ADVERTISING, R&D AND VARIABILITY OF CASH FLOW AND INTANGIBLE FIRM VALUE

Maria Merino
Assistant Professor
Instituto Tecnológico Autónomo de México
Av Camino a Santa Teresa, 930 México D.F.
Tel 55-56-28-4000 ext 6530; Fax 55-54-90-4643
Email: mmerino@itam.mx

Raji Srinivasan*
Assistant Professor of Marketing
Red McCombs School of Business
University of Texas at Austin
CBA 7.248, Austin, TX 78712-1176
Phone: 512-471-5441, fax: 512-471-1034
email: raji.srinivasan@ mccombs.utexas.edu

Rajendra K. Srivastava
Roberto C. Goizueta Chair in e-Commerce and Marketing
Goizueta Business School, Emory University
1300 Clifton Road NE, Atlanta, GA 30322
404-727-4858 (office); 404-727-3552 (fax)
email: raj_srivastava@ emory.edu

July 2006

* author for correspondence. The authors thank Lopo Rego and Christophe Van den Bulte for their inputs on the research.

ADVERTISING, R&D AND VARIABILITY OF CASH FLOW AND INTANGIBLE FIRM VALUE

ABSTRACT

Variability in firm performance is a metric of paramount importance to managers of publicly listed firms. Firms with more variable performance have lower stock and bond ratings, higher costs of capital and are more likely to fail. Yet, there are few insights relating firms' strategic choices to the variability of their performance. In this paper, we examine the relationship between a firm's advertising and research and development (R&D) expenditure and related interactions between them and environmental turbulence and competitive intensity in the firm's environment on the variability of two financial performance metrics—cash flow and intangible firm value.

Measuring variability of firm performance by its conditional variance, we examine the relationship between advertising and R&D expenditure on variability of cash flow and intangible firm value using panel data from 245 publicly listed U.S. firms between 1994 and 2001 resulting in 1169 firm-years. We estimate a fixed effect, conditional heteroskedasticity regression model which simultaneously models the effects of the explanatory variables on the mean level and the variance of cash flow and intangible firm value and also accommodates unobserved firm heterogeneity.

The study's findings suggest a significant and important role for a firm's advertising and R&D expenditure on just the level but also the variability of its cash flow and intangible value. Not surprisingly, advertising and R&D expenditure, affect the variability of cash flow and intangible value differently. A firm's advertising expenditure increases the variability of its cash flow but decreases the variability of its intangible value. Importantly, advertising stabilizes both cash flow and intangible value in turbulent and competitive environments. A firm's R&D expenditure always increases the variability of both cash flow and intangible value, both independently, and in turbulent and competitive environments. The findings generate implications for marketing theory and marketing practice, which we discuss.

Keywords: advertising, R&D, cash flow, intangible value, conditional heteroskedasticity model, variability of performance,

INTRODUCTION

Achieving stable financial performance is an important goal for firms. Firms with variable financial performance have low stock and bond ratings, high costs of capital and high discount rates (Minton and Schrand 1999) which negatively affect their performance. Ceteris paribus, firms with more variable performance are more likely to fail than firms with stable performance (Levinthal 1991). In this paper, we examine the relationship between firms' advertising and research and development (R&D) expenditures and the variability of their cash flows and intangible firm values.

Recent theoretical developments (Rust et al. 2004; Srivastava et al. 1998; 1999) suggest that, in addition to their effects on sales revenues and profits, marketing actions including advertising and R&D expenditure create intangible market-based assets and marketing process capabilities that strengthen a firm's cash flows and shareholder value. Consistent with this thesis, several studies document the effect of various marketing actions including brand equity efforts (Lane and Jacobson 1995; Aaker and Jacobson 2001), advertising (Joshi and Hanssens 2005; Srinivasan et al. 2005) and new product introductions (Pauwels et al 2004) on shareholder value.

However, there are few insights relating marketing actions to the variability of firm performance. In a study of service SBU's, (Bharadwaj and Menon 1993) reported that some aspects of marketing such as promotions, sales force expenditure, and relative price were associated with lower variability of return on investment while other aspects such as advertising and customization were associated with higher variability. Related, customer satisfaction, an important market performance metric has been found to stabilize firm performance. Gruca and Rego (2005) reported that customer satisfaction creates shareholder value by increasing cash flow growth and reducing its variability. Fornell et al (2006) found that increased customer

satisfaction increases the returns and stability of a firm's or portfolio's stock returns. Note that the two studies (Bharadwaj and Menon 1993; Gruca and Rego 2005) which examined the effects of marketing actions on variability of performance did not simultaneously consider their effects on the level of performance. However, the level of performance and its variability, while inter-related, are distinct constructs. Thus, modeling the effects of explanatory variables on variability without consideration of their effects on the level of performance may result in mis-specification.

We examine the effects of a firm's advertising and R&D expenditure on the variability and the level of cash flow and intangible firm value—two important performance metrics for publicly listed firms. Cash flow is preferred by the investment community, over traditional earnings-based metrics such as return on assets, as creative accounting practices may, sometimes, be used to manipulate earnings. Further, as Srivastava, Shervani and Fahey (1998; p. 15) noted "cash flow is a relatively under-utilized variable in marketing theory and research…Thus the inclusion of cash flow as a variable in marketing studies will help marketers better understand the influence of marketing activities on intangible firm value." In addition, we focus on the firm's intangible value, a forward-looking, risk-adjusted, capital market-based measure, which is superior to backward looking accounting measures also susceptible to manipulation.

The effects of advertising and R&D expenditures (which as per accounting practice, are expensed annually) on variability of firm performance has high managerial relevance because senior management is especially concerned with their effects on financial performance (Ambler 2003; Rust et al. 2004a). As Rust et al. 2004 (p. 76) note "the spotlight is not on underlying products, pricing or customer relationships…but on marketing expenditures (e.g., marketing

communications, promotions and other activities) and how these measures influence marketplace performance."

Firms must be cognizant of interactions (both positive and negative) among elements of their strategy and environmental characteristics to maximize performance (Zeithaml et al. 1988). Two environmental characteristics that independently affect the variability of firm performance are environmental turbulence and competitive intensity in the firm's environment (Hambrick 1983; Miller and Friesen 1983; Zeithaml et al. 1988). Accordingly, we anticipate interaction effects of these two environmental variables with advertising and R&D expenditure on the variability of cash flow and intangible value. Thus, we propose main effects of advertising and R&D expenditure and related two-way interaction effects between them and with environmental turbulence and competitive intensity on the variability of cash flow and intangible value.

We focus on the effect of the various explanatory variables on the unexpected or unaccounted variance of cash flow and intangible value after accounting for their effects on levels of cash flow and intangible value respectively (Harvey 1976). Consider for example, a regression model of the form, $Y = b'X + e$, where Y is the dependent variable, and X a vector of explanatory variables, b' the vector of parameter estimates and e vector of the error terms. When the assumptions of multiple regression apply (i.e. that the explanatory variables are orthogonal to the errors and the errors are normally distributed with finite variance), the variance of Y, conditional on X is equivalent to the variance in errors (details provided in the method section). The conditional heteroskedasticity model, simultaneously, models the effects of explanatory variables on the variance of errors, which is equivalent to the variance of Y, conditional on X.

We use a cross-industry panel data of 245 publicly listed U.S. firms for the period 1994-2001, resulting in 1169 firm-years, to relate advertising and R&D expenditures, and related

interactions with environmental turbulence and competitive intensity on the mean and the variability of its cash flow and intangible value, measured by its Tobin's Q. We estimate the conditional heteroskedasticity regression model using a fixed effects formulation which accommodates unobserved firm heterogeneity.

The results strongly support the proposed model relating a firm's advertising and R&D expenditure and environmental turbulence and competitive intensity in the firm's environment to the level and variability of its cash flow and intangible value. Advertising and R&D expenditure, both independently, and in turbulent and competitive environments, have complex and contingent effects on both the level and variability of both cash flow and intangible value. The paper's findings have important implications for marketing theory and managerial practice, which we discuss.

The paper is organized as follows. In the next section, we first propose a conceptual framework and discuss the effects relating a firm's advertising and R&D expenditure, and the related interactions with environmental turbulence and competitive intensity to the variability of its cash flow and intangible value. We then describe method and the results. We conclude with a discussion of the paper's contributions, its limitations, and opportunities for further research.

THEORY

Conceptual Framework

Empirical studies indicate several performance rewards to advertising and R&D including increased sales revenues (Leone 1995; Hanssens, Parsons and Schultz 2001) and superior profits (Capon, Farley and Hoenig 1990). Srivastava, Shervani and Fahey (1998) propose that, in addition to their short-term effects on firm performance, advertising and R&D expenditure create intangible market-based assets which create barriers to competition, and can

be leveraged to enhance long term cash flow while simultaneously reducing the variability associated with it, increasing the firm's intangible value and decreasing its variability. Consistent with Srivastava et al's (1998) thesis, several empirical studies have found a link between market-based assets such as brand equity (Aaker and Jacobson 2001; Lane and Robertson 1995) and channel relationships (Srinivasan 2006) and intangible value.

Other recent developments suggest that a firm's advertising (Freider and Subrahmanyam 2004; Grullon et. al 2004; Joshi and Hanssens 2005) and R&D (Chan et al. 2001; Ho, Xu and Yap 2005) and innovation (Pauwels et al. 2004; Srinivasan et al. 2006) directly affect metrics related to its stock, and therefore, its intangible value, over and above, the indirect effects of advertising's through its effects sales revenues and profits and creation of market-based assets.

