PRODUCT INNOVATIONS, MARKETING INVESTMENTS AND STOCK RETURNS

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Abstract

Under increased scrutiny from top management and shareholders, marketing managers feel the need to measure and communicate the firm value of their actions. In particular, how do customer value creation (through product innovation) and customer value communication (through marketing investments) affect stock returns? This paper examines conceptually and empirically how product innovations and marketing investments for such product innovations lift stock returns by improving the outlook on future cash flows. We address these questions with a large-scale econometric analysis of product innovation and associated marketing mix in the automobile industry. We find that investors react favorably to companies that launch innovations, particularly pioneering innovations, backed by substantial advertising support, in large and growing categories. Finally, we quantify the stock return benefits of increasing advertising support for new-to-the-company versus new-to-the-world products.

Key words: Marketing investments, innovations, advertising, firm value, stock-return response modeling.

Marketing managers are under increasing pressure to measure and communicate the value created by their marketing actions to top management and shareholders (Lehmann 2004; Marketing Science Institute 2004). These demands create a need to translate marketing resource allocations and their performance consequences into financial and firm value effects (Rust et al. 2004; Srivastava and Reibstein 2004). In particular, how do customer value creation (through product innovation) and customer value communication (through marketing investments) affect stock returns? Several studies have identified innovation success as a key contributor to long-term firm sales, as well as to financial and stock market performance (Pauwels et al. 2004). In the same vein, Drucker (1973) cites innovation and marketing as the two factors crucial to long-term corporate health. However, new-product failure rate is high (ranging from 33% to over 60%) and has not improved over the last decades (Boulding, Morgan and Staelin 1997; McMath and Forber 1998). For example, Boeing's stock price surged 7% when it scrapped development plans for the 747X in January 1997, and it declined 1.7% when the company revived the idea two years later - at a cost of $4 billion -- to compete with the Airbus 380 (Wall Street Journal 1997; Dresdner Kleinwort Benson Research 2000). Similarly, there is pressure on marketing managers to demonstrate the contribution of advertising to financial performance. This is not surprising given weak evidence for the profit contribution of advertising spending (Hanssens, Parsons and Schultz 2001).

While the consumer response effects of marketing are well researched, we need a better understanding of marketing's impact on investor response, which is typically measured by stock returns. Unlike consumers, investors are motivated by cash-flow expectations, in particular the prospect of enhancing and accelerating future cash flows and of reducing associated risks (Srivastava, Shervani and Fahey 1998). Moreover, many marketing actions are costly, and investors consider both their (expected) benefits and downsides. Furthermore, the stock return impact of marketing actions needs to be assessed in the presence of other

important drivers, as identified in the accounting and finance literature (Fama and French 1992; Jegadeesh and Titman 1993). Thus our central research question is: to what extent do marketing actions improve stock returns, over and above the typical accounting and finance measures?

Our empirical research focuses on one industry, automobiles, in order to enhance its internal validity. Moreover, we believe that findings in this industry will be generalizable to other settings, as a meta-analysis (Capon et al. 1996, p. 214) indicates few industry-specific effects of innovation performance and while high returns need not be sustainable in any particular market, the process of generating high returns can be sustainable.

The automobile industry is of substantial economic importance, representing over 3% of the U.S. Gross Domestic Product (J. D. Power and Associates 2002). In addition, the industry relies heavily on new products, promotional incentives and advertising. The main thrust of competition is in product development, with each company competing in multiple market segments "with a plethora of niche models designed to attract a particular group of consumers, and to renew them rapidly enough to keep interest fresh" (The Economist 2004, p.14). However, the costs of such design changes can be substantial, and their success is far from certain. Therefore, large automobile firms face substantial innovation investment decisions across distinct product categories (called 'segments' in industry parlance) that differ in category attractiveness and competitive conditions. Further, automobile manufacturers invest billions of dollars every year in various forms of advertising to influence customers and prospects to buy their products and services. General Motors alone spent over $2.8 billion in 2004 to advertise its lines of automobiles (TNS Media Intelligence 2005). However, concerns persist about the financial impact and wisdom of such substantial communications spending.

