VALUE CONTRIBUTION OF PERSONAL SELLING AND DIRECT-TO-CONSUMER ADVERTISING IN THE PHARMACEUTICAL INDUSTRY

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This research explores the value contribution of detailing and direct-to-consumer advertising among the six major pharmaceutical firms in the U.S. market using data from 1995 to 2012. Value of a firm is measured with Tobin's q and stock returns. A valuation model with ROI as the primary explanatory variable is employed to parameterize the effects of these two key promotional approaches on the value of a firm. Both detailing and advertising are found to contribute to the overall value of a firm, while detailing makes far greater contribution per unit than advertising. This study also proposes a possible explanation for the lack of interaction between these two factors.

INTRODUCTION

Academic researchers and pharmaceutical firms alike have been interested in knowing the value contribution of consumer advertising, detailing, and the complementary nature of these two marketing tools. This study intends to examine these research questions at the individual firm level. To the best of our knowledge, there is only one major piece of academic research (i.e., Osinga, Leeflang, Srinivasan, and Wieringa (2011) published in this area where, relying on monthly data from 1993 to 2000, a positive impact is found for both DTCA and detailing on stock returns. However, potential interactive effects are not examined in that study. Given changing regulations in the pharmaceutical industry during the last two decades (e.g., the FDA officially relaxing regulations for DTCA in 1997 and the Physician Payments Sunshine Act in 2010), we use a recent data set to assess the impact that detailing and DTCA activities have on a pharmaceutical firm's value in this new regulatory environment. Additionally, we introduce the notion of interaction effects between detailing and DTCA and test accordingly.

Since the pharmaceutical industry has seen major changes in the past 15 years (Schramm and Hu 2013), there is a definite need for an update of the ever-changing role of the marketing activities such as detailing and DTCA within this industry. The present study extends Osinga et al.'s (2011) research by analyzing pharmaceutical firm value in a more recent time frame (1995 to 2012, compared to 1993-2000). A valuation model that allows for significance testing of the coefficients of detailing and DTCA is used in the present study. Potential interaction between these two promotional devices will also be identified and explained.

With detailing, pharmaceutical representatives make multiple rounds of presentations informing and educating physicians in hopes that these physicians will consider their drug when writing prescriptions. Detailing is highly relational, as pharmaceutical representatives work in a competitive setting where each is vying for a physician's commitment (Homburg, Bornemann, and Kretzer 2014). The other main marketing activity in the pharmaceutical industry, DTCA, was initiated with the approval of FDA, bringing about big changes in regulations and permitting pharmaceutical firms to have promotional advertisements on broadcast media, directly telling consumers about their prescription drugs (Mogull 2008; Liu and Gupta 2011) so as to make a connection between the brand and its users as a way of increasing commitment (Martin, Collier, and Engelland 2014).

The contribution of this study lies in proposing a valuation model to capture the effects of detailing and DTCA on overall firm value. The

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financial metrics used to measure a firm's value are Tobin's q and stock returns, and annual year -end stock prices are the key inputs to the construction of these measures. Results with Tobin's q and stock return are largely the same, finding that DTCA and personal selling through detailing both serve as marketing expenditures that increase the value of a pharmaceutical firm. This study further contributes to the literature on valuation modeling and sheds light on the use of Tobin's q and stock return.

In the following sections, a background of the industry and its environmental and structural factors will first be presented, followed by a discussion of the product portfolio strategy. Next, a review of previous academic work on detailing and DTCA will be given. Study design, sample and the valuation model used will then be presented, followed by a discussion of analysis and results. Finally, managerial insights, theoretical conclusions, and limitations complete the paper.

U.S. PHARMACEUTICAL INDUSTRY

The Rise of the Generic Drug Sector

Product pricing impacts corporate financials, making the generic drug sector of interest in the pharmaceutical industry. The Waxman-Hatch Act passed in 1984 was designed to remove barriers to entry for generic drugs. Before 1984, filling of generic equivalent drugs took place long after the expiration of the incumbent drug patent. With the Waxman-Hatch Act, generic drugs can be marketed on the day of patent expiration of the incumbent drugs. As physicians were mostly loyal to branded drugs, shortly after 1984 the percent of total prescriptions being filled that were generic actually went down. However, prescriptions of generics took off in the early 1990s as the change in labor laws forced insurance companies to seek less expensive alternatives to branded drug prescriptions. Financial incentives were provided to purchase generic equivalent drugs whenever possible. As a result, generic drugs have literally shortened the product life cycle of branded drugs.

New Product Introduction

Top line growth in the branded sector is traditionally dependent of the introduction of new products. With patent protection, companies can enjoy years of reasonably high rates of return on investment, allowing the companies to recover the high product development costs. Yet, new product development is always a highly risky venture. Product development costs typically run in hundreds of millions of dollars with no guarantee that the product will even be introduced into the marketplace. In addition, it has become harder and harder to identify an opportunity for a blockbuster drug, as the product space for most chronic diseases has already been occupied or has become crowded (Kornfield, Donohue, Berndt, and Alexander 2013). For example, for the treatment of cardiovascular disease with a class of drugs called statins for lowering cholesterol level, Merck first introduced Mevacor in 1987, followed by its own updated version, Zocor in 1994. In the same year, 1994, Bristol-Myer Squibb introduced Pravachol while Novartis AG introduced Lescol. The introduction of Lipitor by Pfizer in 1997 and Astra Zeneca PLC's Crestor in 2003 further crowded the market. Even though Lipitor remains the number one blockbuster drug of all time, branded drug companies are concerned about the nature of competition even within their own sector.

Shifts in Product Portfolio Strategy

As a result of the erosion of market share toward the generic drug sector and high costs associated with new product introductions, firms in the branded sector are pressured to meet expectations for earnings and rates of return on investment. Resource investments in new product development are shifted to incremental products and extended branding. Extension drugs are less costly to develop, as the bulk of research and development expenditures have already been borne by the incumbent brand. The extension drug reaps the benefits from the incumbent brand equity. For example, when Merck extended its osteoporosis drug Fosamax by adding Vitamin D, the extended drug, Fosamax Plus D, benefited from

the established market position of the Fosamax brand. Furthermore, the Market Exclusive Period clause under the Waxman-Hatch Act allowed a three-year extension of the incumbent drug's patent after the extension drug was brought into the market.

Schramm and Hu (2013) utilized data from public sources and compiled the number of new and extended drugs introduced from 1980 to 2011. In the pre-1995 period, the number of new drug introductions by major U.S. pharmaceutical firms was slightly higher than the total for extended drugs. After 1995, the annual number of brand extensions far exceeded that of new products, except in 2011 when the number of new products introduced exhibited a strong uptick to be at the same level as the number of extensions.