Accordingly, we hypothesize that a firm's advertising and R&D expenditure will affect the variability of its cash flow and intangible value, arising both from their indirect effects via the firm's sales revenues and profits and market-based assets, and their direct investor response effects on the firm's stock (Figure 1).

---- Insert Figure 1 here ----

Further, to account for interactions of a firm's marketing actions with environmental characteristics, we consider the interaction effects between advertising and R&D expenditure and environmental turbulence and competitive respectively on the variability of its cash flow and intangible value.

We note three key issues about our theory development approach. First, following extant theory, we anticipate similar effects of advertising and R&D expenditure on the variability of cash flow and intangible value. For example, differentiation from brand equity accruing from

advertising generates both higher and less variable cash flow. To the extent that these effects persist in the future (e.g., by creating barriers to competition, by providing strategic options) higher and less variable cash flow will be associated with higher and less variable intangible value. However, we do estimate separate models for the variability of cash flow and intangible value enabling us to observe their (distinct, if any) effects on each performance metric. Second, given our focus on the variability of cash flow and intangible value, we do not formally propose effects of advertising and R&D expenditure (which are well-established in the extant literature) on the level of either cash flow or intangible value. However, we do observe these effects because we simultaneously estimate the effects of explanatory variables on both level and variability of both cash flow and intangible value. Third, given the limited research relating marketing actions to variability of firm performance, extant theory, in some cases, suggests opposing effects. In such cases, we present arguments for the opposing effects and observe the direction of the effects.

Advertising

Diverse, empirical studies provide robust and strong evidence of a consistent, positive effect of advertising on various firm performance metrics. Empirical studies on sales response to advertising across diverse industry contexts indicate a positive, albeit small, sales response elasticity both in the short-term and long-term (Assmus et al. 1984; Dekimpe and Hanssens 1995; Leone 1995), which should, ceteris paribus, increase level of cash flow. Other empirical studies suggest that advertising positively affects levels of various performance metrics including return on assets (Erickson and Jacobson 1992), intangible firm value (Chauvin and Hirschey 1993), market capitalization (Joshi and Hanssens 2005) and weighted average cost of capital (Singh, Faircloth and Nejadmalayeri 2005).

Our interest is in the effect of a firm's advertising expenditure on the variability of its cash flow and intangible value. Advertising creates a differentiation advantage for a firm's products (Kirmani and Zeithaml 1993), increasing price premiums (Ailawadi et al. 2003) and reducing consumer price sensitivities both in the short-term (Kaul and Wittink 1995; Sethuraman and Tellis 1991) and long-term (Mela et al. 1997). Higher advertising creates higher brand equity, a rare and inimitable asset, which creates significant entry barriers to both product-based and price-based competition, strengthe ning the and stabilizing firm's sales revenues and profits (Aaker 1996; Keller 1998). Thus, a firm's increased advertising, may decrease the variability of its cash flow and intangible value.

In addition to these indirect effects via sales revenues and profits, a firm's advertising, affects its visibility with the investors which may also directly affect the variability of intangible value. Joshi and Hanssens (2005) reported such a direct, investor response effect of advertising on the firm's market capitalization (see Figure 1). A firm's advertising increases its salience among individual investors who prefer holding stocks with high recognition, consistent with higher advertising (Frieder and Subrahmanyam 2005). Firms with higher advertising expenditures, ceteris paribus, have a larger number of both individual and institutional investors, and greater liquidity of their common stock (Grullon, Kanatas and Weston 2004) increasing the stock returns and stabilizing the stock price. Investors, alert to the benefits of increased advertising through enhanced brand equity (Barth et al. 2001; Rao et al. 2004) may look beyond a firm's current cash flows, to the long term benefits of its advertising, increasing their expectations of stable, and enhanced future cash flow, further increasing and stabilizing

intangible value. Thus, a firm's increased advertising, may, directly decrease the variability of its intangible value.[1]

However, other developments suggest that a firm's advertising may increase the variability of its cash flow. Advertising is a risky, market experimentation endeavor (Eastlack and Rao 1989) with uncertain returns. A meta-analysis of 389 advertising campaigns indicated that advertising campaigns are more effective if they conveyed new information (Lodish et al. 1995). Indeed, only a fraction of advertising campaigns are effective in achieving their stated objectives and vivid examples of failed advertising campaigns abound. Thus, a firm's increased advertising which may include both effective and ineffective campaigns, may increase the variability of its cash flow and intangible value.

R&D

As with advertising expenditure, extensive empirical evidence suggests that a firm's R&D expenditure is positively related to various metrics including return on assets (Erickson and Jacobson 1992), stock prices (Lev and Sougiannis 1996), stock returns (Chan et al. 2001; Mizik and Jacobson 2003) and intangible value (Cockburn and Griliches 1988). Our interest is in the effect of a firm's R&D expenditure on the variability of its cash flow and intangible value.

The prospects of R&D intensive firms are related to the success of new, untested technologies, which, by definition, are risky and unpredictable. R&D projects require considerable financial outlays both at the outset and on an ongoing basis, even as their outcomes (e.g. technically and commercially viable new products) are both distal and uncertain. Consistent with this idea, empirical studies in accounting and finance indicate that R&D expenditure increases volatility in stock returns (Chan, Lakonishok and Sougiannis 2001;

[1] We thank an anonymous reviewer for guiding the development of this section.

Kothari et al 2002) and systematic risk of the firm's stock (Ho, Xu and Yap 2004). Analysts exhibited greater disagreement about year-ahead earnings for R&D intensive firms relative to less R&D intensive firms (Barth et al 2001). Extending these developments suggests that a firm's R&D expenditure may increase the variability of cash flo w and intangible value.

However, other recent research (Mizik and Jacobson 2003) indicates that R&D expenditure fosters a value creation capability resulting in superior products and superior stock returns. Thus, increased R&D expenditure may produce a superior value creation capability, enabling the firm to stabilize its cash flow and intangible value. In addition, investors cognizant that a larger pipeline of innovative products may result from the firm's increased R&D expenditure may look beyond its current performance, increase their expectations of enhanced and more stable future cash flow, in turn, increasing and stabilizing its intangible value. Thus, a firm's increased R&D expenditure may decrease the variability of its intangible value.

Advertising and R&D

Integrating the arguments for the main effects of a firm's advertising and R&D expenditure above, suggests opposing interaction effects between them on the variability of its cash flow and intangible value. On the one hand, increased advertising and R&D expenditure, which may independently increase the variability of cash flow and intangible value, together may further increase the variability of cash flow and intangible value.

On the other hand, advertising and R&D expenditure are complementary with R&D expenditure fostering a value-creation capability and advertising expenditure fostering a value appropriation capability (Mizik and Jacobson 2003). Taken together, they may enable a firm to both increase and stabilize its cash flow and intangible value. Further, as noted, advertising is more effective when it conveys new information (Lodish et al. 1995). Increased R&D

expenditure, which should, ceteris paribus, produce more novel products may result in more effective advertising, lowering the variability of both cash flow and intangible value.

Turbulent Environments

We define environmental turbulence by the extent of change in the firm's market environment (Lawrence and Lorsch 1967). Environmental turbulence increases the uncertainty in the demand for the firm's products, because of diversity in consumers' needs and preferences and the products and technologies required to satisfy these needs (Lawrence and Lorsch 1967; Miller and Friesen 1983). Because of the high uncertainty inherent in turbulent environments, firms are severely challenged in coping and succeeding in such environments. The pertinent question here is whether the effects of a firm's advertising and R&D expenditure on variability of cash flow and intangible value are contingent on the level of turbulence in its environment.

Advertising and Environmental Turbulence. Turbulent environments are characterized by shifting demand patterns and changing customer needs. In such environments, firms with high brand equity consistent with higher advertising expenditure (relative to low brand equity firms) may achieve lower marketing costs (e.g., channel and brand management costs, customer acquisition and retention costs), build entry barriers to low-cost competitors, increasing and stabilizing their sales revenues, and profits. In addition, high brand equity firms may also achieve superior and stable revenues and profits, through up-selling and cross-selling products to current and potential customers with changing needs (Kamakura et al. 2003).

Further, high brand equity firms can reduce the uncertainty of market response to new products, which may be more frequently introduced in more turbulent environments (relative to less turbulent environments). For example, such firms can introduce new products later, and at much lower costs, when the market uncertainty has resolved, as observed in the advantages for

incumbent, late entrants with superior market-based assets (Golder and Tellis 1993) not only their improving sales revenues and profits, but also, we suggest, stabilizing them. In addition, in turbulent environments, we anticipate that the investor response effect of advertising may also increase as a firm's increased advertising may directly raise the saliency of its stock among the investment community, further stabilizing its stock price and intangible value. Thus, given these arguments, we anticipate that a firm's increased advertising in turbulent environments may lower the variability of its cash flow and intangible value.

R&D and Environmental Turbulence. As noted above, in turbulent environments, consumer needs and both the products and technologies to satisfy them change rapidly. As with advertising, the R&D efforts of firms in turbulent environments may represent a high degree of technical and market experimentation resulting in a mix of successful and unsuccessful products and technologies. In addition, product lifecycles in turbulent environments are very short because of changing market needs (and technological developments) resulting in uneven financial returns to a firm's R&D expenditure (Cohen and Levinthal 1990; Griffith, Redding and Van Reenen 2004; Mairesse and Sassenou 1991) increasing the variability of its sales revenue, profit and therefore, the variability of its cash flow and intangible value.

