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Advertising, Research and Development and Variability of Cash Flow and Shareholder Value

Maria Merino, Raji Srinivasan, and Rajendra K. Srivastava

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Advertising, Research and Development and Variability of Cash Flow and Shareholder Value

Maria Merino is Assistant Professor at Instituto Tecnológico Autónomo de México.

Raji Srinivasan is Assistant Professor of Marketing at Red McCombs School of Business at the University of Texas at Austin.

Rajendra K. Srivastava is Roberto C. Goizueta Chair in e-Commerce and Marketing and Director of Zyman Institute of Brand Science at Goizueta Business School at Emory University in Atlanta.

Summary

Stable financial performance is a key objective for 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 on the variability of two key financial performance metrics—cash flow and shareholder value. We measure the firm's shareholder value by its Tobin's Q.

Measuring variability of firm performance by its variance, we examine the relationship between advertising and R&D expenditure on variability of cash flow and shareholder value using panel data from 254 publicly listed U.S. firms between 1994 and 2001 resulting in 1215 firm-years. We estimate a fixed effect, conditional heteroskedasticity regression model which simultaneously models both the mean and the variance of cash flow and shareholder value and also accommodates unobserved firm heterogeneity.

The study's findings which suggest a multi-faceted, impact of advertising and R&D expenditure on the variability of cash flow and shareholder value importantly extend past research in marketing that has generally focused on mean levels of financial performance metrics. The paper's findings have important implications for marketing theory and practice, which we discuss.

Keywords: marketing metrics, marketing strategy, business performance, conditional heteroskedasticity model, risk.

Background and Purpose

Achieving stable financial performance is an important goal for managers. Firms with more variable financial performance have lower stock and bond ratings, higher costs of capital and higher discount rates (Minton and Schrand 1999). Controlling for resources, firms with variable performance are more likely to fail (Levinthal 1991). Not surprisingly, therefore, shareholders not only value superior performance, but also more stable performance, giving such firms a survival advantage (Kasznik and McNichols 2002). In this

paper, we examine the relationship between firms' advertising and research and development (R&D) expenditures and the variability of their cash flow and shareholder value.

Marketing scholars (Day and Fahey 1988; Rust et al. 2004; Srivastava et al. 1998) argue that marketing expenditure create intangible market-based assets (e.g., customer relationships and channel relationships) and marketing process capabilities (e.g., supply chain management and customer relationship management) that strengthen firm performance and *reduce* its variability. However, other developments in the marketing response literature (Eastlack and Rao 1989; Lodish et al. 1995) suggest that complex processes underlie the effects of a firm's advertising investment, such that increases in a firm's advertising expenditure may, in fact, increase the variability of its cash flow.

Yet, few empirical studies have related 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 mix such as higher levels of promotions, sales force expenditure, and relative price were associated with lower variability of return on investments while higher levels of advertising and customization were associated with higher variability. A recent study (Gruca and Rego 2005) linked customer satisfaction, a direct outcome of marketing actions, to both growth and stability of cash flows and found that advertising strengthened the effect of customer satisfaction, a key marketing performance outcome, on the growth of cash flow, but had no effect on the variability of cash flow. Their model formulation did not explore the main effect of advertising on the variability of cash flow.

Note that these studies examined the effects of explanatory variables on variability of firm performance without consideration of the mean level of

performance. However, mean performance and its variability are distinct dimensions with complex inter-relationships (Bettis and Mahajan 1985) and modeling the effects of explanatory variables on the variability of firm performance ignoring the effects of explanatory variables on the mean level of firm performance can result in model mis-specification (Chandrashekar et al. 2000).

In this paper, we simultaneously examine the effects of advertising and R&D expenditure on both the mean and variability of two performance metrics—cash flow and shareholder value—of keen interest to managers of publicly listed firms. Specifically, we address the following research questions: What are the effects of advertising and R&D expenditure on the variability of performance? Do these effects vary for firms by the level of turbulence in the firm's environment? We measure the firm's shareholder value by its Tobin's Q, a forward-looking, stock-market based measure of shareholder value.

We focus on advertising and R&D expenditure because senior management and financial executives are concerned with their direct impact on financial performance (Ambler 2003; Rust et al. 2004). 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." In particular, the accountability of advertising expenditure is under extensive scrutiny from senior management and finance executives focused on wealth creation for their shareholders.

Firms are urged to leverage complementarities among elements of their strategy and environmental characteristics to optimize resource allocation (Hambrick 1983; Miller and

Friesen 1983; Zeithaml et al. 1988). To explore such complementarities, we consider both the main effect and two-way interaction effects between advertising and R&D expenditure and between advertising and R&D expenditure with environmental turbulence respectively, on the variability of cash flow and shareholder value.

Following the empirical tradition in strategy (Fleming 2001; Fleming and Sorenson 2001; Sorensen 2002) and marketing (Chandrashekar et al. 2000) literatures, we focus on the ex-post variability of firm performance by the variance of the errors i.e. the unexpected or unaccounted variance of firm performance. 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. In this case, the $Var(Y) = Var(b'X) + Var(e)$. When the model fits perfectly, the R-square for the above regression is 1.00, the error term above is zero and the variance of the error terms is also zero, even though the variance of Y is not zero. However, as a pragmatic matter, the model's R-square is always less than 1.00, so that the variance in errors is the conditional variance of Y (i.e. conditional on the X 's). In this paper, the variance of the errors, $Var(e)$ is the dependent variable of interest representing the unexpected/unaccounted variability of the firm's cash flow and shareholder value.