It is reasonable to expect personal selling to physicians through detailing to be emphasized during the first several years of new product introduction because of the need to educate prescribers about newly available options. Then, as the drug gains acceptance in the marketplace by physicians and patients alike, firms will tend to shift their promotion strategy toward DTCA. Brand extensions are used to delay market erosion. These brand extensions typically are heavily supported by DTCA since these drugs are no longer under patent protection. DTCA serves as a reminder for the consumers who are already loyal to the brand.

PHARMACEUTICAL MARKETING ACTIVITIES

The prior section of this paper discusses the life cycle of pharmaceutical products and implications and regulations that are unique to this industry (e.g., generics, extensions). Additionally, intricacies arise due to the nature of physicians writing scripts for these prescription drugs, rather than end users having complete control of product selection. Because of how unique this industry is, it is important to determine the most effective way for firms to promote and market these products.

How does a company choose how to market its products? Stewart (2009) finds that marketing expenditures account for 20 to 25 percent of the overall corporate budget, yet accountabilities of these expenses are mixed. Marketing expenditures are necessary for prescription drugs to be successfully innovated (Leeflang and Wieringa 2009). In general, pharmaceutical firms have used detailing, DTCA, meetings and events, internet marketing, and journal advertising for their marketing communication strategies (Jambulingam and Sharma 2010). However, these marketing activities are not delivered equally, and the majority of spending is on detailing and DTCA. In fact, in 2008, pharmaceutical companies averaged expenditures of 58.7 percent of their marketing budget on detailing and 22.8 percent on DTCA (SDI 2009). Accounting for over 80 percent of the marketing budget, this paper focuses on the activities of detailing and DTCA, as they should be critical variables to predict a firm value.

These promotions of pharmaceuticals are heavily regulated (Mogull 2008; Tipton, Bharadwaj, and Robertson 2009). In 2003, the Office of Inspector General under the Department of Health and Human Services issued its Compliance Program Guidance for Pharmaceutical Manufacturers (Federal Register 2003). It was designed to engage the healthcare community in preventing and reducing fraud and abuse in health care programs. A strong emphasis was placed on kickbacks and other illegal remunerations used to reward physicians for their prescriptions, but the enforcement of this Guidance was largely voluntary.

Subsequent compliance guidelines were also issued in 2006, when the Physician Payment Sunshine Act began to require drug and medical device manufacturers to publicly report gifts and payments with a value of $10 or more. The Affordable Health Care for America Act signed into law on March 23, 2010 by President Barack Obama clearly spells out how compliance will be administered as well as the penalties associated with non-compliance. A centralized Sunshine Act Tracking system was created. It was reported in the New York Times (October 1, 2014: B1) that from August 1 to December 31, 2013, pharmaceutical firms in the U.S. made payments totaling $3.48 billion to physicians in the form of research payments ($1.49 billion), ownership interest ($1.02 billion), speaking and consulting fees ($380

million), royalties and licenses ($302 million), travel, food, lodging ($167 million), and other expenses ($128 million). The data base with this information was made accessible to the general public in 2013, fueling public outcry against pharmaceuticals in their business operations.

While prescription drugs utilizing DTCA are the "largest and fastest selling medicines" (Herzenstein, Misra, and Posavac 2004: 202), they still require a prescription. Research involving the advertising and personal selling efforts for pharmaceuticals within a single framework has been sparse and, moreover, there is not yet consensus in terms of effectiveness of an integrative approach. For example, Azoulay (2001) reports a negative impact of advertising and sales force operations on marketing outcomes, whereas Gatignon and Hanssens (1987) report positive outcomes of advertising and sales force interactions.

Accountability of marketing managers is ever-increasing, and quantifiable outcomes of their work are in high demand (Balasubramanian, Mathur, and Thakur 2005; Sridhar, Narayanan, and Srinivasan 2014). Results of their responsibilities are often expressed in terms of sales or profits at the brand or product level, and marketing scholars have long placed emphasis on the sales of a brand or product (Chevalier and Mayzlin 2006; Chintagunta, Gopinath, and Venkataraman 2010; Edeling and Fischer 2016; Graham and Frankenberger 2000; Kumar, Choi, and Greene 2016). However, marketing responsibilities look different at the firm level than they do at the brand or product level. As Pasa and Shugan (1996) state, "marketing expertise helps a firm make better marketing decisions that can improve the performance and profitability of the firm" (p. 370). At the corporate level, CEOs are accountable to shareholders in upholding the value of stock prices, and changes in stock prices—combined with the total number of shares outstanding—reflect the firm's market value. Marketing executives must translate marketing expenditures into sales, profits, or stockholder value for board members in order to decrease the likelihood of removal from the firm's overall budget.

Stock price changes reflect how investors perceive the value of a firm and, recently, attention has shifted to that of stock price movement (Luo 2007; McAlister, Sonnier, and Shively 2012). Marketing activities such as advertising can increase shareholder value because they lead to increased revenues. For example, Barber and Odean (2008) find that advertising during the Super Bowl may increase a firm's stock price. Accordingly, the marketing activities of companies can impact firm value, and the selection of pharmaceutical representatives to accomplish these roles appropriately is essential (Sager and Ferris 1986). Yet, a challenge exists in identifying what is "appropriate" for detailing and what reduces interference in DTCA (Groza 2015).

Academic research in this area basically takes on two related dimensions—firm value implications of marketing investments and synergies between personal selling and consumer advertising. In most cases where detailing and DTCA have been studied, research examines these communication strategies at disaggregate levels such as the physician, brand, or product-category level (Kremer, Bijmolt, Leeflang, Wieringa 2008). While limited research examines detailing and DTCA within the veterinary pharmaceutical industry, the majority of research considers pharmaceutical representatives approaching physicians. Mixed findings have been reported for the impact of detailing and DTCA. Examining sales force effort, Manchanda and Chintagunta (2004) find that detailing has a positive impact on prescriptions written but a diminishing return overall. Cavusgil, Deligonul and Calantone (2011) examine DTCA on sales of Nexium, a late entrant into the prescription gastrointestinal market. They find that DTCA does not have a significant impact on sales across brands in the product category, yet DTCA is positive and significant specifically for Nexium sales. Narayanan, Desiraju, and Chintagunta (2004) study the effects of both detailing and DTCA on different brands of antihistamines—Claritin, Zyrtec, and Allegra.

