

The Information Content of Marketing Investment Announcements

Anne T. Coughlan*
Kissan Joseph**
Duane Myer***
M. Babajide Wintoki****

December 2011

Comments Welcome

***John L. and Helen Kellogg Professor of Marketing, Kellogg School of Management,
Northwestern University, Evanston, IL 60208-2008, a-coughlan@kellogg.northwestern.edu**
****Associate Professor and Stockton Faculty Fellow, School of Business, University of
Kansas, Lawrence, KS 66045-7585, kjoseph@ku.edu**
***** Ph.D. Candidate, School of Business, University of Kansas, Lawrence, KS 66-45-7585**
******Assistant Professor of Fiannce, School of Business, University of Kansas, Lawrence,
KS 66045-7585, jwintoki@ku.edu**

The Information Content of Marketing Investment Announcements

ABSTRACT

Although the short-run response of the financial markets to announcements of marketing investments has been well-established in the extant literature, less is known about *how* the basic information inherent in these announcements flows from the “black box” of the firm to external market participants. In response, we conceptualize that since marketing investments are determined by individuals with the best knowledge of the firm’s future environment, announcements of a marketing investment provide valuable information about the future productivity of that marketing investment. Our analysis yields two distinct predictions. First, market reaction to an investment decrease announcement will be *less* pronounced than market reaction to an investment increase announcement, a result that stands in sharp contrast to received theory. This is because the mean-shifting and uncertainty-reducing aspects of new information tend to mitigate each other for decrease announcements but reinforce each other for increase announcements. Second, the information content of marketing investment announcements will be intimately related to investors’ prior information; consequently, firms that announce similar marketing investments can provoke markedly different market reactions. Examining a sample of sales force size change announcements by 131 firms in the pharmaceutical industry, we find broad support for our analytical conceptualization.

Keywords: Event-Study Analysis; Marketing-Finance Interface; Stock Market Valuation; Stock Return Modeling; Information Content of Announcements

The Information Content of Marketing Investment Announcements

1. INTRODUCTION

The short-run response of the financial markets to announcements of marketing investments has received much attention in the extant literature. In an early investigation, Horsky and Swyngedouw (1987) examine the market response to a company changing its name. Subsequently, researchers have investigated the response of the financial markets to a myriad set of marketing investments, including investments in new products (Chaney, Devinney, and Winer (1991)); celebrity endorsements (Agarwal and Kamakura (1995)); brand extensions (Lane and Jacobson (1995)); joint ventures (Houston and Johnson (2000)); launching an Internet channel (Geyskens, Gielens, and DeKimpe (2002)); and quality (Tellis and Johnson (2007)). All of these studies employ the event-study methodology because it is an effective tool to measure the short-run response of the financial markets to announcements of marketing investments.

While these, and related, studies have been successful in illustrating the financial value of marketing investments, less is known about *how* the basic information inherent in announcements of marketing investments flows from the “black box” of the firm to external market participants. Accordingly, the primary objective of our research is to address this gap by developing, and empirically validating, an analytical model that explicitly delineates the information content of announcements of marketing investments. Utilizing the notion of a response function that relates marketing investments to firm profits, we conceptualize that the

announcement of a marketing investment updates investors' beliefs about the parameters of the response function. This updating of the parameters of the response function, in turn, causes a revision in the profitability, and consequently, the market-value of the firm. Further, we also demonstrate that the amount of updating that accompanies a marketing investment is contingent on the prior information available about the firm. Specifically, both uncertainty and weaker prior beliefs heighten the information content of announcements of marketing investments.

We believe that our conceptualization contributes to the emerging body of research at the marketing-finance interface (Srinivasan and Hanssens 2009). In particular, we offer a rigorous, theory-based analytical framework linking market valuation and the response function associated with marketing investments. This is a useful link to examine because response functions represent the impact of marketing investments at a very fundamental level. We also empirically validate the key predictions emerging from our analytical framework by examining the short-run market reaction to a specific marketing investment, namely, sales force resizing announcements in the pharmaceutical industry. Our empirical findings are broadly supportive of our proposed analytical conceptualization.

In addition to advancing and empirically validating an analytical framework that characterizes the information content of marketing investment announcements, our work offers two distinct predictions. First, we derive the novel prediction that announcements communicating decreases in marketing investments will have a *weaker* absolute market reaction than will marketing announcements communicating a corresponding increase in marketing investments. This prediction results from considering the two-fold effect of new information in an announcement: this information both shifts mean expectations and reduces uncertainty. These two effects tend to mitigate each other for decrease announcements, whereas they

reinforce each other for increase announcements. This analytical result is noteworthy because it stands in sharp contrast to received theory. In particular, much previous research suggests a negativity bias in consumer contexts (Ahluwalia 2002; Kahneman and Tversky 1979) and this has been extended to explicitly hypothesize that negative announcements will provoke a *stronger* market reaction than comparable positive announcements (see, for example, Tellis and Johnson 2007).

Our second prediction pertains to the cross-sectional variation in the information content of marketing investments. Specifically, our analytical work demonstrates that prior information moderates the information content of marketing investment announcements. It is well-known that firms differ in the amount of information they provide to market participants (Jaggi and Jain 1998) as well as in the intensity of analyst coverage (Atiase 1985). This suggests that the prior information available to investors will exhibit considerable heterogeneity across firms. Thus, we predict that much of the cross-sectional variation in information content can be explained by the variation in investors' prior information.

The importance of prior information has good precedent in the marketing literature. It has been well-established that the financial markets only respond to new information associated with marketing investments (Joshi and Hanssens 2009; Srinivasan, Pauwels, Silva-Risso, and Hanssens 2009), where prior information is captured via expectations. For example, Joshi and Hanssens (2009) report that post-launch performance of a film studio's stock price is strongly influenced by expectations of sales performance built up prior to release. Accordingly, they first develop an expectations model of sales, and then examine the impact of deviations on stock price. While such an approach is eminently feasible for variables that are continuous (e.g., sales or customer satisfaction), developing an expectations model for events with a more discrete

flavor (e.g., sales force resizing, new product introduction, or the addition of internet channel) creates conceptual and estimation challenges. In particular, it is necessary to estimate the prior probability of such a discrete event and this may be fraught with high error; moreover, it may not even be readily apparent what variables should be included as predictors. Our analytical and empirical analysis reveals that *uncertainty* and *direction of prior beliefs* are two important covariates that should be included in any model that attempts to understand cross-sectional variations in the information content of marketing investment announcements. Our work suggests that measures of these two covariates can serve as significant explanatory variables and help account for different market reactions to otherwise similar marketing announcements.

Our findings imply that academic research on the market reaction to various types of marketing investments can fruitfully include our explanatory variables of uncertainty and direction of prior beliefs, and should investigate the possibility of asymmetric outcomes for positive versus negative announcements as well. Our findings also imply that marketing practitioners can properly benchmark the reaction of the financial markets to announcements of marketing investments. The establishment of investor relations departments to manage the process of communicating with the investor community (Rao and Sivakumar 1999) provides a context where such benchmarking may be particularly germane. To the extent that the response to a marketing announcement is contingent on the availability and amount of prior information, it follows that increases in marketing investments may not always be accompanied by an increase in market valuation. In particular, if investors already possess considerable information about the firm, the increase announcement may be foreshadowed; consequently, the market response will be muted or non-existent. Similarly, decreases in marketing investments may not always be accompanied by a decrease in market valuation. As such, it may be unreasonable to expect the

investor relations function to always meet the standard of obtaining a positive market reaction following an increase in marketing investment. Conversely, accommodating a negative market reaction for a size decrease may be too lenient a standard to gauge the efforts of the investor relations function. In either case, our theory prescribes that benchmarking the investor relations function requires adjustments for the extent of prior investor information.