We use a cross-industry panel data of 254 publicly listed U.S. firms for the period 1994-2001, resulting in 1215 firm-years, to estimate the proposed model relating advertising and R&D expenditure, and related interactions on the mean and the variability of cash flow and shareholder value. We estimate the effects of advertising and R&D expenditure on the variability of cash flow and shareholder value using

fixed effects, conditional multiplicative heteroskedasticity regression models (Harvey 1976) that simultaneously model the effects of explanatory variables on both the mean level and unexpected variance of the dependent variable while accommodating unobserved firm heterogeneity.¹ The results strongly support the model relating a firm's advertising and R&D expenditure and environmental turbulence in the firm's environment to the mean and variability of its cash flow and shareholder value.

The results indicate that advertising and R&D expenditure, both independently and in conjunction with environmental turbulence, have complex and contingent effects on the level and variability of both cash flow and shareholder value. The study's findings which suggest a multi-faceted, impact of advertising and R&D expenditure on the variability of cash flow and shareholder value importantly extend past research in marketing that has, for the most part, focused on mean levels of performance (for two exceptions, see Bharadwaj and Menon 1993; Gruca and Rego 2005). The paper's findings have important implications for marketing theory and practice, which we discuss.

The paper is organized as follows. In the next section, we provide definitions of cash flow and shareholder value and then propose a conceptual framework relating a firm's advertising and R&D expenditure to the variability of its cash flow and shareholder 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.

¹ Henceforth, we use the term 'variability' to refer to the unexplained or unaccounted variance in the firm's performance.

Theory

Definitions

Cash flow. We focus on cash flow over traditional earnings-based metrics such as return on sales or return on assets, as the latter metrics may be manipulated by varying accounting practices. Variability of cash flow is especially important as firms with higher cash flow volatility also have higher equity and capital costs as a result of which, they may delay and forego capital investments (Minton and Schrand 1999) decreasing their long-term performance and shareholder value. 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 shareholder value." Consistent with this idea, Gruca and Rego (2005) report a significant relationship between a firm's customer satisfaction, a key marketing performance outcome, and its cash flow growth and variability.

Shareholder value. We also examine the effects of advertising and R&D expenditure on the variability of shareholder value measured by Tobin's Q, a forward-looking, risk-adjusted, capital market-based measure that incorporates information about expected future revenue streams. Tobin's Q, as a measure of firm value, has gained wide acceptance in the marketing literature (Lee and Grewal 2004; Rao et al. 2004) and managers of publicly listed firms are looking to stabilize their firm's shareholder value.

Conceptual Framework

According to Srivastava, Shervani and Fahey (1998), advertising and R&D expenditure result in long-term

multi-period benefits, creating 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 these cash flows, which in turn, increases both the level of shareholder value and decreases the variability of shareholder value. However, other developments in the marketing response literature (Eastlack and Rao 1989; Lodish et al. 1995) and in the finance literature (Barth et al. 2001; Kothari et al. 2002) suggest that complex processes underlie the effects of a firm's advertising and R&D programs respectively, such that an increase in advertising and R&D expenditure may, in fact, increase the variability of its cash flows. Integrating these two ideas, we anticipate opposing effects of advertising and R&D expenditure and their related interactions on the variability of cash flow and shareholder value.

Further, firms are urged to leverage complementarities among elements of their strategy and between their strategy and their environment to optimize resource allocation (Hambrick 1983; Zeithaml et al. 1988). In particular, the level of environmental turbulence in the firm's environment which directly affects the variability of firm performance (Lawrence and Lorsch 1967; Miller and Friesen 1983) has the potential to influence the effects of a firm's advertising and R&D expenditure on the variability of its cash flow and shareholder value. Thus, we consider the main effect and two-way interaction effects between advertising and R&D expenditure, and between advertising and R&D expenditure and environmental turbulence respectively on the variability of cash flow and shareholder value.

The theoretical processes underlying the effects of advertising and R&D expenditure on cash flow and shareholder value are similar. For

example, innovation and differentiation from intellectual property accruing from R&D generates both higher and more stable cash flow. To the extent that these effects persist in the future (e.g., by creating barriers to competition, by providing strategic options) one might expect higher levels of cash flow (and shareholder value) and lower variability associated with cash flow (and shareholder value). Thus, based on extant theory, *a priori*, we expect similar effects of a firm's advertising and R&D expenditure on the variability of both its cash flow and shareholder value. However, we do estimate separate models for cash flow and shareholder value which allows us to empirically observe their (distinct, if any) effects on each performance metric.

Further, given this paper's focus on the variability of cash flow and shareholder value, we do not develop arguments for the effects of advertising and R&D expenditure on the mean level of either cash flow or shareholder value. However, we do observe these effects because the conditional heteroskedasticity regression procedure, we implement, simultaneously estimates the effects of explanatory variables on both the mean and variance of cash flow and shareholder value.

