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Financial Markets and Marketing The Tradeoff between R&D and Advertising During an Economic Downturn

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Stock Market Valuation of the Tradeoff Between R&D and Advertising Intensities During an Economic Downturn

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Abstract

This paper examines the association between stock returns and earnings changes of firms that have made different tradeoffs with respect to R&D and advertising spending during an economic downturn. During the 2000-2002 bear market that was associated with a downturn in the U.S. economy, we find the coefficient that relates stock returns and earnings changes to be significantly greater for firms that increased their advertising expenditures and decreased their R&D expenditures than for firms that increased their R&D expenditures and decreased their advertising expenditures. Our results suggest that investors perceive that an increased emphasis on advertising can enable firms to stem earnings erosion that can potentially occur during an economic downturn.

During an economic downturn, investors pressure firms to closely evaluate and change discretionary expenditures (Srinivasan, Rangaswamy, and Lilien, 2005). We, however, do not know how investors respond to changes in discretionary expenditures that firms make during an economic downturn. This study examines investor response to relative changes in the key discretionary expenditures of R&D and advertising that firms made during an economic downturn. Specifically, we compare the coefficient that relates stock returns to changes in earnings for firms that, during an economic downturn, increase their R&D expenditures and decrease their advertising expenditures with firms that decrease their R&D expenditures and increase their advertising expenditures.

The coefficient that relates stock returns and earnings, called the Earnings Response Coefficient (ERC), indicates the extent to which investors revise their expectations about a firm's future earnings based on information conveyed by changes in current earnings (Beaver, 1968; Collins and Kothari, 1989). Typically, ERC studies focus on the significance of the study variable coefficients rather than the predictive ability of the overall model. This is because numerous non-accounting variables affect the firm's stock return, thereby the predictive ability of the ERC model is typically low (Francis et al, 2003; Lev and Zarowin, 1999).

Our study is in the mold of ERC studies that examine whether the stock market response to earnings changes differs based on changes in some earnings component of interest (Bodnar and Weintrop, 1997; Christophe, 2002). The earnings component of interest in this study is relative changes in R&D and advertising expenditures.

The rest of the paper is organized as follows. We first hypothesize the relationship between ERC and changes in R&D and advertising expenditures during an economic

downturn. Then, we present our model and describe our data. Next, we discuss the results of our analyses. Finally, we present a summary, conclusions, and limitations.

ERC AND SHIFTS IN DISCRETIONARY EXPENDITURES DURING AN ECONOMIC DOWNTURN

R&D, Advertising, and Firm Value

Both R&D and advertising create and/or strengthen key intangible assets that contribute to the future earnings potential of the firm (Erickson and Jacobson, 1992). Investment in R&D leads to production efficiencies, improvements of existing products, and creation of innovative products that enable a firm to compete more effectively with its competitors. Advertising contributes toward building strong brands that enable a firm to earn a price premium relative to competing brands and reduces its vulnerability to competition (Keller, 1998). Strong brands serve as market entry barriers for potential competitors (Aaker, 1996; Keller, 1998). Advertising also has a significant long-term effect on a firm's sales by influencing the attitudes of consumers and changing their consumption behaviors.

Many empirical studies find a positive relationship between firm value and changes in R&D and advertising intensities (expenditure scaled by sales). For example, Chan, Martin and Kesinger (1990) and Woolridge and Snow (1990) find a positive investor reaction to firms' announcements of increased R&D spending, while Reilly, McGann, and Marquardt (1977) find a positive relationship between changes in advertising expenditures and changes in stock prices. Likewise, changes in advertising activity such as hiring celebrity endorsers or sponsoring events are found to create value

for the participating firms (Agarwal and Kamakura, 1995; Miyazaki and Morgan, 2001).

Changes in R&D and Advertising Expenditures during an Economic Downturn and ERC

Firms change their resource deployment patterns in response to environmental changes (Miller, 1987; Miller and Friesen, 1983; Weick, 1979). A firm's assessment of the nature of environmental changes determines its response (Dutton and Jackson, 1987). During an economic downturn, some firms might see the changed economic environment as an opportunity and respond by increasing their discretionary expenditures, whereas other firms might perceive it as a threat and respond by conserving resources. Accordingly, during an economic downturn, some firms may increase/decrease R&D and advertising, or increase one and decrease the other activity.