The remainder of the paper is organized as follows. In the next section, we develop and analyze an analytical model that examines the information content of marketing investments. We encapsulate the major insights from our analytical model in the form of propositions. Next, we empirically examine a sample of firms in the pharmaceutical industry that announce changes in their primary marketing vehicle, namely, the size of the sales force. Our objective here is to validate our analytical model by testing its key predictions. Finally, we offer a summary and discuss the implications of our work.

2. Model and Analysis

2.1 Model

We represent the firm's market value in a two-period world, consisting of a current period (1) and a future period (2). In a world of complete information about the productivity parameters in both periods, the market value of the firm at time t , MV_t , is given as:

$$MV_t = k_1 R_1^{0.5} - R_1 + \frac{k_2 R_2^{0.5} - R_2}{(1 + \delta)}. \quad (1)$$

In equation (1), k_i is a productivity parameter which scales the output of the marketing investment, R_i , in period i . Moreover, the marketing investment reflects diminishing returns

which is captured by the exponent, 0.5.¹ In straightforward fashion, profit in the second period is discounted by the firm's discount rate, δ .

Given this description of the benefits and costs associated with the marketing investment, the firm chooses its marketing investment to maximize profit in each period. We thus have:

$$R_i^* = \frac{k_i^2}{4}. \quad (2)$$

Consequently, under full information about the profit-response function, the market value of the firm at time 1 is given as:

$$MV_1 = \frac{k_1^2}{4} + \frac{k_2^2}{4(1 + \delta)}. \quad (3)$$

Equation (3) succinctly incorporates the notion that the market value of the firm under full investor information is influenced by the productivity parameter associated with the response function, k_i , $i = 1, 2$. However, investor information about market response parameters is in fact incomplete. We therefore modify the baseline model above by assuming that marketing investment productivity in the current period, k_1 , is known symmetrically to all market participants, but that information about future marketing productivity is asymmetric: specifically, future productivity is known completely to the managers of the firm but that investors only have diffuse beliefs about it.

We operationalize this asymmetry of information in the following way: in the absence of any announcement of marketing investments, investors believe that $k_2^2 \square N(K_{NoEvent}^2, \sigma_{NoEvent}^2)$.²

¹ Any exponent less than 1 in value generates the same qualitative results; we only require concavity in the profit function with respect to marketing investment in order to generate an interior solution.

² Absent an announcement, investors will typically ascribe the same productivity parameter to period 2 as period 1, i.e., $K_{NoEvent}^2 = k_1^2$. However, allowing them to be different is more general and does not impact our insights.

This implies that investors believe the profit associated with the firm in the second period to be normally distributed with mean $\frac{K_{No\ Event}^2}{4(1+\delta)}$ and variance $\frac{\sigma_{No\ Event}^2}{16(1+\delta)^2}$.

Given this understanding of the information possessed by investors, it is now possible to write investors' valuation of the firm in period 1 under incomplete information as follows:

$$MV_{1/No\ Event} = \frac{k_1^2}{4} + \frac{K_{No\ Event}^2}{4(1+\delta)} - r \frac{\sigma_{No\ Event}^2}{16(1+\delta)^2}. \quad (4a)$$

In equation (4a), the first term represents profits arising from marketing investments in period 1. Since there is no uncertainty about period 1's marketing investment productivity, no adjustment for variance is necessary. The second and third terms represent the expected market value of the firm arising from profits during period 2; here, two terms are required because of uncertainty associated with the response in the second period. To capture the impact of uncertainty, we adopt a mean-variance formulation. As such, the second term is positive and incorporates the mean (expected) profit in the second period and the third term is negative and incorporates the risk penalty associated with the uncertainty of market response in the future. The risk penalty is represented as a function of investors' risk-aversion, r , and the variance in profit, namely,

$$\left[\frac{\sigma_{No\ Event}^2}{16(1+\delta)^2} \right].$$

Such a mean-variance formulation has good support in the finance literature. Lintner (1969), for example, demonstrates that the equilibrium price for a risky asset is its certainty equivalent (which is the average of individuals' expectations of its final value), *minus* a risk penalty. Further, this risk penalty is adequately expressed as the product of average market risk-aversion and variance.

In our subsequent analysis, we find it convenient to work in terms of the precision of prior beliefs. Accordingly, (4a) is rewritten in terms of the precision, $\tau \equiv \frac{1}{\sigma_{No\ Event}^2}$, as:

$$MV_{1/No\ Event} = \frac{k_1^2}{4} + \frac{K_{No\ Event}^2}{4(1+\delta)} - r \frac{1}{16(1+\delta)^2} \frac{1}{\tau}. \quad (4b)$$

We are now in a position to present our analysis and model predictions.

2.2 Analysis: Market Response and Asymmetry Between Increase and Decrease Announcements

Consider an event in which a firm that announces an increase in marketing investments in period 1, to take effect in period 2. Since the marketing investment is a reaction to the firm's information about the response function in the future, investors can rightfully use this information to update their beliefs of k_2^2 . If the firm announces an increase (decrease) in its marketing investments, the event provides positive (negative) information about the productivity parameter in period 2. More formally, we model investors who interpret the announcement as information on the productivity parameter sampled from a normal distribution with some unknown mean, $\tilde{\mu}$, and variance, σ_{Event}^2 . The information signal associated with an increase announcement is K_{High}^2 and that for a decrease announcement is K_{Low}^2 , with $K_{Low}^2 < K_{No\ Event}^2 < K_{High}^2$. Following Cyert and DeGroot (1987), an announcement event thus allows investors to update their prior beliefs to obtain the following posterior mean and variance for k_2^2 :

$$\text{Posterior Mean of } k_2^2 \text{ for an increase announcement} = \frac{\tau \cdot K_{No\ Event}^2 + h \cdot K_{High}^2}{\tau + h} \quad (5a)$$

$$\text{Posterior Mean of } k_2^2 \text{ for a decrease announcement} = \frac{\tau \cdot K_{No\ Event}^2 + h \cdot K_{Low}^2}{\tau + h} \quad (5b)$$

$$\text{Posterior Variance of } k_2^2 = \frac{1}{(\tau + h)}, \quad (5c)$$

where h represents precision of the information associated with the event and is defined as $h = \frac{1}{\sigma_{Event}^2}$. Equations (5a) – (5c) reveal that an increase announcement enhances investors' beliefs about future productivity whereas a decrease announcement degrades investors' beliefs about future productivity. However, both announcements improve the precision of investors' beliefs, and for simplicity we assume the same diminution in variance for either an increase or a decrease announcement.