The remainder of this paper is organized as follows: First, we develop the research framework and specify a comprehensive stock return response model to quantify these

relationships. Next we discuss the marketing and financial data sources and estimate the models. Finally, we formulate conclusions, cross-validate the empirical results, and discuss their implications for marketing strategies.

Research Framework

Previous literature in accounting and finance has demonstrated that stock returns react to changes in firm financial measures, including firm earnings, asset size, stock return momentum and market-to-book ratio (e.g. Fama and French 1992, Jegadeesh and Titman 1993). Moreover, the overall stock market environment may impact a firm's stock returns, as captured by general stock market indices (e.g. S&P500), industry-specific indices (e.g. the Dow Jones transportation index) and seasonal fluctuations (e.g., Siegel 2002). Controlling for these factors, we develop a conceptual framework to capture the effects of marketing activity on stock returns. We argue that such impact on firm valuation may occur through one or more of three routes: (1) enhancing cash flows, (2) accelerating cash flows and (3) reducing vulnerability in cash flows. First, marketing investments, which can involve substantial costs in the short run, can increase shareholder value by *enhancing the level of cash flows (i.e., more cash),* notably by increasing revenues and lowering costs. As an example, automobile innovations that are responsive to unmet customer needs in specific segments, including the Ford Mustang for young drivers and the Chrysler Minivan for families with children, have resulted in substantial revenue increases for these companies. Second, marketing investments can enhance shareholder value by accelerating the receipt of cash flows *(i.e., faster cash).* This is especially important in high-fixed cost industries that depend on fast turnovers to finance their operations. As an example, aggressive advertising helps develop instant awareness of new products that may accelerate the diffusion process. Finally, marketing investments can increase shareholder value by lowering the vulnerability and volatility of

these cash flows *(i.e., safer cash),* which results in a lower cost of capital or discount rate (Srivastava et al. 1998).[1] Thus, all else equal, cash flows that are predictable and stable have a higher net present value and thus create more shareholder wealth. For example, advertising may help smooth out the variability in highly seasonal demand patterns.

The outlook for investors on enhancing, accelerating and stabilizing the firm's cash flows, can be influenced by marketing actions. We formulate the hypotheses in this section in terms of which brand-level marketing actions influence the stock returns, modeled through the main effect as well as the interaction effect with new-product introductions. Figure 1 and Table 1 present a summary of these drivers and their hypothesized effects.

--- Insert Figure 1 and Table 1 about here ---

Marketing Actions and Stock Returns

Innovativeness The innovativeness, or relative advantage of new products is a consistently important determinant of accelerated consumer adoption rate (Holak and Lehmann 1990) and new-product success (Montoya-Weiss and Calantone 1994). Based on venture portfolio theory (Booz, Allen and Hamilton 1982), the extent of innovation in new products can be classified based on two dimensions: new-to-the-company and new-to-the-market.[2] The first dimension measures the extent to which the new product introduction is innovative compared to the firm's existing products. The second dimension measures the extent to which the firm's new product is a new introduction to the market. An example of a new-to-the-company innovation within the automobile industry context is the Porsche Cayenne, which was the first SUV developed by the company (and thus scores highly on the first dimension, offering Porsche-loyals the opportunity to drive an SUV), but which entered a market already full of SUVs (and thus scores low on the second dimension). As for the second dimension, an

example of a new-to-the-market innovation is the Toyota Prius hybrid. We discuss the impact of these innovation dimensions, in turn.

New-to-the-Company: Innovation Level

Renewing one's products is widely regarded as necessary for long-term survival and as an engine of growth, thus enhancing cash flows and future profitability (Chaney et al. 1991). Recent evidence on new-product introductions, in the context of the PC market, suggests that enhancement in cash flows occurs due to reduced selling and general administrative expenses (Bayus, Erickson and Jacobson 2003). On average, the higher the new product's improvement over previous versions, the higher its long-term financial performance and firm value impact (Pauwels et al. 2004).

