and transitory earnings as unexpected earnings. Transitory earnings have three main attributes: (i) unpredictability, (ii) irrelevance to subsequent earnings and (iii) special, extraordinary items (Ohlson (1999)). In this paper, I use sales as earning proxy and define permanent income as the three-year average of long-run expected income and transitory income as unexpected income.

In this paper, I aim to examine the relationship between permanent income theory and investment. The analysis employed in this study follows two approaches: the first approach examines the non-stationarity of investment and income series in a co-integration study. I apply the methods of Tsay and Tiao(1990) and Lee (1996) to account for the possible existence of co-integration between investments and sales income in the decomposition process to differentiate between permanent and transitory income. A possible co-integrating relation between sales income and investments implies that there is some long-run equilibrium relation tying the two data series together. I estimate a bivariate time-series model of income and investments and the restrictions suggested by a model of investment determination is formally tested. I identify the permanent and transitory components of investments and income so we can evaluate the central idea of the PIH: the extent to which changes in investments are a result of permanent changes in sales.

The second approach is an empirical method that employs three lag measures of permanent income in cross-sectional analysis. I test for the PIH of investment using the portfolio approach. I examine whether investment behavior is different for different types of firms (e.g., small vs. large market cap firms, growth vs. value firms, high debt-equity ratio vs. low debt-equity ratio firms and liquid vs. non-liquid firms). My hypothesis is that large, mature, less financially constrained companies are more likely to follow the permanent income theory since less financially constrained, larger firms likely to have more financial slack and it makes possible to let firms to make a relatively more carefully planned investment plan based on their cumulated previous income. Smaller (younger) companies are less likely to follow the permanent income theory and invest without long-term profit accumulation. Smaller firms may be more focused on survival rather than investments for the long-term, either because of a need for rapid growth or because of the danger of default.

The principal finding in this article is that investment changes are determined by changes in some measure of permanent income. In other words, firm managers make a decision on investment changes primarily when they have some confidence on the changes in permanent income, whereas managers respond little, if at all, to transitory changes in income. I also find more liquid, larger, lower debt firms are more likely to make an investment decision when they have a permanent income increases than smaller, younger, less liquid, higher debt firms. The more closely following PIH the firm is, the less financially constrained the firm is.

The paper proceeds as follows. In Section 1.2, I perform the co-integration study, in Section 1.3, I present the empirical model, and I discuss the data and provide empirical results along with our findings. Section 1.4 is the conclusion of the paper.

1.2. Co-integration Study

Investment is represented by capital expenditures. Capital expenditure series and sales income series are non-stationary processes. Meghir and Pistaferri (2004) showed that an income shock includes two types of disturbances: permanent and transitory. Following Meghir and Pistaferri (2004) and Lee (1996), I model that sales income also can be presented as composed of two types of disturbances: permanent (X_t^p) and transitory (X_t^s).

Because sales and capital expenditures series are non-stationary and heteroskedastic, it is better to transform the data by first differencing them to make them stationary. After the first differencing transformation, the changes in capital expenditure investment and sales are homoskedastic and normally distributed. After first-differencing, if investment (I_t) and sales (X_t) are co-integrated (sharing a common unit root), the data can be used as multiple time-series data. Sales are decomposed as follows:

$$X_t = X_t^p + X_t^s = q(L)e_{1t} + r(L)e_{2t}, \qquad where \quad Var(e_t) = I \tag{1}$$

$$\Delta X_t^p = X_t^p - X_{t-1}^p = \Sigma_{qke_{1t-k}}, \qquad X_t^s = \Sigma_{rke_{2t-k}}, \tag{2}$$

$$\Sigma_k = \Sigma_{k=0}^{\infty}$$

where L is the lag, L= 0,1, 2, 3, 4.. The disturbance vector e_t = [$e_{1,t}$, $e_{2,t}$]' is serially uncorrelated by construction, and $e_{1,t}$and $e_{2,t}$ are *assumed to be* contemporaneously uncorrelated by an appropriate orthonormalization. That is, Var (e_t) = I, where I is the identity matrix.

In Equation (2), by construction, the permanent component of earnings, X_t^p, is a non-stationary process and the transitory component of income, X_t^s, is a stationary process. The decomposition of income into the two components - permanent and transitory - is necessary for income series because, in the PIH, it is changes of long-term permanent income, rather than current income, which drive investment decisions.

The permanent component of sales is a non-stationary process and the transitory component of sales is a stationary process. If the linear combination of (the spread between) X_t and I_t is stationary, then X_t and I_t can be co-integrated. Let S_t be the spread, which is defined as a linear combination of current sales and investments and is stationary:

$$S_t = X_t - \gamma I_t,$$

Where S_t is stationary and γ is a constant. X_t and I_t are co-integrated when the spread S_t is a stationary process even though X_t and $I_t$are non-stationary processes. Investment (I_t) and sales (X_t) are co-integrated if the spread between them is stationary.

1.2.1. Data

Annual data of capital expenditure and sales on all U.S. firms from 1984 to 2009 were obtained from COMPUSTAT and CRSP databases. My objective is to test the relationship between cumulated past and current sales profits (and expected profits in the future) and investment (proxied by capital expenditures). I do not include research and development expenses as part of investment because R&D expenditures are heavily concentrated in the IT industries (Lach and Schankerman (1989)); hence, the data are not evenly distributed, and for many of the firms, R&D expense data are missing.

First, the data were divided by the consumer price index (CPI) to nominalize them. Next, the data were divided into four different groups based on market cap size and P/E ratio. We sorted all firms into four different groups based on the market cap and P/E ratio (with P/E=15 as the dividing point because a P/E ratio of 15 is considered to be appropriate for a firm with an average growth rate (Malmendier and Tate, 2005)). The purpose of these categories is to determine for which types of firms (large/small and growth/value) the PIH applies. The PIH can be expected to work better in the case of firms expecting sales increases. The distribution of firms is established as follows: Group 1, large market cap, high-P/E companies; Group 2, large market cap, low-P/E companies; Group 3, small market cap, high-P/E companies; and Group 4, small market cap, low-P/E companies.

Unit root tests can be used to determine if the investment and sales series follow a non-stationary process. The Augmented Dickey-Fuller (ADF) unit root test can be used to examine the null hypothesis that the data series is non-stationary. It was assumed investment and sales series are non-stationary processes, but the spread between them is a stationary process. Table 1 reports the results of the ADF unit root test. The null hypothesis is that the series is non-stationary.

[Insert Table 1 here]

The test results support the null hypothesis that X_t and I_t are non-stationary series. The ADF test cannot reject the unit root null hypothesis for investment and sales series at a 5 percent significance level. The unit root test is also applied to the first differenced series, and this time, the unit root null hypothesis is statistically rejected at a 10 percent significance level. Thus, the unit root test results strongly suggest that investment and sales follow non-stationary processes. Therefore, sales earnings and investment series can be used as multiple time series data, and each series has two components: permanent and transitory.

For the unit root test of I_t, and X_t, in Table 1, critical values for the *t*-test are 10 percent, -1.60; and 5 percent, -1.95 [Fuller (1976, pp. 371-373, Tables 8.5.1 and 8.5.2)].For the co-integration test of S_t, critical values for the *t*-test with 26 observations are 10 percent, -3.28; 5 percent, -3.67 [Engle and Yoo (1987, Table 2) p. 157].

My hypothesis is that the prime determinant of an increase in capital expenditures is an increase in sales considered by the managers to be "permanent." To determine whether changes in X_t (*sales*) will impact changes in I_t (*investment*), we perform a Granger causality test. Table 2 depicts the Granger causality test results for sales (X_t) and investment (I_t).We also conducted Man and Chen's (2009) stepwise hypotheses testing procedure. The causality test shows that investment is caused by sales:

[Insert Table 2A here]

The Granger causality test results show statistical significance at a 5 percent level for the Group 1 sample, Group 2 sample, and the entire data sample. On the other hand, small-size groups, such as Group 3 (small size and high P/E) and Group 4 (small size and low P/E) do not provide statistically significant results for this test. Table 2B shows the trace test results to test the significance of the co-integrating vectors. The tests result rejects the null of zero cointegrating vectors. Again it confirms the significance of the two vectors' co-integration.

[Insert Table 2B here]

In Table 3, we estimate a co-integrating regression of X_t on I_t to obtain the spread, S_t, for the sample period from 1984 to 2006.

[Insert Table 3 here]

Engle and Granger (1987) propose regressing X_t on I_t (or I_t on X_t); this regression is termed co-integrating regression. The regression exhibits an R^2 of 0.9765 (Total data), which indicates a strong association between the X_t and I_t series; the coefficient of I_t is about 0.08, indicating that on average about 16 percent of current sales have been used as investment for the sample period. The co-integration test in Table1 shows that the non-stationarity of S_t is rejected based on an augmented Dickey-Fuller regression at the conventional significance level of 5 percent. Thus, the investment and sales series are co-integrated, or move together. Figure 1 visually depicts the co-movement of the two series.

[Insert Figure 1 here]

1.2.2. Tests of restrictions on the BVAR

Investment and sales are co-integrated; however, the permanent component of sales affects investment is another question. The Blanchard and Quah (1989) method of Structural VAR (SVAR) to decompose financial variables into permanent and transitory components can be applied here. Consider the bivariate moving average regression (BMAR) of Z_t, which consists of the first difference in investments and the spread:

$$Z_t = \begin{bmatrix} \Delta I_t \\ S_t \end{bmatrix} = \begin{bmatrix} I_t - I_{t-1} \\ X_t - \gamma I_{t-1} \end{bmatrix} \equiv \begin{bmatrix} C_{11}(L), C_{12}(L) \\ C_{21}(L), C_{22}(L) \end{bmatrix} \begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} \tag{3}$$

Any interpretation of the relationship between investment and sales income is characterized by the restrictions it imposes on the BMAR. This paper considers a model of a permanent component of sales.

1.2.3. Model: Investment is proportional to the permanent component of sales income

The hypothesis is that firm managers change the investment rate when there is a change in the permanent component of sales increases. That is, a transitory change in sales would not affect the investment decisions.

$$I_t = \alpha \ X_t^p$$

$$\Delta I_t = I_t - I_{t-1} \qquad (4)$$

where α is a positive constant. Because X_t^p (permanent component) is a non-stationary process, it follows that I_t is a non-stationary process and ΔI_t is a stationary process[1].

If the investment is a constant fraction of the permanent component of sales earnings (i.e., I_t is proportional only to X_t^p and not to X_t^s), the bivariate model Zt (= $[\Delta I_t, S_t]'$) is characterized by the restriction:

$$\Sigma C_{12}(L) = 0 \quad and \quad \Sigma C_{21}(L) = 0 \quad for \quad all \quad L \qquad (5)$$

(5) implies that the temporary components of sales earnings do not affect investment and the permanent parts in earnings do not affect the spread.

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1. The proof follows:

$$I_t = \alpha \ X_t^p \equiv \alpha \Sigma q_l e_{1t-L}$$

$$S_t = X_t - \gamma I_t = (X_t{}^p + X_t{}^s) - \gamma\alpha X_t{}^p = (1-\gamma\alpha) X_t{}^p + X_t{}^s = X_t{}^s = r(L) e_{2t}$$

by setting γ = 1/α to make the spread stationary.

It is because the spread is determined only by transitory (and also stationary) disturbance in sales earnings since the transitory part of sales earnings is stationary and the permanent part is non-stationary. In order to make the spread stationary, only the transitory stationary part must be affected. The moving average coefficient $C_{12}(L)$ measures the effect of (transitory disturbance)e_2 on ΔI in L periods. Therefore the restriction $C_{12}(L) = 0$, for all L, implies that the transitory disturbances in earnings do not affect the investment changes at all. The changes in investments are only determined by the permanent disturbances in earnings. The restriction means that the long-term cumulative effect of on ΔI is zero because $C_{12}(L)$measures the cumulative effect of e_2 on ΔI. Since $\Sigma C_{21}(L)$ measures the effect of e_1(non-stationary disturbance) on ΔI in L periods, the restriction $C_{21}(L) = 0$, for all L, implies the permanent disturbance in earnings does not affect the spread. On the contrary, the permanent disturbance in earnings has a long-term permanent effect on investment. The spread is exclusively determined by the transitory (and stationary) disturbances in earnings.

Equation (2) BMAR can be rewritten as the following BVAR model:

$$Z_t = \begin{bmatrix} \Delta I_t \\ S_t \end{bmatrix} = A(L) z_{t-1} + u_t \equiv \begin{bmatrix} A_{11}(L), A_{12}(L) \\ A_{21}(L), A_{22}(L) \end{bmatrix} \begin{bmatrix} \Delta I_{t-1} \\ S_{t-1} \end{bmatrix} + \begin{bmatrix} u_{1t} \\ u_{2t} \end{bmatrix}$$

By applying the restrictions of the BMAR and BVAR models from Equation (5), we obtain the following table. The restriction on the BMAR $C_{12}(L) = C_{21}(L) = 0$ can be translated as $A_{12}(L) = 0$ and$A_{21}(L) = 0$ on the BVAR. The coefficients of $C(L)$ in the BMAR represents the responses to shocks in particular variables. Because e_t is serially and contemporaneously uncorrelated, we can allocate the variance of each element in Z_t elements of e by imposing restrictions on the BVAR and conduct a restricted VAR analysis.

Restrictions on BMAR	Restrictions on BVAR
$Z_t = C(L)e_t$	$Z_t = A(L)z_{t-1} + u_t$
$\Sigma C_{12}(L) = 0 \& \Sigma C_{21}(L) = 0$	$\Sigma A_{12}(L) = 0 \& \Sigma A_{21}(L) = 0$

1. 2. 4. Bivariate auto-regression test

This section reports the test results of the restrictions of the model on the BVAR. Prior to conducting the test, we need to decide how many lags to use. I use four lags for the entire data and three lags for each group of the BVAR because the t-values are not significant after four lags. The estimates of the BVAR test results are presented in Table 4.

[Insert Table 4 here]

In the model, the investment is proportional to the permanent component of sales. The significance levels associated with the restriction are 0.075 for the whole data set, 0.702 for large size and high P/E firms and 0.112 for large size and low P/E firms; therefore, the null hypothesis (investment decisions are affected by the permanent part changes of sales income) is not rejected at the 5 percent significance level for large size firms. The small size and high P/E and small size and low P/E groups tests are rejected when I use three lags; however when two lags are used, the small size and high P/E group chi-square test does not reject the null hypothesis. This is strong evidence that investment decisions are made based on the permanent component of sales profits.

I have examined the time-series behavior of investment series in relation to sales income series. I investigate the interpretation of investment behavior based on the permanent income hypothesis (PIH)-investment decisions are made based on permanent income increase. The non-stationarity of investment and sales income series and the cointegration of the two series are thoroughly considered throughout the analysis. I test the empirical validity of interpretations of the theoretical relationship between investment and sales income, the extent to which investment change due to permanent changes in sales income, and the decomposition of investment and spread series into permanent and transitory components. The findings in this section confirm investments decision is made primarily by permanent changes in income at least in large size firm groups. Investment decisions appear to be driven by changes in some measure of permanent sales income.

1.3. Empirical Method

In this section, I conduct an OLS and fixed effect cross-sectional analysis. Investment can be written as a function of sales changes over previous years, with positive coefficients for each of these previous sales changes if increases in sales generate increased investment over a period of years. In other words, it is a linear function of sales change when sales change variance is considered essentially permanent. I can expect the higher the proportion of sales change considered to be permanent, the higher the regression coefficients. The coefficients will be higher for firms that have increasing sales in comparison to firms that have decreasing or fluctuating sales. An increase in sales that is followed by a decrease in sales will result in no investment increase according to the PIH.

I also sorted firms into various groups. The purpose of these grouping is to determine for which types of firms the PIH applies more. The PIH can be expected to work better in the case of firms expecting sales increases; that are less financially constrained, and have some financial slack since PIH requires projected financing planning on investments based on previous cumulative several years' sales income increase record. Financially constrained firms most likely do not have the luxury to have the internal funds financing plan on the increasing investments based on the previous sales records.

1.3.1. Data and Multiple Time Series Regression

Twenty six years (1986-2009) of investment and sales data on all U.S. firms were obtained. I exclude the financial services industry from my study and deleted any missing values from the data. If there was a gap between consecutive years, it was also deleted because I used the distributed lags in the regression. I sorted all firms into four different groups based on the market cap and book-to-market, the market cap and Tobin's Q, the market cap and debt-equity ratio (with D/E=1 as the dividing point), and the market cap and Liquidity.

I conduct OLS and a fixed effect regression for the 7,627 companies in our sample, representing 49,337 observations over 26 years on the four different groups. When I run seven lags of sales and profit to the entire data, I find that the sales change variables are statistically significant (by t-values) only up to 4 years ago, and the profitability lags are significant up to 2 years ago. Therefore, in the regressions by firm groups, I keep the sales changes for this year and the last 4 years and the profitability for this year and the last year.

I conduct a multiple time series regression in which the dependent variable is capital expenditures that have been scaled by fixed assets. The independent variables are the three-year average sales changes over the last four years, profit (income before extraordinary earnings) that has been scaled by fixed assets, profits for the previous two years, total liabilities to fixed assets, depreciation to fixed assets, Tobin's Q, liquidity (a current asset is divided by the current liability) and Altman's Z. When managers invest, they can either use internally generated funds or raise funds externally through debt or equity issues. I control for firms' use of debt by including total liabilities in our models. I use four lags of sales since t-values starting lag-five are insignificant.

$$\frac{I_t}{F_{t-1}} = \beta_0 + \beta_1(\frac{3(S_t - S_{t-1})}{S_t + S_{t-1} + S_{t-2}}) + \beta_2(\frac{3(S_{t-1} - S_{t-2})}{S_{t-1} + S_{t-2} + S_{t-3}}) + \beta_3(\frac{3(S_{t-2} - S_{t-3})}{S_{t-2} + S_{t-3} + S_{t-4}}) + \beta_4(\frac{3(S_{t-3} - S_{t-4})}{S_{t-3} + S_{t-4} + S_{t-5}}) + \beta_5 \frac{P_t}{F_{t-1}} + \beta_6 \frac{P_{t-1}}{F_{t-2}} + \beta_7 \frac{L_t}{TotalAsset} + \beta_8 \frac{D_t}{F_{t-1}} + tobinq_t + liq_t + altmanz + u \quad (6)$$

In the equation above, β_0 is constant, *I* represents gross capital expenditures, *F* represents gross fixed assets, *S* represents net sales, *P* represents income before extraordinary items, *D* represents depreciation (a measure of durability of capital and replacement requirements) and *L* represents total liabilities. Tobin's Q ratio is calculated as the market value of a company divided by the firm's total assets; *Liq* is the liquidity, which is calculated by dividing the total current assets by the total current liabilities; and Altman's Z is calculated as Z = $1.2T_1 + 1.4T_2 + 3.3T_3 + 0.6T_4 + 0.999T_5$, where T_1 = working capital / total assets, T_2 = retained earnings / total assets, T_3 =

earnings before interest and taxes / total assets, T_4 = market value of equity / total liabilities, and T_5 = sales / total assets.