The announcement therefore allows investors to update their estimate of the market value both because it changes investors' beliefs about the productivity parameter and because it resolves uncertainty about future firm performance. In particular, we assume that investors employ the posterior mean and variance of the marketing productivity parameter k_2^2 to compute the revised market value of the firm at time 1. Employing a positive symbol for an increase announcement and a negative symbol for a decrease announcement, we have:

$$MV_{1/Event+} = \left[\frac{k_1^2}{4} + \frac{\tau \cdot K_{No\ Event}^2 + h \cdot K_{High}^2}{4(\tau + h)} \right] - r \frac{1}{16(1+\delta)^2} \frac{1}{(\tau + h)} \quad (6a)$$

$$MV_{1/Event-} = \left[\frac{k_1^2}{4} + \frac{\tau \cdot K_{No\ Event}^2 + h \cdot K_{Low}^2}{4(\tau + h)} \right] - r \frac{1}{16(1+\delta)^2} \frac{1}{(\tau + h)} \quad (6b)$$

Given the expressions in equation (4b), (6a), and (6b), it is now possible to write an expression for the change in market value immediately following the announcement. Denoting

the change in market value as Δ and continuing to employ the positive symbol for an increase announcement and a negative symbol for a decrease announcement, we have:

$$\begin{aligned}
\Delta_+ &= MV_{1/Event+} - MV_{1/No\ Event} \\
&= \left[\frac{k_1^2}{4} + \frac{\tau \cdot K_{No\ Event}^2 + h \cdot K_{High}^2}{4(1+\delta)} \right] - r \frac{1}{16(1+\delta)^2} \frac{1}{(\tau+h)} - \left[\frac{k_1^2}{4} + \frac{K_{No\ Event}^2}{4(1+\delta)} \right] + r \frac{1}{16(1+\delta)^2} \frac{1}{\tau} \\
&= \frac{\tau \cdot K_{No\ Event}^2 + h \cdot K_{High}^2 - K_{No\ Event}^2}{4(1+\delta)} + r \frac{1}{16(1+\delta)^2} \frac{h}{\tau(\tau+h)} \\
&= \frac{h(K_{High}^2 - K_{No\ Event}^2)}{4(\tau+h)(1+\delta)} + r \frac{1}{16(1+\delta)^2} \frac{h}{\tau(\tau+h)}
\end{aligned} \tag{7a}$$

$$\begin{aligned}
\Delta_- &= MV_{1/Event-} - MV_{1/No\ Event} \\
&= \left[\frac{k_1^2}{4} + \frac{\tau \cdot K_{No\ Event}^2 + h \cdot K_{Low}^2}{4(1+\delta)} \right] - r \frac{1}{16(1+\delta)^2} \frac{1}{(\tau+h)} - \left[\frac{k_1^2}{4} + \frac{K_{No\ Event}^2}{4(1+\delta)} \right] + r \frac{1}{16(1+\delta)^2} \frac{1}{\tau} \\
&= \frac{\tau \cdot K_{No\ Event}^2 + h \cdot K_{Low}^2 - K_{No\ Event}^2}{4(1+\delta)} + r \frac{1}{16(1+\delta)^2} \frac{h}{\tau(\tau+h)} \\
&= \frac{h(K_{Low}^2 - K_{No\ Event}^2)}{4(\tau+h)(1+\delta)} + r \frac{1}{16(1+\delta)^2} \frac{h}{\tau(\tau+h)}.
\end{aligned} \tag{7b}$$

Equation (7a) reveals that the change in market value for a size increase announcement consists

of two components. The first component, $\frac{h(K_{High}^2 - K_{No\ Event}^2)}{4(\tau+h)(1+\delta)}$, can be called the “expected value”

effect because it reflects the improvement in investors’ beliefs about the productivity parameter

from $K_{No\ Event}^2$ to K_{High}^2 . The second component, $r \frac{1}{16(1+\delta)^2} \frac{h}{\tau(\tau+h)}$, can be called the “uncertainty reduction” effect, because the firm’s announcement serves to reduce the penalty for uncertainty. Since both of these components are positive, the predicted net effect of an increase announcement on the market value of the firm is unambiguously positive.

Equation (7b) reveals that the change in market value for a decrease announcement also consists of two components. The first component, $\frac{h(K_{Low}^2 - K_{No\ Event}^2)}{4(\tau+h)(1+\delta)}$, can be called the “expected value” effect because it reflects the degradation in investors’ beliefs about the productivity parameter from $K_{No\ Event}^2$ to K_{Low}^2 . Not surprisingly, this is a negative quantity. As before, the second component, $r \frac{1}{16(1+\delta)^2} \frac{h}{\tau(\tau+h)}$, can be called the “uncertainty reduction” effect, and it is again positive in value because the firm’s announcement serves to reduce the penalty for uncertainty. Thus, the expected market reaction to a decrease announcement is comprised of one negative and one positive component. We anticipate that the “negative” expected value effect will dominate because it is unusual for an adverse event to erase so much of the uncertainty penalty as to overcome the expected value effect. Accordingly, we predict that the market response to a decrease announcement will be negative, but attenuated relative to that for an increase announcement, on account of the positive effect of uncertainty reduction. Given this analysis, we formally state:

P₁: An announcement of an increase in marketing investments signals strong future productivity and reduces profit uncertainty; consequently, it will lead to an *increase* in the market value of the firm. An announcement of a decrease in marketing investment, on the other hand, signals weak future productivity but also

reduces profit uncertainty. Consequently, it will lead to a *decrease* in the market value of the firm but with *smaller* magnitude.

Proposition 1 reveals an asymmetric impact: a decrease in marketing investments is predicted to generate a *weaker* market response than a corresponding increase in marketing investments, because the mean-shifting and uncertainty reducing aspects of new information tend to mitigate each other for decrease announcements but work synergistically for increase announcements. As mentioned previously, this is a noteworthy finding because it stands in sharp contrast to the received conceptualization (Tellis and Johnson 2007).

We next examine how the information content of sales force sizing announcements varies cross-sectionally across firms due to variations in investors' prior information.

2.3 Analysis: Moderating Impact of Investors' Prior Information

For a variety of reasons, the prior information possessed by investors may vary considerably across firms. As mentioned previously, firms differ in how much information they provide to market participants (Jaggi and Jain 1998) and also in the intensity of analyst coverage (Atiase 1985). Recall that we characterize investors' prior beliefs about future productivity as $k_2^2 \sim N(K_{NoEvent}^2, \sigma_{NoEvent}^2)$. In terms of this notation, prior information has two components: uncertainty and direction (or alternatively, strength) of beliefs. It is natural to represent uncertainty via the parameter $\sigma_{NoEvent}^2$. In addition, we can characterize direction of beliefs by examining how close $K_{NoEvent}^2$ is to the information signal associated with the marketing announcement (i.e., K_{High}^2 or K_{Low}^2). We next examine how these two aspects of investors' prior

information, uncertainty and direction of beliefs, will moderate the information content of marketing investments.

To examine the impact of prior uncertainty on the information content of a marketing announcement, we consider the change in market value represented in equations (7a) and (7b) with respect to the level of pre-announcement precision, τ . Mathematically, this amounts to computing $\frac{\delta\Delta_+}{\partial\tau}$ and $\frac{\delta\Delta_-}{\partial\tau}$. Increases in τ unambiguously decrease both the first term and the second term of equation (7a), implying that $\frac{\delta\Delta_+}{\partial\tau}$ is unambiguously negative (and hence, the corresponding comparative static, $\frac{\delta\Delta_+}{\partial\sigma^2_{No\ Event}}$, is unambiguously positive).