Developing new products faster and moving them faster through the supply chain can accelerate cash flows from product innovation (Srivastava, Shervani and Fahey 1999). In contrast, many products have failed to realize their potential because of insufficient attention to speeding up the market acceptance cycle for these products (Robertson 1993). Large companies, especially, have been criticized for delaying the renewal and upgrade of their product offerings in the face of changing consumer preferences (Ghemawat 1991).

Companies can reduce the vulnerability of their cash flows by completing their product portfolio with new-to-the-company products that allow them to address new consumer segments. For example, Toyota reduces cash-flow volatility by offering a full line of products and managing the migration of customers from its economy models to its luxury cars, from *Echo* to *Corolla,* for example, or from to *Camry* to *Lexus*. Furthermore, synergies between and within product lines, including sharing components and design elements across such different products, can reduce production costs and inventory risk (Fisher, Ramdas and Ulrich 1999). For these reasons, we postulate:

H1: New-to-the-company innovations increase stock market returns.

Pioneering Innovations

While new-product introductions benefit firm value on average, new-to-the-market products have a higher impact (Chaney et al. 1991). Indeed, the new-product literature has consistently related innovation success to the product's ability to provide benefits and features not offered by alternative products (Holak and Lehmann 1990; Henard and Szymanski 2001). Pioneering innovations have better potential to unlock previously unmet customer needs and thus ultimately surpass me-too innovations product in terms of enhancing cash flows (Kleinschmidt and Cooper 1991; Moorman and Miner 1997).

It is not clear a priori whether or not pioneering innovations will accelerate cash flows compared to other innovations. On the one hand, relative advantage is a consistently important determinant of accelerated adoption rate (Holak and Lehmann 1990). On the other hand, consumers may also consider pioneering innovations riskier, which delays adoption (Gatignon and Robertson 1985).

Finally, while the short-term risk may appear higher, pioneering products also have option value, i.e. they "offer the possibility for greater long-term financial gain given the possibility of revolutionizing the category" (Moorman and Miner 1997). Indeed, firms can reduce the vulnerability of their cash flows by staying ahead of competition in product innovation and introducing hard-to-copy new products Moreover, investors may view such pioneering innovations both as platforms for future product introductions and as signals that the firm is successful in the innovation process itself. Finally, pioneering innovations offer new strategic choices for the firm by providing the opportunity to leverage these innovations to future products. For example, Dupont has leveraged their invention of nylon and Teflon in a series of successful new-product introductions in a variety of categories. At the same time,

radical pioneering innovations are likely to increase the volatility of cash flows in the short run but can eventually lead to stable cash flows. A notable example of a radical pioneering innovation is the Toyota Prius hybrid, which is tracking to commercial success as a result of radical but visionary strategy. Thus, in general, pioneering innovations are likely to decrease the vulnerability of future cash flows. Overall, we postulate:

H2: Pioneering (new-to-the-world) innovations have a higher stock return impact than non-pioneering innovations.

Advertising Support

Research over the past decade has shown that marketing activity such as advertising can lead to more differentiated products characterized by lower own-price elasticity (Boulding, Lee and Staelin 1994). This in turn, enables the company to charge higher prices, attain greater market share and sales (Boulding et al. 1994), command consumer loyalty (Kamakura and Russell 1994), and hence ward off competitive initiatives. Empirical evidence from the automobile market suggests that advertising expenditures generate greater cash flows for pioneers than for later entrants (Bowman and Gatignon 1996). In general, advertising effectiveness is higher when companies have 'something new to tell' to consumers (Lodish et al. 1995). Therefore advertising support for innovations, especially pioneering innovations, can enhance cash flows for the company.

Second, advertising builds awareness, which is an essential component of new-product success. Bly (1993, p. 125), for example, notes that the "new-product innovator will spend more than twice as much on advertising and promotion as a business with fewer new products." Recent evidence suggests that firms which invest more in marketing resources can better sustain the innovation and, hence, accelerate the adoption rate of their new products (Chandy and Tellis 2000). These benefits can lead to cash flow acceleration.

