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Does the Stock Market React Differently to Intangible Asset Investments than to Tangible Asset Investments?

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Using a large sample, we show that customer acquisition and customer service spending create intangible customer assets, much as research and development (R&D) spending creates intangible technology assets. We find that stock prices react positively to significant investments in these activities, similar to the positive reaction earlier studies find for investments in R&D. Conversely, we show that investments in physical assets produce negative stock price reactions. These results suggest that policies to encourage investment in intangible, rather than in physical, assets may be more valuable, at least in terms of stock market value.

Keywords: Intangibles, Valuation, Investments, Budgeting

JEL Classification: G12, G14, G31, M37

I. Introduction

The U.S. economy has shifted heavily toward service industries. Service industries accounted for 81.8 percent of non-farm employment at the end of 2002 compared to 57.8 percent in 1955, with a commensurate decline for manufacturing employment.[1] Service firms typically invest more in intangible assets such as research and development, brand, and customer loyalty (attraction and retention), but these assets do not usually appear on their balance sheets.[2] Akhigbe and Madura (2008) and Daniel and Titman (2006) suggest that firms with more intangible assets are more difficult to value, hence, the market response to intangible asset investments could differ from the response to tangible asset investments.

Consistent with Nelson (2006), who shows that intangibles are an important asset pricing factor, we find firms investing in intangible assets significantly outperform those investing in tangible assets. The two largest forms of intangible asset investment are research and development (R&D) and customer acquisition and service (A&S). Some studies such as Eberhart *et al*. (2004) and Hall *et al*. (2005) have examined the value effects of R&D investment, but few studies (including Chan *et al.* (2001) and Chauvin and Hirschey (1993)) have studied the effects of A&S.

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[1] Strauss and Walster (2003) base their calculations on data from the U.S. Department of Labor, Bureau of Labor Statistics.

[2] Goodwill on the corporate balance sheet usually reflects only a small portion of the intangible assets created by a service firm. Goodwill measures the unimpaired capitalized value of the difference in market value and book value arising from a merger or acquisition that has not been assigned to specific assets or liabilities or from an intangible or tangible asset purchase. Goodwill does not represent the values of intangible assets created in-house from normal operating activities.

We separate A&S spending into two components: advertising and marketing expense (A&M) used mostly to attract customers, and customer service spending (CS) used mostly to retain them. Our study isolates the contemporaneous and future firm value impacts of A&S investments, and compares them to the impacts of investments in R&D and tangible capital expenditures (CAPEX).

Eberhart *et al.* (2004) examine long-term abnormal returns following significant increases in R&D expenditure. They find that R&D improves firm value in the long term, but is not immediately reflected in stock prices. Chauvin and Hirschey (1993) find a positive relationship between firms' contemporaneous R&D or A&M spending and their market values. Chan *et al.* (2001) find that stock price accurately reflects the level of a firm's investment in R&D and A&M, that is, investors cannot earn positive abnormal returns after buying stocks with current high levels of either.

Other studies find that output measures of R&D investments, such as patents or Food and Drug Administration (FDA) drug approvals, are positively related to firm value. Hall *et al.* (2005) and Hirschey *et al.* (2001) show that "knowledge stock" or innovation output, measured by patent counts or patent citations, are significantly related to firms' market values.[3] Bosch and Lee (1994), Ahmed *et al.* (2002), and Alefantis *et al.* (2004) find that FDA decisions concerning new drugs undergoing R&D significantly affect firms' stock prices.

For firms with few physical assets, a substantial portion of their equity market value is the expected future cash-flows that accrue from their repeat customers. We posit that, analogous to the findings of Eberhart *et al.* (2004) for R&D expenditures, significant unexpected increases in A&M and CS expenditures should increase firms' stock price performance. We use cutoffs of at least 5 percent annual increase in A&M spending and a 10 percent increase or more for the much large CS spending.

Our study contributes to the extant finance literature in several ways. We compare the stock price performance of firms that significantly increase investments in A&M or CS against those that significantly increase R&D or CAPEX. Earlier studies do not consider CS spending, and studies like Chan *et al.* (2001) consider A&M in less detail with different methods.

We also use the actual fiscal year end month as the annual event date. Other studies establish annual event dates by assuming that all firms have a December fiscal year end and a four-month report lag, or they use the true fiscal year end and a three-month lag. We believe that it is more accurate to use a firm's true fiscal year end without lags because firms have already released investment information in quarterly reports and press releases by their fiscal year-end date.

Overall, our results show that firms that significantly increase their investments in intangible assets (A&M, CS, and R&D) earn positive abnormal returns following those investments. Firms investing in tangible assets (CAPEX) earn negative abnormal returns. The results from the Carhart four-factor event-time model find an economically and statistically significant positive 60-month cumulative return of around 20 percent, 10 percent, and 26 percent from significant increases in A&M, CA, and R&D spending respectively; the same model produces significant negative returns of approximately -6 percent for large increases in CAPEX spending. The monthly abnormal returns findings from a calendar-time study are similar is scope. Our results imply that policies designed to encourage investments in intangible assets have more value than tangible investments in manufacturing assets.

The rest of this paper proceeds as follows. Section II describes the data and the sample. Section III explains the empirical models, and Section IV presents their results. Section V is a conclusion.

[3] Hall *et al.* (2005) define "knowledge stock" as the intangible asset obtained as the output from investment in R&D.

II. Data Collection and Sample

A. Measures of A&M and CS Intensity

Previous studies in the finance literature define various measures of R&D intensity, a standardized measure of R&D. Chan *et al.* (2001) primarily measure R&D intensity as the ratio of R&D expenditures to market value of equity, and Eberhart *et al.* (2004) use R&D expenditure relative to total assets.