The impact of τ on Δ_- (equation (7b)) is not as straightforward. An increase in τ increases the first term (i.e., makes it less negative). However, as before, the second term is decreasing in τ . Overall, it is thus apparent that $\frac{\delta\Delta_-}{\partial\tau}$ cannot be signed without further consideration. Consistent with the discussion of our first Proposition, we hypothesize that the “expected value effect” dominates the “risk reduction effect.” We thus expect that $\frac{\delta\Delta_-}{\partial\tau}$ will be positive (and hence, the corresponding comparative static, $\frac{\delta\Delta_-}{\partial\sigma^2_{No\ Event}}$, will be negative).

Our derivations $\frac{\delta\Delta_+}{\partial\sigma^2_{No\ Event}} > 0$, and $\frac{\delta\Delta_-}{\partial\sigma^2_{No\ Event}} < 0$, demonstrate that prior uncertainty does

indeed moderate the market reaction to announcements of marketing investments. Specifically, we expect prior uncertainty to magnify the market reaction to the announcement of marketing investment, irrespective of whether the announcement reflects an increase or decrease (here, we

continue to make the assumption that “expected value” effect will continue to dominate the “uncertainty reducing” effect for decrease announcements). In other words, *a priori* uncertainty increases the market reaction to an increase announcement and it further depresses the market reaction to a decrease announcement. Intuitively, this is because additional information has greater value when there is more *a priori* uncertainty. Formally, we state:

P₂: *A priori* uncertainty will *increase* the market reaction to the announcement of a marketing investment (increase or decrease).

Finally, we examine the direction of prior belief contained in the information set possessed by investors. At some firms, the direction of belief is one of *high* future productivity. At other firms, the direction of belief is one of *low* future productivity. These effects are encapsulated in our analytic framework via the comparative difference between $K_{NoEvent}^2$ and the information signals (either K_{High}^2 [a positive announcement] or K_{Low}^2 [a negative announcement]) in equations (7a) and (7b). For example, when $K_{NoEvent}^2$ is relatively close to K_{High}^2 , investors’ prior direction of belief is one of strong future productivity. In contrast, when $K_{NoEvent}^2$ is relatively close to K_{Low}^2 , investors’ prior direction of belief is one of weak future productivity.

Naturally, the information content of marketing investments is influenced by the direction of belief. In straightforward fashion, we posit that market reaction to announcement of marketing investments will be stronger when it contradicts the direction of belief. Accordingly, market reaction to an increase announcement will be stronger when the direction of belief is one of low future productivity (i.e., when $K_{NoEvent}^2$ is closer to K_{Low}^2 than it is to K_{High}^2). This follows directly

from equation (7a): Δ_+ is larger, the lower is $K_{NoEvent}^2$. In contrast, market reaction to a decrease announcement will be stronger when the direction of belief is one of high future demand ($K_{NoEvent}^2$ is closer to K_{High}^2 than it is to K_{Low}^2). This follows directly from equation (7b): Δ_- is larger in absolute value (i.e., more negative), the higher is $K_{NoEvent}^2$.

Given these arguments, we can now formally state:

P₃: Market reaction to an increase in marketing investments will be more pronounced when investors' direction of belief is one of *low* future productivity. Conversely, market reaction to a decrease in marketing investments will be more pronounced when investors' direction of belief is one of *high* future productivity.

3. Empirical Validation

3.1 Objective and Empirical Strategy

As mentioned previously, the objective of our empirical efforts is to validate our analytical conceptualization by empirically testing key predictions. We use the event study methodology to test our predictions. An event study is founded on the premise of market efficiency, where stock market prices reflect all public information about a stock (Fama 1970, 1998).³ Thus, this methodology is ideally suited to study the information content of marketing investments.

³ For more information on the event study methodology, see Brown and Warner 1985, Binder 1998, and Horsky and Swyngedouw 1987.

3.2 Data and Variables

Our data include all sales force announcements in the pharmaceutical industry over the period September, 1986 to December, 2010. Using the Factiva database, we queried the term “sales force” in conjunction with the terms and variations of “increase,” “expand,” “boost,” “add,” “reduce,” “decrease,” “realigned,” “restructure,” “layoff,” or “cut” to identify firms that announced a sales force resizing (increase or decrease). In our data, only the discrete event is coded since most announcements do not offer sufficient detail on the precise magnitude of the resizing. This coding is not as problematic as it first appears: the level of detail is consistent with the inference that investors can make from such an announcement. In particular, investors can only credibly infer a directional change in the sales force size; the actual magnitude of the resizing can be ascertained only at a later date. In addition, ancillary information was coded when provided concurrently by the firm. In the case of sales force size increases, these concurrent events included announcements pertaining to earnings, new product introduction, additional R&D investment, and new capital issue. In the case of sales force size decreases, these concurrent events included announcements pertaining to low anticipated sales, increased sales efficiency, or a one-time expense (not expected to recur). Our sample consists of 85 pharmaceutical firms that announced size increases and 46 firms that announced sales force size decreases.

To calculate the market response to sales force sizing announcements, we analyze two-day [-1, 0] and six-day [-5, 0] event windows (where “0” represents the day of the announcement itself) and record the associated Cumulative Abnormal Return (CAR) of the firm’s stock. Although event studies typically employ a small window around the event date, the use of a slightly longer window captures any leakage of information that may have occurred before the

date of the resizing announcement. In particular, it accounts for that fact that our noted announcement date is only the date the event was announced to the major news sources. There may very well have been other announcements made to trade groups that could have preceded the announcement in the major news sources.⁴

We employ proxies for uncertainty and direction of belief associated with investors' information set as predictors of the firm's CAR around the time of a sizing announcement. The extant literature has employed several proxies for uncertainty. The first proxy is the idiosyncratic volatility of the firm's stock price.⁵ This is typically measured by using the variance of the error term from a four-factor model estimated over some time horizon, say, [-150,-10].⁶ The literature has also identified a firm's market-to-book ratio and age as proxies for uncertainty; age has long been considered an inverse proxy for uncertainty and closely related to the market-to-book ratio (Pastor and Veronesi 2003). Finally, a fourth proxy for uncertainty is firm size. This is typically measured by the log of market capitalization. It is well-known that firm size is inversely related to the uncertainty associated with the firm. For example, analyst forecasts are more accurate for large firms (Lang and Lundholm 1996). In addition, large firms display more stable growth and earnings (Hodgkinson 2001).

Given the overlap and correlations among these proxies, we believe it is appropriate to employ principal components analysis to obtain a composite proxy for uncertainty. Indeed, a principal components analysis reveals a single component that explains 69% and 68% of the

⁴ For short run event studies, a window of 1 to 5 days around the event is typical in the empirical finance literature; see Campbell, Lo and MacKinlay (1997) and Kothari and Warner (2005) for numerous references.

⁵ Idiosyncratic volatility has been widely used in the finance literature as a proxy for investor uncertainty or the divergence of investor opinion. Please see Boehme, Danielson and Sorescu (2006) for a list of references.