All variables except sales were divided by net fixed assets. The justification for using net fixed assets as a deflator in the cross-section data is that it serves in multiple regressions to eliminate substantial heteroscedasticity caused by variance in firm size. Estimation techniques are ordinary least squares and unbalanced panel fixed effects. The dependent variable (representing the current capital expenditures divided by fixed assets, lagged one year) is a measure of the relative change in investment. The *sales change ratio* is calculated as the change in sales divided by the three-year averaged sales, which is a measure of the relative change in sales. This is a method of smoothing the volatility of sales using the three-year average. Ahsan (2008) also used a similar measure in his study. I use income before extraordinary earnings instead of EBIT as our profit variable because it represents permanent account earnings, whereas extraordinary items are considered to be transitory earnings (see Pan (2007); Moore and Schaller (2002)). I also control for firms' leverage and include depreciation to compare the replacement costs among the four groups.

In addition, I run a panel fixed regression to control for unobservable individual firm effects and time effects. There is heterogeneity across firms. I test which empirical model, that is, OLS regression or fixed panel regression, is better suited to model the impact of permanent sales increases on investment.

$$\frac{I_{i,t}}{F_{i,t-1}} = b_0 + \lambda_t + b_1\left(\frac{3(S_{i,t}-S_{i,t-1})}{S_{i,t}+S_{i,t-1}+S_{i,t-2}}\right) + b_2\left(\frac{3(S_{i,t-1}-S_{i,t-2})}{S_{i,t-1}+S_{i,t-2}+S_{i,t-3}}\right) + b_3\left(\frac{3(S_{i,t-2}-S_{i,t-3})}{S_{i,t-2}+S_{i,t-3}+S_{i,t-4}}\right)$$
$$+ b_4\left(\frac{3(S_{i,t-3}-S_{i,t-4})}{S_{i,t-3}+S_{i,t-4}+S_{i,t-5}}\right) + b_5\frac{P_{i,t}}{F_{i,t-1}} + b_6\frac{P_{i,t-1}}{F_{i,t-2}} + b_7\frac{P_{i,t-2}}{F_{i,t-4}}$$
$$+ b_8\frac{L_{i,t}}{TotalAsseti,t} + b_9\frac{D_t}{F_{t-1}} + Q_{i,t} + Liq_{i,t} + \mu_i + \epsilon_{i,t} \qquad (7)$$

λ_t is a set of year dummies that control for possible differences in the macroeconomic environment of each year, μ_i is the individual effect of firm *i*, and ε_i is the error term.

Summary statistics of capital expenditures, sales, income before extraordinary items, liability and depreciation, liquidity, Tobin's Q, and Altman's z and correlation of the data variables are presented in Table 5 and 6.

[Insert Table 5 here]

[Insert Table 6 here]

Table 5 presents summary statistics for capital expenditures, sales, income before extraordinary items, liability and depreciation, liquidity, Tobin's q, and Altman's z. The mean value of investment is about 0.41. The mean value of sales changes year on year are around 0.11 to 0.13. The liability and current and lagged profits variables exhibit high variations based on the high standard deviations that are recorded. Table 6 presents correlations among the variables. The correlations between investment and sales changes are positive and reach almost 13%. Tentatively, this positive correlation is consistent with our main premise that sales increase is associated with higher firm investment. With regard to the other correlations of Table 6, it can be seen that investment is positively correlated with other variables except Altman's z, and this is consistent with the intuitive notion that more distressed firms have lower levels of investment activity.

1.3.2. Regressions by firm types based on growth prospects (size and the B/M ratio)

Since B/M both is considered for growth measurement, I run the OLS and fixed effect regressions on the four different groups based on market cap and B/M (large-size and low-B/M, large-size and high-B/M, small-size and low-B/M and small-size and high-B/M). I sort the group first on market cap and then B/M. Table 7 depicts the regression results.

[Insert Table 7A here]

[Insert Table 7B here]

The results for the overall regression reveal that the company's investments are a function of a number of past sales changes. The break point of the high/low B/M ratio is 1. *Large companies closely follow the PIH.* They have positive coefficients on all sales variables. For large, high-growth firms, cumulative sum of the betas of investment to changes in sales lies between 0.60 (OLS) and 0.40 (FE) and for large, low-growth firms the sensitivity lies between 0.27 (OLS) and 0.19 (FE). *For large firms, a permanent increase in sales is strongly related to an increase in investment. Small companies do not have all positive sales variable coefficients*. OLS and FE show some different results in small companies. For large, high-growth (low B/M) firms, aggregate sensitivity of investment to changes in sales lies between 0.95 (OLS) and 1.19 (FE) and for large, low-growth (high B/M) firms the sensitivity lies between0.73 (OLS) and -0.44 (FE)

In the case of Group 3 (small-size and low-B/M), the cumulative beta (OLS: 0.95, FE:1.19) is larger than the current year's beta in OLS (0.88) and FE(1.17), and thus, the PIH holds; however, in the case of Group 4, OLS and FE show contradictory results. The current year's OLS beta

(0.38) is smaller than the cumulative beta in OLS (0.73); however, the current year's beta (0.27) is larger than the cumulative beta (-0.44) in FE and thus, the PIH does not hold in this case.

The coefficients of this year's change in sales for small firms (between 1.17and 0.27 in FE) are much higher than those of large firms (between 0.27 and 0.08). This shows that investments by small firms exhibit much higher sensitivities to recent sales increases than investments by large firms; however, lagged sales change for small firms are not always significant (i.e., negative coefficients), especially in the case of FE. We can again conclude that small firms do not closely follow the PIH.

Unlike sales coefficients, the coefficients associated with the profit variables do not generally show statistical significance; instead, they coefficients are small and close to zero, except for Group 4. The liability variable coefficient is positively related to investment in all four groups, whereas the depreciation variable coefficient is negatively related to investments in all four groups, as in the case of Section 3.2.

The growth effect (that is lower B/M group has higher cumulative beta coefficients) is not as significant as the size effect; however, the low-B/M group consistently has higher cumulative beta coefficients of investment than the high-B/M group in the same size group. Higher cumulative beta coefficient means it follows more closely the PIH. Therefore, we can conclude that B/M impacts the PIH.

1.3.3. Regressions by firm types based on investment opportunities (size & Tobin's Q)

Next, I examine the relationship between size and Tobin's-q and the PIH. Tobin's-q has been widely used in the literature as a proxy for firm investment, although there is controversy regarding the Tobin's-q's ability to predict investment. Nevertheless, it is the most widely used investment prediction variable (Blanchard, Rhee and Summers, 1993).The higher the Tobin's-q ratio, the greater the investment opportunities are. The better investment opportunity means that investors have more confidence on the future income increase opportunity. It is expected that those types of firms will follow PIH more closely. The regression results are depicted in Table 8. The break point between the high/low Tobin's-q groups is 1.

[Insert Table 8A here]

[Insert Table 8B here]

The results exhibit similar trends as those in Tables 8A and 8B. *The results indeed show that large and higher Tobin's-q firms more closely follow the PIH*. They have positive coefficients for all of the sales variables. For large, high Tobin's-q firms' cumulative sum of the betas of investment to changes in sale lies between 0.76 (OLS) and 0.46 (FE) of the investment and for large, low Tobin's-q firms it lies between0.25 (OLS) and 0.18 (FE) of the investments. For large and high Tobin's-q firms, a permanent increase in sales is strongly related to an increase in investments. Small and low Tobin's q companies do not have all positive sales variable coefficients. For those companies, the current year's sales change has the greatest impact. The coefficients of the variable for *current year's* change in sales for Group 3 small firms (approximately 3.42 OLS) are much larger than those of large firms (between 0.40 and 0.12). This shows that investments by Group 3 small firms exhibit much higher sensitivities to recent sales increases than investments by large firms. After the first year, however, the beta coefficients are either negative or statistically insignificant. We can again conclude that small firms do not closely follow the PIH.

The high-Tobin's q groups consistently have higher beta coefficients than the low-Tobin's q groups in the same size group (large size high-Tobin's q: OLS (0.76), FE (0.47); large size low-Tobin's q: OLS (0.25), FE(0.18); small size high Tobin's q: OLS (1.77), FE (1.4); small size low Tobin's q: OLS(0.17), FE(-0.03)). Therefore, we can conclude that Tobin's q impacts the PIH.

1.3.4. Regressions by firm types based on outside funding availability (size and the debt-ratio)

According to the pecking order theory, debt is the primary source of outside funding for investments after retained earnings. I examine how debt-ratio of firms affects the PIH. Debt-ratio tells us the external funding source of the investment. Extreme high debt ratios are considered as signs of poor performance of the external source of funding. It signals the firm is financially constrained. For firms to follow PIH, the low leverage ratio will be expected. I divide the investigated portfolio into six size group/debt-equity ratio combinations: large-size and high-D/E, large-size and medium-D/E, large-size and low-D/E, small-size and high-D/E, small-size and medium-D/E and small-size and low-D/E. The high-debt group has a D/E ratio that is greater than 2, whereas the medium-debt group has a D/E ratio that is greater than or equal to 1 but less than 2. The low-debt group has a D/E ratio that is less than or equal to 1.

Next I conduct regression with four lags of average changes in sales and two lags of profitability by firm groups. The regression results are depicted in Table 9.

[Insert Table 9A here]

[Insert Table 9 B here]

The results exhibit similar trends as those in Tables 7 and 8. For large, high-debt ratio firms, aggregate coefficient of investment to changes in sales lies between 0.29 (OLS) and 0.17(FE) and for large, low-debt ratio firms, it lies between 0.67 (OLS) and 0.45 (FE). *These large firms have all positive coefficients. Small high- or low-debt-equity ratio companies do not conform to the PIH.* In general, a high debt-to-equity ratio indicates that a company may not be able to generate enough cash to satisfy its debt obligations; however, a low debt-to-equity ratio may also indicate that the company is not taking advantage of the increased profits that financial leverage may bring. Small firms with average debt-equity ratio are the most stable firms, so they confirm to the PIH. The coefficients for the first year's change in sales for small, low-D/E firms (approximately 2.48 OLS) are much higher than those of large firms (between 0.34 and 0.15). This indicates that investments by small, low-D/E firms exhibit much higher sensitivities to recent sales increases than investments by large firms. After the first year, the beta coefficients are either negative or statistically insignificant for small, high- or low-D/E ratio firms.

The lower D/E ratio has more effect on the PIH than higher D/E ratio among the large-size groups. The large-size, low-D/E group consistently has higher beta coefficients than the large-size, high-D/E group (large size high-debt: OLS (0.28), FE (0.17); large size medium-debt: OLS (0.41), FE (0.23); large size low-debt: OLS(0.67), FE(0.45)). *Among the small-size groups, OLS results show that the low-D/E group has the highest cumulative beta coefficient; however, FE results show that the medium-D/E (1< D/E <2) group has the highest cumulative beta coefficient.* (Small size high-debt: OLS (0.46), FE (0.15); small size medium-debt: OLS (0.46), FE (0.26);

small size low-debt: OLS (1.46), FE (0.12)). Among small-size firms, medium-D/E ratio firms most closely follow the PIH.

Coefficients of the profit variables show significance, as do those of sales coefficients in the context of the first lag profit coefficient. They are all positively correlated to investment, whereas depreciation and Altman's Z are negatively related to investments.[2]

1.3.5. Regressions by firm types based on liquidity

This time, I divide the portfolios by size and the liquidity ratio to check whether the more liquid firms have the higher sensitivity to permanent income increase on investment decision. Here, liquidity is calculated as current assets divided by current liabilities. The breaking point between high and low liquidity is 1.

I accordingly conduct regression with four lags of average changes in sales and two lags of profitability by firm groups. The regression results are depicted in Table 10.

[Insert Table 10A here]

[Insert Table 10B here]

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2. Although I do not report them here, when we sort the portfolio into six groups based on size and Altman's Z, the results are almost identical to those obtained for the size and D/E ratio; that is, large-firm groups exhibit positive coefficients, whereas less-distressed firms have higher beta coefficients. Non-distressed, small firms and gray zone firms (medium-distressed firms) are more or less consistent in following the PIH; however, high-distressed firms do not follow the PIH.

They have all positive sales variable coefficients. For large, high-liquidity ratio firms aggregate sensitivity of investment to changes in sales lies between 0.65 (OLS) and 0.43 (FE) and for large, low-liquidity ratio firms it lies between0.39 (OLS) and 0.24 (FE). For large size firms, a permanent increase in sales is strongly related to an increase in investment. Again, not all coefficients for the sales variable associated with small companies are positive.

The coefficient for this year's change in sales for small, low-liquidity firms is approximately 1.8 (OLS), whereas that for small, high-liquidity firms is much higher than that of large firms0.7 (FE). These data show that investments by small firms exhibit much higher sensitivities to recent sales increases compared to investments by large firms. After the first year, the beta coefficients are either negative or statistically not significant for small-size, both high- and low-liquidity ratio firms. Thus, small firms again do not closely follow the PIH.

The FE result demonstrates that the *higher-liquidity group consistently has a higher beta coefficient in comparison to the lower-liquidity group for both small and large firms* (large size high-liquidity: OLS (0.65), FE (0.43); large size low-liquidity: OLS (0.39), FE (0.23); small size high-liquidity: OLS (0.49), FE(0.95); small size low-liquidity: OLS(0.87), FE(-0.37)). A high liquidity ratio indicates that a company is in a better position to meet its short-term financial obligations. We can conclude that there is a liquidity effect associate with the PIH.

1.3.6. Robustness Check

Next, I check the robustness of our results. First, I count the number of years with sales changes out of the previous five years for each firm. When a firm has a sales increase, I count this as 1, whereas if a firm has a decrease in sales, I count this as -1. Finally, if sales remain the same as those of the previous year, I assign a 0. Thus, if a firm has sales increases in all of the last four years, I record a value of 4 for the number of sales changes. If a firm has three years of sales increases and one year of sales decline, then I record a value of 2 for the number of sales changes [(1+1+1–1)=2]. A regression is conducted with investment as the dependent variable and each company's years of sales change as the independent variable. The presumption of the PIH hypothesis is that the higher the number, the longer the company has accumulated sales increases. Table 11 provides the results of this analysis.

[Insert Table 11 here]

The results indicate that Group 3 and 4 companies exhibit negative coefficients. According to our assumptions, this result reveals that Group 3 and 4 companies do not incorporate "permanent" earnings in their investment decisions; hence, this result re-confirms our hypothesis that small, high-growth companies do not consider cumulative sales income when investing. As expected, the coefficient is the highest in Group 1 and decreases in Groups 2, 3 and 4. We re-confirm the PIH for these groups.

Second, I re-balance the portfolio every year from 1994 to 2009. Each year, all stocks are sorted by size and P/E ratio then these stocks are allocated to four portfolios. Using cross-sectional analysis, investment is regressed over sales change and other explanatory variables on each portfolio. Next, I average out the corresponding beta of each year. The time-series means of the yearly regression slopes then provide the standard tests of whether sales change variables and other variables considered over their average provide an effect on investment[1]. Table 12 shows the results for the four different groups of companies.

[Insert Table 12 here]

The results consistently bear out that the past years' cumulative sales increase is significant in large firms; whereas this is not the case with small firms.

1.4. Conclusions

I investigate the time-series behavior of investment (capital expenditure) series in relation to sales income series based on the PIH. According to the PIH, I hypothesize that managers increase investments when they have confidence in the permanence of a sales increase. I provide strong, supporting evidence for our hypothesis using two different approaches.

In the first cointegration analysis, I confirm that the notion that investment decisions are made based on some measure of permanent income increase. Investments respond strongly to permanent changes in sales income while they respond minimally to transitory changes in sales income. I apply co-integration PIH testing to different types of portfolios: 1) 1984 to 2009 total data; 2) large-size, high-growth firms; 3) large-size, low-growth firms; 4) small-size, high-growth firms and 5) small-size, low-growth firms with three lags. The co-integration test results demonstrate that investment and sales profit series are co-integrated in all of these subgroups, and only the permanent part of the sales profits influences the investment. This confirms the notion that managers change investments only when sales earnings changes are caused by permanent shocks, not when sales earnings changes are caused by transitory shocks. As a result, the impact of transitory shocks on sales earnings that do not affect investments is reflected in the spread between sales earnings and investments.

Our second stage analysis is based on the multiple time series regressions. The results show that capital expenditures (investments) are a function of a number of past yearly sales changes. The results also indicate sales coefficients are significantly positive for at least up to three lags. The cumulative sum of the betas of four years sales changes is higher than the current year's beta. This implies that the cumulative inter-temporal effect has a greater impact than the current year effect, and it indicates that managers decide to increase investment when they are more confident the sales increase will be sustained in the future; however, when I apply our analysis to firms grouped by size and growth, size and liquidity, size and debt-ratio, I show that the PIH primarily holds for large, higher growth, more liquid, lower debt companies. The results further suggest smaller, higher debt, less liquid, and lower growth firms spend their internal funds without accumulating them. Therefore, the latter companies do not conform to the PIH to the same extent. Every firm is sensitive to current year's sales profit when making a decision to invest. However, the current year's sales profit is more significant to small/young firms than to large firms' as there are higher chance of these small firms to be short on cash or do not have enough time to survive in the industry. Liquidity and debt ratio results show that cash constrained firms are not following PIH closely. Thus we conclude the more firms follow PIH, the less firms are financially constrained

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Table 1

Augmented Dickey-Fuller Unit Root Regression Test Results (1984-2009)

Augmented Dickey-Fuller Unit Root Regression test results on the data as a whole as well as the results when the data is separated into 4 groups (large and high growth, large and low growth, small and high growth, small and low growth).

$$\Delta y_t = a_0 + \alpha y_{t-1} + \sum_{t=1}^{2} \gamma_i \Delta y_{t-i} + v_t$$

	Variables (y_t)	**α**	**T-test (α)**	**Pr> |t|**	**Ho: α = 0**
	It	-0.039	-0.51	0.615	Not rejected
Total data	*Xt*	-0.108	-1.06	0.306	Not rejected
	St	-0.647	-3.57	0.002	Rejected
	It	-0.096	-1.1	0.285	Not rejected
Group1	*Xt*	-0.164	-1.35	0.193	Not rejected
	St	-0.565	-3.64	0.002	Rejected
	It	0.396	1.42	0.172	Not rejected
Group2	*Xt*	0.470	1.59	0.128	Not rejected
	St	-1.720	-4.78	0.000	Rejected
	It	-0.117	-0.83	0.415	Not rejected
Group3	*Xt*	-0.095	-0.78	0.447	Not rejected
	St	-0.498	-2.48	0.023	Rejected
	It	-0.271	-1.27	0.219	Not rejected
Group4	*Xt*	-0.246	-1.12	0.278	Not rejected
	St	-0.518	-2.11	0.049	Rejected

Table 2A
Granger-Causality Wald Test

Granger-Causality Wald Test between variables *Xt*(capital expenditure) and *It*(Sales Income) results on the data as a whole as well as the results when the data is separated into 4 groups (large and high growth, large and low growth, small and high growth, small and low growth).