Further, R&D programs are characterized by lumpy and front-loaded expenditure (i.e. large. fixed investments in the early stage of product development cycles) which cannot be effectively scaled up or down in response to market changes in turbulent environments either in the short term (i.e. the current accounting year) or perhaps, even in the medium term (i.e. two to three years) further exacerbating the uneven returns to R&D expenditure in such environments. Accordingly, the interaction effect between a firm's R&D expenditure and environmental turbulence may increase the variability of its cash flow and intangible value.

Competitive Environments

Competitive intensity refers to the degree of competition the firm faces in its industry. Competitive intensity suggests that the industry is characterized by a few firms with a large share of the market, with both disproportionate market and financial power (Barnett 1997). Competitive environments will be characterized by lower prices and lower customer switching costs producing lower profits, on average, for all firms in the industry. The question of interest, to us, is whether the effects of a firm's advertising and R&D expenditure on the variability of its cash flow and intangible firm value are contingent on the level of competition in its industry.

Advertising and Competitive Intensity. As in the case of turbulent environments, high brand equity firm may be able to differentiate themselves effectively in competitive environments, achieving both high prices and high customer loyalty increasing and stabilizing its sales revenues and profits. High customer switching costs for high brand equity firms may also create customer inertia raising the barriers for both lower priced competitors and competitors from outside the industry to increase their market presence (Smith and Park 1992). Further, in competitive environments, a high brand equity firm may be able to respond cost-effectively (because of lower marketing costs) to competitive onslaughts (e.g., new products, lower prices) stabilizing its sales revenue and profit, in turn, decreasing the variability of its cash flow and intangible value.

In addition to these indirect effects of advertising on the variability of cash flow and intangible value, in competitive environments, the investor response effect of advertising may also increase as a firm's increased advertising may directly raise the saliency of its stock (relative to less advertised firms) among the investment community, both increasing and stabilizing its

intangible value. Integrating the several arguments above, in competitive environments, a firm's increased advertising may decrease the variability of its cash flow and intangible value.

R&D and Competitive Intensity. In competitive environments, firms may face many strong competitors with the ability to serve customers' needs. Frequently, such environments are characterized by R&D races between firms (e.g., Intel and Advanced Micro Devices in the 64 bit processor market) where several firms simultaneously pursue multiple aggressive, new product and technology development efforts. Because of the intense price competition in such environments, such R&D races not only provide lower innovation rents for all firms in the race (Dixit 1988; Doraszelski 2003). Further, given the intense and continually dynamic nature of the R&D activities of various competitors in such markets, the returns to each firm's R&D efforts may not only be lower but also less certain and available for a shorter time window. As in turbulent environments, a firm cannot effectively change its lumpy, front-loaded R&D expenditure cannot in response to competitive activity (e.g., new technology development) exacerbating the uneven returns to R&D expenditure in competitive environments, increasing the variability of its sales revenue, profit and cash flow.

Other arguments suggest the opposite. In competitive environments, investors may be cognizant that a larger future pipeline of innovative products from the firm's increased R&D expenditure may enable it to compete more effectively in the future, increasing their expectations of increased and more stable future cash flows, stabilizing its intangible value. Thus, a firm's increased R&D expenditure may also directly decrease the variability of its intangible value. In sum, the interaction effect between a firm's R&D expenditure and competitive intensity may increase the variability of its cash flow and intangible value.

Table 1 summarizes the effects of a firm's advertising and R&D expenditures, in conjunction with environmental turbulence and competitive intensity on the variability of its cash flow and intangible value. We next discuss the method we use to test the proposed conceptual framework.

---- Insert Figure 1 here ----

METHOD

Conditional Heteroskedasticity Model

We model the unexpected/unexplained variance of cash flow and intangible firm value, conditional on the levels of cash flow and intangible firm value respectively. In other words, we define the variability in performance as the residual variance about the predicted regression values.

We use the conditional heteroskedasticity regression model (Harvey 1976; Woolridge 2002) to relate a firm's advertising and R&D expenditure to the variability of cash flow and intangible firm value. The conditional heteroskedasticity regression model extends the standard linear regression model of the expected value of the dependent variable to include a model of the variance of Y, conditional on X. Consider for example, a regression model of the form,

(1) $Y = b'X + e$,

where Y is the dependent variable, and X a vector of explanatory variables, b' the vector of parameter estimates and e vector of the error terms, so that $Y_i = m_i + s_i e_i$ and $m_i = E(Y_i) = b'X_i$ where Y_i is the dependent variable with mean m_i and variance s_i, with a linear model for the mean of the dependent variable.

When the following assumptions of multiple regression apply: 1) that the vector of explanatory variables X is orthogonal to the errors, 2) that the errors, conditional on the

explanatory variables are normally distributed with finite variance such that $E[e \mid X] = 0$) and $E(e^2 \mid X\} is finite)$ the variance of Y, conditional on X is given as:

$$Var(Y \mid X) = E[Y^2 \mid X] - \{E[Y \mid X]\}^2 = E[b^2X^2 + 2bXe + e^2 \mid X\}] - \{E[bX + e \mid X]\}^2 = E[e^2 \mid X].$$

Thus, the variance in errors conditional on X is equivalent to the conditional variance of Y (i.e. variance of Y conditional on X's). The proposed conditional heteroskedasticity regression which models the effects of the explanatory variables on the unexpected variance in Y has the following form:

(2) $s^2_i = Var(Y_i) = Var(e^2) = \exp(g'Z_i)$, which is a log-linear model for the variance of the dependent variable, conditional on a set of explanatory variables. The g parameters capture the effect of the explanatory variables Z_i, which may be identical to or different from X_i on the variance in the dependent variable. Explanatory variables that increase (decrease) the variability of the firm's performance should have $g > 0$ ($g < 0$).

In the conditional heteroskedasticity model, the two equations (1) and (2) are estimated jointly using the maximum likelihood method in multiple iterations. Since s_i, a population parameter is unknown, ordinary least squares estimation of (1) produces the residuals $\hat{e}_i$; $\hat{e}^2_i$ is the estimate of s^2_i (the variance of Y_i). In the next step, the model estimate ordinary least squares regression of $Log(s^2_i)$ on Z_i to obtain the predicted values of $\hat{s}_i$. In the next steps, $\hat{s}_i$ is substituted in (1), which is then re-estimated using ordinary least squares approach. This iterative procedure is repeated for $j+1$ iterations until the estimated values of b and g converge i.e. $\hat{b}_j = \hat{b}_{j+1}$ and $\hat{g}_j = \hat{g}_{j+1}$ (Greene 2003, pp. 229-239).

The heteroskedasticity formulation we propose in Equation (2) is multiplicative and specifies $s^{2}_{i} = Var(y_i) = \exp(g'Z_i)$. Alternative formulations of the heteroskedasticity formulation include linear and square formulations: $s^{2}_{i} = Var(y_i) = 1 + g'Z_i$ and $s^{2}_{i} = Var(y_i) = (1 + g'Z_i)^2$ respectively (Harvey 1976). The multiplicative heteroskedasticity formulation is generally preferred for estimation three reasons (Harvey 1976; p. 465). First, the likelihood function is bounded and no problems arise with estimated variances being negative or zero. Second, the error terms in the two-step estimators of the two-step equation are asymptotically homoskedastic so that the estimated covariance matrix of $\hat{g}$ is consistent. Third, the likelihood ratio test has a much simpler form in the multiplicative model. We subsequently report on the empirical tests of alternative formulations of the heteroskedasticity.

In marketing, Chandrashekaran et al. (2000) used the conditional (multiplicative) heteroskedasticity model to model the effect of affective and continuance commitment, and critical sales events on the magnitude and uncertainty of sales person intention to quit. In the strategy literature, the conditional (multiplicative) heteroskedasticity approach has been used by Sorensen (2002) for modeling the effects of organizational culture on the mean and variability of firm performance.[2] To our knowledge, no studies in marketing have applied the conditional heteroskedasticity model to examine the variability of firm performance.

Conditional Heteroskedasticity Model and Panel Data

The regression approach developed earlier is applicable to cross-sectional data. However, as we discuss in the following section, we use a panel data with observations for a firm for multiple years as follows:

(3) $Y_{it} = X_{it}b + c_i + u_{it}$

[2] We thank two anonymous reviewers for the development of the method section.

Accordingly, we adapt the cross-sectional conditional heteroskedasticity model in (1) to the panel data case. To account for potential dependencies across observations of a given firm over time, we perform a fixed effects or a "within transformation" by averaging the dependent variable Y_i and independent variables X_i, Z_i over *i*= 1, 2, ….for Equation (3) for all *t*. (Woolridge 2002; pp. 267-269).

(4) $\overline{Y}_i = \overline{X}_i b + c_i + \overline{u}_i$ where $\overline{Y_i} = T^{-1} \sum_{t=1}^{T} Y_{it}$, $\overline{X}_i = T^{-1} \sum_{t=1}^{T} X_{it}$ and $\overline{u}_i = T^{-1} \sum_{t=1}^{T} u_{it}$.