An economic downturn affects how investors use information from current earnings to revise expectations of future earnings (Johnson, 1999). During a depressed economic environment, investors have lower risk tolerance and tend to develop a short-term orientation. Consequently, they are likely to favor activities that have a more certain and shorter payback period over activities that have a less certain and a longer payback period. Typically, the returns from R&D are more uncertain than the returns from advertising. Doukas, Pantzalis, and Kim (1999) note that R&D investment represents a high risk-return long term strategic decision, whereas advertising investment is a low-risk strategy that is more likely to yield results in the short run. Likewise, Chan, Lakonishok, and Sougiannis (2001) maintain that R&D projects entail large initial expenditures, uncertain outcomes, and potential benefits typically materialize over the long run.

Consistent with this conceptualization, Chan, Lakonishok, and Sougiannis (2001) find R&D expenditures increase volatility in stock returns, but advertising expenditures do not have the same effect.

When the economy slows, many firms will have to steal market share from competitors to maintain or grow earnings. In such an environment, a greater thrust on advertising can enable a firm to better restrict competition and maintain its earnings. In fact, empirical evidence shows a positive relationship between advertising and earnings persistence (Kessides, 1990; Mueller, 1990).

Given the relative risk-reward profile of R&D and advertising, investors are likely to favor advertising over R&D during an economic downturn. Accordingly, they will react more positively to earnings changes for firms that have decreased their R&D expenditures and increased their advertising expenditures than to the earnings changes of firms that have increased their R&D expenditures and decreased their advertising expenditures.

Given our arguments regarding the tradeoff between R&D and advertising expenditure changes, firms that choose to increase or decrease both R&D and advertising during an economic downturn may experience some dilution between the effects of the changes in both investments. The positive effect of increasing advertising (decreasing R&D) may be neutralized by the negative effect of increasing R&D (decreasing advertising). Accordingly, investor response to earnings changes would not be significantly different for firms that increased both R&D and advertising expenditures and firms that decreased both R&D and advertising expenditures.

HYPOTHESES TESTS

To examine the link between the ERC and the tradeoffs made between R&D and advertising expenditures, we create four dummy variables to represent four possible tradeoff strategies that firms can follow: firms that increase both R&D and advertising expenditures; decrease both R&D and advertising expenditures; increase R&D and decrease advertising expenditures; and decrease R&D and increase advertising expenditures. Following our discussion in the previous section, we expect the ERC of firms that increased advertising and decreased R&D expenditures to be greater than the ERC of firms that decreased advertising and increased R&D expenditures during an economic downturn. We also expect the ERC of firms that increased both R&D and advertising expenditures to be the same as that of firms that decreased both R&D and advertising expenditures. Our hypothesized effects are shown in Figure 1.

Insert Figure 1 about here

Method

To examine the shift in the ERC for firms that increase their R&D expenditures and decrease their advertising expenditures compared with firms that decrease their R&D expenditures and increase their advertising expenditures, we test the following model:

$$\begin{aligned} CAR_{it} = {} & \alpha + \beta_1 SIZE_{it} + \beta_2 NIC_{it} + \beta_3 RDI\,\&\,ADD_{it} + \beta_4 RDD\,\&\,ADI_{it} \\ & + \beta_5 NIC_{it} * RDI\,\&\,ADD_{it} + \beta_6 NIC_{it} * RDD\,\&\,ADI_{it} + \varepsilon \end{aligned} \quad (1)$$

Where:

- CAR_{it} is the cumulative daily abnormal return for firm i for year t accumulated over a 12-month period starting from 3 months after the beginning of the fiscal year t to 3 months after the end of fiscal year t,

- SIZE is the firm size as measured by the logarithm of the company's total assets,

- NIC_{it} is the change in net income (after adding back R&D and advertising expenses) scaled by sales for firm i between years $t-1$ and t,

-RDI&ADD is a dummy variable representing firms that have increased R&D expenditures *and* decreased advertising expenditures. It takes a value 1 if the change in R&D expenditure scaled by sales is positive *and* the change in advertising expenditure scaled by sales is negative and 0 otherwise,

- RDD&ADI is a dummy variable representing firms that have decreased R&D expenditures *and* increased advertising expenditures. It takes a value 1 if the change in R&D expenditure scaled by sales is negative *and* the change in advertising expenditure scaled by sales is positive and 0 otherwise.

In Equation 1, β_2 represents the ERC and β_5 and β_6 represent the shift in ERC for companies that adopted different tradeoffs between R&D and advertising. We expect β_6 to be significantly higher than β_5.