We use similar measures of A&M intensity and CS intensity. The data to calculate these measures are obtained from the COMPUSTAT Active and Research files and the Center for Research in Security Prices (CRSP) database. A&M intensity and CS intensity are measured as the ratio of expenditures to market value of equity. Market value of equity is measured as the product of closing price at calendar year end (COMPUSTAT annual data item 24) and common shares outstanding (COMPUSTAT annual data item 25). A&M expenditure is advertising expense (COMPUSTAT annual data item 45). No direct measures of customer service expenditure are available in the COMPUSTAT database. Our study focuses on firms whose primary assets are its customers, so our measure of CS expenditure is selling, general, and administrative spending (COMPUSTAT annual data item 189) less advertising spending (COMPUSTAT annual data item 45).[4] Our measure of R&D intensity is defined as the ratio of R&D expenditures (COMPUSTAT annual data item 46) to market value of equity, and CAPEX intensity is measured as the ratio of capital expenditures (COMPUSTAT annual data item 128) to market value of equity.

B. Sample Construction

Sample selection criteria are analogous to that of Eberhart *et al.* (2004). Our samples include all firm-year observations from 1951 to 2005 that have sufficient data available in the COMPUSTAT and CRSP databases, subject to the following requirements. First, our findings would be better revealed for firms that have economically significant levels of spending. Hence, firms in our samples have A&M, R&D, or CAPEX intensity measures of at least 5 percent. Since CS spending is a much larger component of spending, we use a cut-off of 25 percent – close to the median CS intensity measure of firms in our initial sample. Second, dollar A&M, R&D or CAPEX spending must increase by at least 5 percent (given the high level of CS spending relative to market value of equity, the CS sample only includes firms that increase spending by at least 10 percent).

Applying the first selection criterion of high investment intensity produces 17,783 A&M, 15,805 CS, 7,143 R&D, and 18,412 CAPEX firm-year observations. The second selection criterion of significant changes in investments reduces firm-year observations to 10,422 for the A&M sample, 12,369 for the CS sample, 5,790 for the R&D sample, and 14,310 for the CAPEX sample.

[4] All of the expenses in the COMPUSTAT database definition of SG&A may not clearly fit within our two variables i.e. advertising and marketing (A&M) and customer service (CS), but we believe that the majority do. During sample selection we select firms with relatively larger SG&A and examine when they make relatively larger changes in SG&A. For these firms, we believe that our definitions are especially good proxies, because sample selection identifies firms whose main business is customer service. Furthermore, the focus of our study is to compare effects between service firms' intangible asset investments and mostly manufacturers' tangible asset investment. Note that CAPEX or R&D measures face the same measurement problems because some of the expenditures do not fit into a pure definition of those terms (e.g., they can include transportation and installation costs).

We use the last day of the fiscal year-end month as the event date. To obtain the event date, we use a fiscal year variable (COMPUSTAT annual data item YEAR A) and a fiscal year-end month (COMPUSTAT annual data item FYR). In line with COMPUSTAT data assignment, for firms with a fiscal year end month between January and May, the actual calendar year corresponds to the year after the fiscal year variable YEAR A. For the other months (June to December), the actual calendar year is the same as the fiscal year variable YEAR A.

We examine in detail the characteristics of the firm-year observations in our samples. The statistics of interest are sales (COMPUSTAT annual data item 12), total assets (COMPUSTAT annual data item 6), book value of equity (COMPUSTAT annual data item 60), market value of equity, and A&M, CS, R&D and CAPEX intensity measures. We also study whether these characteristics differ over the various investment types.[5]

III. Empirical Models

We study abnormal returns around the event dates for various time windows. These abnormal returns may reflect premiums for risk differentials, rather than long-term abnormal stock returns. Consequently, we test for long-term abnormal stock returns using the market model and the Fama and French (1993) multifactor model. In additional tests, we include the momentum factor suggested by Carhart (1997).

There is considerable debate in the finance literature regarding the use of event-time or calendar-time and buy-and-hold returns or cumulative returns for long-run studies. Fama (1998) suggests that long-run studies suffer from the bad model problem, and that abnormal returns depend on the approach (event-time or calendar-time), the risk-adjustment model, the method used to aggregate returns, and the power of the statistic used to test for significance.[6] To check for the robustness of our findings, we specify our empirical models using various approaches.

A. Event-Time Approach

A.1 Cumulative Average Abnormal Return (CAAR)

In this traditional event-study approach, we calculate the cumulative average abnormal returns for various time windows around the sample events. We examine CAARs generated using various risk-adjustment models.

The traditional market model,[7] our first risk-adjustment model, takes the form:

$$R_{jt} = \alpha_j + \beta_j R_{mt} + \varepsilon_{jt}.$$

The empirical specification to obtain abnormal return is defined as:

$$AR_{jt} = R_{jt} - (\hat{\alpha}_j + \hat{\beta}_j R_{mt}),$$

where, for stock j in period t after an event,

AR_{jt} = abnormal return on stock,

R_{jt} = return on stock,

[5] The various intensity measures come from the models in the paper. The other variables (sales, total assets, book value of equity, and market value of equity) are widely-followed descriptors of company characteristics, and are used extensively in the finance and accounting research literature.

[6] See Eberhart *et al.* (2004) for a detailed exposition of the debate.

[7] While Fama (1998) and others have criticized this model specification as particularly sensitive to the bad model problem for long-term studies, we present the results for the sake of completeness and to demonstrate the consistency of our overall findings using various model specifications.

R_{mt} = return on the market index,

$\hat{\alpha}_j, \hat{\beta}_j$ = market model parameter estimates in estimation period using OLS.