Narayanan et al. (2004) link promotional expenditures to return on investment (ROI) among antihistamines and antivirals. They find that the ROI for detailing is higher than that of DTCA. It is conceivable that the effects of

detailing and DTCA are complementary in nature, yielding significant interaction between these two promotional mechanisms. Iizuka and Jin (2007) use the same three brands in their study. Consumers are surveyed reporting which brand they would choose and how many units would be purchased. Their findings further confirmed the complementary nature of the two promotional mechanisms of detailing and DTCA within the product category.

Academic research examining marketing efforts at the firm level, as identified in the current study, is limited. Osinga and colleagues (2011) first examined the effects of detailing and DTCA on stock returns at the firm level using data from the years 1993-2000. The eight largest U.S.-based drug manufacturers—Abbott, Bristol-Myers-Squibb, Johnson and Johnson, Pfizer, Schering-Plough, Eli Lilly, Merck, and Wyeth—constituted the sample of their study. Monthly stock returns from Kenneth French's website were the primary measure of value, and the four factor Carhart model (1997) was used to extract systematic and idiosyncratic risk for each firm. The Karman filter was also used to further remove noise in the data. The study found positive and moderate effects of both DTCA and detailing on stock returns. Their study did not examine the interaction between DTCA and detailing.

The current study extends and updates these findings, given changes in the pharmaceutical industry to DTCA requirements established by the FDA in the 1990s and changes to the overall healthcare industry since 2000. Using a comparable (but more recent) sample, this research examines the main and interactive effects of these two factors on the overall value of a pharmaceutical firm. A central research hypothesis we propose for this study is that the interaction between detailing and DTCA will affect the overall value of a pharmaceutical firm. Plausible explanations will be presented indicating why interactive effects should or should not exist in our sample of pharmaceutical firms.

VALUATION MODEL AND MEASURES

Valuation models derived in economics and finance propose that a firm's value depends largely on key fundamentals underlying operations (Luo and de Jong 2012). How much the firm possesses of these fundamentals (levels), and the associated growth rate (changes), are used as model inputs to explain value (Mizik and Jacobson 2003). ROA (Return on Assets) or ROI (Returns on Investments) are typically the primary explanatory variables for firm value. After specifying the baseline model, the variables of interest (in this case, detailing and DTCA) and their interaction will be introduced to capture marginal contribution to overall firm value.

Valuation Measures

Two commonly used measures of a firm's value are stock return (STK) and Tobin's q. Stock price is the key input into the computation of both of these measures. Investors rely on stock prices as a reflection of relevant information about a firm's potential future earnings (Fama and French 1992), and Jambulingam and Sharma (2009) find that "stock prices are good indicators of the pharmaceutical firm value" (p. 333). Srinivasan and Hanssens (2008) recommend using Tobin's q for empirical modeling of firm valuation. Tobin's q is well grounded in economic theory (Tobin 1969). Offering a different perspective, Mizik and Jacobson (2009) express a preference for stock returns. In each case measurement issues, associated with calculating asset replacement value, introduce an added source of measurement bias. The appropriateness of each measure depends largely on modeling effort and whether it is level- or change-based. No convincing argument has been presented in the academic literature yet in favor of one over the other.

Tobin's q is the ratio of the firm's market value over the replacement cost of its tangible assets (Tobin 1969, 1978). It has been widely used in marketing (Anderson, Fornell, and Mazvancheryl 2004; Morgan and Rego 2006) and within the context of pharmaceutical marketing (Boasson, Boasson, MacPherson, and Shin 2005; Grewal, Chakravarty, Ding, and Liechty 2008; Wang, Zhang, and Ouyang 2009) as a forward-looking measure that provides a market-based view of the firm's future earnings. In this study, a slight variation of Tobin's measure will be proposed as firm value (McNichols and Stubben 2008), such that

$$\text{Tobin's q} = \frac{\text{Market Value of Equity} + \text{Total Assets} - \text{Book Value of Common Equity}}{\text{Total Assets}}$$

.

The market value of equity is equivalent to stock price times the numbers of shares outstanding. Using Total Assets in place of the traditional measure of Replacement Costs helps to circumvent the measurement errors associated with calculating replacement costs.

Stock return assumes that investors view new information about a firm as a signal for change in the future discounted cash flow of the firm. As signaling changes, investors adjust expectations of future cash flow, and the changes in their expectations of future cash flow lead to changes in stock price. Stock return is calculated with the following formula

$$\text{Stock Return}_{it} = \frac{\text{Number of Shares Outstanding} \times \text{Price}_{it} + \text{Dividends}_{it} - \text{Number of Shares Outstanding}_{it-1} \times \text{Price}_{it-1}}{\text{Number of Shares Outstanding}_{it-1} \times \text{Stock Price}_{it-1}}$$

where, ***i*** refers to firm i, and ***t*** refers to time t. Stock return has been used to examine the market reaction to a dynamic process that occurs over time (Mizik and Jacobson 2003). Other examples of work using stock return in marketing include Aaker and Jacobson (2001), Morgan and Rego (2006), Luo and Homburg (2007, 2008), Srinivasan and Hanssens (2009), Luo and Bhattacharya (2009), Verniers, Stremersch, and Croux (2011), and Mani and Luo (2015).

Since both Tobin's q and stock return are used is this study, results will serve to cross-validate these measures and provide insights as to why one measure is more appropriate than the other in this study. The value of a firm at time *t* is largely a function of the basic fundamentals of how the firm operates. ROA and ROI typically correspond to these basic fundamentals. In this study, since detailing is a form of investment employed by the pharmaceutical firms to stimulate sales of their products, ROI is used as the key driver of the overall firm value. ROI is computed as:

$$\text{ROI} = \frac{\text{Net Income before Extraordinary Items}}{\text{Total Invested Capital}}$$

where

$$\text{Total Invested Capital} = \text{Total Long Term Debt} + \text{Preferred Stock} + \text{Minority Interest} + \text{Total Common Equity}$$

Level and change terms associated with ROI will be used in combinations to specify an appropriate baseline model. After the baseline model is specified, detailing and DTCA will be added into the model to capture the marginal effects of these marketing mechanisms with ROI already in the model.

DATA AND SAMPLE

Data for this study come from two major sources. Data for Tobin's q, STK, and ROI are annual year-end data generated from COMPUSTAT. Data for detailing and DTCA of pharmaceutical firms come from SDI, a subscribed data service of Encuity Research, LLC. Encuity Research is considered to be one of the most reliable data sources for the pharmaceutical industry. From this source, we have annual data from 1990 to 2012 (expanding beyond Osinga et al's sample time frame of 1990-2000). The data contains information for each product on personal selling to hospital physicians, office physicians, nurse practitioners and physicians assistants; consumer advertising; samples; and eAnswers for online marketing. Detailing corresponds to the personal selling data, and DTCA is consumer advertising. The unit for each item is millions of dollars. Data was aggregated across all products for each company's detailing and DTCA.