Advertising Expenditure

Past research suggests that advertising positively affects mean levels of various performance metrics including return on assets (Erickson and Jacobson 1992), shareholder value (Chauvin and Hirschey 1993) and market capitalization (Joshi and Hanssens 2005). There is a large body of diverse, empirical studies in the marketing literature that provide robust and strong evidence of a consistent, positive effect of advertising on various firm performance metrics. For example, 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, which should, *ceteris paribus*, increase the level of cash flow (Assmus et al. 1984; Dekimpe and Hanssens 1995; Leone 1995).

Our interest, here, is in the effect of advertising expenditure on the variability of cash flows and shareholder value. A firm's advertising creates a differentiation advantage for its products (Kirmani and Zeithaml 1993), increasing price premiums (Ailawadi et al. 2003) and reducing consumer price sensitivities (Kaul and Wittink 1995; Sethuraman and Tellis 1991). Other things being equal, higher advertising creates higher brand equity, a rare and inimitable asset, which creates significant entry barriers to both product-based and price-based competition (Aaker 1996; Keller 1998). These arguments suggest that increased advertising may decrease the variability of both cash flow and shareholder value.

However, extrapolating other empirical evidence from advertising response studies suggests 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. Indeed, a meta-analysis of 389 advertising campaigns indicated that advertising campaigns were effective only if they conveyed new information (Lodish et al. 1995). Only a fraction of a firm's advertising campaigns appear to be effective in achieving their stated objectives and vivid examples of both ineffective and failed advertising campaigns abound across diverse industries. Thus, increased advertising expenditure, which will include a mix of both effective and ineffective campaigns, may increase the variability of cash flow and shareholder value.

R&D Expenditure

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

R&D intensive firms have few tangible assets and indeed, their prospects are related to the success of new, untested technologies, which, by definition, are risky and unpredictable (Cockburn and Griliches 1988). 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 these ideas, recent developments in accounting and finance indicate that R&D expenditure is positively associated with volatility in stock returns (Kothari et al 2002). Analysts exhibited greater disagreement about year-ahead earnings for R&D intensive firms relative to less R&D intensive firms (Barth et al 2001). These arguments suggest that increasing levels of R&D expenditure may increase the variability of cash flow and shareholder value.

However, other recent research in marketing (Mizik and Jacobson 2003) indicates that R&D expenditure fosters a value creation capability resulting in superior products and superior stock return. Thus, increased R&D expenditure which should result in a superior value creation capability may shield the firm against competitive and technological uncertainty and threats lowering the variability of its cash flow and shareholder value.

Advertising and R&D Expenditure

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

On the other hand, advertising and R&D expenditure may also be considered complementary with R&D expenditure fostering a value-creation capability and advertising expenditure fostering a value appropriation capability (Mizik and Jacobson 2003). Together, they may shield the firm against competitive threats and market uncertainty, stabilizing both cash flow and shareholder value. Further, empirical evidence from advertising response studies indicate that advertising is more effective (e.g., eliciting a superior consumer response and superior marketing performance) when it conveys new information (Lodish et al. 1995). Increased R&D expenditure, which should, on average, produce more innovative and novel products may result in more informative advertising campaigns increasing the effectiveness of increasing advertising investments, lowering the variability of cash flow and shareholder value.

Advertising Expenditure and Turbulent Environments

Environmental turbulence increases both the diversity of consumer needs and preferences and the products and technologies required to satisfy these needs increasing the potential for product and brand differentiation (Lawrence and Lorsch 1967; Miller and

Friesen 1983), which is achieved by increased advertising expenditure. The question of interest to us is whether the effects of advertising expenditure on the variability of cash flow and shareholder value are contingent on the level of environmental turbulence.

Advertising expenditure which creates intangible market-based assets may provide several competitive advantages for firms operating in turbulent environments. Higher customer switching costs for high brand equity firms may create customer inertia raising the entry barriers for potential competitors (Smith and Park 1992). Firms with high brand equity, consistent with higher advertising, may also achieve superior cash flow (than firms with low advertising) in turbulent environments, through up-selling and cross-selling to more profitable products to their current customers (Kamakura et al. 2003). In turbulent environments, these firms may achieve both lower customer acquisition and retention costs and lower customer attrition rates and thereby, more stable performance.

Firms with high brand equity, consistent with high advertising, can also reduce the uncertainty of the market's response to their new products. For example, such firms can enter new markets later when the market uncertainty has resolved, as observed in the well-documented advantages for incumbent, late entrants with superior market-based assets (Golder and Tellis 1993) not only their improving cash flow and shareholder value, but also, we suggest, stabilizing them. Given these several arguments, we anticipate that increased advertising in turbulent environments may decrease the variability of cash flow and shareholder value.

R&D Expenditure and Turbulent Environments

As noted above, in turbulent environments, both consumer needs and the products and technologies to satisfy consumer needs change very rapidly. As with advertising, the R&D efforts of firms in turbulent environments represent a high degree of technical and market experimentation resulting in a mix of both successful and unsuccessful products (Sorenson 2000). In addition, product lifecycles in turbulent environments are very short with products being phased out frequently to keep pace with changing technological developments and market needs resulting in uneven financial returns to a firm's R&D expenditure increasing the variability of its cash flow.