Granger-Causality Wald Test (*Xt, It)*		
	Chi-Square	Pr>ChiSq
Total data	10.44	0.005
Group1	9.72	0.008
Group2	28.39	0.021
Group3	0.74	0.690
Group4	2.25	0.325

Man and Chen (2009) Stepwise Causality Test

CAUSALITY TEST BETWEEN VARIABLES CAPX_R AND SALE_R

RESULT BASED ON THE BACKWARD PROCEDURE (Y:CAPX_R , X: SALE_R)
CAPX_R <= SALE_R (Y IS CAUSED BY X)

RESULT BASED ON THE FORWARD PROCEDURE (Y:CAPX_R , X: SALE_R)
CAPX_R <= SALE_R (Y IS CAUSED BY X)

Table 2B
Co-integration Rank Test Using Trace

This table shows Trace test results on sales income and investment

Co-integration Rank Test Using Trace						
H0: Rank=r	H1: Rank>r	Eigenvalue	Trace	5% Critical Value	Drift in ECM	Drift in Process
0	0	0.29	14.42	12.21	NOINT	Constant
1	1	0.15	4.58	4.14		

Table 3
Cointegration Regression Results

Cointegration regression results the data as a whole as well as the results when the data is separated into 4 groups (large and high growth, large and low growth, small and high growth, small and low growth): $St = Xt + \beta o + \beta_1 I_t$

Data	β_0	β_1	R^2
Total data	4,329.040	0.080	0.977
	(19,792)	(0.003)	
Group1	10,628	0.072	0.937
	(-17165)	(-0.004)	
Group2	-7,673.036	0.093	0.990
	(-6713.807)	(-0.002)	
Group3	-482.521	0.064	0.862
	(-398.846)	(-0.005)	
Group4	-535.729	0.053	0.929
	(-348.745)	(-0.003)	

(Standard deviations are in parentheses)
I_t = Investment (capital expenditures) value weighted series
X_t= Sales value weighted series
S_t=the spread between sales and capital expenditure series computed by *Xt+4329.04008+0.08005It (Total data)*
Δ = Difference operator $(e.g., \Delta X_t = X_t - X_{t-1})$

Table 4
Test of Restrictions on the BVAR

This table shows the restricted bivariate vector auto regression results on the data as a whole as well as the results when the data is separated into 4 groups (large and high growth, large and low growth, small and high growth, small and low growth). Restricted Lag vector components numbers are in parentheses.

Data	**Chi-Square Test**		**Pr>ChiSq**	**Comment**
Total	Chi-Square(6)	11.49	0.075	Not rejected
	Chi-Square(8)	13.57	0.094	Not rejected
Group1	Chi-Square(6)	3.81	0.702	Not Rejected
Group2	Chi-Square(6)	10.33	0.112	Not Rejected
Group3	Chi-Square(6)	15.41	0.017	Rejected
	Chi-Square(4)	9.36	0.053	Not Rejected
Group4	Chi-Square(6)	14.86	0.021	Rejected

Table 5
Summary Statistics of Variables

Summary statistics of Investment, Salechange, Profit, Liability and Depreciation, Liquidity, Tobin's Q, and Altman's Z. Data are obtained from the COMPUSTAT database from 1984 to 2009. *Investment* is capital expenditures divided by fixed assets. *Sales change* is calculated as one year sales change divided by three year average sales. *Profit* is Income before Extraordinary Items. Liability is Total Liability divided by Fixed Assets. *Dep* is depreciation divided by fixed asset. Liq is liquidity, calculated by current asset divided by current liability. Tobin's Q is calculated as the market value of a company divided by the total firm's assets. Altman Z is calculated as $Z = 1.2T_1 + 1.4T_2 + 3.3T_3 + 0.6T_4 + 0.999T_5$ where T_1 = Working Capital / Total Assets, T_2 = Retained Earnings / Total Assets, T_3 = Earnings before Interest and Taxes /Total Assets, T_4 = Market Value of Equity /Total Liabilities, T_5 = Sales/ Total Assets.

Variable	N	Mean	Std	Median
Investment	64,163	0.407	6.88	0.218
salechange_1	60,899	0.136	0.265	0.099
salechange_2	57,378	0.13	0.27	0.096
salechange_3	53,728	0.121	0.274	0.09
salechange_4	50,311	0.118	0.275	0.089
profit_p1	63,801	0.929	15.074	0.22
profit_p2	60,449	0.657	9.212	0.188
Liability	51,155	4.431	54.838	1.653
Dep	66,455	0.237	3.932	0.148
Liq	52,632	2.568	7.276	1.896
TobinQ	66,917	1.361	6.036	0.894
Altman_Z	51,040	1.321	0.869	1.169

Table 6
Correlations among the Variables of Interest

	Investment	salecΔ_1	salecΔ_2	salecΔ_3	salecΔ_4	Profp1	prof_p2	Liability	Dep	Liq	Tobinq
Investment											
saleΔ_1	0.13										
	(<.0001)										
saleΔ_2	0.0131	0.2416									
	(0.0018)	(<.0001)									
saleΔ_3	0.0055	0.0686	0.2426								
	(0.2053)	(<.0001)	(<.0001)								
saleΔ_4	0.0206	0.0736	0.0758	0.2363							
	(<.0001)	(<.0001)	(<.0001)	(<.0001)							
profit_p1	0.2492	0.0464	-0.0097	-0.0007	-0.0184						
	(<.0001)	(<.0001)	(0.0208)	(0.8694)	(<.0001)						
profit_p2	0.1698	0.0253	0.0733	0.0108	0.0282	0.0367					
	(<.0001)	(<.0001)	(<.0001)	(0.0132)	(<.0001)	(<.0001)					
Liability	0.2438	0.1006	0.0118	0.0136	0.0094	0.4388	0.1285				
	(<.0001)	(<.0001)	(0.0124)	(0.0054)	(0.0624)	(<.0001)	(<.0001)				
Dep	0.0003	-0.0114	-0.0006	-0.0020	0.0002	0.0226	0.0032	0.0392			
	(0.9321)	(0.0054)	(0.8960)	(0.6464)	(0.9713)	(<.0001)	(0.4330)	(<.0001)			
Liq	0.0117	0.0038	0.0169	0.0310	0.0238	0.0577	0.0824	-0.0011	0.0148		
	(0.0089)	(0.4197)	(0.0004)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(0.7930)	(<.0001)		
TobinQ	0.0054	0.0414	0.0389	0.0237	0.0205	0.0103	0.0132	-0.0023	0.583	0.0572	
	(0.1728)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(0.0101)	(0.0010)	(0.6001)	(<.0001)	(<.0001)	
AltmanZ	-0.0044	0.0224	0.0219	0.0065	0.0007	0.0082	0.0098	0.0196	0.0410	0.0030	0.0557
	(0.3365)	(<.0001)	(<.0001)	(0.1970)	(0.8948)	(0.0703)	(0.0360)	(<.0001)	(<.0001)	(0.5100)	(<.0001)

Table 7A
Size and B/M OLS Result

This table shows the regression results on four different groups of firms. The regression model has the following form:

$$\frac{I_t}{F_{t-1}} = b_0 + \Sigma_{i=1}^{4} b_i \Delta S_{t+1-i} + \Sigma_{i=5}^{6} b_i P_{t+6-i} + b7\frac{L_t}{F_{t-1}} + b8\frac{Dep_t}{F_{t-1}} + tobinq + liq + AltmanZ + u$$

Investment is the dependent variable. Sales Change, Profit, Liability, Depreciation, Tobin's Q, Liquidity and Altman's Z are the independent variables. Refer to Table 5 for the descriptions of each variable.

Variable	Large Size Low B/M	Large size High B/M	Small Size Low B/M	Small Size High B/M
Intercept	0.073	0.029	0.196	0.378
	(<.0001)	(<.0001)	(<.0001)	(<.0001)
salechange_1	0.329	0.129	0.879	1.743
	(<.0001)	(<.0001)	(<.0001)	(<.0001)
salechange_2	0.143	0.059	-0.008	-0.581
	(<.0001)	(<.0001)	(-0.890)	(<.0001)
salechange_3	0.090	0.053	-0.100	-0.819
	(<.0001)	(<.0001)	(-0.050)	(<.0001)
salechange_4	0.047	0.032	0.181	0.389
	(<.0001)	(<.0001)	(<.0001)	(<.0001)
profit_p1	0.041	0.003	0.032	0.293
	(<.0001)	(-0.261)	(<.0001)	(<.0001)
profit_p2	-0.009	0.011	0.017	0.207
	(<.0001)	(<.0001)	(<.0001)	(<.0001)
Liability	0.012	0.015	0.013	-0.005
	(<.0001)	(<.0001)	(<.0001)	(<.0001)
Dep	-0.063	0.145	-0.355	-0.401
	(-0.0002)	(<.0001)	(<.0001)	(<.0001)
Liq	0.002	0.000	0.016	-0.020
	(0.161)	(-0.864)	(0.008)	(-0.002)
TobinQ	0.032	0.115	0.010	-0.195
	(<.0001)	(<.0001)	(0.494)	(-0.023)
Altman_Z	0.026	0.019	-0.014	-0.047
	(<.0001)	(<.0001)	(-0.428)	(-0.112)
Number of Observations Used	11,225	8,581	4,239	12,299
R-Square	0.306	0.309	0.203	0.164
Adj R-Sq	0.306	0.309	0.201	0.163

Table 7B
Size and B/M Fixed Effect Result

Fixed effect unbalanced panel regression results on the four different groups of firms. The regression model has the following form:

$$\frac{I_t}{F_{t-1}} = b_0 + \lambda_t + \Sigma_{i=1}^{4} b_i \Delta S_{t+1-i} + \Sigma_{i=5}^{6} b_i P_{t+6-i} + b7\frac{L_t}{F_{t-1}} + b8\frac{Dep_t}{F_{t-1}} + tobinq + liq + altmanZ + \mu_i + \epsilon_{i,t}$$

λ_t is a set of time dummies that control for possible differences in the macroeconomic environment of each year. Investment is the dependent variable. Sales Change, Profit, Liability, Depreciation, Tobin's Q, Liquidity and Altman's Z are the independent variables. μ_i is the individual effect of firm i, and ε_i is the error term. Refer to Table 5 for the descriptions of each variable. Standard errors are in parentheses.*** p<0.01, ** p<0.05, * p<0.1

Variable	Large size Low B/M	Large size High B/M	Small Size Low B/M	Small size High B/M
salechange_1	0.263***	0.0829***	1.172***	0.268**
	(0.014)	(0.006)	(0.112)	(0.132)
salechange_2	0.0959***	0.0506***	0.0807	-0.0536
	(0.013)	(0.006)	(0.101)	(0.124)
salechange_3	0.044***	0.040***	-0.262***	-0.778***
	(0.013)	(0.006)	(0.091)	(0.116)
salechange_4	-0.0004	0.0186***	0.199**	0.128
	(0.012)	(0.006)	(0.088)	(0.110)
profit_p1	0.066***	0.020***	0.054***	0.317***
	(0.003)	(0.004)	(0.007)	(0.014)
profit_p2	-0.010***	-0.017***	0.009	0.240***
	(0.002)	(0.003)	(0.006)	(0.012)
Dep	-0.394***	-0.383***	-0.558***	-0.112
	(0.028)	(0.030)	(0.152)	(0.074)
Tobinq	0.0260***	0.0956***	-0.0523	-0.364***
	(0.002)	(0.008)	(0.0321)	(0.130)
Lliq	-0.009***	-0.007***	0.019	0.018**
	(0.003)	(0.002)	(0.013)	(0.009)
Liability	0.016***	0.029***	0.014***	0.010*
	(0.001)	(0.001)	(0.002)	(0.006)
Altman_z	-0.009	-0.010*	-0.076	-0.075
	(0.011)	(0.006)	(0.063)	(0.068)
Constant	0.274***	0.163***	0.366	0.507*
	(0.051)	(0.021)	(0.328)	(0.303)
Observations	11,131	8,630	4,166	12,162
R-squared	0.260	0.253	0.186	0.171
N of Firms	2,020	1,672	1,969	3,614

Table 8A
Size and Tobin' Q OLS Result

The table shows the regression results on the four different groups of firms. The regression model has the following form:

$$\frac{I_t}{F_{t-1}} = b_0 + \Sigma_{i=1}^{4} b_i \Delta S_{t+1-i} + \Sigma_{i=5}^{6} b_i P_{t+6-i} + b7\frac{L_t}{F_{t-1}} + b8\frac{Dep_t}{F_{t-1}} + liq + AltmanZ + u$$

Investment is the dependent variable. Sales Change, Profit, Liability, Depreciation, Tobin's Q, Liquidity and Altman's Z are the independent variables. Refer to Table 5 for the descriptions of each variable.

Variable	Large Size High Q	Large size Low Q	Small Size High Q	Small Size Low Q
Intercept	0.116	0.076	0.287	0.077
	(<.0001)	(<.0001)	(0.067)	(0.001)
salechange_1	0.403	0.124	3.429	0.119
	(<.0001)	(<.0001)	(<.0001)	-0.0109
salechange_2	0.179	0.049	-0.753	-0.090
	(<.0001)	(<.0001)	(0.000)	(0.048)
salechange_3	0.116	0.049	-1.750	0.077
	(<.0001)	(<.0001)	(<.0001)	(0.066)
salechange_4	0.064	0.031	0.842	0.067
	(<.0001)	(<.0001)	(<.0001)	(0.091)
profit_p1	0.043	0.050	-0.052	0.233
	(<.0001)	(<.0001)	(<.0001)	(<.0001)
profit_p2	-0.016	0.000	0.197	-0.014
	(<.0001)	-0.968	(<.0001)	(0.000)
Dep	-0.118	0.275	-0.239	-0.299
	(<.0001)	(<.0001)	(0.010)	(<.0001)
Liability	0.015	0.007	0.002	0.045
	(<.0001)	(<.0001)	(0.051)	(<.0001)
Liq	0.007	0.005	-0.019	0.015
	(<.0001)	(0.000)	(0.168)	(<.0001)
Altman_Z	0.031	0.021	-0.118	-0.023
	(<.0001)	(<.0001)	(0.109)	(0.045)
Number of Observations Used	9,491	9,818	5,256	12,321
R-Square	0.292	0.278	0.126	0.408
Adj R-Sq	0.292	0.277	0.124	0.408

Table 8B
Size and Tobin' Q Fixed Effect Result

Fixed effect unbalanced panel regression results on the four different groups of firms. The regression model has the following form:
$\frac{I_t}{F_{t-1}} = b_0 + \lambda_t + \Sigma_{i=1}^{4} b_i \Delta S_{t+1-i} + \Sigma_{i=5}^{6} b_i P_{t+6-i} + b7\frac{L_t}{F_{t-1}} + b8\frac{Dep_t}{F_{t-1}} + liq + AltmanZ + \mu_i + \epsilon_{i,t}$ λ_t is a set of time dummies that control for possible differences in the macroeconomic environment of each year. Investment is the dependent variable. Sales Change, Profit, Liability, Depreciation, Tobin's Q, Liquidity and Altman's Z are the independent variables. μ_i is the individual effect of firm i, and ε_i is the error term. Refer to Table 5 for the descriptions of each variable. Standard errors are in parentheses.*** p<0.01, ** p<0.05, * p<0.1

Variable	Large size High Q	Large size Low Q	Small Size High Q	Small size Low Q
salechange_1	0.299***	0.106***	1.189***	0.304***
	(0.017)	(0.006)	(0.081)	(0.047)
salechange_2	0.107***	0.042***	0.107	-0.182***
	(0.016)	(0.005)	(0.075)	(0.044)
salechange_3	0.063***	0.035***	-0.154**	-0.135***
	(0.015)	(0.005)	(0.070)	(0.041)
salechange_4	-0.004	0.010*	0.255***	-0.021
	(0.014)	(0.005)	(0.063)	(0.041)
profit_p1	0.062***	0.051***	0.045***	0.454***
	(0.003)	(0.004)	(0.004)	(0.005)
profit_p2	-0.016	0.003***	0.014***	0.187***
	(0.002)	(0.001)	(0.004)	(0.004)
Dep	-0.501***	-0.229***	-0.325***	-0.176***
	(0.031)	(0.029)	(0.079)	(0.032)
Liq	-0.003	-0.003	0.014**	0.009**
	(0.003)	(0.003)	(0.006)	(0.004)
Liability	0.023***	0.010***	0.002***	-0.028
	(0.001)	(0.000)	(0.000)	(0.002)
Altman_z	0.0338**	-0.009***	-0.135**	-0.015**
	(0.013)	(0.005)	(0.053)	(0.021)
Constant	0.227***	0.232***	0.419*	0.231**
	(0.059)	(0.019)	(0.224)	(0.108)
Observations	9,491	9,818	5,256	12,321
R-squared	0.273	0.196	0.187	0.59
Number of numbern	1,814	1,634	2,120	3,687

Table 9A
Size and D/E Ratio OLS Result

The table shows the regression results on the four different groups of firms. The regression model has the following form:

$$\frac{I_t}{F_{t-1}} = b_0 + \Sigma_{i=1}^{4} b_i \Delta S_{t+1-i} + \Sigma_{i=5}^{6} b_i \Delta P_{t+6-i} + +b_7 \frac{Dep_t}{F_{t-1}} + b_8 Liq + b_9 Tobinq + b_{10} AltmanZ + u$$

Investment is the dependent variable. Sales Change, Profit, Liability, Depreciation, Tobin's Q, Liquidity and Altman's Z are the independent variables. Refer to Table 5 for the descriptions of each variable.