Subtracting Equation (4) from Equation (3) for each *t* gives the fixed effects transformed equation,

(5) $Y_{it} - \overline{Y}_i = (X_{it} - \overline{X}_i) b + (u_{it} - \overline{u}_i)$

Ordinary least squares estimation of Equation (5) provides consistent fixed effects estimators that accounts for unobserved firm heterogeneity. We implement the model in SAS 9.1.

Data

We use data from a panel of publicly listed firms to test the proposed model. The panel includes 245 firms for the period between 1994 and 2001 resulting in an unbalanced panel of 1169 complete observations resulting in an average length of 4.77 years. We provide a distribution of the firms across different industries in Table 2.

---- Insert Table 2 here ----

From Table 2, we see that the firms included in the dataset cover a wide range of industries including manufacturing, financial services, high technology and pharmaceuticals. We collected data from COMPUSTAT and other secondary data sources.

Measures

Cash flow. We define cash flow as net income plus capital expenditure and depreciation less interest expenses, taxes and dividends. Given our focus on the effects of advertising and R&D expenditures which do not influence a firm's capital expenditure decisions, we add back capital expenditure into cash flows.[3] We scale the firm's cash flow by its total assets to account for varying asset intensities across firms and industries (Gruca and Rego 2005).

Intangible firm value. We measure intangible firm value by Tobin's Q and calculate it as follows: $Q = \frac{MVE + PS + DEBT}{TA}$ where MVE is (the closing price of shares at the end of the financial year × number of common shares outstanding), PS is the liquidation value of the firm's outstanding preferred stock, DEBT is the sum of book value of inventories, long term debt and current liabilities less current assets, and TA is the book value of total assets (Chung and Pruitt 1994).

Advertising expenditure. Because advertising data is missing for a number of firms and time periods in COMPUSTAT, we collected data on advertising expenditure from *Leading National Advertisers' Multi-media Service,* published by Taylor Nelson, which we, believe provides a more accurate estimate of firms' advertising expenditures, than that reported in COMPUSTAT database.

We operationalize a firm's advertising expenditure by its stock, which takes into consideration advertising over the past two years as well, as a focus on current year's expenditure may not capture intangible market-based assets (e.g., brands and customer relationships) and product innovations resulting from advertising and R&D expenditure as their

[3] We thank an anonymous reviewer for this suggestion.

effects persist beyond the accounting year in which the expenditure is incurred (Hirschey 1982; Hirschey and Weygandt 1985). We compute advertising stock in a given year using advertising expenditure for the previous three years using a 30% depreciation rate (Hirschey and Weygandt 1985). We subsequently report robustness of the results to an alternative stock measure of both advertising and R& D expenditure.

R&D expenditure. We use the firm's R&D expenditure reported in DATA46 in COMPUSTAT. We computed R&D stock using the firm's R&D expenditure for the previous seven years using a 15% depreciation rate (Hirschey and Weygandt 1985).

Environmental turbulence. Given our focus on financial performance metrics, we use the Fama and French industry classification which combines industries based on the Standard Industry Classification codes (SIC) to obtain a manageable number of industries that cover stocks in the U.S stock exchanges (Fama and French 1997). We computed the environmental turbulence measure by computing the industry average of the coefficient of variation defined as the standard deviation of the previous twelve quarters' sales divided by the mean of the sales for the same period. We included all firms in a given industry in COMPUSTAT for the computation of this measure. For the computation of environmental turbulence and competitive intensity, the mean number of firms in each industry (in a given year) was 80 (standard deviation = 23) ruling out the possibility that environmental turbulence was endogenously determined by the advertising and R&D expenditures of a few large firms in the industry.

Competitive intensity. We computed the competitive intensity measure by the four-firm Herfindahl's concentration index of the industry's sales i.e. the proportion of industry sales of the largest four firms. Again, we included all firms in a given industry in COMPUSTAT for the computation of this measure.

Table 3 contains the descriptive statistics and correlation matrix of the measures in the study. The correlations were within acceptable limits. The highest correlation (? =.68) is between advertising expenditure and R&D expenditure. We assessed potential threats from multicollinearity and found that the VIF (Variance Inflation Factor) and condition numbers were much lower than 10 (average = 1.13; maximum = 3.35) and 15 respectively (average= 1.24; maximum = 2.88), suggesting that multicollinearity and ill-conditioning of variables may not be a threat to the validity of the study's findings.

---- Insert Table 3 here ----

RESULTS

Variability of Cash Flow

Following the procedure to adapt the conditional heteroskedasticity model to panel data, we first mean-centered all explanatory variables and then created the interaction terms. We included the firm's financial leverage which was computed as the ratio of its long-term debt to its total assets (Jensen and Meckling 1976) and its size measured by its sales revenues as control variables in the model. In addition, we included control variables for the firm's industry and the different time periods in the model. We also included the main effects of environmental turbulence and competitive intensity to ensure proper specification of the model. Finally, following the suggestion of an anonymous reviewer, we included a control variable for the cash flow performance trend—i.e. whether the cash flow growth, over the past year, was positive or negative.

The parameter estimates from the conditional heteroskedasticity regression model are presented in Columns (1) and (2) respectively of Table 4 (SBC [Schwarz Bayesian Criterion] = -

3029.98). The pseudo-R-square of the proposed model is .29. The Chi-square test for heteroskedasticity is significance ($p < .01$) strongly supporting the proposed heteroskedasticity formulation. We present the results of the models for both cash flow and intangible value below. The detailed implications of these findings are examined in the discussion section that follows.

With respect to the control variables, firm size has no effect on cash flow ($b = .00$, ns) or its variability ($b = .00$, ns). Debt leverage lowers the level of cash flow ($b = -19.32$, $p < .01$) and decreases its variability ($b = -32.78$, $p < .05$). Both environmental turbulence and competitive intensity do not affect the level of cash flow ($b = -2.68$, ns; $b = 52.63$, ns respectively) but increase its variability ($b = 900.01$, $p < .01$, $b = 784.13$, $p < .01$). Some of the control variables for both time periods and industry have significant effects on both the level and the variability of cash flow.

With respect to the main effects of advertising and R&D expenditures, consistent with the past literature on the various performance rewards to firms' advertising and R&D programs, both advertising expenditure increase the level of cash flow (advertising: $b = .01$ $p < .01$; R&D: $b = .11$, $p < .10$) and its variability (advertising: $b = .63$, $p < 0.05$; R&D: $b = .05$, $p < .01$). However, the interaction effect between advertising and R&D expenditure affects neither cash flow ($b = .02$, ns) nor its variability ($b = .01$, ns).[4]

[4] As suggested by an anonymous reviewer, an alternative explanation for these effects may be that firms with high advertising (or R&D expenditure) can cut advertising (or R&D) expenditure when their environments get tough. We tested this explanation by creating a new variable—which denotes changes industry sales growth, and then creating two data sets using a median-split of industry sales growth: one where sales growth is higher than the median (munificent environment) and one where the sales growth is lower than the median (hostile environment). We created another variable that represented changes in advertising and R&D expenditure and correlated these changes advertising and R&D expenditure respectively. If the secondary explanation is true, in the hostile environment there should be a significant, positive correlation between advertising expenditure (and R&D) and changes in advertising (and R&D). In the hostile environment, the correlation between advertising expenditure and changes in advertising expenditure was not significant ($? = -0.029$, ns) and the correlation between R&D expenditure and changes in R&D expenditure is positive but small ($? = 0.07$, $p < .10$) suggesting that this secondary explanation does not apply.

With respect to environmental characteristics, the interaction effect between a firm's advertising expenditure and environmental turbulence does not affect the level of cash flow (b = -.03, ns) but decreases its variability (b = -25.78, $p < 0.01$) while the interaction between a firm's R&D expenditure and environmental turbulence affects neither cash flow (b = -.01, ns) nor its variability (b = -.06, ns). The interaction effect between advertising expenditure and competitive intensity decreases the level of cash flow (b = -.05, $p < 0.01$) and its variability (b = -25.48, $p < 0.01$) while the interaction between R&D expenditure and environmental turbulence has not effect on cash flow (b = .00, ns) but increases its variability (b = 1.09, $p < .01$). We next discuss the results pertaining to intangible firm value.

---- Insert Table 2 here ----

Variability of Intangible Firm Value

The model for the effects of a firm's advertising and R&D expenditure on its intangible value includes all variables included in the model for cash flow and cash flow and cash flow trend. Thus, this model estimates the effects of the various explanatory variables on the variability of intangible firm value, after *controlling* for the effect of cash flow.

The parameter estimates from the heteroskedasticity regression model are presented in Columns (3) and (4) respectively of Table 2 (SBC [Schwarz Bayesian Criterion] = 3659.46). The pseudo-R-square of the proposed model is .23. Again, the Chi-square test for heteroskedasticity is significance ($p < .01$) strongly supporting the proposed heteroskedasticity formulation.

With respect to the control variables, firm size increases its intangible value (b = .21, $p < .10$) but does not affect its variability (b = .00, ns). Financial leverage does not affect intangible value (b = -.36.42, ns), but decreases its variability (b = -194.35, $p < 0.01$). Environmental

turbulence does not affect the firm's intangible value (b = 52.63, ns) but increases its variability (b = 784.13, p < .01), while competitive intensity does affect the firm's intangible value (b = 20.76, ns) but decreases its variability (b = -1274.58, p < .01). Cash flow increases both the level of intangible firm value (b = 1.76, p < .01) and its variability (b= 0.40, p < 0.05). With respect to the control for the performance trend of cash flow, we find that it has no effect on the level of intangible value (b = -1.48, ns) but lowers its variability (b = -8.24, p < .05). In other words, a positive performance trend in cash flow stabilizes the firm's intangible value. As in the model for cash flow, some of the control variables for time periods and industry have significant effects on the level and the variability of intangible value.