Further, R&D expenditure is a lumpy, front-loaded expenditure which cannot be effectively scaled up or down in response to technological or market changes 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 problem of uneven returns to R&D expenditure in turbulent environments. Given these arguments, the interaction effect between a firm's R&D expenditure and environmental turbulence may increase the variability of its cash flow and shareholder value. We next discuss the method we use to test the proposed conceptual framework.

METHOD

Data

We use data from a panel of publicly listed firms to test the proposed model. The panel includes 254 firms for the period between 1994 and 2001 resulting in an unbalanced panel of 1215 complete observations resulting in an average length of 4.78 years. Firms included in the dataset cover a wide range of industries (e.g., manufacturing, financial services, high

technology, pharmaceuticals). We collected data from COMPUSTAT and other secondary data sources that we describe below.

Measures

Cash flow. We define cash flow as the lagged operating income before depreciation minus total income taxes, minus change in deferred taxes from the previous year to the current year minus gross interest expense minus preferred dividend requirement on cumulative preferred stock and dividends paid on non-cumulative preferred stock minus total dollar amount of dividends declared on common stock. In order to enable comparability across firms and industries with varying asset intensity, we scale a firm's cash flow by its total assets (Gruca and Rego 2005).

Shareholder value. We measure shareholder 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 \times 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.

We operationalize a firm's advertising expenditure by its stock level (Erickson and Jacobson 1992) 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 effects persist beyond the accounting year in which the expenditure is incurred. We compute advertising stock in a given year using advertising expenditure for the previous three years using a 45% depreciation rate (Chauvin and Hirschey 1993).

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 (Chauvin and Hirschey 1993).

Environmental turbulence. Given our focus on financial performance metrics, we use the industry classification widely used in the finance literature (Fama and French 1992). 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.

We also 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 as control variables in the model. Table 2 contains the descriptive statistics and correlation matrix of the measures.

The correlations were within acceptable limits (highest correlation = 0.63 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 lower than 10 (average = 1.24; maximum = 3.19) and 15 respectively (average = 1.19; maximum = 3.98), suggesting that

multicollinearity and ill-conditioning of variables may not be a threat to the

validity of the study's findings.

Table 2
Descriptive Statistics and Correlation Matrix

| Variable | Mean (standard deviation) | 1. | 2. | 3. | 4. | 5. |
|---|------------------------------|---------|--------|---------|---------|------|
| 1. Shareholder value (Tobin's Q) | 1.71 (3.45) | 1.00 | | | | |
| 2. Cash flow | 0.07 (0.08) | 0.15*** | 1.00 | | | |
| 3. Advertising expenditure (\$ mil.) | 112.87 (377.33) | 0.06*** | 0.04* | 1.00 | | |
| 4. Research and development expenditure (\$ mil.) | 1504.12 (3357.32) | 0.02*** | 0.02 | 0.63*** | 1.00 | |
| 5. Environmental turbulence | 0.28 (0.11) | 0.13*** | 0.07** | 0.03** | 0.15*** | 1.00 |

Conditional Heteroskedasticity Model

As noted in the introduction, we model the unexpected/unexplained variance of cash flow and shareholder value, conditional on the mean levels of cash flow and shareholder 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 or variance function model (Harvey 1976; Woolridge 2002) to relate a firm's advertising and R&D expenditure to the variability of cash flow and shareholder value. The conditional heteroskedasticity regression model (Harvey 1976) extends the standard linear regression model of the expected value of the dependent variable to include a model of the variance as follows:

$$Y_i = \mu_i + \sigma_i \varepsilon_i$$

$$(1) \quad \mu_i = E(Y_i) = \beta'X_i$$

$$\sigma_i = \text{Var}(y_i) = \exp(\gamma'Z_i)$$

where Y_i is the dependent variable with mean μ_i and variance σ_i , with a linear model for the mean of the dependent variable and a log-linear model for the variance of the dependent variable, conditional on a set of covariates predicting the mean and variance. The γ parameters capture the effect of the covariates Z_i , which may be identical to or different from X_i (Chandrashekar et al. 2000; Sorensen 2002) on the variance in the dependent variable. Covariates that increase (decrease) the variability of the firm's performance should have $\gamma > 0$ ($\gamma < 0$).

In marketing, Chandrashekar et al. (2000) used the conditional 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. The conditional heteroskedasticity approach has also been used by Sorensen (2002) for modeling the effects of organizational culture on the mean and variability of firm performance and Fleming (2001) and Fleming and Sorenson (2001) for simultaneously modeling the effects of explanatory variables on firms' innovative outputs.