Variable	Large Size High D/E	Large size Medium D/E	Large Size Low D/E	Small Size High D/E	Small size Medium D/E	Small Size Low D/E
Intercept	0.080	0.126	0.093	-0.226	0.187	0.474
	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
salechange_1	0.159	0.217	0.344	0.369	0.335	2.488
	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
salechange_2	0.049	0.086	0.155	-0.020	0.062	-0.545
	(<.0001)	(<.0001)	(<.0001)	(0.566)	(0.055)	(0.000)
salechange_3	0.046	0.082	0.110	-0.007	0.042	-1.088
	(<.0001)	(<.0001)	(<.0001)	(0.833)	(0.135)	(<.0001)
salechange_4	0.036	0.024	0.062	0.120	0.021	0.602
	(0.001)	(0.038)	(<.0001)	(0.000)	(0.413)	(<.0001)
profit_p1	0.165	0.306	0.024	0.088	0.188	0.125
	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
profit_p2	0.000	-0.093	0.008	0.031	0.012	0.099
	(0.742)	(<.0001)	(<.0001)	(<.0001)	(0.002)	(<.0001)
Dep	0.068	-0.177	0.139	-0.027	-0.188	-0.264
	(0.004)	(<.0001)	(<.0001)	(0.672)	(<.0001)	(<.0001)
Liq	0.000	-0.012	0.001	0.209	-0.005	0.000
	(0.937)	(<.0001)	(0.427)	(<.0001)	(0.481)	(0.959)
TobinQ	0.022	0.004	0.026	0.137	0.042	-0.222
	(<.0001)	(0.136)	(<.0001)	(<.0001)	(0.003)	(<.0001)
Altman_Z	0.027	0.031	0.022	0.013	-0.002	-0.093
	(<.0001)	(<.0001)	(<.0001)	(0.092)	(0.798)	(0.075)
N	4041	7476	8380	2684	4712	9221
R-Squared	0.287	0.467	0.321	0.275	0.210	0.110
Adj R	0.285	0.466	0.320	0.272	0.209	0.109

Table 9B
Size and D/E RatioFixed Effect Result

Fixed effect unbalanced panel regression resultson four different groups of firms. Regression model has the following form:

$$\frac{I_t}{F_{t-1}} = b_0 + \lambda_t + \Sigma_{i=1}^4 b_i \Delta S_{t+1-i} + \Sigma_{i=5}^6 b_i P_{t+6-i} + b_7 \frac{Dep_t}{F_{t-1}} + b_8 liq + b_9 AltmanZ + \mu_i + \epsilon_{i,t}$$

λ_t is a set of time dummies that control for possible differences in the macroeconomic environment of each year. Investment is the dependent variable. Sales Change, Profit, Liability, Depreciation, Tobin's Q, Liquidity and Altman's Z are the independent variables. μ_i is the individual effect of firm *i*, and ε_i is the error term. Refer to Table 5 for the descriptions of each variable. Standard errors are in parentheses.*** p<0.01, ** p<0.05, * p<0.1

Variable	Large Size High D/E	Large size Medium D/E	Large Size Low D/E	Small Size High D/E	Small size Medium D/E	Small Size Low D/E
salechange_1	0.114***	0.139***	0.268***	0.310***	0.0745	1.032***
	(0.010)	(0.011)	(0.014)	(0.031)	(0.049)	(0.169)
salechange_2	0.015	0.031***	0.109***	-0.095***	0.0381	-0.056
	(0.010)	(0.010)	(0.013)	(0.028)	(0.045)	(0.158)
salechange_3	0.037***	0.033***	0.056***	-0.022	0.078*	-0.986***
	(0.010)	(0.010)	(0.013)	(0.027)	(0.042)	(0.143)
salechange_4	0.006	0.024**	0.015	-0.040	0.071*	0.128
	(0.009)	(0.010)	(0.012)	(0.027)	(0.038)	(0.135)
profit_p1	0.333***	0.399***	0.049***	0.059***	0.309***	0.007
	(0.011)	(0.005)	(0.002)	(0.007)	(0.016)	(0.009)
profit_p2	0.001	-0.065***	0.006***	-0.011*	0.030***	0.178***
	(0.001)	(0.004)	(0.002)	(0.006)	(0.010)	(0.009)
Dep	-0.289***	-0.375***	-0.404***	-0.380***	-0.550***	-0.065
	(0.037)	(0.038)	(0.028)	(0.098)	(0.101)	(0.095)
Tobinq	0.010	-0.021***	0.026***	0.065*	0.009	0.013
	(0.007)	(0.004)	(0.002)	(0.036)	(0.030)	(0.059)
Liq	-0.005	-0.027***	-0.002	0.016	-0.013	0.004
	(0.007)	(0.004)	(0.002)	(0.014)	(0.014)	(0.010)
Altman_z	-0.035***	-0.025***	-0.052***	-0.009	-0.014	-0.185*
	(0.009)	(0.009)	(0.013)	(0.014)	(0.026)	(0.104)
Constant	0.336***	0.282***	0.336***	0.334***	0.296***	0.547
	(0.055)	(0.031)	(0.044)	(0.093)	(0.101)	(0.413)
Observations	4,041	7,476	8,380	2,684	4,712	9,221
R-squared	0.293	0.615	0.238	0.193	0.157	0.083
N of firms	889	1,518	1,668	1,229	1,986	2,935

Table 10A
Size and Liquidity Ratio OLS Result

The table shows the regression results on the four different groups of firms. The regression model has the following form:

$$\frac{I_t}{F_{t-1}} = b_0 + \Sigma_{i=1}^{4} b_i \Delta S_{t+1-i} + \Sigma_{i=5}^{6} b_i P_{t+6-i} + b_7 \frac{Dep_t}{F_{t-1}} + b_8 \frac{L_t}{F_{t-1}} + b_9 tobinq + b_{10} Altman_Z + u$$

Investment is the dependent variable. Sales Change, Profit, Liability, Depreciation, Tobin's Q, Liquidity and Altman's Z are the independent variables. Refer to Table 5 for the descriptions of each variable.

Variable	Large Size High Liquidity	Large Size Low Liquidity	Small Size High Liquidity	Small Size Low Liquidity
Intercept	0.085	0.098	0.278	0.146
	(<.0001)	(<.0001)	(<.0001)	(0.097)
salechange_1	0.340	0.200	0.385	1.802
	(<.0001)	(<.0001)	(<.0001)	(<.0001)
salechange_2	0.158	0.078	-0.126	-0.407
	(<.0001)	(<.0001)	(0.046)	(0.015)
salechange_3	0.089	0.071	0.042	-1.075
	(<.0001)	(<.0001)	(0.477)	(<.0001)
salechange_4	0.066	0.040	0.188	0.547
	(<.0001)	(<.0001)	(0.001)	(0.000)
profit_p1	0.017	0.229	0.244	0.058
	(<.0001)	(<.0001)	(<.0001)	(<.0001)
profit_p2	0.008	-0.009	-0.093	0.311
	(0.000)	(<.0001)	(<.0001)	(<.0001)
Dep	0.055	-0.061	-0.137	-0.375
	(0.003)	(<.0001)	(<.0001)	(0.031)
Liability	0.006	0.003	0.002	0.023
	(<.0001)	(<.0001)	(0.000)	(<.0001)
TobinQ	0.031	0.008	-0.063	0.016
	(<.0001)	(<.0001)	(0.000)	(0.789)
Altman_z	0.028	0.019	-0.028	-0.034
	(<.0001)	(<.0001)	(0.225)	(0.358)
Number of Observations Used	7,012	13,123	9,814	6,937
R-Square	0.325	0.406	0.310	0.142
Adj R-Sq	0.324	0.405	0.310	0.141

Table 10B
Size and Liquidity Ratio Fixed Effect Result

Fixed effect unbalanced panel regression results on the four different groups of firms. The regression model has the following form:

$$\frac{I_t}{F_{t-1}} = b_0 + \lambda_t + \Sigma_{i=1}^{4} b_i \Delta S_{t+1-i} + \Sigma_{i=5}^{6} b_i P_{t+6-i} + b_7 \frac{Dep_t}{F_{t-1}} + b_8 liq + b_9 AltmanZ + \mu_i + \epsilon_{i,t}$$

λ_t is a set of time dummies that control for possible differences in the macroeconomic environment of each year. Investment is the dependent variable. Sales Change, Profit, Liability, Depreciation, Tobin's Q, Liquidity and Altman's Z are the independent variables. μ_i is the individual effect of firm i, and ε_i is the error term. Refer to Table 5 for the descriptions of each variable. Standard errors are in parentheses.*** p<0.01, ** p<0.05, * p<0.1

Variable	Large Size High Liquidity	Large Size Low Liquidity	Small Size High Liquidity	Small Size Low Liquidity
salechange_1	0.250***	0.135***	0.706***	0.12
	(0.017)	(0.007)	(0.048)	(0.216)
salechange_2	0.107***	0.038***	0.097**	0.19
	(0.015)	(0.007)	(0.043)	(0.205)
salechange_3	0.064***	0.038***	-0.025	-0.858***
	(0.014)	(0.007)	(0.041)	(0.191)
salechange_4	0.012	0.0281***	0.168***	0.181
	-0.014	-0.007	-0.039	-0.184
profit_p1	0.039***	0.329***	0.046***	0.171***
	(0.003)	(0.005)	(0.004)	(0.017)
profit_p2	0.007***	-0.005***	0.006	0.358***
	(0.002)	(0.001)	(0.004)	(0.015)
Dep	-0.493***	-0.469***	-0.073***	-1.665***
	(0.033)	(0.023)	(0.025)	(0.363)
Tobinq	0.026***	0.004*	-0.027	0.099
	(0.002)	(0.002)	(0.017)	(0.102)
Liability	0.010***	0.009***	0.003***	0.102***
	-0.001	-0.001	0.000	-0.012
Altman_z	-0.047***	-0.003	-0.123***	0.02
	(0.015)	(0.006)	(0.030)	(0.090)
Constant	0.327***	0.211***	0.467***	0.165
	(0.048)	(0.026)	(0.107)	(0.587)
Observations	7,012	13,123	9,814	6,937
R-squared	0.246	0.483	0.123	0.168
N of Firms	1,508	1,923	3,051	2,625

Table 11
Robustness Check Table

A regression is conducted with investment as the dependent variable and company's summed sales increases over the last four years as the independent variable:

$I = \beta o + \beta_1 A$

(A is the sum of increases in sales in the last four years)

Group	Coeff	Std	t value	Pr>|t|	N	R-sqr
Group1	0.033	0.007	2.45	<.0001	21,319	0.001
Group2	0.024	0.001	15.04	<.0001	11,626	0.028
Group3	-0.001	0.068	-0.97	0.97	13,362	0.002
Group4	-0.009	0.018	-1.55	0.34	14,515	0.001

Table 12
Fama-MacBeth Regression Result

The portfolio is rebalanced every year from 1994 to 2009. Regression is conducted on the four different groups of firms. The regression model has the following form:

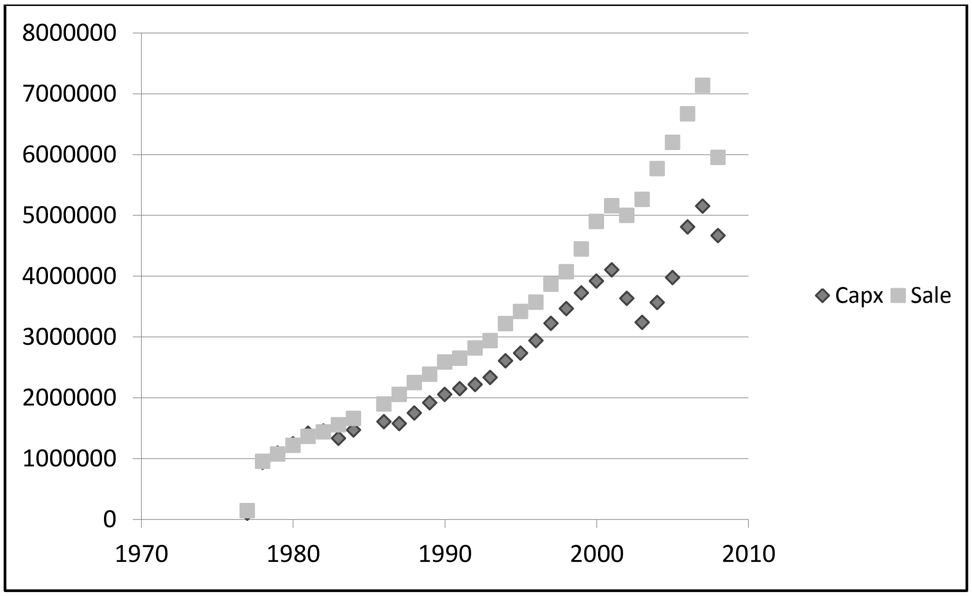
$$\frac{I_t}{F_{t-1}} = b_0 + \Sigma_{i=1}^{4} b_i \Delta S_{t+1-i} + \Sigma_{i=5}^{6} b_i P_{t+6-i} + b7\frac{L_t}{F_{t-1}} + b8\frac{Dep_t}{F_{t-1}} + tobinq + liq + AltmanZ + u$$

Investment is the dependent variable. Sales Change, Profit, Liability, Depreciation, Tobin's Q, Liquidity and Altman's Z are the independent variables. Refer to Table 5 for the descriptions of each variable.

Variable	Large size high P/E	Large size Low P/E	Small Size High P/E	Small Size Low P/E
Intercept	0.061	0.085	0.141	-0.020
	(0.003)	(0.000)	(0.108)	(0.176)
salechange_1	0.263	0.152	1.283	0.963
	(0.000)	(0.000)	(0.000)	(0.117)
salechange_2	0.106	0.068	-0.020	-0.330
	(0.002)	(0.135)	(0.171)	(0.282)
salechange_3	0.064	0.045	0.033	0.099
	(0.031)	(0.202)	(0.214)	(0.448)
salechange_4	0.018	0.031	-0.390	-0.338
	(0.270)	(0.025)	(0.270)	(0.264)
profit_p1	0.009	-0.004	0.032	-0.053
	(0.008)	(0.110)	(0.158)	(0.116)
profit_p2	0.009	0.032	-0.015	0.004
	(0.095)	(0.082)	(0.246)	(0.191)
Liability	0.011	0.011	0.032	0.037
	(0.000)	(0.006)	(0.000)	(0.034)
Dep	0.086	0.080	-0.135	-0.183
	(0.053)	(0.120)	(0.129)	(0.380)
Liq	0.011	0.003	0.040	0.090
	(0.004)	(0.323)	(0.176)	(0.079)
TobinQ	0.034	0.042	-0.052	0.027
	(0.000)	(0.007)	(0.055)	(0.453)
Altman_Z	0.015	0.007	-0.017	-0.025
	(0.116)	(0.283)	(0.515)	(0.361)
N of Obs	16	16	16	16

Figure I
Scatter Plot
Sales and Capital Expenditure (1975-2010)

This figure illustrates the relationship between United States' aggregated capital expenditure and sales (CRSP listed 28,879 firms) from year 1975 to 2010.



The Capital Expenditure series is scaled to match the comparable Sales series.

Chapter Two: FIRM INVESTMENT AND STOCK RETURN: OVERINVESTMENT PUZZLE VERSUS INVESTMENT OPPORTUNITY HYPOTHESIS

Abstract

Recent empirical studies have shown a negative relationship between corporate investment and stock returns. The dominant explanation presented in the literature is overinvestment theory (Titman, Wei and Xie, 2004), which postulates that the market initially under reacts due to the possibility of overinvestment of the firms. *This paper is the first full-scale empirical study which finds* a positive relationship between corporate investment and stock returns through consideration of investment increase/decrease over a multiple-year framework rather than a single-year frame as considered by previous studies. *When* firms continually increase investment, the investment/return relationship is shown to become positive. This paper postulates that the announcements of increases in capital expenditures positively affect firm returns when markets acknowledge value in investment opportunities via consecutive increases in investment. In addition, even within the single-year investment increase time frame, this paper's finding finds that overinvestment concern can be overridden due to factors such as insufficient cash flow or small size constraint, producing a positive investment/return relationship.

2.1. Introduction

This paper builds on the theoretical framework examining the response of stock returns to firm investment. Recent empirical studies have shown a negative relationship between corporate investment and stock returns; firms that increase investment have generally generated negative stock returns. For example, Lamont (2000) finds that investment and stock returns have significant negative contemporaneous co-variation, and that investment and future stock returns have a co-variation not statistically different from zero. Baker, Stein and Wurgler (2003) find that current capital expenditures are negatively associated with future stock returns. They suggest that corporations tend to invest more when their stock is overpriced, bringing on a negative relationship between firm investment and subsequent stock returns. They state that market prices initially tend to underreact to information contained in corporate investment announcements. Titman, Wei and Xie (2004), and Anderson and Garcia-Feijóo (2006) conclude firms that substantially increase capital expenditures subsequently achieve negative returns. Polk and Sapienza (2009) use discretionary accruals as a proxy for stock market mispricing and find a positive relationship between abnormal investment and discretionary accruals; that is, the more overvalued firms are, the more they invest and tend to have lower subsequent stock returns than do undervalued firms. In general, these studies find a negative relationship between firm investment and subsequent stock returns in the U.S. market.

Various explanations have been offered for this negative relationship. Li and Zhang (2010) show that increasing investment earns even lower returns when frictions (the lag between the decision to invest and the actual investment expenditure and the irreversible characteristics of investment) associated with increasing investment are stronger. Baker, Stein and Wurgler (2003) suggest that firms tend to invest more when their stock is overpriced. The explanation for this negative relationship offered by Titman, Wei and Xie (2004) is overinvestment theory—investors are uncertain about possible overinvestment by a firm's managers, consequently generating negative stock returns. Jensen (1986), the originator of overinvestment theory, states that firms with higher free cash flows are most likely to overinvest. Richardson (2006) finds that for firms with positive free cash flow, the average firm overinvests 20 percent of its free cash flow. Titman, Wei and Xie (2004) argue that firms that increase their investment expenditures tend to overinvest, and the market initially under reacts to the negative implications of the higher level of investment. Even though there is no overinvestment, investors generally do not favor high capital expenditures because it negatively impacts the firm's cash flow over the short term. Thus, investment increase\return has a negative relationship in general.

Other studies document different results, showing a positive investment and return relationship. Such studies (McConnell and Muscarella, 1985; Blose and Shieh, 1997; Vogt, 1997) claim stock prices tend to respond favorably to announcements of major capital investments. In explaining this, McConnell and Muscarella (1985) use an event-time study between two groups of 285 firms: industrial vs. public utility firms. Their empirical evidence shows that public announcements of increases in capital expenditures lead to significant positive stock returns for industrial firms; however, for public utility firms, they find that announcements of capital expenditure decisions do not have any material effect on stock returns. Chan, Martin and Kensinger (1990) examine the market response to announcements of R&D spending by firms in both high- and low-technology industries. They find that firms in high-technology industries that announce increases in R&D spending, on average, experience abnormal positive returns, whereas low-technology industries experience negative returns. Using data from 308 firms, Chung, Wright and Chareonwong (1998) find announcements of increases in capital expenditures positively affect stock prices of firms with high Tobin's Q ratios; however, for low Tobin's Q firms, the effect is negative. They explain their findings by claiming investors see more valuable investment opportunities in high Tobin's Q firms because Q represents investment opportunities.