Again, we first discuss the main effects of explanatory variables, followed by their interaction effects. To start with, a firm's advertising expenditure (b = .11, p < .10) and R&D expenditure (b = .02, p < .01) increase its intangible firm value, while advertising decreases the variability of intangible value (b = -.62, p < .01) while R&D increases it (b = 0.06, p < .01). The interaction between advertising and R&D expenditure does not affect its intangible value (b = .01, ns) but increases its variability (b = .20, p < .01).

With respect to environmental characteristics, the interaction between advertising expenditure and environmental turbulence lowers the level of intangible value (b = -3.18, p < .05) but decreases its variability (b = -6.23, p < .10) while the interaction between R&D expenditure and environmental turbulence neither affects the level of intangible value (b = -.26, ns) nor its variability (b = .32, ns). As with environmental turbulence, the interaction between the firm's advertising expenditure and competitive intensity lowers intangible value (b = -8.54, p < .01) and decreases its variability (b = -10.87, p < .01). Finally, a firm's R&D expenditure in

competitive environments does not affect the level of intangible value (b = -.20, ns) but increases its variability (b =.96, p <.01).

In sum, the proposed model relating a firm's advertising and R&D expenditure, both independently and in conjunction with its environmental characteristics significantly affects the level and variability of its cash flow and intangible value. However, the pattern of results we obtain with respect to the effects of advertising and R&D expenditure on the level of cash flow and intangible value (when variability is incorporated in the model) is different from that suggested by developments in prior research. We examine the emergent insights from the pattern of effects of advertising and R&D expenditure on the level and variability of cash flow and intangible value in detail in the discussion section. We next discuss the results of additional analyses that examine the robustness of the results.

Additional Analyses [5]

Specification of Heteroskedasticity. Specifically, the heteroskedasticity formulation we propose in Equation (2) is exponential and specifies $s^{2}_{i} = Var(y_i) = \exp(g'Z_i)$ while the linear and square formulations specify $s^{2}_{i} = Var(y_i) = 1 + g'Z_i$ and $s^{2}_{i} = Var(y_i) = (1 + g'Z_i)^2$ respectively.

We re-estimated the conditional heteroskedasticity models reported in Table 4 with linear and square formulations of the heteroskedasticity error term. The models for both cash flow and intangible value with the linear heteroskedasticity error formulation failed to converge. The model with the square heteroskedasticity error formulation was outperformed (results not reported in the paper but available on request from the authors) by the model with multiplicative heteroskedasticity error formulation for both cash flow ($SBC_{(square)}$ = -2792.16; $SBC_{(multiplicative)}$

[5] We acknowledge the suggestions of four anonymous reviewers in the development of this section on robustness checks of the results.

= -3029.98; lower SBC denotes superior fit) and intangible value ($SBC_{(square)}$ =3830.32; $SBC_{(multiplicative)}$ = 3659.46) supporting the multiplicative heteroskedasticity error formulation.

Incorporation of heteroskedasticity in errors. We compared the performance of the proposed model, with an ordinary least squares model which does not incorporate heteroskedasticity in errors. For both cash flow and intangible firm value, the models with the conditional heteroskedasticity error formulation outperformed the models without it supporting the proposed heteroskedasticity model formulation: cash flow: model with heteroskedasticity (SBC = -3029.98) compared to model without heteroskedasticity (SBC = -2854.82); intangible firm value: model with heteroskedasticity (SBC = 3659.46) compared to model without heteroskedasticity (SBC = 4861.11).

Model specification including interaction effects. We also compared the proposed model with a baseline model with conditional heteroskedasticity formulation that *includes* the main effects but *excludes* interaction effects to examine the explanatory power of the proposed interaction effects. The baseline model is outperformed by the proposed model for both cash flow ($SBC_{(baseline)}$ = -2824.61 compared to $SBC_{(proposed)}$ = -3029.98) and intangible value ($SBC_{(baseline)}$ = 4086.34 compared to $SBC_{(proposed)}$ = 3659.46) supporting the proposed interactions between advertising, R& D expenditure and environmental turbulence and competitive intensity.

Different data lengths in panel data. We examined the robustness of the results to the length of the firm-years in the data. We re-estimated a model retaining only those firms which had a sequence longer than 6 years in the data set. The pattern of results (not reported here) are consistent with those reported in Table 4 indicating that the results are robust to varying lengths of data for firms.

Alternative measure of advertising and R&D expenditure. We used the Hirschey and Weygandt (1985) approach to capitalize advertising and R&D expenditure to account for 1) the contemporaneous effect of advertising and R&D expenditure which captures the direct investor response effect of advertising and R&D and 2) their effects beyond the year in which they are expensed. We examined the robustness of the estimation results to an alternative approach to capitalize advertising and R&D expenditure (Erickson and Jacobson 1992). Again, the pattern of results (not reported here) are generally consistent with those reported in Table 4 indicating that the results are robust to this alternative stock measure of advertising and R&D expenditure.

Reverse Causality. As noted earlier, the model we estimated considered the impact of the firm's advertising stock and R&D stock (which factors these expenditures in the previous years) on cash flow and intangible value using the formulation proposed by Hirschey and Weygandt (1985). To rule out reverse causality (i.e. that increased cash flow increases advertising and R&D expenditures) we performed the Granger-Causality Wald Tests (Dekimpe and Hanssens 2000; Granger 1969).

Specifically, we performed Granger-causality Wald tests for each time series in the data set using a bivariate approach (Leeflang and Wittink 1992) between 1) the firm's cash flow and its advertising expenditure and 2) the firm's cash flow and its R&D expenditure(both measured as stock). The results of the Wald tests indicated that a firm's cash flow did not "Granger cause" either advertising or R&D expenditure, empirically ruling out the reverse causality explanation.

In addition, we performed two additional regressions to rule out reverse causality explanations: 1) we regressed advertising expenditure (measured as stock) in time period t as a function of cash flow, sales revenues, environmental turbulence and competitive intensity in time period t-1 and 2) we regressed R&D expenditure (measured as stock) in time period t as a

function of cash flow, sales revenues, environmental turbulence and competitive intensity in time period t-1. Both models included fixed effects, and time and industry control variables. The results of the regressions (not reported here) indicated that, consistent with the lack of reverse causality established above, cash flow in time period t-1 does not affect either advertising or R&D expenditure in time period t.

In sum, the estimation results and additional analyses suggest that the proposed model relating a firm's advertising and R&D expenditure, in conjunction with environmental turbulence and competitive intensity on the level and variability of both cash flow and intangible firm value is robust to model specifications, panel data lengths, and measures of advertising and R&D expenditures and rules out reverse causality explanations.

DISCUSSION

Although marketing scholars have long argued that marketing may reduce the variability of firm performance, there are few empirical insights on this issue in the academic literature. In this paper, we examine the relationship between advertising and R&D expenditure and the variability of two key performance metrics of interest to finance executives and senior management—the firm's cash flow and intangible firm value.

We conclude with a discussion of the pattern of the study's findings, theoretical contributions and managerial implications, the limitations and opportunities for future research.

Pattern of Findings

While, we had, *a priori*, hypothesized generally similar effects of advertising and R&D expenditure and the related interaction effects on cash flow and intangible firm value, the estimation results indicated their differential effects on both the level and variability of cash flow

and intangible firm value. We summarize the study's findings pertaining to the proposed effects in Table 5.

---- Insert Table 5 here ----

To facilitate exposition, we first discuss the effects of a firm's advertising expenditure on the level of its cash flow and intangible value followed by its effects on their variability of cash flow and intangible value. We then discuss the effects of a firm's R&D expenditure on the level of its cash flow and intangible value followed by its effects on the variability of cash flow and intangible value.

Effects of Advertising Expenditure on Level of Cash Flow and Intangible Value. Advertising increases the levels of cash flow and intangible value - but these effects are either nullified (for cash flow in turbulent environments) or reversed (for cash flow and intangible value in competitive environments and for intangible value in turbulent environments).

The positive effects of advertising on the levels of cash flow and intangible value are consistent with past research that advertising increases both short-term firm performance and intangible value (Joshi and Hanssens 2005). However, the null and negative effects of advertising on the level of cash flow in turbulent and competitive environments respectively and the negative effects of advertising on intangible value in turbulent competitive environments are somewhat surprising. Below, we propose post-hoc explanations of these surprising effects.

We conjecture that in turbulent environments, characterized by frequent changes in market demand and consumer needs, firms may have to focus on efficient operations to manage costs, an emphasis which may be inconsistent with increased advertising, at least in the short term. We propose a different explanation for the negative effect of a firm's advertising on cash

flow in competitive environments. Competitive environments are characterized by a high degree of competitive reaction, even perhaps over-reaction (Leeflang and Wittink 1996, 2001) such that firms in such environments may have larger advertising budgets than is optimal (i.e. firms are operating on the part of the advertising response function with diminishing returns) resulting in the observed negative effect of advertising on both cash flow and intangible value. The negative effects of advertising on the level of cash flow and intangible value are novel findings. The generalizability of these findings to other industry contexts and other performance metrics (e.g. return on assets) emerges as an important area for further research.