⁶ This is similar to the definition used in Ang, Hedrick, Xing and Zhang (2006).

variance in these four variables in the increase and decrease samples, respectively. We thus use this composite component as our proxy for uncertainty. Next, we use the recent sales trajectory of the firm as a proxy for the *a priori* direction of belief contained in the investors' information set. The recent sales trajectory is measured as the change in sales from last year to this year, scaled by last year's sales and in excess of the median sales growth for the industry overall.

3.3 Findings

We organize our findings into three main parts. In the first, we present summary statistics on our two sub-samples. We then report findings pertaining to the cumulative abnormal returns around the event date. Finally, we present findings pertaining to the cross-sectional variation in cumulative abnormal returns.

3.3.1 Summary Statistics

We report summary statistics for the two sub-samples in Table 1. Panel A provides summary statistics for the increase sub-sample whereas Panel B provides summary statistics for the decrease sub-sample. We first discuss the four variables that we employ as proxies for uncertainty. In this regard, Table 1 reveals that the mean of idiosyncratic volatility is 3.77 in the increase sample and 3.67 in the decrease sample. There is no statistically significant difference between the mean idiosyncratic volatility of the firms in our sample and those reported by Boehme, Danielson and Sorescu (2006) for a broader sample for firms – they report a mean idiosyncratic volatility of 3.89 in 1998 for all U.S.-domiciled common stocks listed on the New York Stock Exchange and NASDAQ. The mean value of the market-to-book ratio takes on relatively high values in both samples: 4.61 in the increase sample and 1.97 in the decrease

sample.⁷ This is not unusual given that the assets of this sample of firms are essentially intellectual in nature. Moreover, the higher value within the increase sample is reflective of the growth opportunities available to them. With respect to age, firms announcing an increase appear to be younger on average than firms announcing a decrease (17.2 years versus 28.5 years), suggesting that growth associated with sales force expansion is more likely for younger firms. Lastly, with respect to market capitalization, all numbers are adjusted to 2008 dollars. As discussed previously, we use a principal components analysis to create a single construct to represent uncertainty from these four variables and normalized summary statistics for this variable are also provided in Table 1.

***** INSERT TABLE 1 ABOUT HERE *****

Next, Table 1 reveals that for the increase sample, the direction of prior belief is skewed positive – the mean sales growth is 67%, indicating substantial growth for this sample of firms. Among the decrease sample, the direction of belief is skewed negative – the mean sales growth is -18%, indicating a slowing of sales. These findings suggest that, in the aggregate, a sales force size increase announcement is more likely to be associated with robust sales growth. Conversely, a sales force size decrease announcement is more likely to be associated with degradation in sales.

Finally, Table 1 also displays summary statistics pertaining to two important control variables: the advertising-to-sales and R&D-to-sales ratios. We include these variables in our analysis to account for heterogeneity in our sample of firms. Table 1 reveals that firms in the increase sample spend about 2% of their sales on advertising while firms in the decrease sample

⁷ Historically, the average value of Q for all firms has been 0.72, which means that the market value of all equities outstanding in the US has usually sold for about 72% of replacement value. The maximum value from 1945 to 2007 was 1.83 reached in 1999 during the dot.com bubble and the minimum value was 0.33 in 1948. Source: http://wiki.fool.com/Tobin's_q.

spend about 4% of their sales on advertising. Both samples of firms report substantially higher R&D investment as a percentage of sales, with increase firms reporting over 16% and decrease firms reporting approximately 13.5% of sales in the prior year. This is to be expected, given the R&D-intensive nature of these industries.

Table 1 also reveals that the number of decrease announcements is much smaller than the number of increase announcements. This is not surprising: firms are likely to be hesitant in disclosing negative information about sales force size decreases, especially since such disclosure is not legally required. As such, decrease announcements may be skewed towards instances of large resizings; in effect, the large magnitude of the change forces disclosure. Moreover, the nature of concomitant information provided varies markedly across the two sub-samples. While the increase announcements are accompanied by announcements pertaining to new products, FDA approvals, and increased R&D spending, the decrease announcements are accompanied by attempts at explaining the decrease as stemming from weak future sales and/or increased efficiency.

3.3.2 Cumulative Abnormal Returns

Table 2 displays the Cumulative Abnormal Returns (CARs) for both the increase and decrease subsamples. The returns are displayed for two event windows: [-1, 0] and [-5, 0], and two adjustments: the standard four-factor adjustment [*market*, *size*, *book-to-market*, and *momentum*] and a two-factor adjustment [*market* and *industry*]. In the latter adjustment, *industry* controls for the returns associated with firms in the pharmaceutical industry; this alternative adjustment is appropriate since all firms belong to the pharmaceutical industry and size, book-to-

market, and momentum are less salient since these are generally included in other studies to capture cross-sectional variation across industries.

***** INSERT TABLE 2 ABOUT HERE *****

Table 2 reveals significant market reaction to both increase as well as decrease announcements. This speaks to the substantial information content associated with sales force sizing announcements in the pharmaceutical industry. Clearly, this is driven by the large role of the sales force in the overall marketing efforts of pharmaceutical firms.

The market reaction to an increase announcement is significant for both event windows and for both adjustments. The market reaction to a decrease announcement is significant only for the [-5,0] event window but for both adjustments. Further, for both increase and decrease announcements, market reactions are larger over the [-5, 0] window than over the [-1, 0] window. This may be because information about impending sales force size announcements is likely to leak into trade circles before being announced in the mainstream press. The fact that the market reaction to decrease announcements is significant only over the [-5, 0] window but not over the [-1, 0] window is consistent not only with this notion of informal trade circle information dissemination prior to a formal market announcement, but also with the notion that those directly affected by the impending announcement – the firm’s salespeople themselves – may take pre-emptive action in the case of a decrease in sales force size, by putting their resumé on the market prior to a formal downsizing announcement. For both of these reasons, we focus on the [-5, 0] window in our ensuing empirical analyses.

Consistent with Proposition 1, we find that increase announcements are associated with a positive abnormal return on average, while decrease announcements are associated with a negative abnormal return on average. But contrary to the Proposition’s prediction, we do not

find that the response to a decrease announcement is attenuated (in absolute value) relative to the response to an increase announcement. In fact, the $[-5, 0]$ market reaction is larger in absolute value for decrease announcements than for increase announcements, across both adjustments. As hinted in the discussion of summary statistics above, this is consistent with the idea that many of the decreases with smaller impacts are likely not announced by firms.

3.3.2 Cross-sectional variation in Cumulative Abnormal Returns

Tables (3a) and (3b) display regression results pertaining to CAR for the increase and decrease samples, respectively.

***** INSERT TABLES 3a and 3b ABOUT HERE *****

Consistent with our analytical prediction stemming from Proposition 2, we find that prior uncertainty heightens the market reaction to a sales force resizing announcement. Specifically, both *increase* announcement effects and decrease announcement effects are larger in magnitude in the face of greater prior uncertainty (uncertainty has a positive sign in Table 3a and a negative sign in Table 3b). This finding supports our prediction that marketing investment information is more valuable in the face of higher prior uncertainty.

We also find support for Proposition 3, concerning the effect of prior beliefs on market value. The market reaction to a sales force size *increase* announcement (Table 3a) is largest for firms at which sales growth is relatively weak, suggesting weak future productivity. In this instance, the announcement provokes a strong response because it contradicts the prior belief. Conversely, in the case of the decrease sample (Table 3b), the market reaction is largest for firms at which sales growth is relatively strong, suggesting strong future productivity. Here also, the announcement provokes a strong response because it contradicts the prior belief.