In summary, a small number of studies have shown that the investment\return relationship is positive in some special cases, such as industrial firms, low-technology firms, or when Tobin's Q is high. Otherwise, studies have found the relationship to be negative in general. Titman, Wei and Xie (2004) argued that the results from the above positive investment\return result event studies should be interpreted cautiously because these studies examine only a limited number of publicly announced investments, which induces a bias. They explained that market prices initially underreact to information contained in corporate announcements, suggesting it makes sense to look at the long-term effect of these events. In their long-term event study, Titman, Wei and Xie (2004) report that firms that increase investment subsequently earn lower risk-adjusted returns in the following five years. They claim that the negative capital investment/return relationship is stronger for firms with higher cash flows, thus suggesting that overinvestment theory works. Using the compiled data of all stocks listed on NYSE, AMEX and NASDAQ, they showed a monotonic decrease of return with increasing investment.

This paper hypothesizes a positive relationship between stock return and investment as the time span is expanded from a one-year event relationship between return and investment to a multiple year framework while investigating firm-specific investment patterns over the previous several years. Negative relationship theory holds true within a one-year span investment increase/decrease consideration; however, expanding the time span to a multiple year framework changes the investment/return relationship to positive. This may possibly be due to investors looking for valuable investment opportunity stocks with the potential for firm growth or expansion. I would like to term this as the "Investment Opportunity Hypothesis". As a firm begins increasing its investment because of a managerial attempt to seize growth opportunities or expand, the market responds positively to capital expenditure increase plans. Investment possibility for these types of stocks is an important factor in determining the market response to the capital expenditure increase plans. Through examination of stock returns of portfolios sorted on the increase/decrease of investment over the last few years, the results show an increase of return when there is a cumulative positive increase of investment. A possible explanation for this is that the "Investment Opportunity Hypothesis" begins to outweigh overinvestment concerns in firms with consecutive investment increase.

Another interesting finding of this paper is that a positive investment/return relationship can be realized even in the single-year event relationship between investment increase and return if overinvestment concern is overridden due to some other factors. This result differs from the results of previous papers which claim a monotonic decrease of return with higher investment in the single-year time frame. I propose that if capital markets have confidence in a firm's expansion or growth potential and its management spending on it, then the investment/return relationship is more likely to be positive. In this case, the market considers investment as a positive movement for future firm growth and consequently increases stock return. Corporate investment is essential for firm growth, eventually bringing increased stock returns. If investors are confident that the firm is not overinvesting, a positive investment/return relationship should result. It is found that small firms with high cash flows do not have the same problem of overinvestment as large firms with high cash flows do. In addition, large firms with low cash flows are also not susceptible to overinvestment concerns because they do not have surplus cash to overinvest.

This paper contributes to the literature by being the first full-scale empirical study that shows a positive investment/return relationship when expanding the time frame of cumulative investment as well as investigating firm specific investment patterns. The positive relationship found in this paper and previous negative relationship theories can be seen as complementarily explanations when considered through their different respective time frames.

The study is organized as follows: In section 2, the hypothesis is described. In section 3, the data and outline of the empirical framework is summarized. Section 4, describes the main empirical results in a multiple-year framework. In Section 5, positive investment/return relationships within the one-year window are analyzed. Section 6 summarizes and concludes the study.

2.2. Hypothesis Development

According to classical theory of finance, companies invest with the expectation of increasing their profits for the future as well as expanding business. Market reaction to a firm's capital expenditure decisions depends on the market's assessment of firms' investment opportunities. If firms increase investment over one year, markets have difficulty in determining certainty of the firm's investment value; however, if firms continuously increase investment, markets gain more confidence about the investment value raising the expectation of the future profit. This paper postulates that the announcements of increases in capital expenditures positively affect the returns of firms when markets see valuable investment opportunities when there are cumulative increases in investment. This paper develops a formal hypothesis from these predictions.

Hypothesis: Cumulative firm investment increases occur in the prospect of growth or expansion opportunities. In the response to this investment opportunity, markets react positively.

Empirically, this hypothesis posits that a firm's investment opportunity set is increasing with cumulative investment increase. Overall, the empirical results are consistent with the predictions. By examining the difference between benchmark portfolios return with the test portfolios, Fama-French regression alpha, and short run (some long run) cumulative abnormal returns (CAR) in the event study, the inference can be made that market share reaction to cumulative increase in capital expenditure decisions is positive.

2.3. Data and Empirical Methods

2.3.1 Data

Annual data on all U.S. firms from 1960 to 2009 were obtained from COMPUSTAT and monthly data from CRSP databases. Any missing values of capital expenditure and stock price were removed. Any gap between consecutive years was also removed because of the use of a lagged year value for investment increase in the regression. The data should have the COMPUSTAT book equity and return for year *t-1* because portfolios were sorted based on year *t* size, year *t-1* book to market and return. To reduce the influence of outliers, each variable at the 0.5_{th} and 99.5_{th} percentile has been winsorized.

The COMPUSTAT final sample spans 49 years, 23,871 firms and includes 321,579 yearly observations. The monthly CRSP data has 2,195,006 observations. The financial services industry is excluded from the study. Investment is proxied by capital expenditures. R&D expenses are not considered investment because they are heavily concentrated in the IT industries (Lach and Schankerman, 1989). Hence, the data are not evenly distributed, and for many of the firms, R&D expense data are missing. Multiple analytical methods are utilized including OLS, Fama-Macbeth (1973), fixed effect cross-sectional regression, benchmark portfolio, Carhart model and Event study.

Firms were sorted into several different groups based on accumulated investment change of the last one, two, three, and four years to check each firm's pattern of investment trend. Firms were also sorted by size and cash flow, size and book to market (BM), and size and leverage to check whether overinvestment theory holds in a single-year (or current year). Benchmark portfolios were formed to calculate excess returns or to run the Carhart Fama-French adopted regression based on size, year t-1 book to market and returns.

Summary statistics of the data variables are presented in Table 1. The average lagged investment change ($\text{Investmentchange}_{t-1,\ t-2}$) is around eight percent. The monthly CRSP data mean value of return is about 1.2 percent. The lagged cash flow, lagged Tobin Q, lagged BM and lagged debt-rate, and size all exhibit high variations based on the high standard deviations recorded. Table 2-1 presents correlations among the variables. The correlation between lagged investment change ($\text{Investmentchange}_{t-1,\ t-2}$) and return is negative and reaches almost negative five percent. Tentatively, this negative correlation is consistent with previous results showing a negative association between investment increase and return. Regarding the other correlations of Table 2-1, it can be seen investment is positively correlated with cash flow, debt, Tobin's Q and BM, but negatively correlated with size. This is consistent with the intuitive notion that larger and less financially distressed firms have higher levels of investment activity.

[Insert Table 2-1 here]

2.3.2. Three Empirical Methods

At the end of each June between 1960 and 2009, one-year, two-year, three-year, four-year cumulative investment increase/decrease test portfolios are formed based on the cumulative investment (proxied by capital expenditure) increase. To examine the returns on the test portfolios formed on the basis of cumulated years of investment, I adapt the three empirical methods that Titman, Wei and Xie (2004) used. The first method measures excess returns of test portfolios by comparing them to benchmark portfolios constructed to have very similar size, BM and momentum characteristics. The second method is Carhart's (1997) adaptation of Fama-French method. The third is a short window event study around the company's earnings announcement date.

2.3.2.1. Benchmark Portfolio Method

125 benchmark portfolios are formed that capture three stock characteristics: size, BM and momentum. Starting with July of year *t*, all common stocks are first sorted into quintiles based on each firm's size (SZ) at the end of June of year *t*. Firms in each size quintile are further sorted into quintiles based on their BM ratio at the end of June of year *t-1*. Finally, the firms in each of the 25 size/BM portfolios are sorted into quintiles based on previous year return, calculated through the end of May of year *t*, making a total of 125 portfolios. The value-weighted returns on benchmark portfolios are calculated from July of year *t* to June of year *t+1*. All benchmark portfolios are rebalanced every year. Once these 125 benchmark portfolios are formed, I calculate the excess return. Each stock is assigned to a benchmark portfolio each year according to its rank based on size and previous year BM and return. Excess monthly returns of a particular stock are calculated by subtracting the stock's corresponding benchmark portfolio's returns from the stock's returns. The excess returns on individual stocks are then used to calculate the value-weighted excess monthly returns on test portfolios formed based on the sorting of increase/decrease of investment. The excess returns on test portfolios are called benchmark-adjusted portfolio returns.

2.3.2.2. Carhart four factors

Benchmark-adjusted portfolio returns are regressed on the Carhart four factors to control for factor risk.

$$R_{p,t} = \alpha_p + \beta_{HML,p} R_{HML,t} + \beta_{SMB,p} R_{SMB,t} + \beta_{Mkt,p} (R_{Mkt,t} - Rf_t) + \beta_{PRYR,p} R_{PRYR,t} + \varepsilon_{p,t} ,$$

(3)

Where $R_{p,t}$ is the benchmark-adjusted return on cumulative increased/decreased investment portfolio p in month t, Rf_t is the risk-free rate in month t, R_{HML}, R_{SMB}, and R_{MKT} are Fama and French (1992, 1993) three factors, and $R_{PRYR,p}$ is the return on the high minus low prior-year return momentum portfolio p.

2.3.2.3. Event study

An event test is conducted to account for the possible abnormal returns of grouped firms based on the cumulative number of increase/decrease investment around earnings announcement dates. A check is made to determine if a significant portion of the abnormal performance for the higher number of cumulative investment increase firms over the lower number of cumulative investment increase firms will occur around the earnings announcements.

Stock returns around earnings announcement dates are examined. Specifically, market-adjusted returns are examined over a three-day window (-1, 0, +1) centered on quarterly earnings announcement dates after portfolio formation. The earnings announcement dates are obtained from the COMPUSTAT quarterly industrial database. If excess returns arise because investors have biased expectations, then I expect excess returns to be higher around earnings announcement dates when new information is realized. For each quarter, three-day market-adjusted returns are equally weighted across all stocks in a given portfolio to compute the portfolio's average event date market-adjusted return. These quarterly earnings announcement date market-adjusted returns are then aggregated into annual returns by summing up the four quarterly earnings announcement date market-adjusted returns.

2.4. Results

2.4.1. **One Year Window Results**

Before conducting the test, the relationship between the increase in corporate investment and stock returns in the one-year window is examined. More specifically, this examination is used to determine whether returns on portfolios with lower investments are higher than those with higher investments using the benchmark portfolio method described in 2.3.2.1. First, benchmark portfolios are formed as described in section 2.3.2.1. Next five test portfolios from 1960 to 2011 are formed on the basis of investment levels. Starting with July of year *t*, all stocks are sorted into quintiles based on their year *t-1* investment level measures in ascending order. The firms remain in these test portfolios from July of year *t* to June of year *t+1* and are rebalanced each year. Then the relationship between investment and subsequent stock returns is examined in these test portfolios.

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[Insert Table 2-2A here]

The distributional characteristics of the benchmark-adjusted returns on the investment level sorted portfolios are reported in Table 2-2A. Table 2-2A shows monotonic decrease in portfolio returns in association with an increase in investment, except for the lowest level investment portfolio. The returns on the portfolios with low level investments are higher than those with higher investments; thus our results are very similar to those reported in previous studies (i.e., Titman, Wei and Xie, 2004; Lamont, 2000; etc.) based on the negative relationship between investment and stock returns.

2.4.2. **Multiple-year Window Results**

2.4.2.1. Sorted Groups: Multiple Year Change

The relationship between investment increase and stock return is negative in the one-year window. Next, the relationship between a firm's investment increase and subsequent stock return in the multiple-year window is examined. This is to determine whether the accumulated investment portfolio earns higher returns compared to benchmark portfolios, which are formed based on the rank of last year BM, return and firm size of this year, and then rebalanced each year.

I sort groups based on the number of years of investment increase. Then the number of years with investment changes that occurred within the previous years for each firm is counted. When a firm increases investment spending over the previous year, this is counted as 1, whereas if a firm decreases its investment spending, this is counted as -1. Finally, if a firm's investment remains the same from the previous year, this is counted as 0. Thus, if a firm increases its investment spending in each of the last two years, a value of 2 is recorded to indicate the number of investment changes. The groups are as follows:

(1) N= 4: (Four year consecutive increase group)

(2) N= 3: (Three year consecutive increase group)

(3) N= 2: (Two year consecutive increase group)

(4) N= 1: (One year increase group)

(5) N= -1: (One year decrease group)

(6) N= -2: (Two year consecutive decrease group)

Starting with July of year *t*, I form test portfolios by sorting all stocks into quintiles in year *t-5* to year *t-4* (N=1 or N=-1), year *t-5* to year *t-3* (N=2, or N=-2), year *t-5* to year *t-2* (N=3, or N=-3), or year *t-5* to year *t-1* (N=4, or N=-4), etc., cumulated consecutive increase or decrease in the amount of capital expenditures change.

Before I conduct the empirical tests, accounting variable statistics between increasing and non-increasing investment groups are examined first and shown in Table 2-2B.

[Insert Table 2-2B here]

The table shows mean values for Total Assets, Book to Market (BM), Cash Flow (Income

Before Extraordinary Items plus Depreciation), Total Liability, Net Income, and Market Cap in year *t-1*(pre-year), year *t* (present year), and year *t+1*(post-year) of one time increase in investment group, four times consecutive increase in investment group, and all other firms except the one to four times consecutive increase in investment group. The results show that the increased investment groups (one time and four times increase in investment group) show clearly higher values in almost every accounting variable. The numbers increase almost monotonically with an increase in number of investments. The values of firms' net income, debt, and cash flow are all shown to be increasing. Book to market ratio is also increasing: this might suggest that firms turn into the value firms through cumulative investments from the growth firms. The four years consecutive increase group has a higher value in Market Cap suggesting that larger firms generally continually increase their investments over smaller size firms.

2.4.2.2. Benchmark adjusted portfolio excess return

First, benchmark portfolios are formed as described in section 2.3.2.1. Next test portfolios from 1960 to 2011 are formed based on two-year, three-year, and four-year cumulated investment portfolios as described in section 2.3.2.1. The firms remain in these test portfolios from July of year *t* to June of year *t+1* and are rebalanced each year. Then the relationship between investment and subsequent stock returns is examined in these test portfolios.

[Insert Table 2-3A & 2-3B here]

[Insert Figure 2-1 here]

The distribution characteristics of the benchmark-adjusted returns on the cumulative investment test portfolios are reported in Table 2-3A. It is evident that if the cumulative amount of investment increases, an increase in positive return is realized. In other words, if firms increase investment within consecutive years, the investment increase positively affects stock return.

The spread denotes a zero investment portfolio that has a long position in the second and third highest top two portfolios (N=3 and N=2 portfolios), and a short position in the second and third lowest bottom two portfolios (N=-2 and N=-3 portfolios). The return for this portfolio is calculated by subtracting the sum of the return on the top two portfolios from that of the bottom two portfolios, which is then divided by 2. The mean excess return on the spread portfolio is 0.042, and this is significantly different from zero with a p-value of less than 0.01. The statistics of panel A of Table 2-3 indicates that the better performance of more consecutive investment increased firms is not due to outliers.

In the one-year window, the current year decrease in the investment group (N= -1) yields a much higher mean return (0.015) than the current year increase group (N=1) return (-0.004). The result is consistent with the negative relationship between investment/return in a one year window.

Figure 2-1 shows the year-to-year return (from July 1964 to June 2009) of the spread portfolio (a zero investment portfolio) that has a long position in the second and the third highest top two portfolios (N=3 and N=2 portfolios), and a short position in the second and the third lowest bottom two portfolios (N=-2 and N=-3 portfolios). The spread is calculated by subtracting the sum of returns on the highest two portfolios from that of the lowest two portfolios, and then dividing by 2. Figure 2-1 suggests that the stock returns of firms that increase investment consecutively for two to three years outperform the stock returns of firms that decrease investment two to three years. If an investor holds a stock with consecutive increases in his/her investment portfolio, he/she can earn a 0.042 percent higher return, on average each month, 0.504 percent per year and about twenty two percent higher cumulated return if he/she holds the portfolio for 45 years from 1964 to 2009.

A close look at the year to year performance of the spread portfolio in Figure 2-1 reveals that the stock returns of firms that increase investment consecutively tend to outperform firms that decrease investments in about two thirds of the years. The year to year returns strongly outperform particularly in years 1970, 1979-1980, 1991, 2003 and 2007-2009. During economic recession, the stock returns of firms that increase investment cumulatively tend to strongly outperform firms that decrease investments. This return pattern is not very likely to occur purely due to chance, which is supported by a formal t-test on the null hypothesis that the chances of having a positive or a negative annual return on the spread portfolio are 50-50.

To test the original hypothesis, test portfolios are formed by sorting the same firm stocks (2,303 firms) into quintiles on the increase in capital investment in year *t-5* to year *t-4, one year increase*, in year *t-5* to year *t-3*, *two year consecutive increase*, year *t-3* to year *t-2, three year consecutive increase*, and year *t-5* to year *t-1,* four year, consecutive increase starting with July of year *t*. Year *t-1* to year *t* investment change is not included because the most current year *t* investment change shows negative investment/return relationship as in the case of N=1 and N=-1 portfolios in Table 2-3A. The panel B of Table 2-3 presents these results. Panel B shows the test portfolio's benchmark-adjusted mean return increases monotonically with the increase of capital investments as in Table 2-3A. The statistics of spread portfolio (The difference between N=4 and N=1) is 8.3% and p-value is significant.

2.4.2.3. The Carhart Four-Factor Model

To control for factor risk, benchmark-adjusted portfolio returns were regressed using the Carhart four-factor model. The results are reported in Table 2-4.

[Insert Table 2-4 here]

The Carhart alpha series is defined as the estimated intercept plus residuals. The results again show that the consecutive increase in the investment group yields the highest alpha (0.042 and 0.023). The Carhart four-factor model shows the decrease of alpha with the increase in the amount of investment except N=1. N=-1(0.012) is higher than N=1(0.006) in the one year window as expected. The mean of excess return on the spread portfolio (The difference between highest two portfolios and lowest two portfolio returns is divided by 2) is 0.108 and is significantly different from zero with a p-value of less than 0.097. The F-values of Wilks' Lambda statistics (F value=1.68 and p-value of 0.102) are used to test that the means are equal across the test portfolios, and the results again confirmed this significant difference. The results indicate that firms which increase investment realize higher stock returns than firms that decrease investment after controlling for the Carhart four factors. A further inspection on the mean excess returns indicates that underperformance from decreased investment portfolios and outperformance from increased investment portfolios is not symmetric. Portfolios with positive gains increased by ((0.042+0.023)/2=0.033) per month, while portfolios with losses decreased by ((-0.082+-0.079)/2= -0.081) per month. Increasing portfolios earn, on average, a return of about

0.113% (p-value 0.097) or 1.36% per year more than decreasing portfolios.