The regression equation in (1) above is applicable to cross-sectional data. However, in this study, we use a panel data of firms where we have multiple observations on the same firms for multiple years as follows:

$$(2) Y_{it} = X_{it}\beta + c_i + u_{it}$$

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 $i = 1, 2, \dots$ for Equation (2) for all t . (Woolridge 2002; pp. 267-269).

$$(3) \bar{Y}_i = \bar{X}_i\beta + c_i + \bar{u}_i \quad \text{where}$$

$$\bar{Y}_i = T^{-1} \sum_{t=1}^T Y_{it} ,$$

$$\bar{X}_i = T^{-1} \sum_{t=1}^T X_{it} \quad \text{and} \quad \bar{u}_i = T^{-1} \sum_{t=1}^T u_{it} .$$

Subtracting Equation (3) from Equation (2) for each t gives the fixed effects transformed equation,

$$(4) Y_{it} - \bar{Y}_i = (X_{it} - \bar{X}_i)\beta + (u_{it} - \bar{u}_i)$$

Ordinary least squares estimation of Equation (4) provides consistent fixed effects estimators that accounts for unobserved firm heterogeneity. Thus, the multiplicative heteroskedasticity regression model

we estimate provides parameter estimates of the explanatory variables on both the mean and the variability of firm performance. Please see (Harvey 1976) and Chandrashekar et al. (2000) for details of the statistics involved in the conditional heteroskedasticity model. We implement the model in SAS 9.1.

RESULTS

Variability of Cash Flow

We first mean-centered all explanatory variables and then created the interaction terms. We also included the main effects of environmental turbulence to ensure proper specification of the model. In addition, the model also included the control variables of firm size and financial leverage and seven time dummies for the eight year time period. The parameter estimates from the conditional heteroskedasticity regression model are presented in Columns (1) and (2) respectively of Table 2 (SBC [Schwarz Bayesian Criterion] = -3947.60). The pseudo-R-square of the proposed model is 0.17. The overall t-test for the significance of the parameter estimates of the explanatory variables on the variance of cash flow is significant ($t = 18.76, p < 0.01$) supporting the proposed heteroskedasticity formulation.

We first discuss the effects of the control variables and then discuss the proposed effects. With respect to the control variables, firm size increased cash flow ($b = 0.04, p < 0.01$) and decreased its variability ($b = -0.14, p < 0.10$). The evidence that larger firms enjoy higher levels of cash flow and lower variability in cash flow is not surprising because large, reputed firms have greater resources and market power which can be leveraged into superior and more stable cash flow. Debt leverage did not affect the level

of cash flow ($b = -0.01$, ns) but increased its variability ($b = 0.40$, $p < 0.05$), consistent with the idea that over-leveraged firms must deliver a risk premium to investors. Environmental turbulence appears to create both opportunity and risk, resulting in both higher cash flow ($b = 0.10$, $p < 0.05$) and higher variability of cash flow ($b = 10.32$, $p < 0.01$). The time dummies had no effect on cash flow, but increased their variability ($p < 0.01$).

We first discuss the results for the proposed main effects, followed by the interaction effects. To start with, both advertising expenditure ($b = 0.00$, ns) and R&D expenditure do not affect cash flow ($b = 0.01$, ns), but increase ($b = 1.57$, $p < 0.05$) and decrease the variability ($b = -0.07$, $p < 0.01$) of cash flow respectively.

The interaction effect between advertising and R&D expenditure

affects neither cash flow ($b = 0.01$, ns) nor their variability ($b = -0.00$, ns). In sum, for the firms we studied, firms' advertising and R&D expenditure, both independently and together, did not affect their mean levels of cash flow. These null effects are interesting and we examine these results in detail in the discussion section.

Finally, the interaction effect between advertising expenditure and environmental turbulence increases cash flow ($b = 0.54$, $p < 0.05$) and decreases its variability ($b = -0.13$, $p < 0.01$) while the interaction between R&D expenditure and environmental turbulence affects neither cash flow ($b = 0.02$, ns) nor its variability ($b = 0.01$, ns). We next discuss the results pertaining to shareholder value.

Table 2

Conditional Heteroskedasticity Model Relating Advertising and R&D Expenditure to Variability of Cash Flow and Shareholder Value

| Variable | Mean cash flow # (1) | Log variance of cash flow (2) | Mean shareholder value (3) | Variance of shareholder value (4) |
|---|-------------------------------|----------------------------------|-------------------------------|--------------------------------------|
| Intercept | 0.02 (0.00) ^{***} | - | -0.09 (0.05) | |
| Proposed Effects | | | | |
| Advertising expenditure (AD) × 10 ⁻³ | 0.00 (0.00) | 1.57 (0.08) ^{**} | -0.20 (0.90) | -2.46 (0.93) ^{***} |
| Research and Development expenditure (R&D) × 10 ⁻³ | 0.01 (0.01) | -0.07 (0.01) ^{***} | -0.08 (0.07) | -0.14 (0.01) ^{***} |
| AD × R&D × 10 ⁻⁵ | 0.01 (0.01) | 0.00 (0.00) | -0.04 (0.04) | -0.08 (0.04) ^{**} |
| AD × Environmental turbulence (ENV) × 10 ⁻³ | 0.54 (0.20) ^{**} | -0.13 (0.02) ^{***^} | -0.02 (0.02) [^] | 0.10 (0.02) ^{***^} |
| R&D × ENV × 10 ⁻¹ | 0.02 (0.05) | 0.01 (0.01) | -0.05 (0.02) | 0.11 (0.02) ^{**} |
| Control Variables | | | | |
| Firm size × 10 ⁻⁵ | 0.04 (0.02) ^{***} | -0.14 (0.08) [*] | 0.20 (0.85) | 0.43 (0.07) ^{***} |
| Financial leverage × 10 ⁻³ | -0.01 (0.01) | 0.40 (0.19) ^{**} | -0.36 (0.13) | 0.40 (0.20) ^{**} |
| Cash flow | - | - | 1.76 (0.50) ^{***} | 2.78 (0.49) ^{***^} |
| Environmental turbulence | 0.10 (0.05) ^{**} | 10.32 (1.15) ^{***} | -0.95 (1.01) | 9.32 (1.29) ^{***} |
| Number of observations (number of firms) | | | | |
| | 1215 (254) | | 1128 (245) | |
| Schwarz Bayesian Criterion (SBC) | -3947.60 | | 4618.83 | |
| Pseudo-R2 | 0.17 | | 0.13 | |