Since the mid-1990s, pharmaceutical companies have been allowed more leniencies in advertising. Now, while still very regulated, pharmaceuticals may advertise to consumers via television broadcast without providing the previously-required "brief summary" of drug effectiveness, side effects, or contraindications for help-seeking or reminder ads since they do not discuss benefits (Bala and Bhardwaj 2010). For product claim ads, drug makers must include a "fair balance" of risks and benefits through either the traditional "brief summary" or through a "major statement" with adequate provision for access to the brief summary (Ventola 2011). As a result, advertising and promotion expenditures have greatly increased, utilizing this avenue for pharmaceutical companies to interact with a broader audience. Given that the present study considers the effects of detailing and DTCA over the same period, only data from 1995 to 2012 is retained for analysis.

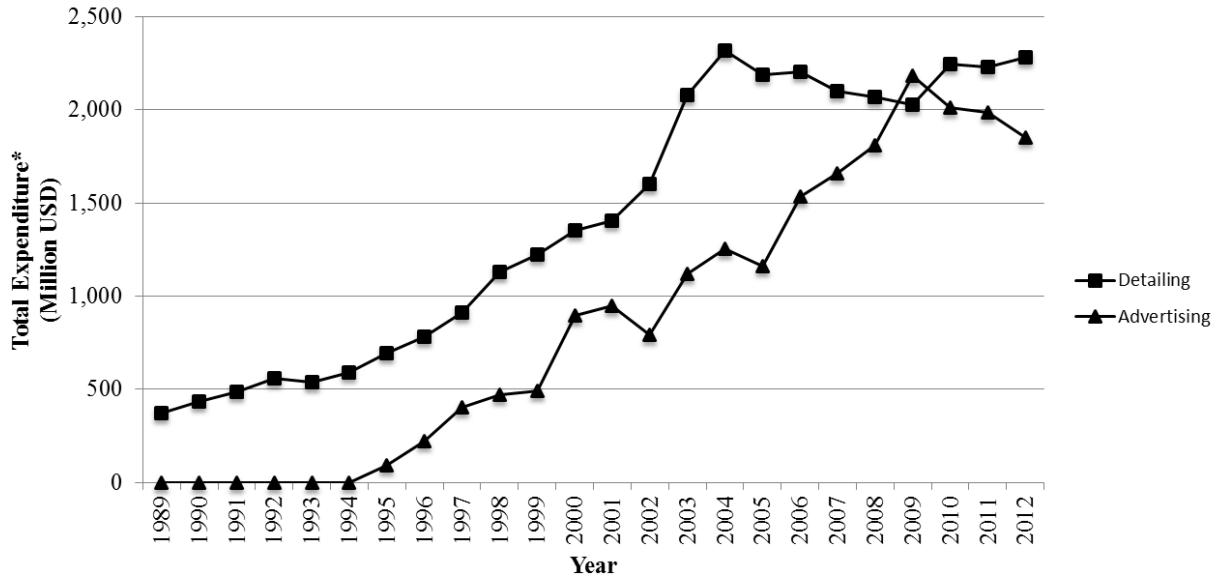
The firms selected for the present study are similar to those selected by Osinga et al. (2011). In their paper, Osinga and colleagues analyzed the eight main pharmaceutical firms for the time period from 1993 to 2000. In 2009, larger pharmaceutical firms acquired two of the eight firms they studied. The remaining six pharmaceutical firms—Abbott, Bristol-Myers-Squibb, Eli Lilly, Johnson & Johnson, Merck, and Pfizer—are selected for the present study. These firms have consistently accounted for over 50 to 60 percent of the sales volume in the brand name sector. As an option for increasing the size of the sample, consideration was given to including medium and small size pharmaceutical firms in the sample. These firms were not included since non-sampling error would then be introduced, rendering our sample of pharmaceutical firms to be highly heterogeneous.

A cross-sectional time-series approach is deemed appropriate for this panel of six firms over an 18-year time period. Advertising data in the early 1990s tend to be outliers, due to the nature of regulation changes beginning in 1995, so the balanced panel of six firms from 1995 through 2012 forms the current study's dataset, with 108 total observations. It should be noted that firm-specific events like new product introductions will vary from firm to firm. The use of cross-section time series approach allows for each of the six time-series to vary. Variation among these series will be incorporated in the estimation of the model coefficients. Furthermore, time-related variation will be reduced by taking the first difference of the measures over time.

The time period of the current study (1995-2012) includes all of the major regulatory changes for advertising in the pharmacy industry as of late. Prior research and its mixed findings occurred during a different environment with much less regulation. Accordingly, this data set creates a prime opportunity for studying the integrative effects of detailing and DTCA in modern times.

Figure 1 presents the total expenditures (in million dollars) of detailing and DTCA for the six firms from 1995 through 2012. This time

FIGURE 1:
Total Expenditure on Detailing and Direct-to-Consumer Advertising, 1989-2012



*Note: Total expenditure is calculated across the six firms Abbott, Bristol-Myers-Squibb, Eli Lilly, Johnson & Johnson, Merck, and Pfizer. Data attained from promotional audits and personal selling audits of Encuity Research, LLC. Encuity's data on promotional audit began in 1995. There may be a minimal amount of advertising occurring prior to 1995, which is not reflected in this Figure.

period is noteworthy, for reasons beyond providing a more recent view of Osinga and colleagues' (2011) study. In fact, based on conversations the FDA began in 1995, 1997 was the first year pharmaceutical firms were provided guidelines that allowed them to advertise directly to consumers without the advertisement providing a summary of drug effectiveness, side effects or contraindications. The total of DTCA for the six firms increased from $91.6 million in 1995 to its peak ($2,179.8 million) in 2009 and declined gradually in the subsequent three years. As detailing has been the dominant form of promotion in the pharmaceutical industry, the six firms invested $693.5 million with detailing reaching its peak in 2004 at $2,314.7 million. Expenditures in detailing have stabilized within a very limited range ever since.

It is quite understandable that the growth rate of DTCA far exceeded that of detailing in this study period. In fact, DTCA expenditures actually exceeded detailing expenditures ($2,026.7 million) in 2009 by a small margin. Conceivably, the growth of DTCA expenditure is the result of a number of factors, such as the relaxation of federal regulation of pharmaceutical firms' ability to advertise directly to consumers or the shifting of product emphasis from new to incremental products and pressure from the generic sector to meet ROI expectations. As for detailing, voluntary and involuntary compliance play a major role in the decline of investments made in detailing. Pressure from social groups has been mounting for decades challenging and accusing pharmaceutical firms of making exorbitant profits.