To examine the shift in ERC of firms that increased both their R&D and advertising expenditures, and firms that decreased both their R&D and advertising expenditures, we test the following model:

$$CAR_{it} = \alpha + \beta_1 SIZE_{it} + \beta_2 NIC_{it} + \beta_3 RDI\,\&\,ADI_{it} + \beta_4 RDD\,\&\,ADD_{it} + \beta_5 NIC_{it} * RDI\,\&\,ADI_{it} + \beta_6 NIC_{it} * RDD\,\&\,ADD_{it} + \varepsilon \quad (2)$$

Where:

-RDI&ADI is a dummy variable representing firms that have increased both R&D and advertising expenditures. It takes a value 1 if the change in R&D expenditure scaled by sales is positive *and* the change in advertising expenditure scaled by sales is positive and 0 otherwise,

- RDD&ADD is a dummy variable representing firms that have decreased both R&D and advertising expenditures. It takes a value 1 if the change in R&D expenditure scaled by sales is negative *and* the change in advertising expenditure scaled by sales is negative and 0 otherwise.

- Other variables are as previously defined.

We expect no significant difference between β_6 and β_5 in Equation 2.

Chauvin and Hirschey (1993) find that firm size and industry have an effect on the relationship between both R&D and advertising intensities and firm value. We control for firm size effect by including the variable SIZE in our models. We also control for any potential industry effect by including dummy variables for all double digit SIC codes that are represented in our sample. Finally, we estimate Equations 1 and 2 as fixed effects models by including dummy variables for the years in the study period to allow the constant to change with any fixed effects related to a specific year.

The dependent variable, the cumulative abnormal return (CAR) is accumulated daily over a 12-month period starting from 3 months after the beginning of the fiscal year to 3 months after the end of fiscal year as follows:

$$\tilde{C}AR_{it} = \sum (Ret_i - \hat{\alpha}_{it} - \hat{\beta}_{it} * Ret_m)$$

Where:

$\mathrm{Re}t_i$ = the daily rate of return of firm *I,*

Ret_m = the daily value-weighted market index rate of return, and

$\hat{\alpha}_{it}$, $\hat{\beta}_{it}$ = the regression estimates of CAPM parameters.

Because changes in R&D and advertising expenditures are typically not publicly announced but revealed to the market as part of the quarterly or annual accounting reporting process, we do not conduct an event study that examines stock returns over short windows around a particular announcement/event. Instead, we conduct an ERC association study that examines whether the returns-earnings relationship is mediated by the type of changes in a particular earnings component, viz. discretionary expenditures. Because the reporting period of earnings and its components is fiscal quarters and years, we use a long window to capture the market reaction to the quarterly and yearly earnings announcements. Collins and Kothari (1989) explain the rationale for a long window ERC study.

We follow the "random walk" model based on which unexpected earnings are measured by the difference between earnings of years $t-1$ and t. This approach is consistent with ERC studies that examine components of earnings (cf. Bodnar and Weintrop, 1997; Christophe, 2002) and also with other types of ERC studies in the accounting literature (cf. Ghosh and Moon, 2005).

Sample and Data

Our initial sample is the list of manufacturing companies (SIC codes starting with digits 2 or 3) in the Compustat active and research files for the year 2003. Data are for the years 2000, 2001, and 2002. During this period, U.S. equities experienced a bear market that was associated with a downturn in the U.S. economy. For a company to be included in the sample, we require that data on R&D expenditures, advertising expenditures, sales,

and earnings should be available in the Compustat files. We use the company's sales to scale the R&D and advertising expenditure variables and the logarithm of total assets as a proxy for the company's size. In addition, we require the daily returns of the company and the value-weighted daily market returns necessary to estimate the Cumulative Abnormal Return (CAR) to be available in CRSP files. We require a minimum of 90 daily return observations as an estimation period for the CAR market model. These conditions result in a final sample of 1139 firm-year observations pooled over the three-year period. The break up of sample firms that followed the four tradeoff strategies is as follows: firms that increased both R&D and advertising (290), firms that decreased both R&D and advertising (344), firms that increased R&D and decreased advertising (333), and firms that decreased R&D and increased advertising (172).

RESULTS

Sample Characteristics

Table 1 shows the industrial classification of the sample. Most industry categories are represented in the sample. As stated earlier, we have incorporated dummy variables for all double digit SIC codes in our regression models to control for any industry affect.

Insert Table 1 about here

Table 2 provides the descriptive statistics and the correlations among the variables used in the study. The correlations reveal that the level of advertising expenditure is positively and significantly correlated with CAR (.048, $p < .1$), but the level of R&D expenditure is not significantly correlated with CAR (-.009, $p > .1$).