The average of abnormal returns (AAR_t) in period t after an event is measured as:

$$AAR_t = \frac{1}{N}\sum_{j=1}^{N} AR_{jt},$$

where N = number of stocks in the sample.

The cumulative average abnormal returns ($CAAR_T$) during event-time window T is calculated as:

$$CAAR_T = \sum_{t=1}^{T} AAR_t.$$

In additional tests, we use the risk-adjustment models of Fama-French (1993):

$$R_{jt} = \alpha_j + \beta_j R_{mt} + s_j SMB_t + h_j HML_t + \varepsilon_{jt},$$

and Carhart (1997):

$$R_{jt} = \alpha_j + \beta_j R_{mt} + s_j SMB_t + h_j HML_t + u_j UMD_t + \varepsilon_{jt},$$

where

SMB_t = the return on a portfolio of small stocks minus the return on a portfolio of big stocks,

HML_t = the return on a portfolio of high book-to-market ratios minus the return on a portfolio of low book-to-market ratios,

UMD_t = the return on a portfolio of high momentum stocks minus the return on a portfolio of low momentum stocks,

α_j = monthly abnormal stock returns measure,

β_j, s_j, h_j, u_j = factor loadings on the systematic risk factors R_m, SMB, HML, UMD respectively.

Similar to the market model defined above, abnormal returns (AR_{jt}) using the Fama-French three-factor model and the Carhart four-factor model are defined respectively as:

$$AR_{jt} = R_{jt} - (\hat{\alpha}_j + \hat{\beta}_j R_{mt} + \hat{s}_j SMB_t + \hat{h}_j HML_t)$$

$$AR_{jt} = R_{jt} - (\hat{\alpha}_j + \hat{\beta}_j R_{mt} + \hat{s}_j SMB_t + \hat{h}_j HML_t + \hat{u}_j UMD_t),$$

where $\hat{\alpha}_j, \hat{\beta}_j, \hat{s}_j, \hat{h}_j, \hat{u}_j$ = model parameter estimates in estimation period using OLS.

The average abnormal return (AAR_t) and cumulative average abnormal returns ($CAAR_T$) using the Fama-French or Carhart models are calculated similarly to that for the market model defined above.

A.2. Buy-and-Hold Abnormal Return (BHAR)

We also test for the significance of long-term abnormal returns using a traditional buy-and-hold abnormal return model. The approach is defined as:

$$BHAR_{jt} = \prod_{t=1}^{T}(1 + R_{jt}) - \prod_{t=1}^{T}(1 + R_{mt}),$$

where, for stock j in event time window T,

BHAR = buy-and-hold abnormal return measure,

R_{jt} = return on stock in month t,

R_{mt} = return on market index in month t.

B. Calendar-Time Approach

Our study also tests for significance of long-term abnormal returns using the Fama-French (1993) three-factor model in calendar-time. The empirical model takes the form:

$$R_{pt} - R_{ft} = \alpha_p + \beta_p (R_{mt} - R_{ft}) + s_p SMB_t + h_p HML_t + \varepsilon_{pt},$$

where, for portfolio p in calendar period t,

R_{pt} = the average portfolio return,

R_{ft} = the one-month Treasury-bill rate,

R_{mt} = the return on the market index,

SMB_t = the return on a portfolio of small stocks minus the return on a portfolio of big stocks,

HML_t = the return on a portfolio of high book-to-market ratios minus the return on a portfolio of low book-to-market ratios,

α_p = monthly abnormal stock returns measure,

β_p, s_p, h_p = factor loadings on the systematic risk factors R_m, SMB, HML respectively.

Portfolios are created each calendar month during our sample period. A firm's stock return is part of the monthly portfolio return if the month is part of the firm's event window.

IV. Results of Study

A. Descriptive Statistics

In Table 1, we present key characteristics of the firm-year observations in our samples. The median values of sales, total assets, and book value of equity are statistically indistinguishable from that of the average firm in the COMPUSTAT North America database. Although the median values of market value of equity and the market-to-book ratio are consistently lower than that of the average COMPUSTAT firm, the differences are not statistically significant. In any case, we use the Fama-French (1993) three-factor model in additional tests to control for size and value effects.

The increase in investment expenditure for a typical firm in the COMPUSTAT database is between 8.3 percent and 10.7 percent, depending on the type of investment. Since we study firms that significantly increase investments, the firms in our samples have much higher increases in investments, ranging from 21.4 percent to 60.1 percent. The change is particularly striking for firms that increase capital expenditure investments.

Intensity measures vary depending on the type of investments. The typical firm only spends between 2.5 percent and 3.0 percent on A&M and R&D. However, capital expenditure spending is higher at 6.2 percent. CS expenditure is much higher at 37.6 percent for the median firm, because it includes all selling, general, and administrative expenses as defined in the COMPUSTAT database. Since our study requires high levels of investments relative to market value of equity, firms in our samples have significantly higher intensity measures for each investment category compared to the typical firm.