parameter estimates, standard errors rounded to two decimal places; *** $p < 0.01$, ** $p < 0.05$ and * $p < 0.10$. All models include seven time dummies for the 8 year time period. ^ parameter not scaled as noted in the first column.

Variability of Shareholder Value

The model for the effects of advertising and R&D expenditure on shareholder value includes all variables included in the model for cash flow estimated above *and* cash flow. Thus, this model estimates the effects of the various explanatory variables on the variability of shareholder value, after *controlling* for the effect of cash flow on shareholder value.

The parameter estimates from the heteroskedasticity regression model are presented in Columns (3) and (4) respectively of Table 2 (SBC [Schwarz Bayesian Criterion] = 4618.83). The pseudo-R-square of the proposed model is 0.13. The overall t-test for the significance of the parameter estimates of the explanatory variables on the variability of cash flow is significant ($t = 29.05$, $p < 0.01$) again supporting the proposed heteroskedasticity formulation.

With respect to the control variables, firm size has no effect on shareholder value ($b = 0.20$, ns) but increases its variability ($b = 0.43$, $p < 0.05$). While financial leverage did not affect shareholder value ($b = -0.36$, ns), as might be expected, it increases the variability of shareholder value ($b = 0.40$, $p < 0.05$). Environmental turbulence did not affect shareholder value ($b = -0.95$, ns) but, again as might be anticipated, increases its variability ($b = 10.32$, $p < 0.01$). The time dummies decrease shareholder value ($p < 0.01$) but increase its variability ($p < 0.01$). Finally, cash flow increases both the level of shareholder value ($b = 1.76$, $p < 0.01$) and its variability ($b = 0.40$, $p < 0.05$).

Again, we first discuss the main effects of explanatory variables, followed by their interaction effects. To

start with, both advertising expenditure ($b = -0.20$, ns) and R&D expenditure ($b = -0.08$, ns) have no effect on shareholder value, but decrease its variability (advertising: $b = -2.46$, $p < 0.01$, R&D: $b = -0.14$, $p < 0.01$). The interaction between advertising and R&D expenditure does not affect its shareholder value ($b = 0.04$, ns) but lowers its variability ($b = -0.08$, $p < 0.05$). However, the interaction between advertising expenditure and environmental turbulence does not affect shareholder value ($b = -0.02$, ns) but increases its variability ($b = 0.10$, $p < 0.01$). Likewise, the interaction between R&D expenditure and environmental turbulence does not affect shareholder value ($b = -0.05$, ns) but increases its variability ($b = 0.11$, $p < 0.05$).

In sum, while advertising and R&D expenditure, both independently and together decrease variability in shareholder value, these effects are reversed in turbulent environments. We next discuss the results of additional analyses that examine the robustness of the results.

Additional Analyses

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 shareholder 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 = -3947.60)

compared to model without heteroskedasticity (SBC = -3888.05) ; shareholder value: model with heteroskedasticity (SBC = 4618.83) compared to model without heteroskedasticity (SBC = 4952.69). Note that a lower SBC indicates superior model fit.

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*) = -3912.72 compared to SBC (*proposed*) = -3947.60) and shareholder value (SBC (*proposed*) = 4618.83 compared to SBC (*baseline*) = 4757.87) supporting the proposed interactions among advertising, R& D expenditure and environmental turbulence.

In sum, the estimation results and additional analyses suggest that advertising and R&D expenditure, both independently, and in conjunction with environmental turbulence, have a complex and contingent effect on the level and variability of both cash flow and shareholder value.

Implications for Marketing

Although marketing scholars have long argued that marketing may reduce the variability of firm performance, there are few empirical insights on this issue. 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 shareholder 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 shareholder value, the estimation results indicated that they had differential effects on the variability of cash flow and shareholder value. To compare and contrast the differential effects of advertising and R&D expenditure on cash flow and shareholder value, we discuss the findings by each explanatory variable. We summarize the study’s findings pertaining to the proposed effects in Table 3.