Effects of Advertising Expenditure on Variability of Cash Flow and Intangible Value. Consistent with recent empirical evidence that a firm's advertising increases the variability of its cash flow (Gruca and Rego 2005), advertising increases the variability of cash flows but lowers the variability of intangible value. We conjecture that advertising increases the variability of a short-term financial performance metric i.e. cash flow because of the inherent market experimentation aspects of advertising programs (i.e. not all advertising campaigns are effective in achieving their objectives). The stabilizing effect of advertising expenditure on intangible firm value may be arising from the direct investor response effect of advertising on the firm's stock and the long-term benefits of advertising (i.e., beyond the current accounting period) through the creation of intangible market-based assets.

Finally, advertising lowers the variability of cash flow and intangible value in turbulent and competitive environments, suggesting that although advertising lowers the level of cash flow and intangible value in competitive environments (see earlier paragraph), it stabilizes cash flow and intangible value in these environments. These findings suggest that consistent with the empirical evidence for the effects of advertising on the level of shareholder value (Joshi and

Hanssens 2005), a firm's advertising expenditure has both direct (via the firm's stock) and indirect (via sales revenues, profits and market-based assets) effects on the variability of intangible value.

Effects of R&D Expenditure on Level of Cash Flow and Intangible Value. R&D expenditure increases the level of intangible value independently but has no effect on the level of cash flow or intangible value (in conjunction with advertising, environmental turbulence or competitive intensity). The null effect of R&D expenditure on cash flow and intangible value (in conjunction with advertising, environmental turbulence or competitive intensity) indicate that consistent with past research, that both short-term returns to R&D expenditure and the stock market's expectations of the returns to R&D expenditure are low, regardless of the nature of the firm's environment and its advertising expenditure.

Effects of R&D Expenditure on Variability of Cash Flow and Intangible Value: In a departure from recent research (Gruca and Rego 2005) who find no evidence of the effects of a firm's R&D expenditure on its cash flow, we find that a firm's R&D expenditure always increases variability of cash flow and intangible value, both independently, and with advertising and in turbulent and competitive environments. Note that Gruca and Rego (2005) estimated a separate model relating a firm's advertising, R&D (and related interactions with its customer satisfaction) on the variability of cash flow, which they constructed as the coefficient of variation of the firm's quarterly cash flow relative to the industry, while we focus on the variance in the cash flow, conditional on the explanatory variables. The robust finding that R&D expenditure always increases the variability of cash flow and intangible value is consistent with the high uncertainty associated with R&D programs.

Theoretical Contributions

The study's findings extend the existing literature relating marketing to the financial performance of firms in several ways. To our knowledge, this is the first study to empirically demonstrate that, advertising and R&D expenditure affect both the level and variability of cash flow and intangible firm value, supporting a strong, yet hitherto-unexamined link between marketing and the variability of firm performance, an effect that has been theoretically argued for by marketing scholars (Day and Fahey 1988; Srivastava et al. 1998), but, to our knowledge, has seen no empirical validation. By using metrics (i.e. cash flow and intangible firm value) and dollar expenditure (i.e. advertising and R&D expenditure) of keen interest to finance executives and senior management, we address the calls to marketing scholars and practitioners to speak in the language of finance (Rust et al. 2004; Srivastava et al. 1998)

Second, the findings suggest a complex impact of advertising expenditure on cash flow and intangible firm value and their variability extending past research on the performance implications of advertising—an issue of key concern to senior management and marketing managers (Donath 1999). On the one hand, consider that the advertising expenditure independently decreases the level of cash flow but also decreases the variability of cash flow and intangible value in turbulent and competitive environments. This suggests a double-edged effect of advertising suggesting tradeoffs (i.e. lower levels of cash flow against the benefits (more stable cash flow and intangible value) in the performance rewards to advertising cash flow and intangible value. This double-edged effect of advertising suggests potentially complex and opposing processes by which a firm's advertising affects the levels and variability of its performance metrics. Further investigation of the robustness of these effects in other industry contexts and of the specific processes underlying these effects will be useful.

In contrast, however, R&D expenditure always decreases the variability of both cash flow and intangible firm value—independently, in conjunction with advertising and in turbulent and competitive environments, reinforcing the intrinsic uncertainty associated with R&D programs in terms of the technical, commercial and market feasibility of research outputs of firms.

Third, study's findings both support and extend the market-based asset theory (Srivastava et al. 1998; Srivastava et al. 1999) that suggests multi-pronged processes by which a firm's marketing actions build market-based assets and marketing process capabilities enhance intangible firm value by increasing the speed and level of cash flows *and* lowering the risk of these cash flows. Supporting the market-based asset theory, for example, this study's findings provide a test of the hypothesis that market-based assets created by increased advertising by firms in turbulent and competitive environments decrease the variability of cash flow. On the other hand, the contingent effects (which include both positive and negative effects) of advertising and R&D expenditure (both of which create market-based assets for the firm) on the level of cash flow and intangible value indicate that the cash flow and shareholder wealth effects of advertising and R&D expenditure are not unequivocally positive, as suggested by Srivastava et al. (1998; 1999). Further research that examines whether these contingent effects of advertising and R&D expenditures on cash flow and shareholder value metrics persist in other contexts and the boundary conditions that identify negative and positive performance returns to market-based assets and marketing process capabilities will be insightful.

Fourth, while historically, much of the research on the economics of advertising has primarily focused on product-market demand effects of advertising including (Milgrom and Roberts 1986; Stigler 1961), there is an emergent body of research on the investor response effects of advertising (Frieder and Subrahmanyam 2005; Grullon et al. 2004; Joshi and Hanssens

2005; Srinivasan et al. 2006). In the spirit of this research, we find that higher advertising expenditure is associated with higher levels and lower variability of intangible firm value. Future research on other shareholder wealth effects of both advertising and other aspects of marketing (e.g., distribution channels and pricing) on the other shareholder performance metrics (e.g., systematic risk, speed of cash flows, and liquidity of stocks) will be useful.

Managerial Implications

The study's findings also generate some useful implications for marketing practice. Marketing executives are urged to "speak in the language of finance" with top management (Srivastava and Reibstein 2004) as "…financial return is the dialogue required to access funds from the financial purse strings" crucial for the implementation of the firm's marketing programs.

Marketing executives can use the paper's findings to make a case to other stakeholders (e.g., top management, finance executives, and investors who may be skeptical of the financial accountability of marketing) that their firm's advertising lowers the variability of their cash flow and intangible value. Importantly, we stress the need for cognizance of the fact that both advertising and R&D expenditure have complex effects on the levels and the variability of these two performance metrics.

Second, we think the study's findings may perhaps surprise senior management and finance executives, some of whom may view their firm's advertising program as discretionary activities, with little or no impact on financial performance. Importantly, advertising expenditure, both independently, and in turbulent and competitive environments, lower the variability of the firm's cash flow and intangible value which, in turn, affect the firm's risk, discount rates and weighted cost of capital (Singh, Faircloth and Nejadmalayari 2005).

Third, the study's specific findings can guide resource allocation in advertising and R&D expenditure. Finance managers, especially those managing their firms' interface with their shareholders and investment analysts, can use this study's findings to draw attention to the beneficial effects of advertising in turbulent and competitive environments in stabilizing their cash flow, and thereby their intangible value, with a view to stabilizing their firm's intangible firm value. The negative effect of advertising on the level of cash flow (in competitive environments) and the level of intangible value (in turbulent and competitive environments) suggests that, perhaps, that firms can cut back on advertising budgets in such environments to increase the level of cash flow and intangible value. However, such cutbacks in advertising may also increase the variability of the firm's cash flow and intangible value.

Finally, while, we are mindful about the limited influence of one study's findings in changing well-established mindsets about the financial accountability of marketing expenditures, we hope that this paper's findings provide a further impetus for a constructive dialog among senior management, finance and marketing executives on the crucial 'financial' role of both advertising, and research development expenditure, beyond their well-documented effects on market performance metrics (e.g., sales revenues, and profits) as has been suggested by marketing scholars (Rust et al. 2004b; Srivastava et al. 1998)

Limitations and Opportunities for Future Research

Given the lack of extant marketing and finance theory to guide model building and data availability constraints, in this first empirical study that simultaneously examines the effects of marketing actions on variability of firm performance, we focused on the relationship between a firm's advertising and R&D expenditure, two important strategic expenditures and the variability of its cash flow and intangible value. In addition, some of the paper's findings (e.g. that R&D

expenditure increases the variability of cash flow and intangible value) are consistent with some empirical studies (Pauwels et al. 2004; Srinivasan et al. 2005) but represent a departure from other empirical evidence (Gruca and Rego 2005). Perhaps, these differences are arising because of researchers' use of different estimation methods and metrics. Theoretical and empirical research using complementary methods (e.g., in-depth interviews, surveys, field studies) focusing on a model relating other elements of marketing strategy (e.g., marketing channels, customer relationship management and new product development) to the variability of these and other financial performance metrics (e.g. return on assets, price-earnings ratios) to explore the robustness of the emergent findings across various studies and the boundary conditions of these findings will be useful.