Table 1: Summary Statistics

Variable	A&M	CS	R&D	CAPEX
SALES ($MM)	86.1 (57.6)	79.4 (57.6)	53.0 (57.6)	109.6 (57.6)
ASSETS ($MM)	57.3 (70.5)	54.4 (70.5)	49.0 (70.5)	82.3 (70.5)
BVE ($MM)	18.6 (26.4)	22.6 (26.4)	25.6 (26.4)	32.4 (26.4)
MVE ($MM)	28.9 (55.6)	26.3 (55.6)	37.3 (55.6)	42.3 (55.6)
MTB	1.40 (1.46)	1.15 (1.46)	1.34 (1.46)	1.22 (1.46)
A&M change in percent	25.9 (9.1)			
CS change in percent		21.4 (10.7)		
R&D change in percent			25.2 (9.9)	
CAPEX change in percent				60.1 (8.3)
A&M Intensity in percent	12.0 (2.8)			
CS Intensity in percent		61.5 (37.6)		
R&D Intensity in percent			10.1 (2.5)	
CAPEX Intensity in percent				14.3 (6.2)

Notes: The variables are defined as sales SALES (COMPUSTAT annual data item 12), total assets ASSETS (COMPUSTAT annual data item 6), book value of equity BVE (COMPUSTAT annual item 60), market value of equity MVE, market-to-book value of equity MTB, and various investment intensity measures. MVE is calculated as the product of closing price at calendar year end (COMPUSTAT annual data item 24) and common shares outstanding (COMPUSTAT annual data item 25). MTB is calculated as the ratio of MVE to BVE. The investment categories are A&M, CS, R&D, and CAPEX. A&M is advertising and marketing expense (COMPUSTAT annual data item 45). CS is customer service expense, measured as the difference between selling, general, and administrative expenses (COMPUSTAT annual data item 189) and A&M. R&D is research and development expense (COMPUSTAT annual data item 46). CAPEX is capital expenditure (COMPUSTAT annual data item 128). The investment intensity measures are calculated as the ratio of the expenditure to market value of equity MVE. Reported statistics are median values of all variables. Comparative median values of all firms in the COMPUSTAT North America database are in parentheses.

B. Event-Time Approach

We report CAARs for portfolios of events of the four investment categories A&M, CS, R&D, and CAPEX. CAARs are reported for monthly windows (-6, 0), (+1, +6), (+1, +12), (+1, +36), (+1, +60) around the event dates. [8]

In Table 2, we present empirical results where abnormal returns are calculated as market-adjusted returns, that is:

$$AR_{jt} = R_{jt} - R_{mt} .$$

Our sample of firms that have high A&M intensity, and that also significantly increase A&M spending, have poor short-run past returns. These firms under-perform the market by 7.06 percent over the six months before the event.[9] In the period after portfolio formation, however, these firms consistently outperform the market. The short-run CAARs are 6.68 percent over six months and 7.32 percent over one year. These firms continue to out-perform in the long run with cumulative abnormal returns of 24.79 percent over three years, and 35.05 percent over a five-year period. The

[8] We also performed tests using CRSP daily returns. Since the results are qualitatively similar, and for the sake of brevity, we do not report them in the paper.

[9] In reported results, our proxy for the market index is the CRSP value-weighted market index. However, empirical results using the CRSP equal-weighted index, not reported here, are qualitatively similar.

empirical findings are similar for the other investment categories, although CAPEX has smaller magnitude returns.

Table 2: Cumulative Average Abnormal Returns (CAAR) Using Market–Adjusted Returns

CAAR	A&M	CS	R&D	CAPEX
(-6, 0)	-7.06	-6.78	-9.17	-4.09
	(-17.48**, -8.78**)	(-17.23**, -7.66**)	(-15.78**, -9.27**)	(-11.89**, -5.57**)
(+1, +6)	6.68	6.91	5.73	5.98
	(19.87**, 22.03**)	(21.80**, 23.35**)	(11.43**, 13.02**)	(21.18**, 20.61**)
(+1, +12)	7.32	8.16	8.83	6.35
	(15.23**, 21.09**)	(17.86**, 21.82**)	(12.32**, 14.44**)	(15.00**, 17.75**)
(+1, +36)	24.79	25.17	28.45	19.84
	(34.89**, 35.88**)	(36.89**, 37.37**)	(25.90**, 25.30**)	(32.66**, 33.46**)
(+1, +60)	35.05	37.48	39.02	30.31
	(43.18**, 41.08**)	(46.98**, 44.31**)	(31.14**, 29.58**)	(43.03**, 42.05**)
Sample Size	10422	12369	5790	14310

*, ** indicate significance at the 5 percent and 1 percent level respectively.

Notes: $AR_{jt} = R_{jt} - R_{mt}$, where, for stock j over the period t before or after a significant investment event, AR_{jt} is the abnormal return on stock, R_{jt} is the return on stock, and R_{mt} is the return on the market index. CAAR represents the cumulative average abnormal monthly percent return, around the event date for portfolios of firms' stocks formed for each investment category – A&M, CS, R&D, and CAPEX. A&M is advertising and marketing expense. CS is customer service expense, measured as the difference between selling, general, and administrative expenses (SG&A) and A&M. R&D is research and development expense. CAPEX is capital expenditure. CAARs are reported for monthly windows (-6, 0), (+1, +6), (+1, +12), (+1, +36), (+1, +60) around the event date. The data are collected from the COMPUSTAT Active and Research files and the Center for Research in Security Prices (CRSP) database for the period from 1951 to 2005. Patell z statistics and non-parametric generalized sign z test statistics are in parentheses.

Barber and Lyon (1997) and Kothari and Warner (1997) recommend using buy and hold returns (BHARs) because they more accurately reflect the wealth creation of a buy-and-hold investor. They also argue that the statistical tests used in generating long-run event CAARs are biased. Table 3 presents results for BHARs computed as follows:

$$BHAR_{jt} = \prod_{t=1}^{T}(1 + R_{jt}) - \prod_{t=1}^{T}(1 + R_{mt}).$$

BHAR and CAAR results are generally similar; however, the long-run abnormal returns using BHARs are larger in magnitude.[10] Over the six months before the event, firms in all categories underperform. Underperformance varies; -7.33 percent for firms investing in A&M, -7.09 percent for those investing in CS, -9.91 percent for those investing in R&D, and -4.25 percent for those investing in CAPEX.