2.4.2.4. Event study

An event test is conducted to account for the possible abnormal returns of grouped firms based on the cumulative number of increase/decrease in investment around earnings announcement dates. If the original hypothesis holds true, a significant portion of the abnormal performance for the higher number of positive cumulative investment increase firms over the lower number of negative cumulative investment increase firms will occur around the earnings announcements. At the end of each June between 1964 and 2009, one-year, two-year, three-year and four-year cumulative investment increase/decrease portfolios are formed based on the cumulative investment increase

I examined stock returns around earnings announcement dates. Specifically, I assessed the market-adjusted returns over a three-day window (-1, 0, +1) centered on quarterly earnings announcement dates after portfolio formation. The earnings announcement dates were obtained from the COMPUSTAT quarterly industrial database. If excess returns rose because investors had biased expectations, then it is expected that the excess returns would be higher around earnings announcement dates when new information became available. For each quarter, the three-day, market-adjusted returns were equally weighted across all stocks in a given portfolio to compute the portfolio's average event date market-adjusted return. These quarterly earnings announcement date market-adjusted returns were then aggregated into annual returns by summing up the four quarterly earnings announcement date market-adjusted returns. Table 2-5A presents the annual earnings announcement date market-adjusted returns (event returns).

[Insert Table 2-5A here]

[Insert Table 2-5B here]

The panel A of Table 2-5 shows abnormal returns around announcement dates. Abnormal cumulated mean return (CAR) is calculated as:

$AR_{it} = R_{it} - E(R_{it})$

Where *AR* represents the abnormal return for firm *i* in period *t*, R_{it} and $E(R_{it})$ are returns on the test and control firms, respectively. CAR increase is unidirectional, with the increase noted in the cumulative increase in investment, with the exception of the one-time negative group (N= -1). The table reveals a pattern of announcement date market adjusted returns that are consistent with the pattern reported in Table 2-3 and 2-4. Again if the cumulative amount of investment increases, an increase in CAR is realized. When firms increase investment consecutively, it positively affects stock return.

To examine stock returns around earnings announcement dates on cumulative consecutive increase/decrease in capital expenditures portfolios that include the same stock (total 2,303 firms) at different times in the sequence of consecutive increase in investment, an event test was performed on the test portfolios. Panel B of Table 2-5 presents the results. Panel B shows the test portfolio's CAR jumps up with the increase of capital investments from the first to second increase. P-value is significant. In pre- and post- portfolio formation year, the equally weighted CAR event returns for each portfolio are presented also in panel B. They also show unidirectional increase with the increase in number of capital expenditure investments. The CARs for N=1 group in year -1, year +1, and year +2, are -85.95%, -86.47%, and 19.61% respectively. The CARs for N=4 group are, -63.47%, -50,74% and 98.91% respectively. The N=4 group shows a higher CAR than N=1. This shows that during the two years following up to the announcements of the increase of the investment, CAR increases almost five times. During the one year leading up to the announcements, CARs increase about 20%.

Three empirical results support my hypothesis that the market responds positively to firms' cumulative investment increase because growth opportunities are increasing with the number of increases.

2.4.3. Robustness Check

In section 2.4.1, the negative association with stock returns and increase in investment was shown. The returns on the portfolios with low level investments are higher than those with higher investments. However the results are also shown to be limited in a one year window and that for firms which continually increase investment, the relationship turns out positive. In this section, whether investment level is positively related to stock returns is tested in the two to three-year consecutive increase portfolio groups. Test portfolios from 1964 to 2009 were formed from three-year cumulated investment portfolios (N=2 and N=3). The relationship between investment and subsequent stock returns was the examined in these test portfolios. The firms remained in these portfolios from July of year *t* to June of year *t +1* and were rebalanced each year.

[Insert Table 2-6 here]

Table 2-6 shows the positive relationship between investment level and subsequent stock returns. This can be used as further evidence to show that cumulative investment increase positively affects stock returns.

2.4.4. Time Series Regression

In line with the original hypothesis, a cross-sectional time series regression is conducted with stock returns as the dependent variable; the independent variables are: average cumulative investment change, last year free cash flow, last year Tobin's Q, last year total liabilities to total assets, size and book to market (BM). The model has the following form:

$$Ret_t=\beta_1+\beta_2\frac{3(I_{t-1}-I_{t-2})}{(I_{t-1}+I_{t-2}+I_{t-3})}+\beta_3 CF_{t-1}+\beta_4 TobinQ_{t-1}+\beta_5 Debtratio_{t-1}+\beta_6 Size_{t-1}+\beta_7 BM_{t-1}+u \qquad (1)$$

In the equation above, β_1 is constant, *I* represents investment (capital expenditure deflated by net property, plant and equipment at the beginning of the fiscal year following previous studies; i.e., Kaplan and Zingles,1997; Baker, Stein and Wurgler, 2003; etc.). *CF* represents cash flow, that is, earnings before extraordinary items plus depreciation is divided by lagged fixed asset, *TobinQ* ratio is calculated as the market value of a company divided by the firm's total assets, *Debt-ratio* represents total liabilities to total asset, *Size* represents market cap, and *BM* represents book to market. A firm's market equity is defined as its price multiplied by the number of shares outstanding, and its market size is measured as the market equity at the end of June of year *t*. The book to market equity ratio of a firm is computed as the ratio of the book equity of a firm to the firm's market equity at the end of year *t-1*. Book equity is defined as the COMPUSTAT book value of stockholders' equity. Ordinary least squares (OLS), Fama-MacBeth and unbalanced panel fixed effects are used as estimation techniques. The *investment change ratio* is calculated as the change in capital expenditure over the three-year averaged capital expenditure ($\frac{3(I_{t-1} - I_{t-2})}{(I_{t-1}+I_{t-2} + I_{t-3})}$), using the capital expenditure change from year 't-2' to year 't-1' as the numerator, which is a measure of the relative change in capital expenditure. This is a method of smoothing the volatility of capital expenditure using the three-year average. One period lagged variable is utilized. Porter (2005) states correlations between investment/return are higher between lagged investment growth and equity returns than that with contemporaneous equity returns. Lamont (2000) states that investment is generally decided one year in advance. This lagged process generates implications for the time-series properties of investment and stock returns. For this same reason the lagged cash flow, lagged Tobin's Q and lagged debt-ratio are utilized. This regression identifies cross-sectional variation in returns, which is correlated with investment, and controls for investment opportunities (Tobin's Q) and financial slack (cash flow and debt-ratio). Thus, the regression ties return predictability to firm investment behavior.

To control for unobservable individual firm effects and time effects, a panel fixed regression is also run.

$$Ret_{i,t}=b_1+\lambda_t+b_2\frac{3(I_{i,t-1}-I_{i,t-2})}{(I_{i,t-1}+I_{i,t-2}+I_{i,t-3})}+b_3CF_{i,t-1}+b_4TobinQ_{i,t-1}+b_5Debtratio_{i,t-1}+b_6Size_{i,t-1}+b_7BM_{i,t-1}+\mu_i+\varepsilon_{i,t} \qquad (2)$$

λ_t is a set of year dummies that control for possible differences in the macroeconomic environment of each year, μ_i is the individual effect of the firm i and ε_i is the error term.

A regression analysis is conducted with stock return serving as the dependent variable, and each company's years of investment change, last year cash flow, last year total liabilities to total assets, last year Tobin's Q, last year market-cap, and last year's BM as the independent variables. Cash flow and debt-ratio variables were used to assess the liquidity of the firms, and Tobin's Q variables are used to check for investment opportunity. The presumption is that the higher the coefficient number, the more the accumulated investment positively affects the firm's stock returns. Table 2-7 and 2-8 provide the results from OLS and Fama-Macbeth's (1973) cross-sectional analysis.

[Insert Table 2-7 here]

[Insert Table 2-8 here]

Table 2-7 and Table 2-8 show that a company's returns are a positive function of investment changes in firms that have increased their investment spending consecutively. Table 2-7 monthly stock return OLS regression results show that the beta of investment change in year 't-4', year 't-3' (N=1), year 't-4' to year 't-2' (N=2), year 't-4' to year 't-1'(N=3), year 't-4' to year 't' (N=4) increases monotonically with consecutive increase in capital investments. The Fama-Macbeth yearly stock return regression results noted in Table 2-8 summarize the betas of the *annual* investment changes in the previous year for each group. The two-year consecutive investment increase group (N=2 group) exhibits the highest beta coefficient (2.016). The one-year increase group (N=1 group) shows the negative number coefficient (-0.562). On the contrary, the one-time decrease group (N= -1group) shows a positive coefficient (0.231). An increase in investment in the current year yields a negative coefficient. The beta of the two year consecutive increase group (N=2) is 2.017 which is high and significant. The second year returns on these types of stocks are large enough to recover the first year loss ((-0.562+ 2.016)/2=0.727). This is different from previous studies (Lamont, 2000; Wurgler, 2003; Titman, Wei and Xie, 2004; etc.) that show the greater the investment, the more negative the return in the long run–even 5 years after the investment increase (Titman, Wei and Xie, 2004).

In conclusion, if firms increase their investments over the years continuously, the investment/return relationship becomes positive. Capital markets consider this cumulative increase as a positive signal for future growth, not as an indicator of overinvestment. My results contradict with previous studies, which find that greater investment is translated into greater negative returns.

2.5. No Overinvestment Concern: Positive Investment/Return Relationship

Overinvestment theory predicts that the negative capital investment/return relation is stronger for firms with higher cash flows, which have a higher tendency to overinvest. Titman, Wei and Xie (2004) showed the relation between cash flow and the negative capital investment/return relation is stronger for these types of firms and also for large firms. Conversely, overinvestment theory predicts that if firms are highly cash constrained or small, the negative relationship between investment increase and returns is less severe. Titman, Wei and Xie (2004) claim the investment and return relationship is negative—more investment means more negative returns. They claim that mean excess returns are monotonically decreased with capital investments.

In the following section, this paper attempts to show that the investment/return relationship is positive when overinvestment becomes less probable. For example, if large firms do not have enough cash flow, investors are less concerned about overinvestment and hence there is a positive relationship. If small firms have high cash flows or lower debt, the investment/return relationship is again positive because investors do not worry about the possibility of overinvestment as much as large firms. Small firms do not have the same luxury as large firms do because they have to survive first or struggle to grow to become a larger firm. Apparently, overinvestment theory—firms with more cash flow will be predicted to overinvest more—does not hold for small firms. For small firms, high cash flows results in greater investor confidence in firm investment increase. Therefore, to investors, small firms' overinvestment is not as serious a problem as it is to large firms. The hypothesis is tested by running a fixed effect regression on 1) size/free cash flow, 2) size/book to market, 3) size/debt-ratio sorted portfolios. The benchmark adjusted excess return and alpha is also calculated by running the Carhart four-factor model regression.

2.5.1. Regression on Groups Sorted by Size, Free Cash Flow and Investment

Data is sorted to check for a positive investment/return relationship when there is no overinvestment concern. Stocks are first sorted based on size and divided into two groups; large and small, then divided each into five quintiles based on free cash flow (FCF) from highest to lowest. FCF is measured as operating income before depreciation, minus interest expenses, taxes, preferred dividends and common dividends, and is scaled by total assets. FE regression is run on the ten groups of portfolios to find whether the low and high FCF firms will have a positive capital expenditure/return relationship.

[Insert Table 2-9A here]

Table 2-9A fixed effect regression results show that, for large firms, low FCF are positive on stock returns: the beta is 0.053 for large firms and is significant. It does not appear in fixed effect regression; however, when OLS is run, which is not reported here because of space limitations, for small firms, high free cash flow firms show positive results on stock returns; the beta is 0.033(OLS) and significant also. As expected, for small firms, investors have somewhat more confidence in affluent internal cash flow firms than in large firms. Apparently, to investors, small firms' overinvestment is not as serious a problem as large firms' overinvestment is. For large firms, low cash firms will not have overinvestment concerns so a positive relationship is predicted. FE results show that large and low cash firms show positive results as expected, although p-value is not significant.

The difference between small and large firms has been widely studied. Compared to large firms, small firms are, in general, less liquid, exhibit more volatile cash flow and profits, and rely more heavily on short-term debt finance (Peel *et al*., 2000). Moreover, it is the smaller firms that are most likely to be subject to financial distress (Titman and Wessels, 1988) and financial restrictions (Fazzari and Petersen, 1993; Whited, 1992). Investment is sensitive to the availability of cheap internal funds. Because many small firms face capital constraints (e.g., Peterson and Rajan, 1994 and 1995; Cole, 1998; and Danielson and Scott, 2004), the desire to preserve financial flexibility can be especially important to small business owners.

To further test whether or not FCF has any effect on the positive investment/return relationship, two portfolios are formed based on size: large and small; and then each portfolio is again sorted based on FCF. Thus, ten test portfolios are formed based on size and FCF. Each portfolio is again sorted based on investment as follows. Starting with July of year *t*, we place all stocks into two groups according to their year *t-l* size. Within each size group, stocks are equally sorted into five quintiles based on FCF, and then each of the ten portfolios is divided again into higher investment and lower investment groups. As a result, there are a total of twenty portfolios based on size, FCF and investment. The returns of a particular stock are adjusted for its corresponding benchmark portfolio return. Each portfolio's value-weighted monthly excess returns from July of year *t* to June of year *t+1* are then calculated and are rebalanced in June of year *t+1* each year. Forming portfolios in this manner helps determine whether there is a differential pattern between low and high investment firms after controlling for the firm characteristics. Portfolio returns are also regressed on the Carhart four factors to control for risk. Table 2-9B presents the monthly mean excess returns, the regression results on the twenty characteristic-adjusted size, FCF, and investment from year 1960 to 2009.

[Insert Table 2-9B here]

The benchmark-adjusted mean return results of Table 2-9B reveals that higher investment show higher and more positive returns than lower investment in the case of small firms with higher cash flow, and large firms with lower cash flow. This contradicts the Titman, We and Xie (2004) prediction that higher investment firms have more negative returns monotonically; however, it confirms the original prediction that for small and high cash flow firms or large and low cash flow firms, there is a positive investment/return relationship.

In conclusion, Table 2-9A and 2-9B show that large firms within lower cash groups or small firms with medium to high cash groups show a positive relationship between investment and returns as expected.

2.5.2. Sorted by size and BM

Next, a firm's BM growth rate is examined to see whether it affects the positive return\investment relationship. Groups are sorted by size and BM into ten groups. First, they are divided based on size, large and small, and then divided into five quintiles based on BM from highest to lowest. The regression is run on these ten groups of data.

[Insert Table 2-10A here]

Table 2-10A indicates that small firms with high BM companies show a positive relationship (0.249) between capital expenditure/return. Capital markets probably have more confidence in firm managers' decisions on investment when growth rate is low, in other words, in the case of small firms they are considered value firms.

Subsequently, twenty test portfolios are formed based on size, BM and investment as follows. Starting with July of year *t*, all stocks are placed into two groups according to their year *t* - *l*'s size. Within each size group, stocks are equally sorted into five quintiles based on BM, and then each of the ten portfolios is divided again into high investment and low investment groups. As a result, there are a total of twenty portfolios based on size, BM and investment. The returns of a particular stock are adjusted for its corresponding benchmark portfolio returns. Each portfolio's value-weighted monthly excess returns from July of year *t* to June of year *t+1* is then calculated, and then rebalanced in June of year *t+1* each year starting from 1964 to 2009. Forming portfolios in this way helps determine whether there is a differential pattern between low and high investment firms. Portfolio returns are also regressed on the Carhart four factors. Table 2-10B presents the monthly mean excess returns and Carhart alpha, the regression results on the tInty characteristic-adjusted size, cash flow and investment.

[Insert Table 2-10B here]

Benchmark adjusted return and Carhart alpha results shows that for small firms, high BM firms have a positive investment/return relationship and t-value is significant. This confirms the previous fixed effect regression result. In conclusion, in case of small firms, investors favor high BM firms on increasing in investment possibly because small size constraint makes investors do not concern management teams' overinvestment possibility. This is not the case for large firms.

2.5.3. Sorted by size and debt-rate

Here, whether the debt-rate of the firm affects the positive return/investment relationship is examined. The group is sorted by size and debt-rate into ten groups. First they are divided based on size; large and small, then divided into five groups based on debt-rate from highest to lowest. A regression is run on these ten groups.

[Insert Table 2-11A here]

Table 2-11A shows that, for small firms, the second lowest debt-rate group shows positive results on stock returns: the beta is 0.532. P-value is significant. Again, it is interesting that extreme low debt firms do not show a positive result. For small firms, it seems investors have somewhat more confidence on lower debt firms than on extreme low debt or high debt firms.

Finally, twenty test portfolios are formed based on size, debt-rate, and investment as follows. Starting with July of year *t*, we place all stocks into two groups according to their year *t - l'* size. Within each size group, stocks are equally sorted into five quintiles based on debt-rate and then each of the ten portfolios is divided again into high investment and low investment groups. As a result, there are a total of twenty portfolios based on size, debt-rate and investment. The returns of a particular stock are adjusted for its corresponding benchmark portfolio returns. Each portfolio's value-weighted monthly excess returns from July of year t to June of year *t+1* are then calculated, and then rebalanced in June of year *t+1* each year. Forming portfolios in this way, it can be determined whether there is a differential pattern between low and high investment firms. Portfolio returns are also regressed on the Carhart four factors to control for risk. Table 2-11B presents the monthly mean excess returns and FF alpha, and regression results on the twenty characteristic-adjusted size, debt-rate and investment.

[Insert Table 2-11B here]

Benchmark adjusted return and Carhart results show, for small firms, lower debt-rate firms have a positive investment/return relationship as expected. Large firms in the lower debt-rate group also show a positive relationship between investment and return; the higher investment group has more positive returns.

2.5.4. Section 5 Conclusion

It is postulated that overinvestment theory predicts small size and high cash constrained firms will have fewer overinvestment tendencies. This study showed a somewhat different result. A positive relationship between capital expenditure increase and stock returns is shown in lower cash holding large firms. Small firms with a moderate to high amount of cash also have a positive response from the capital market to their investment increase decisions. Small firms with high BM have a positive response as well. High BM indicates small firms as value firms with high cash flow. Thus high BM results correspond with the previous results of small firms with high cash flow. In the case of small firms, lower (though not extremely low) debt firms more likely have a positive investment/return relationship, perhaps because lower debt means the company has greater stability. Thus, this paper concludes that capital markets take some signals as positive as in the case of large firms with low cash or small firms with significant cash.