Table 3
Summary of Findings

| Variable | Mean of cash flow | Log variance of cash flow | Mean of shareholder value | Log variance of shareholder value |
|---|-------------------|---------------------------|---------------------------|-----------------------------------|
| Advertising expenditure | <i>no effect</i> | <i>positive</i> | <i>no effect</i> | <i>negative</i> |
| R&D expenditure | <i>no effect</i> | <i>negative</i> | <i>no effect</i> | <i>negative</i> |
| Advertising expenditure × R&D expenditure | <i>no effect</i> | <i>no effect</i> | <i>no effect</i> | <i>negative</i> |

| | | | | | |
|--------------------------|---|------------------|------------------|------------------|-----------------|
| Advertising expenditure | × | <i>positive</i> | <i>negative</i> | <i>no effect</i> | <i>Positive</i> |
| Environmental turbulence | | | | | |
| R&D expenditure | × | <i>no effect</i> | <i>No effect</i> | <i>no effect</i> | <i>Positive</i> |
| Environmental turbulence | | | | | |

Main effect of advertising expenditure. Advertising expenditure has no main effect on either the level of cash flow or shareholder value. The null effect of advertising expenditure on shareholder value is a surprising result—inconsistent with past research that supports a positive effect of advertising on shareholder value (Chauvin and Hirschey 1993).

With respect to variability of cash flow and shareholder value, advertising expenditure increases the variability of cash flow *but* decreases the variability of shareholder value. We conjecture, perhaps, 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). On the other hand, the stabilizing effect of advertising expenditure on shareholder value may be arising because the benefits of advertising accrue over a longer time horizon (i.e., beyond the current accounting period) through the creation of intangible market-based assets. We surmise, perhaps, that the carryover effect of advertising expenditure may be lowering the variability of shareholder value, as measured by its Tobin's Q, a forward-looking stock market-based measure which incorporates not only current cash flow, but also the stream of expected future cash flows.

Main effect of R&D expenditure. Like advertising, R&D expenditure does not affect the levels of either cash flow or shareholder value which is not surprising given the mixed evidence for the effects of R&D

expenditure on shareholder value in the literature (Barth et al. 2001; Cockburn and Griliches 1988; Kothari et al. 2002).

However, R&D expenditure decreases the variability of *both* cash flow and shareholder value. The negative effect of R&D expenditure on the variability of cash flow is an unexpected finding. These results indicate that, as suggested by Mizik and Jacobson (2003), R&D investments represent a value creation capability resulting in superior technologies, products and process innovations that enable the firm to effectively respond to environmental changes, even in the short term, and stabilize both current cash flow and shareholder value.

Interaction effect of advertising and R&D expenditure. The interaction effect between advertising and R&D expenditure does not affect either the level of either cash flow or shareholder value. With respect to the variability of cash flow and shareholder value, the interaction effect between advertising and R&D expenditure does not affect the variability of cash flow *but* lowers the variability of shareholder value. We conjecture perhaps, that the null interaction effect arises because the positive and negative main effects (discussed above) of advertising and R&D expenditure respectively on the variability of cash flow nullifies their combined interaction effect. On the other hand, the negative interaction effect between advertising and R&D expenditure, which lowers the variability of shareholder value may be arising because of a more sustainable market position in the long term, arising from increased product

differentiation (through R&D) and brand differentiation (through advertising).

Interaction effect of advertising expenditure and environmental turbulence. The interaction effect of advertising expenditure and environmental turbulence increases cash flow and decreases its variability. In turbulent environments, advertising expenditure create intangible market-based assets (i.e. brand and customer equity) which enable firms to penetrate markets faster, thereby enhancing cash flows as well as providing the strategic flexibility capability to counter uncertainty in a turbulent environment.

Interestingly, we find that increased advertising in turbulent environments does not impact the level of shareholder value but increases its variability. This suggests that while firms with high advertising stocks (e.g., Microsoft, Intel) in turbulent environments can leverage their advertising to increase cash flow, perhaps, they also become more visible to the stock market which may respond disproportionately to news about these firms (both good and bad news) increasing the variability of their shareholder value. On the other hand, the observed negative effects of advertising on the level of shareholder value may be arising because, in turbulent environments, the relationship between advertising expenditure and cash flow may be perceived by the stock market to be short-lived with strong decay effects. In such a situation, increased advertising may not enhance shareholder value, but, may, lower it by lowering cash flow.

Interaction effect of R&D expenditure and environmental turbulence. The interaction effect between R&D expenditure and environmental turbulence does not affect either the level of cash flow or shareholder value. With respect to variability, we find that R&D

expenditure in turbulent environments does not affect the variability of cash flow, but increases the variability of shareholder value. As with the interaction effect between advertising and environmental turbulence, we conjecture, that in turbulent environments, the relationship between R&D expenditure and the variability of future cash flows may be perceived by the stock market to be both uncertain and short-lived increasing the variability of shareholder value.

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 shareholder 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 has seen no empirical validation. By using metrics (i.e. cash flow and shareholder 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 multi-faceted, impact of advertising and R&D expenditure on cash flow and shareholder value and their variability. On the one hand, consider that the advertising expenditure independently increases the variability of cash flow but decreases the variability of shareholder value. On the other hand, R&D expenditure decreases the

variability of both cash flow and shareholder value. In addition, the effects of both advertising and R&D expenditure on the level and variability of both cash flow and shareholder value are contingent on environmental turbulence. Interestingly, in turbulent environments, advertising expenditure increases cash flow and decreases its variability but increases the variability of shareholder value.