In addition, in this first empirical work relating a firm's advertising and R&D expenditures to the variability of cash flow and intangible value using the conditional heteroskedasticity formulation, we estimate a model focusing separately on 1) cash flow and 2) intangible value. The paper's findings raise interesting questions about the potential feedback loops and structural models of the relationship between marketing actions, cash flow and intangible value. Our review of the statistics literature indicated that methodological developments on structural models and multiple equation models using the conditional heteroskedasticity approach are in its nascent stages (Engle 2002; S& T 2006). Thus, theoretical development of conditional heteroskedasticity models incorporating structural relationships and feedback loops is an important area for further methodological research, with the potential for applications to substantive issues in marketing and in other fields.

Integrating this study's findings with other recent research (Fornell et al. 2006; Gruca and Rego 2005) suggests an important role for customer satisfaction in stabilizing cash flow and

stock returns raises interesting questions about potential interactions. We initiated a data collection exercise to obtain data on customer satisfaction data for the firms in the data set, but were able to obtain data only for 146 firm-years (of 40 firms) for the 1169 firm-years used for the model estimation, which precluded the estimation of the conditional heteroskedasticity model. Empirical research that explores the combined effect of customer satisfaction, advertising and R&D on variability of performance metrics including cash flow and intangible firm value emerges as an opportunity for further research.

Our use of secondary data precluded consideration of organizational factors (e.g., structure, market orientation) that affect the variability of firm performance. Further, advertising and R&D expenditure represent input measures and do not capture the effectiveness of marketing and new product development programs. While, dollar amounts spent on advertising and R&D are important, especially from the perspective of senior management executives focused on profits, they represent a consolidated, input measure and do not account for differences in the effectiveness of advertising (e.g. creativity of advertising campaigns, efficiency of media planning etc.) and new product development (e.g. commercial feasibility of products, intellectual property regimes etc.). Given considerations of data availability, obtaining such disaggregated measures of advertising and R&D programs for publicly listed firms may not be feasible. Future research focusing on a few industries (e.g., banking and financial services) and using disaggregated measures of the various elements of advertising and/or marketing mix including aspects of their effectiveness will represent an useful extension to generate specific managerial implications on the effects of a firm's on the variability of cash flow and intangible firm value.

In sum, we view this study as a useful, first step in exploring the effects of a firm's marketing activities the variability of its perfomance. We hope this paper stimulates further work in the area.

Figure 1

Advertising, R&D, Cash Flow and Intangible Value

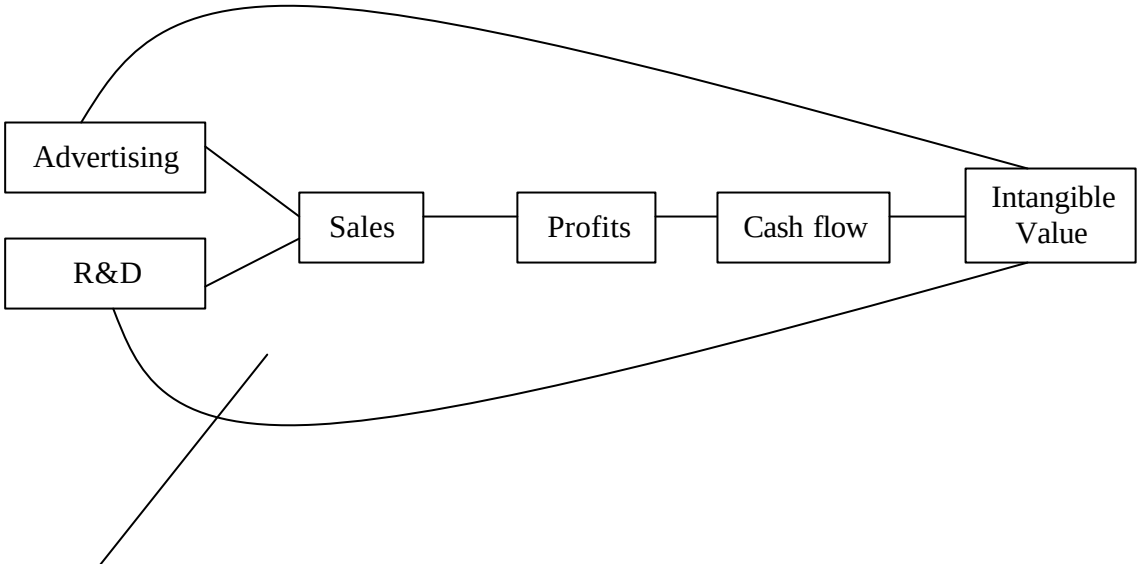

Table 1
Summary of Hypotheses and Results

Variable	Variance of Cash Flow and Intangible Value
Advertising expenditure	Negative/Positive
R&D expenditure	Negative/Positive
Advertising expenditure × R&D expenditure (H_{3c} and H_{3v})	Negative/Positive
Advertising expenditure × Environmental turbulence (H_{4c} and H_{4v})	Negative
R&D expenditure × Environmental turbulence	Positive
Advertising expenditure × Competitive intensity	Negative
R&D expenditure × Competitive intensity	Positive

^ a negative (positive) coefficient denotes lower (higher) variance.

Table 2
Distribution of Firms in Industries (Dollar Amounts in Millions)

Serial Number	Industry	Number of firms	Industry Sales	Sales per firm	Advertising Stock	R&D Stock
1	Aerospace	62	825252	13311	8	1568
2	Building Materials	47	184518	3926	11	280
3	Chemicals	34	381280	11214	38	2006
4	Computer Services	44	766667	17424	131	4461
5	Computer and Office Equipment	100	1117745	11177	60	2149
6	Electronics and Electrical Equipment	83	671290	8088	29	2597
7	Engineering and Construction	16	109497	6844	1	279
8	Entertainment	30	147775	4926	106	75
9	Food	112	1376349	12289	319	335
10	Forest and Paper Products	30	367606	12254	74	323
11	Furniture	28	55052	1966	17	59
12	Industrial and Farm Equipment	79	513511	6500	8	796
13	Metal Products	63	357173	5669	33	218
14	Mining	24	140060	5836	4	79
15	Motor Vehicles	51	3133838	61448	1202	9338
16	Petroleum	31	1878837	60608	62	994
17	Pharmaceuticals	61	927802	15210	472	4952
18	Rubber and Plastic Products	18	104425	5801	44	547
19	Scientific, Photographic and Control Equipment	75	414091	5521	30	1078
20	Soaps and Cosmetics	26	337758	12991	837	1391
21	Retailing	45	596751	13261	183	0
22	Telecommunications	12	456098	38008	687	3716
23	Wholesaling	30	349843	11661	54	31
24	Miscellaneous	68	1563468	21715	223	84320

Table 3
Descriptive Statistics and Correlation Matrix (N=1169)

Variable	Mean (standard deviation)	1.	2.	3.	4.	5.
1. Intangible firm value (Tobin's q)	1.99 (2.36)	1.00				
2. Cash flow^	0.10 (0.11)	.24***	1.00			
3. Advertising expenditure ($ mil.)	180.53 (578.25)	.18***	.00	1.00		
4. Research and development expenditure ($ mil.)	1647.14 (3651.74)	.18***	.06**	.68***	1.00	
5. Environmental turbulence	0.32 (0.11)	.30***	.07**	.03	.15***	1.00
6. Competitive intensity	0.40 (0.20)	-.09***	-.09***	.07**	.04	-.14**

^cash flow adjusted for assets; advertising and R&D expenditures measured by stock levels following Hirschey and Weygandt (1985).

Table 4
Conditional Heteroskedasticity Model of Advertising and R&D Expenditure to Variability of Cash Flow and Intangible Firm Value

Variable	Mean cash flow [#] (1)	Log variance of cash flow (2)	Mean shareholder intangible firm value (3)	Variance of intangible firm value (4)
Intercept	-1.11 (.85)	-	5.33 (8.97)	
Hypothesized Effects				
Advertising expenditure (AD)	.01 (.00)***	.63 (.10)***	. 11 (.06)*	-.62 (.11)***
Research and Development expenditure (R&D)	.01 (.01)	.05 (.01)***	.02 (.00)***	.06 (.01)***
AD × R&D	.02 (.02)	.01 (.02)	.00 (.00)	.20 (.07)***
AD × Environmental turbulence (ENV)	-.03 (.04)	-25.78 (4.02)***	-3.18 (1.49)**	-6.23 (3.47)*
R&D × ENV	-.01 (.01)	-.06 (.29)	-.26 (.17)	.32 (.26)
AD × Competitive intensity (COMP)	-.05 (.01)***	-25.48 (3.25)***	-8.54 (.86)***	-10.87 (3.86)***
R&D × COMP	-.00 (.00)	1.09 (.32)***	-.20 (.14)	.96 (.26)***
Control Variables^				
Firm size	.00 (.00)	.01 (.01)	. 21 (.12)*	.00 (.00)
Financial leverage	-19.32 (1.99)***	-32.78 (14.26)**	-36.42 (25.38)	-194.35 (41.14)***
Cash flow	-	-	122.03 (35.24)***	-5.03 (58.18)
Cash flow trend	-	-	-1.48 (5.70)	-8.24 (3.44)**
Environmental turbulence	-2.68 (5.73)	900.01 (100.03)***	52.63 (82.66)	784.13 (146.77)***
Competitive intensity	3.65(6.94)	513.44 (82.99)***	20.76 (93.44)	-1274.58 (109.31)***
Number of observations (number of firms)	1169 (245)		1098 (245)	
Schwarz Bayesian Criterion (SBC)	-3029.98		3659.46	
Pseudo-R^2	0.29		0.23	

[#] parameter estimates (standard errors) rounded and scaled by 10^{-2}. *** $p < 0.01$, ** $p < 0.05$ and * $p < 0.10$.