We control for other firm investments (advertising, R&D) and also examine the impact of the provision of concomitant information in explaining the cross-sectional variation in CAR. Focusing first on the increase sample (Table 3a), we find that firms that have higher levels of advertising generate a higher market reaction. Higher levels of advertising increase the productivity of sales force investments; consequently, the CAR effect of a sales force size increase announcement is magnified by an accompanying high advertising/sales ratio. Similarly, the concomitant announcement of a new product or of additional R&D investments heightens and reinforces the productivity of sales force investments, and therefore of the market's reaction to a sales force size increase announcement. Interestingly, the provision of earnings information decreases the impact of a sales force size increase. Presumably, this is because the information contained in the earnings announcement is of a higher level and overshadows the information content of the sales force sizing increase announcement. Finally, the level of R&D investment or the raising of new capital turn out to be insignificant.

Turning next to the decrease sample (Table 3b), we find no effects either for other firm investments, or for concomitant announcements, in explaining abnormal returns to a size decrease announcement. Recall that the nature of a concomitant announcement varies markedly across increase and decrease announcements. While increase announcements are accompanied by other signals such as new products, FDA approval, and R&D budget increases, all of which can enhance the productivity of sales force effort, sales force size decrease announcements are characterized mainly by after-the-fact explanations such as loss in sales, efficiency enhancements, or the incurring of a one-time charge, which do not directly influence sales force productivity. Further, the lack of mention of new products, FDA approval, or R&D budget increases when announcing a sales force downsizing makes intuitive sense: it would hardly be

appropriate to cut the sales force in the face of a new product launch or FDA approval. Table 3b thus shows that concomitant announcements, in the face of a sales force downsizing announcement, do not mitigate the “bad news” effect of the announcement, nor do they weaken the effects predicted by our theoretical model.

In sum, our empirical analysis shows support for the predictions of our theory pertaining to the impact of uncertainty and prior belief; moreover, we find this support for both increase and decrease announcements regarding sales force size. In addition, reinforcing information about complementary marketing investments enhances the abnormal returns to a sales force size increase announcement; however, concomitant announcements designed to soften the negative news impact of the downsizing are not successful.

4. Summary, Implications, and Conclusion

4.1 Summary

Our research investigates the response of financial markets to announcements of marketing investments. Our essential thesis is that since marketing investments are determined by individuals with the best knowledge about the firm’s future environment and are often characterized by substantial ramp-up time, an announcement about the level of a marketing investment provides valuable information about the future productivity of that marketing investment. Moreover, our theory also offers two distinct predictions. First, we predict an asymmetric market reaction across increase and decrease announcements. Second, we predict that the information content of marketing investments will vary with two key characteristics of investors’ prior information, namely, uncertainty and the market’s direction of prior beliefs. By

focusing on uncertainty and the mean shift in beliefs due to the announcement, our research encompasses the building blocks of an information-theoretic approach.

Our empirical work examines the specific context of sales force resizing announcements in the pharmaceutical industry. This allows us to focus on an industry where the sales force is a major component of a firm's overall marketing efforts. We find a strong market reaction for these announcements. We also find that the information content of marketing investment announcements is highest when there is substantial *a priori* uncertainty and when the announcement contradicts the direction of investors' prior beliefs.

4.2 Implications

An important implication of our research endeavor is that it can inform future models and analysis of the information content of marketing investment announcements. While the financial impacts of many marketing investments have been examined before, it is likely that many more investments have yet to be studied. For those interested in such investigations, our research predicts an asymmetric abnormal-returns response between increase and decrease announcements and reveals the crucial importance of including the extent of uncertainty and the strength of prior beliefs when explaining these abnormal returns. As such, our work contributes theory-based modeling specifications; moreover, empirical variables representing our model constructs can fruitfully be included in future studies.

Our work also offers insights for marketing practitioners concerning the management and evaluation of the investor relations function. To the extent that investor relations are a form of firm-initiated communication, they rightly fall under the purview of the marketing discipline. Our research shows that the same type of announcement may have different effects under

different conditions; effective management of the investor relations function may therefore imply managing whether to make an announcement or not, depending on these conditions.

First, our findings suggest that *a sales force size increase announcement need not always generate a positive market reaction*. For example, prior uncertainty that is lower than the mean level can blunt the CAR impact of a sales force size increase announcement. For example, uncertainty that is 0.68 standard deviations below the mean level of uncertainty is sufficient to cancel out the otherwise positive impact of an increase announcement (2.71% on average), as the following calculations demonstrate:

$$\begin{aligned} & [(\# \text{ std. dev. away from mean}) \cdot (\text{std. dev. of uncertainty}) \cdot (\text{regression coefficient for uncertainty})] \\ & = [-(\text{mean CAR for increase sample})] \end{aligned}$$

$$\Rightarrow [(\# \text{ std. dev. away from mean}) \cdot (0.8391) \cdot (4.75)] = [-2.71]$$

$$\Rightarrow (\# \text{ std. dev. away from mean}) = -0.68 .$$

Firms characterized by low uncertainty thus obtain no boost in stock price upon announcing a sales force size increase.

Likewise, a prior belief about a firm's growth prospects that is about one standard deviation above the mean prior belief (precisely, $0.95 \left[= \frac{(-2.71)}{1.6248 \times (-1.75)} \right]$ standard deviations above the mean sales growth rate in our increases sample) is sufficient to cancel out the otherwise positive CAR impact of an increase announcement. The sanguine prior belief about the firm's prospects in such a case lessens the incremental "news value" of a sales force size increase announcement.

Similarly, our findings suggest that *a sales force size decrease announcement need not always generate a negative market reaction*. Uncertainty that is low enough can counteract the

otherwise negative CAR resulting from a sales force size decrease announcement. For example, uncertainty that is $1.13 \left[= \frac{4.43}{0.9274 \times (-4.23)} \right]$ standard deviations below the mean level of uncertainty is sufficient to cancel out the otherwise negative impact of a decrease announcement. Firms characterized by low enough uncertainty thus suffer no depreciation in stock price upon announcing a sales force size decrease.

Likewise, a prior belief about a firm's growth prospects that is just $0.72 \left[= \frac{4.43}{0.3293 \times (-18.78)} \right]$ standard deviations below the mean prior belief nullifies the negative impact of a decrease announcement. In short, even a modest prior belief that the firm's growth prospects are poor is sufficient to blunt the negative impact of a sales force size decrease announcement; in effect, such an announcement is simply not viewed by the market as conveying much incremental "news value," given the firm's established sales growth performance.

These findings guide the "benchmarking" of the investor relations function: they suggest that it may be unreasonable to expect the investor relations function always to meet the standard of obtaining a positive market reaction upon announcing a size increase. Conversely, accommodating a negative market reaction for a size decrease may be too lenient a standard by which to gauge the investor relations function. In either case, an adjustment has to be made for the extent of prior beliefs and uncertainty in setting these standards.