2.6. Conclusion

This paper demonstrates a positive relationship between investment/return in two cases. The first is when the firm specific investment pattern is analyzed over the past several years, instead of a one-year period or with concurrent time. The overinvestment concern of previous studies mostly applies within the one-year time horizon.

A positive relationship exists when firms increase investment consecutively over past years. Investors consider the increase of investment positively because of the possibility of potential growth or expansion. Markets seem to consider this as a positive signal in that firm management teams have some determination of future expected profit. Empirical results show a consecutive increase of return with increases in capital expenditures. This paper's Investment Opportunity Hypothesis explains investor behavior in multiple year windows.

Within the one year window, capital expenditure investment increases positively affect stock returns if investors have confidence that overinvestment will not occur or see some possibility of growth. Large firms with low levels of cash as well as small firms with high level of cash, small value stock firms, show a positive investment/return relationship. These types of firms reduce overinvestment concern either because of cash constraint or small size. The same is found when small firms do not carry a lot of debt.

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Table 2-1
Summary Statistics of Variables

Summary statistics of stock returns, investment, investment change, last year free cash flow, last year Tobin's Q, last year debt rate, *size,* and *BM*. Data are obtained from the COMPUSTAT and CRSP database from 1960 to 2009. Dependent variable *ret* is monthly stock return. *Investment* represents capital expenditure, which is deflated by net property, plant, and equipment at the beginning of the fiscal year. Investchange is calculated as last year investment change over three year averaged investment ($3(I_{t-1} - I_{t-2})/(I_{t-1} + I_{t-2} + I_{t-3})$). *CF* is calculated as earnings before extraordinary income plus depreciation divided by lagged fixed asset. *Tobin's Q* is calculated as the market value of a company divided by the firm's total assets. Debt-rate is total liabilities to total assets. *Size* represents market cap, *BM* represents book to market.

Panel A: Summary Statistics

Variable	N	Mean	Median	StdDev
ret_t	1983051	0.012	0.000	0.2
$Investment_t$	1799956	1.069	0.209	42.7
$Investchange_{t-1, t-2}$	1847549	0.081	0.000	1.0
CF_{t-1}	1810655	327.737	0.197	18102.3
$Tobinq_{t-1}$	1982175	11.017	0.828	788.2
$Debt\_rate_{t-1}$	1975280	605.713	0.481	54991.6
$Size_{t-1}$	2031941	1406.106	61.268	10071.8
BM_{t-1}	1951631	-12.379	0.273	5957.08

Panel B: Correlations among the Variables of Interest

	Ret_t	$Investchange_{t-1,t-2}$	CF_{t-1}	$Tobinq_{t-1}$	$Debt\_rate_{t-1}$	$Size_{t-1}$
$Investchange_{t-1,t-2}$	-0.054	1.000				
	(<.0001)					
CF_{t-1}	0.006	0.017	1.000			
	(0.009)	(<.0001)				
$Tobinq_{t-1}$	0.001	0.000	0.000	1.000		
	(0.661)	(0.923)	(0.956)			
$Debt\_rate_{t-1}$	0.013	-0.004	0.309	0.024	1.000	
	(<.0001)	(0.060)	(<.0001)	(<.0001)		
$Size_{t-1}$	-0.032	0.012	-0.002	0.000	-0.004	1.000
	(<.0001)	(<.0001)	(0.250)	(0.988)	(0.045)	
BM_{t-1}	0.004	-0.001	-0.002	0.000	-0.005	0.000
	(0.073)	(0.768)	(0.354)	(0.989)	(0.010)	(0.869)

Table 2-2A
Mean Excess Returns on the Investment Level Sorted Portfolios:
July 1960 to June 2009

Table 2-2A presents the distribution of excess returns on five investment level sorted portfolios from 1960 to 2009. The statistics include the monthly mean of excess returns. At each June of year *t*, all stocks are sorted into quintiles based on their cumulative increase in investment measures in ascending order of investment portfolios. Value-weighted monthly excess returns on a portfolio are calculated from July of year *t* to June of year *t+1*, where the excess return on an individual stock at time *t* is calculated by subtracting the characteristics-based benchmark portfolio's return from the stock's return at time *t.* All portfolios are rebalanced each year.

INV	means	STD	Maxi	Median	Min
Lowest	-0.023	0.001	0.356	-0.031	-0.442
1	0.061	0.002	0.854	0.042	-0.671
2	0.028	0.002	0.358	0.052	-1.245
3	0.020	0.001	0.578	0.022	-0.178
Highest	-0.035	0.002	0.449	-0.050	-0.285

Table 2-2B

Comparison of Accounting Variables among Firms that Increased Investments One Time, Four Times Consecutively, as well as the No-Increase Group: July 1960 to June 2009

Table 2-2B presents the mean of accounting variables in year *t-1*(pre-year), year *t* (present year), and year *t+1*(post-year) of the: One time investment increase group, four times consecutive increase in investment group, and all other firms except the one to four times consecutive increase in investment group. The accounting variables shown are: Total Assets, Book to Market (BM), Cash Flow (Income before Extraordinary Items plus Depreciation), Total Liability, Net Income, and Market Cap. The measurement unit is millions of dollars except in BM.

All Firms except the one to four times consecutive increase in investment group

Year	Total Asset	BM	Cash Flow	Liability	Net Income	Market Cap
Pre	1299.4	-151.1	104.5	790.4	44.6	1761.7
present	1292.7	-168.8	104.7	794.0	43.4	1677.9
post	1247.1	-157.6	108.4	824.5	44.6	1700.2

One time Investment Increase Group

Year	Total Asset	BM	Cash Flow	Liability	Net Income	Market Cap
Pre	1644.1	-8.2	131.2	956.1	73.6	886.1
present	1915.7	-43.1	141.5	954.0	101.2	1666.1
Post	2217.5	119.1	153.7	1095.4	123.2	3298.2

Four Times Investment Increase Group

Year	Total Asset	BM	Cash Flow	Liability	Net Income	Market Cap
Pre	2523.6	15.8	155.8	1169.1	150.9	4931.8
present	2931.7	16.8	159.7	1263.7	177.2	7450.0
Post	3415.0	117.0	174.5	1384.0	184.2	7843.4

Table 2-3A
The Distribution of Excess Returns on Test Portfolios from 1960 to 2009

Table 2-3A presents the distribution of excess returns on consecutive increases or decreases in capital investment portfolios from 1960 to 2009. The statistics include the monthly mean excess returns (Mean), standard deviation (StdDev), the maximum (Max), the 75th percentile (Q3), the median (Median), the 25th percentile (Q1), and the minimum (Min) of the excess returns. At each June of year *t*, all stocks are sorted into quintiles based on their cumulative increase in investment the last two years, three years, and four years measured in ascending order of investment portfolios. Value-weighted monthly excess returns on a portfolio are calculated from July of year *t* to June of year *t + 1*, where the excess return on an individual stock at time *t* is calculated by subtracting the characteristic-based benchmark portfolio's return from the stock's return at time *t*. All portfolios are rebalanced each year. The spread denotes a zero investment portfolio that has a long position in the second and the third highest top two portfolios (N=3 & N=2), and a short position in the second and third lowest bottom two portfolios (N= -2 & N= -3). The return for this portfolio is calculated by subtracting the sum of the return on the highest two portfolios from that on the two lowest portfolios, and then divided by 2. The F-values of Wilks' Lambda statistics is for the test of means to be equal. * and ** represent significance at the 0.10 and 0.05 levels, respectively.

N= 3: Three year consecutive increase in investment
N= 2: Two year consecutive increase in investment
N= 1: One year increasein investment
N= -1: One year decrease in investment
N= -2: Two year consecutive decrease in investment
N= -3: Three year consecutive decrease in investment

Test Portfolio	Mean	StdDev	Max	Q3	Median	Q1	Min
N= 5	0.065	0.249	0.513	0.228	-0.008	-0.058	-0.391
N= 4	0.043**	0.144	0.370	0.101	0.025	-0.057	-0.443
N= 3	0.032**	0.142	0.560	0.102	0.009	-0.034	-0.339
N= 2	0.021**	0.160	0.956	0.055	0.008	-0.043	-0.252
N = 1	-0.004**	0.058	0.174	0.014	-0.002	-0.034	-0.245
N= -1	0.015**	0.082	0.447	0.035	0.016	-0.010	-0.186
N= -2	-0.010*	0.091	0.148	0.023	-0.010	-0.061	-0.305
N= -3	-0.021*	0.085	0.170	-0.003	-0.023	-0.074	-0.330
Spread	0.042						
P-value	(0.009)						
Wilk's P-lambda	1.06						
p-value	(0.038)						

Table 2-3B
The Distribution of Excess Returns on Four Year Consecutive Increase in Capital Investment Portfolios that are composed of the Same Firms

Table 2-3B presents the same firms' distribution of excess returns on consecutive increases in capital investment portfolios in different years from 1960 to 2009. The statistics include the monthly mean excess returns (Mean), standard deviation (StdDev), the maximum (Max), the 75th percentile (Q3), the median (Median), the 25th percentile (Q1), and the minimum (Min) of the excess returns. At each June of year *t*, all stocks are sorted into quintiles based on their cumulative increase in investment the last one year, two years, three years, and four years measured in ascending order of investment portfolios. Value-Weighted monthly excess returns on a portfolio are calculated from July of year *t* to June of year *t + 1*, where the excess return on an individual stock is calculated by subtracting the characteristic-based benchmark portfolio's return from the stock's return. All portfolios are rebalanced each year. The spread denotes a zero investment portfolio that has a long position in the highest top portfolio (N=4), and a short position in the lowest bottom portfolio (N=1). The return for this portfolio is calculated by subtracting the return on the lowest portfolio from that on the highest portfolio. The F-values of Wilks' Lambda statistics is for the test of means to be equal. * and ** represent significance at the 0.10and 0.05 levels, respectively.

N= 4: Four year consecutive increase in investment (year t-5 to year t-1)
N= 3: Three year consecutive increase in investment (year t-5 to year t-2)
N= 2: Two year consecutive increase(year t-5 to year t-3)
N= 1: One year increase(year t-5 to year t-4)

Test Portfolio	Mean	StdDev	Max	Q3	Median	Q1	Min
N= 4	0.082**	0.301	1.318	0.112	-0.003	-0065	-0.317
N= 3	0.064**	0.468	2.967	0.079	-0.005	-0.057	-0.423
N= 2	0.055**	0.385	2.233	0.124	0.022	-0.056	-0.687
N = 1	-0.005*	0.417	0.679	0.090	0.017	-2.499	-0.038
Spread	0.0829						
P-value	(0.027)						

Table 2-4
Regression Results for the Cumulative Increased/Decreased Investment Portfolio Returns on the Carhart Four Factors (July 1960 to June 2009)

Table 2-4 shows the estimates of Carhart Alpha from the following regression model:

$R_{p,t}= \alpha_p + \beta_{HML,p}R_{HML,t}+ \beta_{SMB,p}R_{SMB,t}+\beta_{Mkt,p} (R_{Mkt,t}- Rf_t) + \beta_{PRYR,p}R_{PRYR,t}+ \varepsilon_{p,t}$

The dependent variable $R_{p.t}$ is the excess return on a given cumulative increase/decrease investment portfolio p in month t, Rf_t is the risk-free rate in month t. $R_{HML,t}$ is the return on the HML(High minus Low) factor portfolio. $R_{SMB,t}$ is the return on the SMB (Small minus Big) size factor portfolio. $R_{Mkt,t}$ is the return on the Mkt (Market) factor portfolio. $R_{PRYR,t}$ is the return on the PRYR (High minus Low prior year return) momentum portfolio. The Carhart alpha series is the estimated intercept plus the residuals. The spread denotes a zero investment portfolio that has a long position in the top two portfolios and a short position in the second and third bottom two portfolios. The F-values of Wilks' Lambda statistics is for the test of means to be equal

Portfolios	Excess Return Means	Carhart Alpha
N= 3	0.028*	0.042**
N= 2	0.016**	0.023**
N= 1	0.004	0.006***
N= -1	0.015*	0.012***
N= -2	-0.010**	-0.082***
N= -3	-0.021*	-0.079***
spread	0.055	0.113
P-value	(0.009)	(0.097)
Wilk's P-Lambda	1.06	1.68
P-value	(0.038)	(0.102)

Table 2-5A
Annual Cumulative Earnings Announcement Date Returns on Consecutive Increase/Decrease Investment Portfolios

At the end of each June between 1960 and 2009, two-year, three-year, four-year cumulative investment increase/decrease portfolios are formed based on the cumulative investment increase. Table 2-5A contains equally weighted earnings announcement date returns (event returns) for each portfolio. These are measured quarterly over a three-day window (1, 0, +1) around the announcement date and are then summed up over the four quarters. The spread is a zero-cost portfolio that has a $1 long position in the lowest two investment portfolios and a $1 short position in the highest two investment portfolios, and then divided by 2.

Portfolios	**Event Study Abnormal Cumulative Mean Return**
N= 4	1.27**
N= 3	0.94***
N= 2	0.83***
N= 1	0.58***
N= -1	0.71***
N= -2	0.54***
spread	0.48
P-value	(0.032)

Table 2-5B
Annual Cumulative Earnings Announcement Date Returns on Consecutive Increase/Decrease of Investment Portfolios that are comprised of the Same Firms

At the end of each June between 1960 and 2009, two-year, three-year, four-year cumulative investment increase/decrease portfolios are formed based on cumulative investment increase. The portfolios are composed with the same firms. The spread is a zero-cost portfolio that has a $1 long position in the lowest two investment portfolios and a $1 short position in the highest two investment portfolios, and then divided by 2. Table 2-5B contains equally weighted earnings announcement date returns (event returns) for each portfolio. These are measured quarterly over a three-day window (1, 0, +1) around the announcement date and are then summed up over the four quarters.

Portfolios	**(-1, 0 +1) CAR**	**Year -1 CAR**	**Year +1 CAR**	**Year +2 CAR**
N=4	9.58%**	-63.47%	-50.74%	98.91%
N=3	9.58%**	-90.47%	-50.72%	98.00%
N=2	6.19%**	-86.23%	-78.16%	98.76%
N=1	0.58%**	-85.95%	-86.47%	19.61%
Number of Firms	2,303			
Spread	9.00			
p-value	(0.028)			

Table 2-6
Robustness Check
The Excess Returns and Carhart model intercept reports on two to three year increase (N=2 and N=3) in Capital Investment Portfolios from 1960 to 2009

Table 2-6 presents the distribution of excess returns on two to three consecutive increases/decrease in capital investment portfolios from 1960 to 2009. At each June of year *t*, all stocks are sorted into quintiles based on their cumulative increase in investment the last two years, three years, and four years measured in ascending order of investment portfolios. Value-weighted monthly excess returns on a portfolio are calculated from July of year *t* to June of year *t +1*, where the excess return on an individual stock at time *t* is calculated by subtracting the characteristic-based benchmark portfolio's return from the stock's return at time *t.* All portfolios are rebalanced each year. The spread denotes a zero investment portfolio that has a long position in the highest portfolio, and a short position in the lowest bottom portfolio.

Investment Portfolio	Excess Return	Carhart Alpha
Lowest	-0.032	-0.333***
1	-0.047**	-0.224*
2	0.297**	0.048*
highest	0.020	0.161
Spread	0.052	0.285
t-value	(-0.097)	(-0.104)

Table 2-7
Two-year Investment Increased/Decreased group OLS Result

Table 2-7 reports the results from OLS cross-sectional monthly stock-return regressions on four test portfolios. The independent variables include last year investment changeover three-year averaged investment, cash flow, Tobin's *Q,* debt ratio (firm size, BM). The regression model has the following form:

$$Ret_t=\beta_1+\beta_2\frac{3(I_{t-1}-I_{t-2})}{(I_{t-1}+I_{t-2}+I_{t-3})}+\beta_3CF_{t-1}+\beta_4TobinQ_{t-1}+\beta_5Debtratio_{t-1}+\beta_6Size_{t-1}+\beta_7BM_{t-1}+u$$

β_1 is constant, *I* represents gross capital expenditures, *CF* represents cash flow that is earnings before extraordinary items plus depreciation is divided by lagged fixed asset, *Tobin's Q* ratio is calculated as the market value of a company divided by the firm's total assets*, Debtratio* represents total liabilities to total asset, *Size* represents market cap, and *BM* represents book to market. P-values are in parentheses

N= 4: Four year consecutive increase in investment
N= 3: Three year consecutive increase in investment
N= 2: Two year consecutive increase in investment
N= 1: One year increase in investment

Variables	N=1	N=2	N=3	N=4
Intercept	0.018	0.016	0.011	0.010
	(<.0001)	(<.0001)	(<.0001)	(<.0001)
lag1-investmentchange	**0.018**	**0.020**	**0.020**	**0.041**
	(<.0001)	(0.173)	(0.240)	(0.273)
lag1_CF	0.000	0.000	0.000	0.000
	(0.681)	(0.889)	(0.798)	(0.851)
lag1_tobinq	0.009	0.007	-0.007	-0.003
	(0.164)	(0.452)	(0.121)	(<.0001)
lag1_debt_rate	0.005	0.001	0.000	0.000
	(0.242)	(0.584)	(0.191)	(0.492)
lag1_mktcap	0.000	0.000	0.000	0.000
	(0.001)	(0.434)	(0.008)	(0.005)
lag1_BM	0.000	0.000	0.000	0.000
	(0.003)	(0.909)	(0.000)	(0.590)
N	9567	10541	12224	15980
R-Square	0.0003	0.0045	0.0013	0.0006
Adj R-Sq	0.0001	0.0043	0.0012	0.0001

Table 2-8

Fama-MacBeth Regression Results on Combined Cumulative Investment Sorted Groups

Table 2-8 reports the results from Fama-MacBeth (1973) cross-sectional *yearly* stock return regression statistics for the five different groups of companies. The independent variables include last year investment change over three year averaged investment, cash flow, Tobin's *Q,* and debt ratio (firm size, BM). The regression model has the following form:

$$Ret_t=\beta_1+\beta_2\frac{3(I_{t-1}-I_{t-2})}{(I_{t-1}+I_{t-2}+I_{t-3})}+\beta_3 CF_{t-1}+\beta_4 TobinQ_{t-1}+\beta_5 Debtratio_{t-1}+\beta_6 Size_{t-1}+\beta_7 BM_{t-1}+u$$

β_1 is constant, *I* represents gross capital expenditures, *CF* represents cash flow that is earnings before extraordinary items plus depreciation is divided by lagged fixed asset, *Tobin's Q* ratio is calculated as the market value of a company divided by the firm's total assets*, Debt ratio* represents total liabilities to total asset, *Size* represents market cap, and *BM* represents book to market. P-values are reported in parentheses.