Third, study's findings both support and extend the market-based asset theory (Srivastava et al. 1998; Srivastava et al. 1999) proposed multi-pronged processes by which market-based assets and marketing process capabilities enhance shareholder 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 environment increase the level of cash flow and decrease the variability of cash flow. On the other hand, the negative effects of advertising and R&D expenditure (both of which create market-based assets for the firm) on both the level and the variability of both cash flow and shareholder 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). Further research that examines the boundary conditions of shareholder performance returns to market-based assets and marketing process capabilities will represent useful extensions of this paper.

Fourth, much of the work on the economics of advertising has focused on product-market demand effects of advertising including for example, the creation of product market information (Milgrom and Roberts 1986; Stigler 1961) and brand loyalty (Tirole 1995).

We know much less about the shareholder wealth effects of advertising (Chauvin and Hirschey 1993; Grullon et al. 2004). For example, Chauvin and Hirschey (1993) and Grullon et al. (2004) found that advertising increased shareholder value and liquidity respectively. In the spirit of this research, we find that higher advertising expenditure is associated with higher levels of shareholder value and higher variability of shareholder value. Future research on other shareholder wealth effects of both advertising and other aspects of marketing (e.g., distribution channels and pricing) on other 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 advertising and R&D expenditure affect the variability of cash flow and shareholder value. Of course, firms need to be cognizant that both advertising and R&D expenditure have complex, opposing effects on these two key performance metrics i.e. cash flow and shareholder value.

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. The study's findings indicate that advertising and R&D expenditure have important effects on the variability of the firm's cash flow and shareholder value, which, in turn, affect the firm's risk, discount rates and weighted cost of capital.

Third, the study's specific findings can guide resource allocation in advertising and R&D expenditure. Importantly, this study's finding of the effects of advertising expenditure in turbulent environments across cash flow (increases the level and lowers variability) and shareholder value (increases variability) generates a specific managerial implication for finance managers entrusted with the task of shareholder wealth creation. We conjecture, perhaps, that this reversal may be occurring because of the stock market's *inability* to accurately assess the effects of advertising in turbulent environments. 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 environments on their cash flow, and thereby their shareholder value, with a view to stabilizing their firm's shareholder 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 serve as an impetus to initiate the important and overdue discussion among senior management, finance and marketing executives on the crucial 'financial' role of both advertising, and research development expenditures, as has been suggested by marketing scholars (Rust et al. 2004; 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 in the area, 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 shareholder value. Theoretical research using complementary methods (e.g., in-depth interviews, surveys, field studies) to develop a conceptual model and propositional inventories relating other elements of marketing strategy (e.g., marketing channels and new product development) to the variability of other financial performance metrics (e.g. return on assets, shareholder value) will be useful in setting a research agenda for further empirical 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 the firm's marketing and new product development programs. While, dollar amounts spent on advertising and R&D are important, especially from the perspective of senior management and finance executives focused on profits, they represent a consolidated, input measure and do not account for differences in the quality of implementation and the effectiveness of advertising programs (e.g. creativity of advertising campaigns, efficiency of media planning 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., fast

moving consumer goods, 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 study and generate specific managerial implications on how the various elements of a firm's advertising program, and more

generally, its marketing mix, affect the variability of cash flow and shareholder value.

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

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Contacts:

For further information, please visit www.zibs.com or contact:

Zyman Institute of Brand Science
Goizueta Business School

Emory University
1300 Clifton Road
Atlanta, Georgia 30322 USA
Main: +1 (404) 727-9172
Fax: +1 (404) 727-1082

Web: www.zibs.com

Academic Facing Contacts

Sundar Bharadwaj
Director of Academic Programs
Professor of Marketing
Phone: 404-727-2646
Email: sundar@zibs.com

Doug Bowman
Director of Academic Programs
Professor of Marketing
Phone: 404-727-4613
Email: doug@zibs.com

Sriram Venkataraman
Director, Analytics
Assistant Professor of Marketing
Phone: +1 (404) 727-5275
Email: sriram@zibs.com

Ashish Sood
Director, Analytics
Assistant Professor of Marketing
Phone: +1 (404) 727-4226
Email: ashish@zibs.com

Raj Srivastava
Executive Director
Professor of Marketing
Phone: +1 (404) 727-4858
Email: raj@zibs.com

Business Facing Contacts

Greg Thomas
Director of Research and Programs
Phone : +1 (404) 727-4613
Email: greg@zibs.com

Dana Page
Program Manager
Phone: +1 (404) 727-1078
Email: dana@zibs.com

Reshma Shah
Director of Business Relations
Assistant Professor of Marketing
Phone: +1 (404) 727-6302
Email: reshma@zibs.com

Susan Hogan
Director of Business Relations
Assistant Professor of Marketing
Phone: +1 (404) 727-5516
Email: reshma@zibs.com

Leanne Fesenmeyer
Director of Alliances
Phone: +1 (770) 817-4141
Email: leanne@zibs.com