Second, our work also explicitly demonstrates when the information content of marketing announcements is likely to be high, i.e., when much is at stake. The investor relations function can then funnel greater resources to such events. In particular, among firms announcing a size increase, those that are one standard deviation above the mean with respect to uncertainty enjoy

an incremental abnormal return of +3.99% $[=(0.8391) \cdot (4.75)]$ relative to the average firm in the increase sample. Those that are one standard deviation below the mean with respect to prior beliefs enjoy an incremental abnormal return of +2.84% $[=(-1.6248) \cdot (-1.75)]$ relative to the average firm in the increase sample. The investor relations group may want to emphasize, or hasten, the sales force sizing increase announcement in either of these scenarios. Meanwhile, among firms announcing a size decrease, those that are one standard deviation above the mean with respect to uncertainty experience an incrementally depressed abnormal market return of -3.92% $[=(0.9274) \cdot (-4.23)]$ relative to the average firm in the decrease sample. Those that are one standard deviation above the mean with respect to prior beliefs experience an incrementally depressed abnormal market return of -6.18% $[=(0.3293) \cdot (-18.78)]$ relative to the average firm in the decreases sample. The investor relations group may thus find it prudent to accelerate its damage control strategies in either of these two sales force sizing decrease announcement scenarios.

To reinforce the economic significance of this recommendation, Table 4 displays the dollar impact of the various scenarios just discussed. This is obtained by multiplying the four abnormal returns by the mean value of market capitalization within the respective samples (increase or decrease). We find that as we move away from the mean of uncertainty and prior belief by just one standard deviation, there is considerable economic variation in the information content of sales force resizing announcements. More specifically, the economic impacts of a size increase can plausibly increase by as much as \$136 M while those of a size decrease can be further depressed by as much as \$350M. These effects are in addition to the mean effects, which are already fairly substantial (+\$92 million in the case of sales force size increases and -\$251 million in the case of sales force size decreases).

***** INSERT TABLE 4 ABOUT HERE *****

4.3 Conclusions

The financial impact of marketing investments has received, and will likely continue to receive, much attention in the literature. We add to this well-established literature by providing a rigorous, theory-based analytical conceptualization of the information content of marketing investment announcements. Hopefully, the extant contributions and the present research will motivate additional research that sheds new light on the market reaction to announcements of marketing investments.

REFERENCES

- Agarwal, J. and W. A. Kamakura (1995), "The Economic Worth of Celebrity Endorsers: An Event Study Analysis," *Journal of Marketing* 59 (July), 56 – 62.
- Ahluwalia, Rohini (2002), "How Prevalent is the Negativity Effect in Consumer Environments?" *Journal of Consumer Research* 29 (2), 270 – 279.
- Atiase, R. K. (1985), "Predisclosure Information, firm capitalization, and security price behavior around earnings announcements," *Journal of Accounting Research* 23 (Spring), 21 – 36.
- Ang, Andrew, Robert Hodrick, Yuhang Xing, and Xiaoyan Zhang (2006), "The Cross-Section of Volatility and Expected Returns," *Journal of Finance* 61, 259-299.
- Binder, John J. (1998), "The Event Study Methodology Since 1969," *Review of Quantitative Finance and Accounting* 11, 111 – 137.
- Boehme, R.D., B.R. Danielson, and S.M. Sorescu (2006), "Short Sale Constraints, Differences of Opinion, and Overvaluation," *Journal of Financial and Quantitative Analysis* 41, 455 – 487.
- Brown, Stephen J. and Jerold B. Warner (1985), "Using Daily Stock Returns: The Case Of Event Studies," *Journal of Financial Economics* 14, 3 – 31.
- Campbell, J., A. Lo and A. C. MacKinlay (1997), The Econometrics of Financial Markets (Princeton University Press).
- Chaney, P. K., T. M. Devinney, and R. S. Winer (1991), "The Impact of New Product Introductions on the Market Value of Firms," *Journal of Business* 64 (4), 573 – 610.
- Cyert, Richard M. and Morris H. DeGroot (1987), Bayesian Analysis and Uncertainty in Economic Theory, New Jersey: Rowman and Littlefield.
- Fama, Eugene F. (1970), "Efficient Capital Markets: A Review of Theory and Empirical Work," *Journal of Finance* 25 (2), 383 – 417.
- Fama, Eugene F. (1998), "Market Efficiency, Long Term Returns and Behavioral Finance," *Journal of Financial Economics* 49, 283 – 306.
- Geyskens, I., K. Gielens, M. G. Dekimpe (2002), "The Market Value of Internet Channel Additions," *Journal of Marketing* 66 (April), 102 – 119.
- Hanssens, Dominique M., Roland T. Rust, and Rajendra K. Srivastava (2009), "Marketing Strategy and Wall Street: Nailing Down Marketing's Impact," *Journal of Marketing* 73 (November), 115 – 118.

- Hodgkinson, L. (2001), "Analysts' Forecasts and Broker Relationships," *Journal of Business, Financial and Accounting* 28, 943 – 961.
- Horsky, Dan and P. Swyngedouw (1987), "Does it Pay to Change your Company's Name? A Stock Market Perspective," *Marketing Science* 6 (4), 320 – 335.
- Houston, M. B., S. A. Johnson (2000), "Buyer-supplier Contracts versus Joint Ventures: Determinants and Consequences of Transaction Structure," *Journal of Marketing Research* 37 (February), 1 – 15
- Jaggi, B. and Jain, R. (1998), "An Evaluation of Financial Analysts' Earnings Forecasts for Hong Kong Firms," *Journal of International Financial Management and Accounting* 9, 177 – 200.
- Joshi, Amit M. and Dominique M. Hanssens (2009), "Movie Advertising and Stock Market Valuation of Studios: A Case of "Great Expectations?" *Marketing Science* 28 (2), 239 – 250.
- Kahneman, D and A. Tversky (1979), "Prospect Theory: An Analysis of Decision Under Risk," *Econometrica* 47 (March), 263- 291.
- Kothari, S.P. and Jerold B. Warner (2008), "Econometrics of Event Studies," Handbook of Corporate Finance: Empirical Corporate Finance, Vol 1, Chapter 1.
- Lane, V. and R. Jacobson (1995), "Stock Market Reactions to Brand Extension Announcements: The Effect of Brand Attitude and Familiarity," *Journal of Marketing* 59 (January), 63 – 77.
- Lang, M. and R. Lundholm (1996), "Corporate Disclosure Policy and Analyst Behavior," *The Accounting Review* 71 (4), 467 – 492.
- Lintner, John (1969), "The Aggregation of Investor's Diverse Judgments and Preferences in Purely Competitive Security Markets," *Journal of Financial and Quantitative Analysis* 4 (4), 347 – 400.
- Pastor, Lubos and Pietro Veronesi (2003), "Stock valuation and Learning about Profitability," *Journal of Finance* 58, 1749 –1789.
- Rao, H. and K. Sivakumar (1999), "Institutional Sources of Boundary-Spanning Structures: The Establishment of Investor Relations Departments in the Fortune 500 Industrials," *Organization Science* 10 (1), 27 – 42.
- Srinivasan, Shuba and Dominique M. Hanssens (2009), "Marketing and Firm Value: Metrics, Methods, Findings, and Future Directions," *Journal of Marketing Research* 46 (June), 293 – 312.

Srinivasan, Shuba, Koen Pauwels, Jorge Silva-Risso, and Dominique Hanssens, “Product Innovations, Advertising, and Stock Returns,” *Journal of Marketing* 73 (January), 24 – 43.