Post-event, firms in all investment categories consistently outperform. Six-month future returns range between 4.92 percent for firms that invest in R&D to 6.75 percent for firms that invest in CS. Long-run abnormal returns are considerably larger and statistically significant. After five years (three years) stocks in the A&M portfolio earn abnormal returns of 68.23 percent (35.49 percent), those in the CS portfolio earn 62.09 percent (31.59 percent), those in the R&D portfolio earn 56.25 percent (30.50 percent), and those in the CAPEX portfolio earn 47.94 percent (26.69 percent).

[10] Due to monthly compounding of returns in the BHAR approach, rather than the monthly accumulation in the CAAR approach.

Table 3: Buy-and-Hold Average Abnormal Returns (BHAR)

BHAR	A&M	CS	R&D	CAPEX
(-6, 0)	-7.33	-7.09	-9.91	-4.25
	(-17.52**, -19.64**)	(-17.27**, -21.67**)	(-15.80**, -19.11**)	(-11.92**, -18.66**)
(+1, +6)	6.44	6.75	4.92	5.79
	(19.81**, 11.54**)	(21.77**, 10.71**)	(11.37**, 3.17**)	(21.13**, 8.33**)
(+1, +12)	7.32	8.32	7.57	6.73
	(15.15**, 5.35**)	(17.81**, 3.00**)	(12.25**, -0.68)	(14.91**, 0.18)
(+1, +36)	35.49	31.59	30.50	26.69
	(34.16**, 10.05**)	(36.77**, 5.98**)	(25.72**, 1.11)	(32.44**, 3.18**)
(+1, +60)	68.23	62.09	56.25	47.94
	(42.70**, 9.16**)	(46.73**, 5.90**)	(30.91**, -0.10)	(42.70**, 4.88**)
Sample Size	10422	12369	5790	14310

*, ** indicate significance at the 5 percent and 1 percent level respectively.

Notes: $BHAR_{jt} = \prod_{t=1}^{T}(1+R_{jt}) - \prod_{t=1}^{T}(1+R_{mt})$, where, for stock j over the period t before or after a significant investment event, R_{jt} is the return on stock, and R_{mt} is the return on the market index. BHAR represents the buy-and-hold abnormal monthly percent return around the event date for portfolios of firms' stocks formed for each investment category – A&M, CS, R&D, and CAPEX. A&M is advertising and marketing expense. CS is customer service expense, measured as the difference between selling, general, and administrative expenses (SG&A) and A&M. R&D is research and development expense. CAPEX is capital expenditure. BHARs are reported for monthly windows (-6, 0), (+1, +6), (+1, +12), (+1, +36), (+1, +60) around the event date. The data are collected from the COMPUSTAT Active and Research files and the Center for Research in Security Prices (CRSP) database for the period from 1951 to 2005. Patell z statistics and non-parametric generalized sign z test statistics are in parentheses.

However, our results may be driven by significant differences in risk between our sample firms and the market. Hence, we calculate risk-adjusted abnormal returns using other approaches.

First, consider a risk adjustment using the market model. Table 4 shows that the market model adjustment confirms that short-run (six months) pre-event performance is poor for all investment categories, with CAARS in the range -7.35 percent to -9.68 percent.

In the short run (six months), post-event abnormal returns for investments in intangible assets, A&M, CS, and R&D are positive at 5.43 percent, 4.40 percent, and 3.61 percent, respectively. This trend continues into the long-run with future five-year (three-year) CAARs at 22.09 percent (17.14 percent) for A&M, 14.37 percent (10.39 percent) for CS, and 22.20 percent (16.35 percent) for R&D. Our empirical results for A&M and R&D are in line with those of Chan *et al.* (2001).[11]

The post-event stock returns of the CAPEX sample differ significantly from our intangible asset investment samples. Future cumulative abnormal returns for such firms are 2.01 percent in six months, -1.81 percent in one year, -3.54 percent in three years, and -5.59 percent over a five-year period. Therefore, while firms that increase investments in capital expenditure may have small

[11] In their study, the average high-investment firm (one in Portfolio 4) that invests in A&M (R&D) has an annual return of 17.69 percent (16.87 percent) against 19.81 percent (20.25 percent) for the control sample. They also find that, in the long-run, Portfolio 4 firms do significantly better than the market; over the three-year period after portfolio formation, A&M (R&D) firms have an average annual return of 21.62 percent (21.03 percent) versus 18.92 percent (19.50 percent) for control firms. We do not compare our results to the highest investment firms (Portfolio 5 firms) in the Chan *et al.* (2001) study because our portfolio selection method yields a sample more comparable to their second highest investment group (our sample only includes the upper half of firms that invest in each category, and they need to increase investments significantly).

short-term positive stock price performance, their risk adjusted long-run performance is negative. These findings are in line with Daniel and Titman (2006) who hypothesize that stock markets may have differing reactions to investments in tangible and intangible assets. They are also consistent with Nelson (2006) who suggests that firms with intangible assets should earn larger returns.