^Models include control variables for the 7 year time period and for industry.

Table 5
Summary of Findings

Variable	Mean of cash flow	Log variance of cash flow	Mean of intangible firm value	Log variance of intangible firm value
Advertising expenditure	***Positive***	***Positive***	***Positive***	***Negative***
R&D expenditure	*No effect*	***Positive***	***Positive***	***Positive***
Advertising expenditure × R&D expenditure	*No effect*	*No effect*	*No effect*	***Positive***
Advertising expenditure × Environmental turbulence	*No effect*	***Negative***	***Negative***	***Negative***
R&D expenditure × Environmental turbulence	*No effect*	*No effect*	*No effect*	*No effect*
Advertising expenditure × Competitive intensity	***Negative***	***Negative***	***Negative***	***Negative***
R&D expenditure × Competitive intensity	*No effect*	***Positive***	*No effect*	***Positive***

REFERENCES

Aaker, David (1996), Building Strong Brands. New York, NY: Free Press.

Ailawadi, Kusum L., Scott A. Neslin, and Donald R. Lehmann (2003), "Revenue Premium as an Outcome Measure of Brand Equity," Journal of Marketing, 67 (4), 1-17.

Ambler, Tim (2003), Marketing and the Bottom Line. London, U.K.: Financial Times/Prentice Hall.

Assmus, G., John U. Farley, and Donald R. Lehmann (1984), "How Advertising Affects Sales: Meta-Analysis of Econometric Results," Journal of Marketing Research, 21 65-74.

Barth, Mary E., Ron Kasznik, and M.F. McNichols (2001), "Analyst Coverage and Intangible Assets " Journal of Accounting Research, 39 (1), 1-34.

Bharadwaj, Sundar G. and Anil Menon (1993), "Determinants of Success in Service-based Industries: A PIMS-based Empirical Investigation," Journal of Services Marketing, 7 (4), 19-40.

Chan, Louis K., Josef Lakonishok, and Theodore Sougiannis (2001), "The Stock Market Valuation of Research and Development Expenditures," Journal of Finance, 56 (6), 2431-56.

Chauvin, K. W. and M. Hirschey (1993), "Advertising, R&D Expenditures and the Market Value of the Firm," Financial Management, 22 (3), 231-58.

Chung, K. H. and S Pruitt, W (1994), "A Simple Approximation of Tobin's Q," Financial Management, 23, 70-74

Cockburn, Iain and Zvi Griliches (1988), "Industry Effects and Appropriability Measures in the Stock Market's Valuation of R&D and Patents," American Economic Review, 78 (2), 419-23.

Day, George and Liam Fahey (1988), "Valuing Market Strategies," The Journal of Marketing, 52 (3), 45-57.

Dekimpe, Marnik G. and Dominique M. Hanssens (1995), "Empirical Generalizations about Market Evolution and Stationarity," Marketing Science, 14 (3, Part 2 of 2: Special Issue on Empirical Generalizations in Marketing), G109-G21.

Eastlack, Joseph O. Jr. and Ambar G. Rao (1989), "Advertising Experiments at the Campbell Soup Company," Marketing Science, 8 (Winter), 57-71.

Erickson, Gary and Robert Jacobson (1992), "Gaining Comparative Advantage Through Discretionary Expenditures: The Returns to R&D and Advertising," Management Science, 38, 1264-79.

Fama, Eugene F. and Kenneth R. French (1992), "The Cross-section of Expected Stock Returns," Journal of Finance, 67, 427-65.

Golder, Peter N. and Gerard J. Tellis (1993), "Pioneer Advantage: Marketing Logic or Marketing Legend?," Journal of Marketing Research, 30 (2), 158-70.

Grullon, Gustavo, George Kanatas, and James P. Weston (2004), "Advertising, Breadth of Ownership and Liquidity," The Review of Financial Studies, 17 (2), 439-61.

Hambrick, Donald C. (1983), "High Profit Strategies in Mature Capital Goods Industries: A Contingency Approach," Academy of Management Journal, 26 (4), 687-707.

Harvey, A.C. (1976), "Estimating Regression Models with Multiplicative Heteroskedasticity," Econometrica, 44 (3), 461-65.

Jensen, M. and W. Meckling (1976), "Theory of the Firm: Managerial Behavior: Agency Costs and Ownership Structure," Journal of Financial Economics, 3, 305-60.

Joshi, Amit K. and Dominique M. Hanssens (2005), "Advertising Spending and Market Capitalization," Marketing Studies Center, UCLA Anderson School of Management.

Kamakura, Wagner, Michel Wedel, Jose Antonio Rosa, and Jos Afonso Mazzon (2003), "Cross-Selling through Database Marketing: A Mixed Factor Analyzer for Data Augmentation and Prediction," International Journal of Research in Marketing, 20, 45-65.

Kasznik, R. and M.F. McNichols (2002), "Does Meeting Earnings Expectations Matter? Evidence from Analyst Forecast Revisions and Share Prices," Journal of Accounting Research, 40 (4), 727-59.

Kaul, Anil and Dick R. Wittink (1995), "Empirical Generalizations about the Impact of Advertising on Price Sensitivity and Price," Marketing Science, 14 (3, Part 2 of 2: Special Issue on Empirical Generalizations in Marketing), G151-G60.

Keller, Kevin Lane (1998), Strategic Brand Management. New York, NY: McGraw-Hill Publishing Inc.

Kirmani, Amna and Valarie A. Zeithaml (1993), "Advertising, Perceived Quality, and Brand Image," in Brand Equity and Advertising, Aaker David A. and Biel Alexander L., Eds. Hillsdale, N.J: Lawrence Erlbaum Associates.

Kothari, S.P., T. Laguerre, and A. Leone (2002), "Capitalization versus Expensing: Evidence on the Uncertainty of Future Earnings from Capital Expenditures versus R&D Outlays," Review of Accounting Studies 7, 355-82.

Leone, Robert P. (1995), "Generalizing What is Known about Temporal Aggregation and Advertising Carryover," Marketing Science, 14 (3, Part 2 of 2: Special Issue on Empirical Generalizations in Marketing), G141-G50.

Levinthal, Daniel A. (1991), "Random Walks and Organizational Mortality," Administrative Science Quarterly, 36, 397-420.

Lodish, Leonard M., Magid Abraham, Stuart Kalmenson, Jeanne Livelsberger, Beth Lubetkin, Bruce Richardson, and Mary Ellen Stevens (1995), "How T.V. Advertising Works: A Meta-Analysis of 389 Real World Split Cable T.V. Advertising Experiments," Journal of Marketing Research, 32 (2), 125-39.

Milgrom, P and J. Roberts (1986), "Price and Advertising Signals of Product Quality," Journal of Political Economy, 94, 796-821.

Miller, Danny and Peter H. Friesen (1983), "Strategy-Making and Environment: The Third Link," Strategic Management Journal, 4, 221-35.

Minton, B. A. and C. Schrand (1999), "The Impact of Cash Flow Volatility on Discretionary Investment and the Costs of Debt and Equity Financing," Journal of Financial Economics, 54, 423-60.

Mizik, Natalie and Robert Jacobson (2003), "Trading Off Between Value Creation and Value Appropriation: The Financial Implications of Shifts in Strategic Emphasis," Journal of Marketing, 67 (1), 63-76.

Rust, Roland T. , Tim Ambler, Gregory S. Carpenter, V. Kumar, and Rajendra K. Srivastava (2004a), "Measuring Marketing Productivity: Current Knowledge and Future Directions," Journal of Marketing, 68 (4), 76-89.

Rust, Roland T., Katherine N. Lemon, and Valarie A. Zeithaml (2004b), "Return on Marketing: Using Customer Equity to Focus Marketing Strategy," Journal of Marketing, 68 (1), 109-27.

Sethuraman, Raj and Gerard J. Tellis (1991), "An Analysis of the Tradeoff between Advertising and Price Discounting," Journal of Marketing Research, 28 (2), 160-74.

Smith, Daniel C. and C. Whan Park (1992), "The Effects of Brand Extensions on Market Share and Advertising Efficiency," Journal of Marketing Research, 29 (3), 296-313.

Srivastava, Rajendra K. and David Reibstein (2004), "Metrics for Linking Marketing to Financial Performance," Marketing Science Institute.

Srivastava, Rajendra K., Tasadduq A. Shervani, and Liam Fahey (1998), "Market-Based Assets and Shareholder Value: A Framework for Analysis," The Journal of Marketing, 62 (1), 2-18.

---- (1999), "Marketing, Business Processes, and Shareholder Value: An Organizationally Embedded View of Marketing Activities and the Discipline of Marketing," Journal of Marketing, 63 (Special Issue), 168-79.

Stigler, G. J. (1961), "The Economics of Information," Journal of Political Economy, 69 (213-225).

Tirole, J.P. (1995), The Theory of Industrial Organization. Cambridge, MA: MIT Press.

Woolridge, Jeffrey M. (2002), Introductory Econometrics: A Modern Approach. Mason, OH: South-Western Publishing.

Zeithaml, Valarie A., P. Rajan Varadarajan, and Carl P. Zeithaml (1988), "The Contingency Approach: Its Foundations and Relevance to Theory Building and Research in Marketing," European Journal of Marketing, 22 (7), 37-64.