This study's approach recognizes that some variation exists among the six time series. Specifically within the pharmaceutical industry, one would expect the introduction of blockbuster drugs by each firm to be accompanied by a surge in marketing expenditures and to take place at different points in time. By allowing each time series to vary in the process, pooling across the data sample's six firms introduces an additional source of variability. By the same token, pooling leads to a six-fold increase in the number of observations. This pooled time-series approach entails a trade-off between an increase in the number of observations and an increase in the inherent variability within the proposed model.

TABLE 1:
Specification of Baseline Model (Dependent Variable = Tobin's Q)

	(A)	(B)	(C)	(D)	(E)	(F)
ROI	0.12** (p = .0000)			0.03* (p = .0482)		
ROI (-1)		0.10** (p = .0000)			(*n.s.*) (p = .3130)	
DROI (-1)			0.02 (*n.s.*) (p = .3051)			0.01 (*n.s.*) (p = .4660)
Q (-1)				0.77** (p = .0000)	0.81** (p = .0000)	0.85** (p = .0000)
R-Squared	0.35	0.27	0.01	0.71	0.70	0.70
Adj. R-Squared	0.34	0.27	0.00	0.70	0.69	0.69
F-Statistic	56.75** (p = .0000)	37.80** (p = .0000)	1.06 (*n.s.*) (p = .3051)	118.60** (p = .0000)	113.75** (p = .0000)	112.94** (p = .0000)
Durbin-Watson Statistic	1.01	0.83	0.37	1.91	1.81	1.87

Note: *p < .05; **p < .01

SPECIFICATION OF THE BASELINE MODELS

The procedure and results for specifying the baseline model for Tobin's q are shown in Table 1. Tobin's q is measured as the market capitalization at time *t*, adjusted by the replacement cost of the firm at time *t*. The baseline model for firm value is first specified with the ROI measure, and results are shown in Column A of Table 1. The coefficient for ROI is highly significant (*p*-value = 0.00). This significance is likely caused by the presence of a time-related source of bias, as indicated by the Durbin-Watson statistic value of 1.01. Similarly, for ROI(-1) in Column B, ROI(-1) is highly significant, yet autocorrelation is a concern (Durbin-Watson statistic = 0.83). When the baseline model is specified with DROI(-1), the variable is not even statistically related to Tobin's q, and the Durbin-Watson statistic (0.37) indicates a more serious case of positive autocorrelation.

In order to correct for the time-related source of bias, a first difference approach is applied for these alternate baseline models. The first difference measures are represented with a "D" in front of the variable name, and lagged terms are represented by the addition of "(-1)" in the model's measures. With a slight modification, we use the lagged term Q(-1) as the independent variable to explain Tobin's q at time *t* as the first difference model. Note that in analyzing valuation models with time-series data, change models rather than levels models are often being advocated (Mizik and Jacobson 2009). Autocorrelation is frequently associated with levels measures leading to artificially suppressing the overall model error terms, in turn yielding spurious statistical significance.

Results with Q(-1) for ROI, ROI(-1) and DROI (-1) are shown in Columns D, E, and F of Table 1. It is quite evident that ROI with Q(-1) in the baseline model yields the best results (shown in Column D). ROI takes on a value of 0.03 with a *p*-value = 0.05. The respective Durbin-Watson statistic with a value of 1.91 shows little sign of autocorrelation. The coefficients for ROI(-1) and DROI(-1) are not significant even though these models show no indication of autocorrelation. The baseline model for q is specified with Q(-1) and ROI. Here, the evidence we have gathered indicates the valuation model with ROI is an appropriate and valid approach for modeling the valuation of a firm.

Table 2 provides the study's results for STK. Column A presents results with DROI as the predictor of STK. DROI has a coefficient of -0.01 (*p*-value = 0.05). DROI(-1) results are shown in Column B. The coefficient of DROI(-1) is 0.01 and is significant at the 0.02 level. In addition, DROI(-1) explains more variability in STK, with R-square = 0.05, compared to R-square = 0.04 for DROI. The Durbin-Watson statistic of 2.14 shows little or no presence of autocorrelation. The model with DROI(-1) is identified as the appropriate baseline model for STK.

Mizik and Jacobson (2003) introduce time and industry dummies in their valuation model to further account for these two sources of variability. As mentioned previously, time-related variation is reduced by using the first difference approach. Since all six firms reside in the same industry, between-industry variation is non-existent in our sample.

TABLE 2:
Specification of Baseline Model
(Dependent Variable = Stock Return)

	(A)	(B)
DROI	-0.01 (*n.s.*) (p = .00522)	
DROI (-1)		0.01* (p = .0209)
R-Squared	0.04	0.05
Adjusted R-Squared	0.03	0.04
F-Statistic	3.86 (*n.s.*) (p = .0522)	0.51* (p = .0209)
Durbin-Watson Statistic	1.79	2.14

Note: *p < .05; **p < .01

RESULTS

Table 3 presents the results of the valuation model with Tobin's Q as the dependent variable. The high R-square value (0.71) shown in Column A results largely from the inclusion of Q(-1) in the model. The Durbin-Watson

TABLE 3:
Detailing and Direct-to-Consumer Advertising on Tobin's Q with ROI as Baseline

	(A)	(B)	(C)	(D)
Q (-1)	0.77** (p = .0000)	0.76** (p = .0000)	0.77** (p = .0000)	0.78** (p = .0000)
ROI	0.03 (*n.s.*) (p = .0482)	0.02 (*n.s.*) (p = .0890)	0.83* (p = .0474)	0.02 (*n.s.*) (p = .0918)
DDetail_LN		1.41* (p = .0236)		1.43* (p = .0286)
DAdvertising_LN			0.45** (p = .0010)	0.51** (p = .0019)
DD_LN*DA_LN				-0.91 (*n.s.*) (p = .3026)
R-Squared	0.71	0.72	0.74	0.75
Adjusted R-Squared	0.70	0.71	0.73	0.74
F-Statistic	118.60** (p = .0000)	84.25** (p = .0000)	91.72** (p = .0000)	57.73** (p = .0000)
Durbin-Watson Statistic	1.91	1.89	1.81	1.85

Note: *p < .05; **p < .01

statistic again hovers consistently around 2.00, indicating that autocorrelation is not a problem. The coefficient for DDetail_LN in Column B has a value of 1.41 and is significant at the 0.02 level. By itself, DAdvertising_LN is significant at the 0.00 level with a coefficient of 0.45, shown in Column C. Inclusion of the interaction between advertising and detailing turns out to not be significant, as shown in Column D, while coefficients of the individual variables for detailing and advertising are positive and significant. Therefore, while individual results demonstrate the individual impacts of detailing and DTCA on firm value, our central research hypothesis of an interaction effect is not supported.