Table 4: Cumulative Average Abnormal Returns (CAAR) Using the Market Model

CAAR	A&M	CS	R&D	CAPEX
(-6, 0)	-7.35	-8.15	-9.68	-7.97
	(-14.27**, -10.16**)	(-15.11**, -10.52**)	(-4.61**, -7.84**)	(-23.00**, -11.42**)
(+1, +6)	5.43	4.40	3.61	2.01
	(20.15**, 15.55**)	(19.94**, 13.88**)	(-84.51**, 7.05**)	(11.61**, 10.20**)
(+1, +12)	4.78	3.16	4.75	-1.81
	(15.51**, 12.22**)	(16.21**, 10.63**)	(-55.64**, 8.31**)	(1.61, 4.57**)
(+1, +36)	17.14	10.39	16.35	-3.54
	(33.69**, 18.29**)	(30.04**, 14.14**)	(-19.59**, 13.59**)	(4.44**, 7.94**)
(+1, +60)	22.09	14.37	22.20	-5.59
	(42.08**, 19.16**)	(38.66**, 13.94**)	(-7.58**, 13.73**)	(10.85**, 9.09**)
Sample Size	10422	12369	5790	14310

*, ** indicate significance at the 5 percent and 1 percent level respectively.

Notes: $AR_{jt} = R_{jt} - (\hat{\alpha}_j + \hat{\beta}_j R_{mt})$, where, for stock j over the period t before or after a significant investment event, AR_{jt} is the abnormal return on stock, R_{jt} is the return on stock, R_{mt} is the return on the market index, and $\hat{\alpha}_j, \hat{\beta}_j$ are the market model parameter estimates in estimation period using OLS. CAAR represents the cumulative average abnormal monthly percent return, around the event date for portfolios of firms' stocks formed for each investment category – A&M, CS, R&D, and CAPEX. A&M is advertising and marketing expense. CS is customer service expense, measured as the difference between selling, general, and administrative expenses (SG&A) and A&M. R&D is research and development expense. CAPEX is capital expenditure. CAARs are reported for monthly windows (-6, 0), (+1, +6), (+1, +12), (+1, +36), (+1, +60) around the event date. The data are collected from the COMPUSTAT Active and Research files and the Center for Research in Security Prices (CRSP) database for the period from 1951 to 2005. Patell z statistics and non-parametric generalized sign z test statistics are in parentheses.

The single factor market model may not properly adjust for risk, consequently, tables 5 and 6 present abnormal returns using the multifactor models of Fama and French (1993) and Carhart (1997), respectively.

Table 5 shows that the abnormal returns obtained using the Fama-French three-factor model are similar to those obtained using the market model in Table 4. In the pre-event short run (six months), the average firm in each investment category underperforms by approximately -7.50 percent.

Post-event, as in Table 4, firms outperform after investing in intangible assets (A&M, CS, R&D) by about 3 percent over six months, by between 5.77 and 15.76 percent over three years, and by between 6.93 and 22.68 percent over five years post-event. And again, firms investing in tangible assets underperform post-event by between -8.82 percent (three years) and -13.48 percent (five years). There is a significant performance difference between firms investing in intangibles and those investing in CAPEX.

Table 5: Cumulative Average Abnormal Returns (CAAR) Using the Fama-French Three-Factor Model

CAAR	A&M	CS	R&D	CAPEX
(-6, 0)	-7.40	-7.63	-7.38	-7.18
	(-4.83***, -10.33***)	(-4.84***, -10.82***)	(-3.96***, -8.72***)	(-4.84***, -11.02***)
(+1, +6)	2.97	2.48	3.81	-0.22
	(2.10**, 9.55***)	(1.70**, 7.65***)	(2.21**, 5.05***)	(-0.16, 4.80***)
(+1, +12)	2.69	2.27	5.87	-3.57
	(1.34*, 8.97***)	(1.10, 6.08***)	(2.41***, 6.08***)	(-1.84**, 1.41*)
(+1, +36)	10.11	5.77	15.76	-8.62
	(2.91***, 14.15***)	(1.62*, 10.25***)	(3.73***, 10.96***)	(-2.57***, 4.47***)
(+1, +60)	11.16	6.93	22.68	-13.48
	(2.49***, 15.66***)	(1.50*, 11.19***)	(4.16***, 12.63***)	(-3.11***, 6.85***)
Sample Size	10422	12369	5790	14310

*, **, *** indicate significance at the 10 percent, 5 percent and 1 percent level respectively.

Notes: $AR_{jt} = R_{jt} - (\hat{\alpha}_j + \hat{\beta}_j R_{mt} + \hat{s}_j SMB_t + \hat{h}_j HML_t)$, where, for stock j over the period t before or after a significant investment event, AR_{jt} is the abnormal return on stock, R_{jt} is the return on stock, R_{mt} is the return on the market index, SMB_t is the return on a portfolio of small stocks minus the return on a portfolio of big stocks, HML_t is the return on a portfolio of high book-to-market ratios minus the return on a portfolio of low book-to-market ratios, and $\hat{\alpha}_j, \hat{\beta}_j, \hat{s}_j, \hat{h}_j$ are the Fama-French three-factor model parameter estimates using OLS. CAAR represents the cumulative average abnormal monthly percent return, around the event date for portfolios of firms' stocks formed for each investment category – A&M, CS, R&D and CAPEX. A&M is advertising and marketing expense. CS is customer service expense, measured as the difference between selling, general, and administrative expenses (SG&A) and A&M. R&D is research and development expense. CAPEX is capital expenditure. CAARs are reported for monthly windows (-6, 0), (+1, +6), (+1, +12), (+1, +36), (+1, +60) around the event date. The data are collected from the COMPUSTAT Active and Research files and the Center for Research in Security Prices (CRSP) database for the period from 1951 to 2005. Portfolio time-series *t*-statistics and non-parametric generalized sign z test statistics are in parentheses.

Table 6 reports CAARs based on the Carhart four-factor model. Again, firms investing in each of the four investment categories have negative pre-event six-month CAARs ranging between -5.89 percent and -7.39 percent.