N= 2: Two year consecutive increase in investment
N= 1: One year increase in investment
N= -1: One year decrease in investment
N= -2: Two year consecutive decrease in investment

Variables	N= -3	N= -2	N= -1	N=1	N=2
Intercept	0.915	0.781	0.919	1.616	-0.728
	(0.298)	(0.004)	(<.0001)	(0.001)	(0.381)
Lag1-investmentchange	-2.900	-0.316	0.231	-0.562	2.016
	(0.364)	(0.464)	(0.175)	(0.001)	(<0.001)
lag1_CF	0.054	0.001	0.000	-0.005	0.002
	(0.377)	(0.751)	(0.279)	(0.362)	(0.238)
lag1_debt_rate	-0.465	0.002	0.000	0.077	0.006
	(0.084)	(0.322)	(0.102)	(0.413)	(0.218)
lag1_tobinq	0.001	-0.109	-0.005	-0.050	0.359
	(0.792)	(0.035)	(0.803)	(0.866)	(0.269)
lag1_mktcap	0.000	0.000	0.000	0.000	0.000
	(0.208)	(<.0001)	(0.000)	(0.012)	(0.016)
lag1_BM	-0.003	-0.003	0.000	-0.049	0.002
	(0.666)	(0.325)	(0.195)	(0.347)	(0.472)
N	48	48	48	48	48

Table 2-9A
Fixed Effect Regression Results: Ten Groups Sorted by Size and FCF

Table 2-9A reports the results from fixed effect unbalanced panel regression results on ten groups sorted by size and FCF. FCF is measured as operating income before depreciation minus interest expenses, taxes, preferred dividends, and common dividends. This is scaled by total assets. The independent variables include last year investment change over three year averaged investment, cash flow, Tobin's *Q,* debt ratio (firm size, book-to-market). The regression model has the following form:

$$Ret_{i,t}=b_1+\lambda_t+b_2\frac{3(I_{i,t-1}-I_{i,t-2})}{(I_{i,t-1}+I_{i,t-2}+I_{i,t-3})}+b_3CF_{i,t-1}+b_4TobinQ_{i,t-1+}b_5Debtratio_{i,t-1}+(b_6Size_{i,t-1}+b_7BM_{i,t-1})+\mu_i+\varepsilon_{i,t}$$

λ_t is a set of time dummies that control for possible differences in the macroeconomic environment of each year. μ_i is the individual effect of firm *i*, and ε_i is the error term. Refer to Table 2-7 for the descriptions of each variable. Standard errors are reported in parentheses. Coefficients starred with one, two, and three asterisks are statistically significant at the 10, 5, and 1 percent levels, respectively.

Firm Size	Large					Small				
FCF level	highest	1	2	3	lowest	highest	1	2	3	lowest
lag1-investmentΔ	-2.658***	-2.736***	-2.894***	-0.862***	0.053**	-0.432	-0.624**	-0.308	-0.460**	-0.752
lag1_cf	0.000	0.003	0.080***	0.149	-0.001	0.000	-0.006	0.032***	0.048***	0.000
lag1_tobinq	-0.001	0.028	-0.029	-0.070	-0.007	0.000	-0.007	-0.002	1.250***	-0.003
lag1_debt_rate	0.000	0.167***	1.124***	4.289***	0.118***	0.000	0.006**	-0.009	0.089***	0.000
Constant	4.584***	1.951***	1.472***	2.016***	1.634**	2.801*	1.609***	1.105***	-1.008***	7.495***
Observations	22,184	21,157	20,178	18,543	18,772	20,449	20,688	19,556	17,862	17,817
Number of number	4,898	5,811	5,378	4,615	7,094	3,756	5,309	5,807	5,475	6,366
R-squared	0.001	0.002	0.029	0.003	0.005	0.000	0.001	0.013	0.046	0.000

Table 2-9B

Mean Excess Returns and Carhart Regression Results for the Portfolios Formed on Size, FCF, and Investment

Table 2-9B presents mean excess returns (Mean Return) and intercept estimates (Carhart Alpha) from the following regression model:

$R_{p,t} = \alpha_p + \beta_{HML,p} R_{HML,t} + \beta_{SMB,p} R_{SMB,t} + \beta_{Mkt,p} (R_{Mkt,t} - Rf_t) + \beta_{PRYR,p} R_{PRYR,t} + \varepsilon_{p,t}$

The dependent variable $R_{p,t}$ is the excess return on a given size/FCF/Investment portfolio *p* in month *t*. Refer to Table 2-4 for the descriptions of each variable. The size/FCF/Investment portfolios are formed as follows. At each June of year *t,* all stocks are assigned to two groups according to their size values in year *t -1*. Within each size group, stocks are sorted into quintiles based on their rankings in FCF measured in ascending order. FCF is measured as operating income before depreciation minus interest expenses, taxes, preferred dividends, and common dividends. Then each of the ten portfolios is divided again as higher investment and lower investment groups. The returns of a particular stock are adjusted for its corresponding benchmark portfolio returns. Each portfolio's value-weighted monthly excess returns from July of year *t* to June of year *t + 1* are then calculated, and then rebalanced in June of year *t + 1* each year from 1960 to 2009. Portfolio returns are also regressed on the Carhart four factors. The following table presents the monthly mean excess returns and the regression results on the twenty characteristic-adjusted size, free cash flow, and investment. Coefficients starred with one, two, and three asterisks are statistically significant at the 10, 5 and 1 percent levels, respectively.

Firm Size	FCF	Investment	Excess Return Means	Carhart Alpha
Large	Highest	low	-0.066	-0.170**
		high	-0.069***	-0.343***
	1	low	-0.053**	-0.219**
		high	-0.044**	-0.236**
	2	low	-0.026	-0.190**
		high	0.106*	-0.267**
	3	low	0.041	-0.106
		high	0.074*	-0.003
	Lowest	low	0.025	-0.056
		high	-0.057	-0.085
Small	Highest	low	-0.01	-0.108**
		high	0.022*	-0.103***
	1	low	0.014	-0.028
		high	-0.016	-0.290**
	2	low	-0.017	-0.096**
		high	-0.003	-0.191**
	3	low	0.033	-0.206***
		high	-0.053***	-0.033
	Lowest	low	0.001	-0.436***
		high	-0.043**	-0.088

Table 2-10A
Fixed Effect Regression Results: Ten Groups Sorted by Size and BM

Table 2-10A reports the results from fixed effect unbalanced panel regression result on ten groups sorted by size and BM. First portfolios are divided based on size; large and small, and divided into five quintiles based on BM from highest to lowest. Regression is run on these ten groups of data. The regression model has the following form:

$$Ret_{i,t}=b_1+\lambda_t+b_2\frac{3(I_{i,t-1}-I_{i,t-2})}{(I_{i,t-1}+I_{i,t-2}+I_{i,t-3})}\ b_3CF_{i,t-1}+\beta_4 TobinQ_{t-1}+\beta_5 Debtratio_{t-1}+(\beta_6 Size_{t-1}+\beta_7 BM_{t-1})+u$$

Refer to Table 2-7 for detailed variable descriptions. Coefficients starred with one, two, and three asterisks are statistically significant at the 10, 5 and 1 percent levels, respectively.

Firm Size	Large					Small				
BM level	highest	1	2	3	lowest	highest	1	2	3	lowest
lag1-investmentΔ	-1.255	-1.570***	-0.832	-1.598***	-3.831***	-0.582	0.249*	-0.665***	-1.052***	-0.514
lag1_cf	-0.293***	0.011***	0.000	0.000	0.000	0.042*	0.007***	-0.002	0.001***	0.000
lag1_tobinq	-1.085	-0.001	0.025	1.018***	0.002	-0.137	6.137***	1.305***	-0.005	-0.001
lag1_debt_rate	2.748***	0.0213***	0.011*	0.028***	0.001	0.293**	-0.002	-0.001	0.001***	0.000
Constant	0.776	1.455***	2.488***	0.102	6.118***	0.623	-2.223***	-0.012	1.831***	7.443**
Observations	1,579	11,179	18,247	18,362	20,736	4,300	14,540	18,317	15,087	16,930
Number of number	651	2,989	5,042	5,639	6,520	1,779	4,554	6,087	5,995	6,395
R-squared	0.190	0.006	0.000	0.028	0.002	0.031	0.027	0.037	0.007	0.000

Table 2-10B
Mean Excess Returns and Carhart Regression Results for the Portfolios Formed on Size, BM and Investment

Table 2-10B presents mean excess returns (Mean Return) and intercept estimates (Carhart Alpha) from the following regression model:

$R_{p,t}= \alpha_p + \beta_{HML,p}R_{HML,t}+ \beta_{SMB,p}R_{SMB,t}+\beta_{Mkt,p} (R_{Mkt,t}- Rf_t) + \beta_{PRYR,p}R_{PRYR,t}+ \varepsilon_{p,t}$

Refer to Table 2-4 for detailed description of variables. The size/BM/Investment portfolios are formed as follows. At each June of year *t,* all stocks are assigned to two groups according to their size values in year *t −1*. Within each size group, stocks are sorted into quintiles based on their rankings in BM measured in ascending order. Then each of the ten portfolios is divided again as high investment and low investment groups. As a result, there are total of twenty portfolios based on size, BM and investment classifications. The returns of a particular stock are adjusted for its corresponding benchmark portfolio returns. Each portfolio's value-weighted monthly excess returns from July of year *t* to June of year *t + 1* are calculated, and then rebalanced in June of year *t + 1* each year from year 1960 to 2009. Portfolio returns are also regressed on the Carhart four factors. The following table presents the monthly mean excess returns and the regression results on the twenty characteristic-adjusted size, BM and investment. Coefficients starred with one, two, and three asterisks are statistically significant at the 10, 5 and 1 percent levels, respectively.

Firm Size	BM	Investment	Excess Mean Return	FF alpha
Large	Highest	Low	0.011	-0.104***
		High	-0.085**	-0.129**
		Low	0.151***	0.041
		High	0.002*	-0.019
		Low	0.134**	-0.059**
		High	0.053**	-0.118**
		Low	0.092**	-0.063
		High	-0.005	-0.072
	Lowest	Low	-0.019	0.043
		High	0.004	-0.047**
Small	Highest	Low	-0.059***	-0.036**
		High	0.003*	-0.013***
		Low	0.003*	0.003
		High	0.033***	0.083
		Low	0.020	0.001
		High	0.067*	-0.121**
		Low	0.062	-0.042**
		High	0.069**	0.036
	Lowest	Low	0.137**	-0.068**
		High	0.014	-0.058**

Table 2-11A
Fixed Effect Regression Results: Ten Groups Sorted by Size and Debt-Rate

Table 2-11A reports the results from fixed effect unbalanced panel regression result on ten groups sorted by size and debt-rate. First portfolios are divided based on size; large and small, then divided into five quintiles based on debt-rate from highest to lowest. A regression is run on these ten groups of data. The regression model has the following form:

$$Ret_{i,t}=b_1+\lambda_t+b_2\frac{3(I_{i,t-1}-I_{i,t-2})}{(I_{i,t-1}+I_{i,t-2}+I_{i,t-3})}\ b_3CF_{i,t-1}+\ \beta_4 TobinQ_{t-1}+\beta_5 Debtratio_{t-1}+(\beta_6 Size_{t-1}+\ \beta_7 BM_{t-1})+u$$

Refer to Table 2-7 for detailed variable descriptions. Coefficients starred with one, two, and three asterisks are statistically significant at the 10, 5 and 1 percent levels, respectively.

Firm Size	Large					Small				
BM level	highest	1	2	3	lowest	highest	1	2	3	lowest
lag1-investmentΔ	-1.568	-1.071	-0.905	-3.847***	-2.574***	-1.234**	-0.766**	-0.545	0.532*	-0.412*
lag1_cf	0.000	-0.002*	0.001	0.013**	0.000**	0.000	0.007***	0.000	0.015	-0.016
lag1_tobinq	-0.009	-1.701***	0.043	0.000	0.001	-0.001	-0.262***	0.000	0.743***	-0.047
lag1_debt_rate	0.002***	0.343***	0.018**	0.006***	0.002***	0.000	0.167***	0.000	3.248***	3.179***
Constant	7.544***	6.663***	4.132***	3.133***	2.268***	3.190***	2.312***	2.834***	0.509	1.302***
Observations	4,097	8,971	12,859	19,495	27,849	14,585	17,028	217,754	15,306	7,824
Number of number	1,148	2,447	3,715	4,947	2,516	3,432	5,004	21,323	4,966	2,621
R-squared	0.005	0.155	0.001	0.002	0.004	0.001	0.025	0.000	0.047	0.003

Table 2-11B
Mean Excess Returns and Carhart Regression Results for the Portfolios Formed on Size, Debt-rate and Investment

Table 2-11B presents mean excess returns (Mean Return) and intercept estimates (Carhart Alpha) from the following regression model:

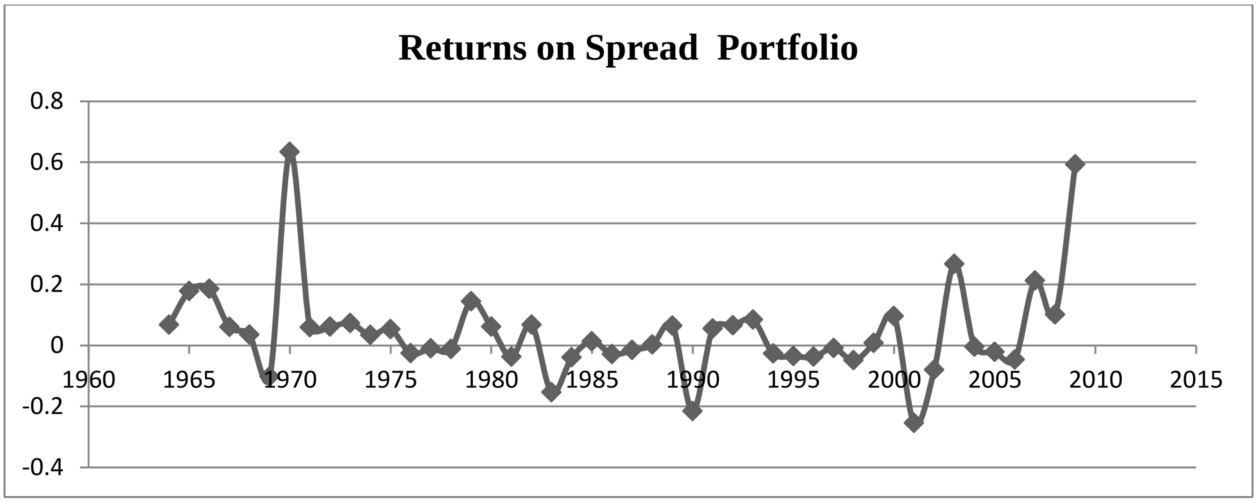
$R_{p,t}= \alpha_p + \beta_{HML,p}R_{HML,t}+ \beta_{SMB,p}R_{SMB,t}+\beta_{Mkt,p} (R_{Mkt,t}- Rf_t) + \beta_{PRYR,p}R_{PRYR,t}+ \varepsilon_{p,t}$

Refer to Table 2-4 for detailed description of variables. The size/Debt-rate/Investment portfolios are formed as follows. At each June of year *t*, all stocks are assigned to two groups according to their size values in year *t–1*. Within each size group, stocks are sorted into quintiles based on their rankings in debt-rate measure in ascending order. Debt-rate is measured as total liabilities are divided by total assets. Then each of the ten portfolios is divided again as high and low investment groups. As a result, there are a total of twenty portfolios based on the size, debt-rate, and investment classifications. The returns of a particular stock are adjusted for its corresponding benchmark portfolio returns. Each portfolio's value-weighted monthly excess returns from July of year *t* to June of year *t+1* is then calculated, and rebalanced in June of year *t+1* each year from year from 1960 to 2009. Portfolio returns are also regressed on the Carhart four factors. The following table presents the monthly mean excess returns and the regression results on the twenty characteristic-adjusted size, debt-rate and investment. Coefficients starred with one, two, and three asterisks are statistically significant at the 10, 5 and 1 percent levels, respectively.

size	Debt-rate	Investment	Excess Mean return	FF alpha
Large	Highest	Low	0.028	-0.220***
		High	-0.033*	-0.262***
	1	Low	-0.051***	-0.270***
		High	-0.025	-0.527***
	2	Low	-0.096**	-0.131**
		High	-0.041**	-0.327***
	3	Low	-0.011	-0.061
		High	0.023	-0.025
	Lowest	Low	0.125***	0.102
		High	0.064	0.072
Small	Highest	Low	-0.006	-0.162***
		High	-0.029*	-0.158**
	1	Low	0.027	0.021
		High	-0.021	-0.255***
	2	Low	-0.015	-0.108*
		High	-0.025*	-0.365**
	3	Low	-0.02	-0.182**
		High	0.02	-0.186*
	Lowest	Low	0.018	-0.341*
		High	0.03**	0.227

Figure 2-1
The Year-to-Year Excess Returns on each Benchmark-adjusted Spread Portfolio: July 1964 to June 2009

Figure 2-1 presents the year-by-year excess returns on the benchmark-adjusted spread portfolio sorted based on consecutive increase/decrease in investment. The spread portfolio denotes a zero investment portfolio that has a long position in the second and third highest top two portfolios (N=3 & N=2), and a short position in the second and third lowest bottom two portfolios (N= -2 & N= -3). The return in year *t* is calculated as a 12-month cumulated return from July of year *t* to June of year *t + 1*. For each formation period, Figure 1 reports the returns (in percentage) on the spread portfolio. The reports in the box are the arithmetic means with the t-statistics in parentheses.



Average	0.042
T-statistics	(2.060)

Conclusion

I investigate the time-series behavior of investment (capital expenditure) series in relation to sales income series based on the PIH. In the first co-integration analysis, we confirm that the notion that investment decisions are made based on some measure of permanent sales income increase. Managers change investments only when sales earnings changes are caused by permanent shocks, not when sales earnings changes are caused by transitory shocks. As a result, the impact of transitory shocks on sales earnings that do not affect investments is reflected in the spread between sales earnings and investments. My second stage analysis is based on the multiple time series regressions. The results also show that capital expenditures (investments) are a function of a number of past yearly sales changes.

The second paper demonstrates a positive relationship between investment/return in two cases. A positive relationship exists when firms increase investment consecutively over the past years. Investors consider the increase of investment positively because they see the possibility of growth potential. Investment Opportunity hypothesis explains investor's behavior in multiple year windows. There is another positive relationship between investment/return in one year window when investors have some confidence a growth potential or overinvestment will not occur. Capital expenditure investment increases positively affects stock returns if there is no overinvestment concern in one year window

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