Similar results are captured in Table 4 with STK as the dependent variable. Column A shows the baseline model with DROI(-1). DROI(-1) is found to be significant at the 0.02 level with R-square = 0.05. The Durbin-Watson statistic is 2.14, indicating little or no sign of autocorrelation. DDetail_LN in Column B is marginally significant with a coefficient of 0.29 and p-value = 0.08, lending support for the positive impact of detailing on the value of a firm. DDetail_LN explains an additional 2.88% (R-square with DDetail_LN = 0.08 – 0.05) of the variation in STK.

In Column C of Table 4, the coefficient for DAdvertising_LN takes on a value of 0.10, significant at the 0.01 level. DAdvertising_LN explains an additional 7.18% of the variance in the dependent measure of STK. Addition of the interaction term, where variations of advertising and detailing measures are multiplied, captures some interesting results. While Column D indicates that the interaction between DAdvertising_LN and DDetail_LN is not statistically significant, it shows that the coefficient for DDetail_LN takes on a positive value of 0.34 (p-value = 0.05) and the coefficient for DAdvertising_LN is 0.13 at the significance level of 0.00. In this case, the R-square assumes a respectable value of 0.16, and the Durbin-Watson statistic hovers around 2.00 showing no sign of autocorrelation. Overall, the coefficients associated with advertising and

TABLE 4:
Detailing and Direct-to-Consumer Advertising on Stock Return with DROI (-1) as Baseline

	(A)	(B)	(C)	(D)
DROI (-1)	0.01* (p = .0209)	0.01* (p = .0143)	0.01* (p = .0232)	0.01* (p = .0147)
DDetail_LN		0.29 (*n.s.*) (p = .0811)		0.34 (*n.s.*) (p = .0533)
DAdvertising_LN			0.10** (p = .0055)	0.13** (p = .0026)
DD_LN*DA_LN				-0.39 (*n.s.*) (p = .1228)
R-Squared	0.05	0.08	0.12	0.16
Adjusted R-Squared	0.04	0.06	0.11	0.13
F-Statistic	5.51* (p = .0209)	4.36* (p = .0153)	6.86** (p = .0016)	4.65** (p = .0018)
Durbin-Watson Statistic	2.14	2.18	2.04	2.15

Note: *p < .05; **p < .01

detailing are consistently positive, showing further support that these marketing expenditures increase the value of a firm.

Results reported in Table 4 largely support and validate findings from Table 3. Evidence shows that DTCA exercises a positive impact on the value of a firm. Likewise, detailing also has a positive, and stronger, influence on firm value. Based on the results shown in Tables 3 and 4, these two factors do not interact with each other, suggesting potential separation of the two markets (prescription drug and consumer health products) served by pharmaceutical firms. As has been pointed out previously, even within the branded drug market, emphasis has been shifted from new product innovation to that of incremental innovation. Promotions of new products are heavily reliant on detailing whereas, for extended products, promotion typically takes the form of DTCA. This further provides support for the separation of markets being served by a company, lessening the likelihood of interaction between detailing and DTCA.

SUMMARY AND CONCLUSIONS

This study employs a valuation model with ROI as the primary explanatory variable to parameterize and test the effects of DTCA and detailing on the overall value of a firm. In doing so, this study sets itself apart from other research in this area. Data in our study was obtained from Encuity Research, LLC over a period of 1995 to 2012. The six largest U.S. pharmaceutical firms in the past 20 years constitute the sample of this study, and the model is shown to be appropriate for estimating the overall value of the sample firms. Tobin's q and stock returns are used to capture the effects of detailing and consumer advertising. Tobin's q measures the value of a firm at a fixed point in time, while stock return identifies changes in value between two consecutive points in time. In both measures, detailing and DTCA are found to have a positive and significant impact on a firm's value. Specifically, changes over time (first difference) in detailing and DTCA expenditures contribute to an increase in firm value as shown in Tobin's q and changes in value over time as reflected in stock return.

The magnitude of the coefficients associated with these explanatory factors indicates that the effects of detailing on firm value are substantially greater than those from DTCA. This comparison is possible since both detailing and DTCA are both measured in millions and the same transformations were applied to these two variables in the valuation model. The impact of detailing was more evident when data from 1990 to 1994 were included for detailing. We found a highly significant impact of

detailing on firm value. Here in the present study, in order to have comparable time periods for both detailing and DTCA, only data that extend from 1995 to 2012 were used.

Another observation should be noted. Tobin's q measures the value of a firm at time t, re-scaled by its replacement cost. Replacement cost is a good indicator of firm size. Therefore, the size effect is removed through rescaling, yielding a more absolute measure of value. Stock return, even though it is differenced, maintains the original unit of measure (dollars).

It is obvious that overall sales of a firm is largely a function of volume of existing sales that can be maintained and new sales that can be attracted through new products. However, in light of government regulation and the major shift in emphasis from almost complete dependence on blockbuster drug introductions to that of market maintenance, the six major U.S. pharmaceutical firms in this study invested heavily in detailing. As evidenced in the results, value contribution of detailing per unit far exceeded that of DTCA, signifying that building a relationship with physicians still plays an absolutely critical role in the overall profitability picture of the firm. Yet, the new role of DTCA for market maintenance should not be understated.

Given our model, it is hard to conceptualize the structure of interaction when separate markets are combined at the firm level. Potential explanation for the lack of interaction between detailing and DTCA, as being put forth in this study, may be the separation of the prescription and over-the-counter product markets. Additionally, insurance companies have more influence on prescription drug choices now than ever before. It would be interesting for future research to study the marketing efforts of pharmaceutical firms that are directed toward insurance companies and how this activity might interact with other marketing activities such as detailing and DTCA.

LIMITATIONS

By nature of this research, several key limitations have to be recognized. Only the top six pharmaceutical firms are used in this study. We could have enlarged the sample to include the top, say, 100 firms in this industry. However, small pharmaceuticals tend to specialize in specific markets, making the sample highly heterogeneous. Our decision to restrict the sample to the top six is primarily based on our desire to have as homogeneous a group of firms as possible, while allowing our results to be projectable to over 50% of the entire pharmaceutical market in terms of sales. The significant results as reported tend to support our presumption.