Firms that invest in intangible assets outperform after the event. In the short run (six months), their CAARs range from 2.53 to 4.19 percent and over longer periods their CAARs range from 7.81 to 26.22 percent.[12] But firms that invest in CAPEX underperform by -4.41 percent over three years, and -5.86 percent over five years.

[12] It is possible that the lower magnitude of returns for firms that invest in CS is due to the measure used in our study. We believe that CS is measured with more noise A&M and R&D; however, in the absence of any other direct measure of CS, this is the closest proxy.

**Table 6: Cumulative Average Abnormal Returns (CAAR)
Using the Carhart Four-Factor Model**

CAAR	A&M	CS	R&D	CAPEX
(-6, 0)	-5.89	-6.72	-7.39	-6.41
	(-4.22***, -7.32***)	(-4.74***, -8.51***)	(-4.79***, -8.54***)	(-4.69***, -9.75***)
(+1, +6)	4.19	2.53	3.92	0.64
	(3.25***, 10.90***)	(1.93**, 8.30***)	(2.74***, 4.54***)	(0.51, 4.26***)
(+1, +12)	4.84	3.21	7.10	-1.43
	(2.65***, 10.85***)	(1.73**, 6.87***)	(3.52***, 6.40***)	(-0.80, 2.47***)
(+1, +36)	14.48	7.81	18.76	-4.41
	(4.58***, 15.89***)	(2.43***, 11.08***)	(5.36***, 11.06***)	(-1.42*, 6.04***)
(+1, +60)	20.27	10.49	26.22	-5.86
	(4.96***, 17.78***)	(2.53***, 11.58***)	(5.80***, 13.19***)	(-1.46*, 7.34***)
Sample Size	10422	12369	5790	14310

*, **, *** indicate significance at the 10 percent, 5 percent and 1 percent level respectively.

Notes: $AR_{jt} = R_{jt} - (\hat{\alpha}_j + \hat{\beta}_j R_{mt} + \hat{s}_j SMB_t + \hat{h}_j HML_t + \hat{u}_j UMD_t)$, where, for stock j over the period t before or after a significant investment event, AR_{jt} is the abnormal return on stock, R_{jt} is the return on stock, R_{mt} is the return on the market index, SMB_t is the return on a portfolio of small stocks minus the return on a portfolio of big stocks, HML_t is the return on a portfolio of high book-to-market ratios minus the return on a portfolio of low book-to-market ratios, UMD_t is the return on a portfolio of high momentum stocks minus the return on a portfolio of low momentum stocks, and $\hat{\alpha}_j, \hat{\beta}_j, \hat{s}_j, \hat{h}_j, \hat{u}_j$ are the Carhart four-factor model parameter estimates using OLS. CAAR represents the cumulative average abnormal monthly percent return, around the event date for portfolios of firms' stocks formed for each investment category – A&M, CS, R&D, and CAPEX. A&M is advertising and marketing expense. CS is customer service expense, measured as the difference between selling, general, and administrative expenses (SG&A) and A&M. R&D is research and development expense. CAPEX is capital expenditure. CAARs are reported for monthly windows (-6, 0), (+1, +6), (+1, +12), (+1, +36), (+1, +60) around the event date. The data are collected from the COMPUSTAT Active and Research files and the Center for Research in Security Prices (CRSP) database for the period from 1951 to 2005. Portfolio time-series *t*-statistics and non-parametric generalized sign z test statistics are in parentheses.

C. Calendar-Time Approach

Fama (1998) argues against buy and hold abnormal returns (BHAR) because systematic model errors get compounded over the long run. Moreover, the BHAR approach does not account for cross-sectional dependence among event firms. Fama (1998) and Mitchell and Stafford (2000) suggest that the calendar-time approach overcomes the cross-sectional dependence problem in the BHAR. They show that the calendar-time approach retains sufficient power to detect abnormal returns, particularly in comparison to the BHAR approach. Eberhart *et al.* (2004) suggest that the calendar-time approach is, in fact, biased in favor of the EMH. Consequently, detection of significant abnormal returns using this approach is stronger evidence than that provided by the BHAR approach.

Table 7 shows the abnormal returns using the calendar-time approach with the Fama-French three-factor model used for risk-adjustment. In Panels A, B, C, and D we present results of tests for investments in A&M, CS, R&D, and CAPEX, respectively. For all categories, in the six months before the event, average monthly abnormal returns range between -1.31 percent for CS investments and -0.61 percent for CAPEX investments. This confirms our earlier findings that firms in our portfolios are past losers (have low pre-event returns).

Post-event, A&M portfolio firms earn positive average long-run abnormal returns. Average monthly abnormal returns are highest (0.31 percent) when measured over the thirty months after

the event. Over the same period, the R&D portfolio earns average abnormal monthly returns of 0.75 percent. The statistically significant abnormal return of 0.60 percent in the 60-month period is similar to that found by Eberhart *et al.* (2004). The CS and CAPEX portfolios do not exhibit statistically significant abnormal returns. The CAPEX results are in line with our previous findings that firms do not earn abnormal returns on tangible capital investments.