Tellis, Gerard J. and Joseph Johnson (2007), “The Value of Quality,” *Marketing Science* 26 (6), 758 – 773.

Table 1
Summary Statistics for Analysis Variables
Panel A: Increase Sample (N = 85)

Variable	Mean	Std. Deviation	Minimum	Maximum
Idiosyncratic Volatility (%)	3.77	3.02	0.93	24.63
Market to Book Ratio	4.61	4.45	0.35	26.89
Age (years)	17.20	17.58	0	66
Market Cap (\$ million)	3,410	8,520	2.23	52,300
Uncertainty (principal components construct)	0	0.8391	-3.4573	1.4979
Sales Growth (%)	67.28	162.48	-112.54	579.58
Controls				
Advertising/Sales (%)	2.15	4.51	0	32.21
R&D/Sales (%)	16.35	21.14	0	131.45
Announcement Characteristics (0-1 Dummy)				
Earnings	0.39			
New Product	0.55			
FDA Approval	0.08			
R&D Investment	0.09			
New Capital Issue	0.09			

Table 1
Summary Statistics for Analysis Variables
Panel B: Decrease Sample (N = 46)

Variable	Mean	Std. Deviation	Minimum	Maximum
Idiosyncratic Volatility (%)	3.67	2.84	0.96	16.32
Market to Book Ratio	1.97	1.07	0.44	4.12
Age (years)	28.5	24.92	3	79
Market Cap (\$ million)	5,660	10,020	1.53	36,400
Uncertainty (principal components construct)	0	0.9274	-1.7463	1.4537
Sales Growth (%)	-18.00	32.93	-115.74	84.77
Controls				
Advertising/Sales (%)	4.03	7.61	0	31.35
R&D/Sales (%)	13.47	9.22	1.65	38.72
Announcement Characteristics (0-1 Dummy)				
Low Sales	0.26			
Increasing Efficiency	0.48			
One-time Expense	0.20			

Table 2
Cumulative Abnormal Returns: Increase and Decrease Announcements
(t-statistics in parentheses, ** significant at .05 level, * significant at .10 level)

Increase Sample (N = 85)

Event Window	Market / Size / Book-to-Market / Momentum Adjusted	Market / Industry Adjusted
[-1,0]	1.67* (1.84)	2.01** (2.24)
[-5,0]	2.05** (2.08)	2.71** (2.48)

Decrease Sample (N = 46)

Event Window	Market / Size / Book-to-Market / Momentum Adjusted	Market / Industry Adjusted
[-1,0]	-0.95 (-1.17)	-1.41 (-1.42)
[-5,0]	-3.38* (-1.76)	-4.43** (-1.97)

Table 3a: Regression Results
Dependent Variable: CAR [-5, 0]
Increase Sample

(t-statistics in parentheses, ** significant at .05 level, * significant at .10 level)

Variable	Expected Sign	Model 1	Model 2
Uncertainty (Principal Component)	+	3.52** (1.93)	4.75** (2.23)
Prior Belief (Sales Growth)	-	-1.71** (-2.10)	-1.75** (-2.72)
Advertising/Sales		0.58* (1.78)	0.63** (2.14)
R&D/Sales		-0.01 (-0.16)	-0.02 (-0.41)
Intercept		2.78* (1.84)	1.81 (1.02)
Announcement Characteristics			
Earnings			-4.28** (-2.26)
New Product			4.35* (1.99)
FDA Approval			3.58 (0.48)
Additional R&D Investment			5.35* (1.70)
New Capital			-3.98 (-1.42)
R ²		0.15	0.32

Table 3b: Regression Results
Dependent Variable: CAR [-5, 0]
Decrease Sample

(t-statistics in parentheses, ** significant at .05 level, * significant at .10 level)

Variable	Expected Sign	Model 1	Model 2
Uncertainty (Principal Component)	-	-4.43* (-1.77)	-4.23* (-1.74)
Prior Belief (Sales Growth)	-	-20.08* (-1.77)	-18.78* (-1.74)
Advertising/Sales		0.04 (0.22)	0.11 (0.33)
R&D/Sales		0.23 (0.87)	0.19 (0.73)
Intercept		-11.32* (-1.74)	-7.13 (-1.00)
Announcement Characteristics			
Loss of Sales			-2.93 (-0.57)
Increasing Efficiency			-4.47 (-1.19)
One-Time Expense			-3.99 (-0.50)
R²		0.31	0.34

Table 4
Economic Impact of Sales Force Resizing Announcements

Dollar Market Cap Impact of Size Increase Announcement: +\$92.41M⁽¹⁾
Dollar Market Cap Impact of Size Decrease Announcement: -\$250.74M⁽²⁾

Variation in Impact⁽³⁾		
	Increase Announcement	Decrease Announcement
Uncertainty	+1σ Δ = \$135.91M	+1σ Δ = -\$222.04M
Prior Beliefs	-1σ Δ = +\$96.96M	+1σ Δ = -\$350.03M

⁽¹⁾Calculated (for increase sample) as:

$$\left[(\text{mean of CAR}) \cdot (\text{mean of Market Cap}) \right] = \left[(0.0271) \cdot (\$3.41 \text{ billion}) \right] = +\$92.41 \text{ million} .$$

⁽²⁾ Calculated (for decrease sample) as:

$$\left[(\text{mean of CAR}) \cdot (\text{mean of Market Cap}) \right] = \left[(-0.0443) \cdot (\$5.66 \text{ billion}) \right] = -\$250.74 \text{ million} .$$

⁽³⁾To understand the entries in the table, consider the top left-hand cell. In this case, a firm announcing a sales force size increase, whose prior uncertainty is one standard deviation above the mean, is predicted to enjoy an incremental increase in CAR of +3.99%, calculated (using values from the increases sample) as:

$$\left[(\text{std. dev. of prior uncertainty}) \cdot (\text{prior uncertainty coefficient}) \right] \% = \left[(0.8391) \cdot (4.75) \right] \% = 3.99\% .$$

This CAR increase is worth \$135.91M in extra market value, calculated (using values from the increases sample) as:

$$\left[(\text{change in CAR}) \cdot (\text{mean of Market Cap}) \right] = \left[(0.0399) \cdot (\$3.41\text{B}) \right] = +\$135.91 \text{ M} .$$

Note that this is in addition to the mean Market Cap effect (+\$92.41M) for a size increase announcement.

Now consider the bottom right-hand cell. In this case, a firm announcing a sales force size decrease, whose prior belief value is one standard deviation above the mean, is predicted to suffer an additional decrease in CAR of -6.18%, calculated (using values from the decreases sample) as:

$$\left[(\text{std. dev. of prior belief}) \cdot (\text{prior belief coefficient}) \right] \% = \left[(0.3293) \cdot (-18.78) \right] \% = -6.18\% .$$

This CAR decrease translates to an extra decline in market value of \$350.03M, calculated (using values from the decreases sample) as:

$$\left[(\text{change in CAR}) \cdot (\text{mean of Market Cap}) \right] = \left[(-0.0618) \cdot (\$5.66\text{B}) \right] = -\$350.03 \text{ M} .$$

Note that this is in addition to the mean Market Cap effect (-\$250.74M) for a size decrease announcement.