In terms of methodology, this paper incorporates a difference model. Using a first difference model helps remove time-related changes going on in the environment during this period, but the exact effectiveness of this is not confirmed. Future research in this realm would be to follow a model similar to Schramm and Hu (2013) to see if the impact of detailing and DTCA differ over time, before and after the regulatory changes.

The role of marketing is diverse and, while this paper focuses on marketing communications activities, it is important to note that marketing operates at a broader level and is especially helpful when learnings from marketing are integrated with the research and development (R&D) process (Becker and Lillemark 2005; Feng, Morgan, and Rego 2017; Peterson and Jeong 2010). The rise of generic drug companies and increase in cost of R&D have greatly changed the landscape of how the pharmaceutical firms go about conducting their business. Comments and feedback from physicians during detailing could conceivably play a role in future R&D. To what extent these restrictions have influenced the results of this study cannot be ascertained and is beyond the scope of this research. This study provides evidence on the value contribution of detailing and DTCA at the firm level.

Answering the call for improving marketing metrics (Hanssens and Pauwels 2016), we aimed to examine the impact of the pharmaceutical industry's two primary marketing methods (detailing and DTCA) on firm value. While our findings may not be counterintuitive, such confirmation is an important contribution to our knowledge base of marketing tactics in light of new legislation and leniencies regarding the

marketing of pharmaceutical products. While the pharmaceutical industry is unique in many ways, this serves to further validate the importance of personal selling and customer relationship building across all business-to-business transactions (Ahearne, Jelinek, and Jones 2007), reminding us that, at the core, stronger relationships lead to better trust, which generates credibility that is essential when prescribing physicians are seeking guidance from pharmaceutical representatives, making decisions, and choosing between products that can quite literally have life-altering consequences.

REFERENCES

Aaker, D., & Jacobson, R. (2001). The value relevance of brand attitude in high-technology markets, *Journal of Marketing Research*, *38*(4), 485-93.

Ahearne, M., Jelinek R., & Jones, E. (2007). Examining the effect of salesperson service behavior in a competitive context. *Journal of the Academy of Marketing Science*, 35, 603-616.

Anderson, E., Fornell, C., & Mazvancheryl, S. (2004). Customer satisfaction and shareholder value. *Journal of Marketing*, *68* (4), 172-185.

Azoulay, P. (2001). Do pharmaceutical sales respond to scientific evidence? Evidence from antiulcer drugs. *Working paper, Management Department,* Columbia University.

Bala, R., & Bhardwaj, P. (2010). Detailing vs. direct-to-consumer advertising in the prescription pharmaceutical industry. *Management Science*, *56*(1), 148-160.

Balasubramanian, S.K., Mathur, I., & Thakur, R. (2005). The impact of high-quality firm achievements on shareholder value: focus on Malcolm Baldridge and J.D. Power and Associates Awards. *Journal of the Academy of Marketing Science*, 33 (4), 413-422.

Barber, B. M., & Odean, T. (2008). All that glitters: The effect of attention and news on the buying behavior of individual and institutional investors. *Review of Financial Studies*, *21*(2), 785–818.

Becker, M., & Lillemark, M. (2006). Marketing/R&D integration in the pharmaceutical industry. *Research Policy*, 35, 105-120.

Boasson, V., Boasson, E., MacPherson, A., & Shin, H. (2005). Firm value and geographic competitive advantage: Evidence from the U.S. pharmaceutical industry. *The Journal of Business*, *78*(6), 2465-2495.

Carhart, M. M. (1997). On performance in mutual fund performance. *Journal of Finance*, 52(1), 57-62.

Cavusgil, E., Deligonul, Z., & Calantone, R. (2011). Late entrant over-the-counter and Rx market entry strategies: An investigation in the pharmaceutical industry. *International Journal of Pharmaceutical and Healthcare Marketing*, *5*(2), 79-98.

Chevalier, J. A., & Mayzlin, D. (2006). The effect of word of mouth on sales: Online book reviews. *Journal of Marketing Research*, *43*(3), 345-354.

Chintagunta, P. K., Gopinath, S., & Venkataraman, S. (2010). The effects of online user reviews on movie box-office performance: Accounting for sequential rollout and aggregation across local markets. *Marketing Science*, *33*(4), 445-460.

Edeling, A., & Fischer, M. (2016). Marketing's impact on firm value: generalizations from a meta-analysis. *Journal of Marketing Research*, *54*(4), 515-534.

Fama, E., & French, K. (1992). The cross-section of expected stock returns. *The Journal of Finance*, *47*(2), 427-465.

Federal Register (2003). *Compliance Program Guidance for Pharmaceutical Manufacturers*, 68(86), 23731-23743.

Feng, H., Morgan, N.A., & Rego, L.L. (2017). Firm capabilities and growth: the moderating role of market conditions. *Journal of the Academy of Marketing Science*, *45*(1), 76-92.

Gatignon, H., & Hanssens, D. (1987). Modeling marketing interactions with application to salesforce effectiveness. *Journal of Marketing Research*, *24*(August), 247-257.

Germann, F., Ebbes, P., & Grewal, R. (2015). The chief marketing officer matters! *Journal of Marketing*, 79(May), 1-22.

Graham, R.C. & Frankenberger, K.D. (2000). The contribution of changes in advertising expenditures to earnings and market values. *Journal of Business Research*, 50(2), 149-55.

Grewal, R., Chakravarty, A., Ding, M., & Liechty, J. (2008). Counting chickens before the eggs hatch: associating new product development portfolios with shareholder expectations in the pharmaceutical sector. *International Journal of Research in Marketing*, 25(4), 261-272.

Groza, M. P. (2015). Advertising interference: Factors affecting attention to super bowl advertisements and their effectiveness. *The Marketing Management Journal*, 25 (2), 123-133.

Hanssens, D. M., & Pauwels, K. H. (2016). Demonstrating the value of marketing. *Journal of Marketing*, *80*(6), 173-190.

Herzenstein, M., Misra, S., & Posavac, S. (2004). How consumers' attitudes toward direct-to-consumer advertising of prescription drugs influence ad effectiveness, and consumer and physician behavior. *Marketing Letters*, *15*(4), 201-212.

Homburg, C., Bornemann, T., & Kretzer, M. (2014). Delusive perception—antecedents and consequences of salespeople's misperception of customer commitment. *Journal of the Academy of Marketing Science*, 42, 137-153.

Iizuka, T., & Jin, G. (2007). Direct to consumer advertising and prescription choice. *The Journal of Industrial Economics*, *55*(4), 771.

Jambulingam, T., & Sharma, R. (2010). Estimating the value of internet marketing in the U.S. pharmaceutical industry. *Journal of Medical Marketing*, *10*(4), 332-343.