Table 7: Abnormal Returns Using the Calendar-Time Fama-French Three-Factor Model

Panel A: A&M	**α**	**β**	**s**	**h**	**R-squared**
(-6, 0)	-1.04	1.0070	1.0229	0.2942	0.7086
	(-6.27***)	(24.60***)	(18.97***)	(4.73***)	
(0, +6)	-0.02	1.0100	1.0333	0.3555	0.6114
	(-0.09)	(19.94***)	(15.55***)	(4.63***)	
(0, +12)	0.04	0.9958	1.0134	0.3789	0.6573
	(0.24)	(23.09***)	(17.65***)	(5.73***)	
(0, +36)	0.26	1.0006	1.0362	0.3743	0.6437
	(1.55)	(23.86***)	(18.17***)	(5.78***)	
(0, +60)	0.09	1.0299	1.0350	0.4172	0.6765
	(0.59)	(26.40***)	(19.29***)	(6.85***)	
Panel B: CS	**α**	**β**	**s**	**h**	**R-squared**
(-6, 0)	-1.31	1.0855	1.1770	0.2522	0.6396
	(-5.51***)	(18.77***)	(15.65***)	(2.90***)	
(0, +6)	0.05	1.0792	1.1273	0.2960	0.6006
	(0.20)	(17.69***)	(14.40***)	(3.23***)	
(0, +12)	0.06	1.0073	1.0764	0.3118	0.6293
	(0.29)	(19.14***)	(15.94***)	(3.94***)	
(0, +36)	0.20	1.0501	1.1822	0.3620	0.6896
	(1.05)	(21.84***)	(19.03***)	(5.01***)	
(0, +60)	0.18	1.0779	1.1502	0.3654	0.7423
	(1.08)	(25.44***)	(21.01***)	(5.75***)	
Panel C: R&D	**α**	**B**	**s**	**h**	**R-squared**
(-6, 0)	-1.17	1.1237	1.1657	-0.0861	0.7291
	(-5.31***)	(21.23***)	(16.91***)	(-1.09)	
(0, +6)	0.12	1.2066	1.2461	-0.0875	0.7111
	(0.49)	(20.10***)	(16.05***)	(-0.97)	
(0, +12)	0.31	1.2332	1.1340	-0.0086	0.7046
	(1.29)	(21.45***)	(15.28***)	(-0.10)	
(0, +36)	0.55	1.2182	1.1961	0.0545	0.6239
	(1.99**)	(17.97***)	(13.65***)	(0.54)	
(0, +60)	0.56	1.2024	1.1819	0.0485	0.6504
	(2.17**)	(19.00***)	(14.45***)	(0.51)	
Panel D: APEX	**α**	**B**	**s**	**h**	**R-squared**
(-6, 0)	-0.61	0.9801	0.9603	0.2283	0.6833
	(-3.50***)	(22.81***)	(17.06***)	(3.49***)	
(0, +6)	0.12	1.0244	0.9029	0.2234	0.5754
	(0.56)	(18.79***)	(12.72***)	(2.70***)	
(0, +12)	0.09	1.0358	0.8753	0.2248	0.6848
	(0.54)	(25.31***)	(16.14***)	(3.59***)	
(0, +36)	0.11	1.0171	0.8837	0.2761	0.7442
	(0.84)	(30.94***)	(19.92***)	(5.45***)	
(0, +60)	0.05	0.9915	0.8956	0.2926	0.7122
	(0.34)	(28.92***)	(19.26***)	(5.54***)	

*, **, *** indicate significance at the 10 percent, 5 percent and 1 percent level respectively.

Notes: $R_{pt} - R_{ft} = \alpha_p + \beta_p (R_{mt} - R_{ft}) + s_p SMB_t + h_p HML_t + \varepsilon_{pt}$ α_p represents the average abnormal monthly return, using the calendar-time Fama-French three-factor model, in percent for each investment category – A&M, CS, R&D, and CAPEX. A&M is advertising and marketing expense. CS is customer service expense, measured as the difference between selling, general, and administrative expenses (SG&A) and A&M. R&D is research and development expense. CAPEX is capital expenditure. R_{pt} is the average portfolio return, R_{ft} is the one-month Treasury bill rate, R_{mt} is the return on the market index, SMB_t is the return on a portfolio of small stocks minus the return on a portfolio of big stocks, HML_t is the return on a portfolio of high book-to-market ratios minus the return on a portfolio of low book-to-market ratios. β_p, s_p, h_p are the factor loadings on the systematic risk factors R_m, SMB, HML, respectively. Abnormal returns are reported for monthly windows (-6, 0), (0, +6), (0, +12), (0, +36), (0, +60) around the event date. The data are collected from the COMPUSTAT Active and Research files and the Center for Research in Security Prices (CRSP) database for the period from 1951 to 2005. *t*-statistics are reported in parentheses.

V. Conclusions

This paper analyzes whether firms' stocks earn abnormal returns after significant increases in investments in intangible and tangible assets. Earlier studies consider A&M in less detail with different methods, and do not consider CS at all. Also, unlike most previous studies, we use the actual fiscal year-end month as the annual event date.

We focus on firms that have high levels of investments in A&M, CS, R&D, and CAPEX, and study abnormal returns over various windows, before and after the investment event. Abnormal performance is measured with various methods including CAAR, BHAR, and calendar-time approaches. Although the CAAR approach may be less reliable for long-run studies, it is acceptable for detecting short-run abnormal performance. In any case, the methods produce similar results except that the calendar time results are somewhat weaker.

First, CAAR and BHAR results show positive short-run abnormal returns for large portfolios of firms that significantly increase their investments in intangible assets (A&M, CS, and R&D). Firms investing in tangible assets (CAPEX) earn no abnormal returns.

Second, we find consistent evidence of positive long-run abnormal performance for firms investing in A&M, CS, and R&D, although the results for CS are not as strong. Conversely, firms that significantly increase their CAPEX earn negative long-run abnormal returns.

Finally, we find that all of the portfolios underperform during the six-months before the investment events, by approximately – 5 percent to -7 percent. These results are consistent across a variety of empirical approaches.

Overall, our results show that stock prices respond favorably when firms invest in intangible assets and unfavorably when they invest in tangible assets. If stock investors have it right, our study suggests that policies designed to encourage intangible asset investment could be more valuable.

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