Insert Table 2 about here

Empirical Tests

The results of the model represented in Equation 1 are given in Table 3. In this model, $(\beta_2 + \beta_5)$ represents the ERC of firms that decreased their advertising and increased their R&D expenditures and $(\beta_2 + \beta_6)$ represents the ERC of firms that increased their advertising and decreased their R&D expenditures. Accordingly, a significant difference between β_5 and β_6 will indicate that the ERC of the firms that decreased their advertising and increased their R&D expenditures is different from the ERC of firms that increased their advertising and decreased their R&D expenditures. The results show that β_5 (NIC*RDI&ADD) is significant and negative ($t = -1.856$, $p < .10$) whereas β_6 (NIC*RDD&ADI) is positive and not significant ($t = .659$, $p > .10$). The one-tail t test for the difference between β_5 and β_6 indicates the two coefficients are significantly different ($p < .10$). Taken together, these results support the expectation that the ERC of the firms that increase their advertising and decrease their R&D spending is higher than the ERC of firms that do the opposite.

Insert Table 3 about here

The results of the model in Equation 2 are given in Table 4. In this model, $(\beta_2 + \beta_5)$ represents the ERC of firms that increased both advertising and R&D expenditures and $(\beta_2 + \beta_6)$ represents the ERC of firms that decreased both advertising and R&D expenditures. Accordingly, a significant difference between β_5 and β_6 will indicate that

the ERC of the two groups of firms associated with these coefficients are different. The results show that both β_5 (NIC*RDI&ADI) and β_6 (NIC*RDD&ADD) are not significant. The one-tail t test for the difference between β_5 and β_6 indicates the two coefficients are not significantly different.

Taken together, the test results for our two propositions in this study support the contention that during an economic downturn the ERC of the firms that increase their advertising and decrease their R&D spending is higher than the ERC of firms that do the opposite, while the market reaction to either increasing or decreasing both of them is not significantly different.

Insert Table 4 about here

We conducted a sensitivity analysis, wherein we estimated the models in equations 1 and 2 after limiting the increase and decrease in both R&D and advertising expenditures to cutoff points of 1%, 5%, and 10% change. Our unreported results are similar to our reported results in both direction and significance level for the 1% and 5% cutoff points, but not significant for the 10% point probably because of the smaller sample analyzed as a result of the 10% restriction.

SUMMARY AND CONCLUSIONS

We find that, during the 2000-2002 bear market period for U.S. equities, investors responded more favorably to earnings changes of firms that increased their emphasis on advertising instead of R&D, rather than firms that increased their emphasis on R&D instead of advertising. This result is observed after controlling for potential firm size and

industry effects. Our results are consistent with Mizik and Jacobson (2003), who find that stock market reacts favorably when a firm increases its emphasis on value appropriation versus value creation.

We argue that firms that increase or decrease both R&D and advertising during an economic downturn may experience some dilution between the effects of the changes in both investments. The positive effect of increasing advertising (decreasing R&D) may be neutralized by the negative effect of increasing R&D (decreasing advertising). Accordingly, investors' response to earnings changes will not be significantly different for firms that increased both R&D and advertising expenditures and firms that decreased both R&D and advertising expenditures. This proposition is supported by our results and reinforces the conclusion that investors see an increased emphasis on advertising and a decreased emphasis on R&D as an appropriate strategy to maintain earnings during a challenging economic environment.

Given the cyclical and almost inevitable occurrence of economic downturns, it is important to build prescriptions for advertising activity during such times. Our results suggest that during economic downturns investors perceive increases in discretionary expenditures on advertising as a defensive strategy that enables the company to maintain its earnings potential. In comparison, investors are not as receptive to increases in R&D expenditures, which are associated with greater uncertainty of outcomes.

Within the academic and practitioner literature, a common belief is that firms overspend on advertising (Aaker and Carman, 1982; Joseph and Richardson, 2002). Our findings suggest that during an economic downturn, investors do not believe that firms are spending more. In fact, investors tend to respond positively to firms that increase

advertising expenditures.

In this study, we examine the direction of the changes in R&D and advertising expenditures and not the magnitude of these changes. Although we conducted sensitivity tests of our model using some cutoff points for the changes in both R&D and advertising expenditures, our model does not enable us to determine optimal cut-off points for changes in these expenditures. For determining the optimal magnitude of the changes in these expenditures, practitioners will need to consider their firm-specific factors.