Kornfield, R., Donohue, J., Berndt, E.R., & Alexander, G.C. (2013). Promotion of prescription drugs to consumers and providers, 2001-2010. *PLoS ONE*, 8 (3), e55504, 1-7.

Kremer, S. T. M., Bijmolt, T. H. A., Leeflang, P. S. H., & Wieringa, J.E. (2008). Generalizations on the effectiveness of pharmaceutical promotional expenditures. *International Journal of Research in Marketing*, *25*(4), 234-246.

Kumar, V., Choi, J.B., & Greene, M. (2016). Synergistic effects of social media and traditional marketing on brand sales: capturing the time-varying effects. *Journal of the Academy of Marketing Science*. doi 10.1007/s11747-016-0484-7, in press.

Leeflang, P. & Wieringa, J. (2009). Modeling the effects of pharmaceutical marketing. *Marketing Letters*, *21*(2), 121-133.

Liu, Q., & Gupta S. (2011). The impact of direct-to-consumer advertising of prescription drugs on physician visits and drug requests: empirical findings and public policy implications. *International Journal of Research in Marketing*, *28*(3), 205-217.

Luo, X. (2007). Consumer negative voice and firm-idiosyncratic stock returns. *Journal of Marketing*, *71*(3), 75-88.

-----, & Bhattacharya, C. (2009). The debate over doing good: Corporate social performance, strategic marketing levers, and firm-idiosyncratic risk. *Journal of Marketing*, *73*(6), 198-213.

-----, & Homburg, C. (2007). Neglected outcomes of customer satisfaction. *Journal of Marketing*, *71*(2), 133-49.

-----, & -----. (2008). Satisfaction, complaint, and the stock value gap. *Journal of Marketing*, *72*(4), 29-43.

-----, & de Jong, P.J. (2012). Does advertising spending really work? The intermediate role of analysts in the impact of advertising on firm value. *Journal of the Academy of Marketing Science*, 40, 605-624.

McAlister, L. Sonnier, G., & Shively, T. (2012). The relationship between online chatter and firm value. *Marketing Letters*, *23*, 1-12.

McNichols, M., & Stubben, S. (2008). Does earnings management affect firms' investment decisions?" *The Accounting Review*, *83*(6), 1571-1603.

Manchanda, P., & Chintagunta, P. (2004). Responsiveness of physician prescription behavior to salesforce effort: An individual level analysis. *Marketing Letters, 15*(2-3), 129-145.

Mani, S., & Luo X. (2015). Product alliances, alliance networks, and shareholder value: evidence from the biopharmaceutical industry. *International Journal of Research in Marketing*, *32*(1), 9-22.

Martin, W C., Collier, J.E., & Engelland, B.T. (2014). Investigating connectedness to brand users: How important is social interaction? *The Marketing Management Journal*, 24 (1), 16-29.

Mizik, N., & Jacobson, R. (2003). Trading off between value creation and value appropriation: The financial implications of shifts in strategic emphasis. *Journal of Marketing*, *67*(1), 63-76.

_____ (2009). Commentaries and rejoinder to "marketing and firm value: metrics, methods, findings and future directions" : financial markets research in marketing. *Journal of Marketing Research*, 46(June), 320-324.

Mogull, S. (2008). Chronology of direct-to-consumer advertising regulation in the United States. *American Medical Writers Association*, *23*(3), 106-109.

Morgan, N., & Rego, L. (2006). The value of different customer satisfaction and loyalty metrics in predicting business performance. *Marketing Science*, *25*(5), 426-439.

Narayanan, S., Desiraju, R., & Chintagunta, P. (2004). Return on investment implications for pharmaceutical promotional expenditures: The role of marketing-mix interaction. *Journal of Marketing*, *68*(4), 90-105.

Osinga, E.C., Leeflang, P.S.H., Srinivasan, S., & Wieringa, J.E. (2011). Why do firms invest in consumer advertising with limited sales response? A shareholder perspective. *Journal of Marketing*. *75*(1), 109-124.

Pasa, M., & Shugan, S. M. (1996). The value of marketing expertise. *Management Science*, *42*(3), 370-388.

Peterson, R. & Jeong, J. (2010). Exploring the impact of advertising and R&D expenditures on corporate brand value and firm-level financial performance. *Journal of the Academy of Marketing Science*, 38, 677-690.

Sager, J. K., & Ferris, G. R. (1986). Personality and salesforce selection in the pharmaceutical industry. *Industrial Marketing Management*, *15*(4), 319-324.

Schramm, M., & Hu, M. (2013). Perspective: The evolution of R&D conduct in the pharmaceutical industry. *Journal of Product and Innovation Management*, *30*(S1), 203-213.

SDI Health Inc. (2009). E-promotion audit. *Promotion Audits, SDI Health*, Yardley, PA.

Sridhar, S., Narayanan, S., & Srinivasan, R. (2014). Dynamic relationships among R&D,

advertising, inventory and firm performance. *Journal of the Academy of Marketing Science*, 42, 277-290.

Srinivasan, S., & Hanssens, D. (2009). Marketing and firm value: Metrics, methods, findings, and future directions. *Journal of Marketing Research*, *46*(3), 293-312.

Stewart, D. (2009). Marketing accountability: Linking marketing actions to financial results. *Journal of Business Research*, *62*, 636-643.

Tipton, M., Bharadwaj, S., & Robertson, D. (2009). Regulatory exposure of deceptive marketing and its impact on firm value. *Journal of Marketing*, *73*(4), 227-243.

Thomas, K., Armendariz, A., & Cohen, S., (2014) Detailing financial links of doctors and drug makers, *New York Times*, October 1, 2014. B1-B2.

Tobin, J. (1969). A general equilibrium approach to monetary theory. *Journal of Money, Credit and Banking*, *1*(1), 15-29.

----- (1978). Monetary policies and the economy: the transmission mechanism. *Southern Economic Journal*, *44*(3), 421-423.

Ventola, C. L. (2011). Direct-to-consumer pharmaceutical advertising: Therapeutic or toxic? *Pharmacy and Therapeutics*, *36*(10), 669-674, 681-684.

Verniers, I., Stremersch, S., & Croux, C. (2011). The global entry of new pharmaceuticals: a joint investigation of launch window and price. *International Journal of Research in Marketing*, *28*(4), 295 -308.

Wang, F., Zhang, X.S., & Ouyang, M. (2009). Does advertising create sustained firm value? The capitalization of brand intangible. *Journal of the Academy of Marketing Science*, 37, 130-143.

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