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FIGURE 1
Grouping of Firms Based on Changes in R&D and Advertising Expenditures

		Advertising Expenditures: Increased	**Advertising Expenditures: Decreased**
R&D Expenditures	**Increased**	Group I Firms	Group II Firms
	Decreased	Group III Firms	Group IV Firms

The ERC of Group III Firms is expected to be greater than the ERC of Group II Firms

The ERC of Group I and Group IV Firms is not significantly different

TABLE 1

Sample Distribution by Industry (N = 1139)

SIC	Code title	Number
20	*Food And Kindred Products*	46
21	*Tobacco Products*	7
22	*Textile Mill Products*	1
23	*Apparel And Other Finished Products Made From Fabrics And Similar Materials*	6
24	*Lumber And Wood Products, Except Furniture*	3
25	*Furniture And Fixtures*	13
26	*Paper And Allied Products*	12
27	*Printing, Publishing, And Allied Industries*	7
28	*Chemicals And Allied Products*	202
29	*Petroleum Refining And Related Industries*	1
30	*Rubber And Miscellaneous Plastics Products*	24
31	*Leather And Leather Products*	12
32	*Stone, Clay, Glass, And Concrete Products*	7
33	*Primary Metal Industries*	10
34	*Fabricated Metal Products, Except Machinery And Transportation Equipment*	23
35	*Industrial And Commercial Machinery And Computer Equipment*	225
36	*Electronic And Other Electrical Equipment And Components, Except Computer Equipment*	243
37	*Transportation Equipment*	56
38	*Measuring, Analyzing, And Controlling Instruments; Photographic, Medical And Optical Goods; Watches And Clocks*	202
39	*Miscellaneous Manufacturing Industries*	39
Total		**1139**

TABLE 2
Descriptive Statistics and Correlation Matrix (N = 1139)

	Mean	S.D.	CAR	ADV	RD	NI	SIZE
CAR	-.12*	1.00	1	.048*	-.009	-.029	.041
ADV	.04*	.08		1	.158***	-.339***	-.054*
RD	.21*	1.04			1	-.634***	-.094***
NI	-.37*	1.69				1	.185***
SIZE	2.37*	1.07					1

** $p < .1$; ** $p < .05$; *** $p < .001$.*

- CAR is the cumulative abnormal return
- ADV is the level of advertising expenditures scaled by sales
- RD is the level of R&D expenditures scaled by sales
- NI is net income scaled by sales
- SIZE is the logarithm of total assets

TABLE 3
Regression Estimates for Comparing ERC of Firms that Increased Advertising and Decreased R&D with Firms that Decreased Advertising and Increased R&D Expenditures ‡

	Coefficient	**t-value**	**p-value**
SIZE	.025	.811	.411
NIC	-.002	-.070	.947
RDI&ADD	-.052	-.707	.480
RDD&ADI	.188	2.421	.016
NIC*RDI&ADD	-.074	-1.856*	.064
NIC*RDD&ADI	.062	.659	.510
R-Squared	.037		
F-Value	3.641***		
t-Value for $\beta_5 - \beta_6 = 0$ test (one tail)	1.35*		

** p < .1; ** p < .05; *** p < .001.*

- SIZE is the logarithm of total assets
- NIC is the change in net income as scaled by sales
- RDI&ADD is a dummy variable that takes 1 if the change in R&D expenditure scaled by sales is positive *and* the change in advertising expenditure scaled by sales is negative, and 0 otherwise
- RDD&ADI is a dummy variable that takes 1 if the change in R&D expenditure scaled by sales is negative *and* the change in advertising expenditure scaled by sales is positive, and 0 otherwise
- ‡ Industry SIC fixed effects and year fixed effects coefficients are omitted from the table

TABLE 4
Regression Estimates for Comparing ERCs of Firms that Increased Advertising and R&D with Firms that Decreased Advertising and R&D Expenditures ‡

	Coefficient	**t-value**	**p-value**
SIZE	.029	1.009	.313
NIC	-.047	-1.310	.191
RDI&ADI	-.096	-1.276	.202
RDD&ADD	-.020	-.279	.781
NIC*RDI&ADI	.073	1.362	.173
NIC*RDD&ADD	.046	1.249	.212
R-Squared	.031		
F-Value	3.042***		
t-Value for $\beta_5 - \beta_6 = 0$ test (one tail)	.48		

** $p < .1$; ** $p < .05$; *** $p < .001$.*

- SIZE is the logarithm of total assets
- NIC is the change in net income as scaled by sales
- RDI&ADI is a dummy variable that takes 1 if the change in R&D expenditure scaled by sales is positive *and* the change in advertising expenditure scaled by sales is positive, and 0 otherwise
- RDD&ADD is a dummy variable that takes 1 if the change in R&D expenditure scaled by sales is negative *and* the change in advertising expenditure scaled by sales is negative, and 0 otherwise
- ‡ Industry SIC fixed effects and year fixed effects coefficients are omitted from the