Finally, investments in the brand through advertising can reduce consumers' perceived risk, particularly for radical innovations (Dowling and Staelin 1994). As such, differentiation of a brand through advertising may lead to monopolistic power which can be leveraged to extract superior product-market performance, leading to more stable (i.e. less vulnerable to competition) earnings in the future (Srivastava, Shervani and Fahey 1998). Therefore, we hypothesize:

H3a: Advertising support for new-to-the-company innovations increases the stock market returns of these innovations.

H3b: Advertising support for pioneering innovations increases the stock market returns of these innovations.

Promotional Support

The power of sales promotions to enhance future cash flows has been investigated extensively in empirical research. On the one hand, sales promotions are effective demand boosters as they often have substantial immediate effects on sales volume and profits (Hanssens, Parsons and Schultz 2001). On the other hand, promotions also signal a weakness in the customer value of the product relative to competition, particularly in the context of new-product introductions. The repeated or sustained use of promotions can decrease long-term profit margins, cash flow generation, and thereby, company value (Pauwels et al. 2004).

To the extent that sales promotions have positive short-term effects on top-line and bottom-line performance (Srinivasan et al. 2004), the use of sales promotions would accelerate cash flows. However, since promotion effects on sales are typically short-lived, any positive cash flow response will dissipate quickly. Finally, promotion-based (hi-lo) pricing strategies lead to crests and troughs in sales that can greatly increase the volatility in cash flows (Ailawadi, Farris and Shames 1999).

Additionally, for durable products (and particularly for automobiles), manufacturers need to build and commit capacity before the product is launched. Promotions and price discounts could signal that the new product is performing below expectation in terms of sales, which, in turn would lead to either low capacity utilization or a chronic dependence on price discounts. Hence, price discounts could be interpreted as signaling profit compression in the future. Overall, we postulate:

H4a: Promotional support for new-to-the-company innovations decreases the stock market returns of these innovations.

H4b: Promotional support for pioneering innovations decreases the stock market returns of these innovations.

Brand's Perceived Appeal and Quality

In general, marketing theory predicts greater success for firms that serve the needs of their customers better, especially by providing products that are superior to the competition in the customers' eyes (Griffin and Hauser 1993). Within the automobile industry, management can significantly improve their company's fortunes by introducing new products with superior quality and minimal deficiencies (e.g., GM's recent push for more appealing new cars with fewer defects). Customer-focused measures of these improvements include customer appeal, quality and satisfaction. In markets for pioneering innovations, prior evidence suggests that the initial growth in customer base and revenue is largely due to perceived quality improvements by incumbents as well as new entrants (Agarwal and Bayus 2002). Investors, in turn, are likely to respond to improvements in customer perception scores (Aaker and Jacobson 1994). In other words, innovations that create and deliver added consumer value contribute significantly to the success of brands (Kashani et al. 2000). Favorable perceptions of product quality and value by customers lead to differentiation and higher brand loyalty,

which, in turn, lead to higher buyer switching costs that can be exploited to enhance current profitability and cash flows.

A priori, it is unclear whether perceived appeal/quality will also accelerate cash flows. In cash flow stability, brands with favorable perceptions of product quality likely enjoy a greater degree of "monopolistic competition" power. In other words, high customer quality perceptions represent competitive barriers that reduce price elasticity and generate more stable (i.e., less vulnerable to competition) earnings in the future. In sum, we postulate:

H5: Perceived appeal of new-product introductions increases stock returns.

H6: Perceived quality of new-product introductions increases stock returns.

Category Characteristics

We consider three category characteristics as control variables – category size, category growth rate and category concentration – based on previous literature (e.g. Capon et al. 1996). While previous marketing literature was helpful in formulating hypotheses on the impact of marketing actions on stock returns, our empirical analysis is exploratory in nature for category characteristics. As such, we do not offer specific hypotheses for the category variables.

Category Size[3] The strength of category demand is an important factor in brand success, and firms neglect market size assessment at their own peril (Cooper and Kleinschmidt 1993; Henard and Szymanski 2001). On the one hand, large categories enable firms to spread their fixed R&D and launch costs over a greater number of potential customers. On the other hand, large categories are also attractive to competitors and, thus, will draw more competitive innovation and attention. Going after larger categories may also reduce the vulnerability of a firm's cash flows. If the new-product introduction misses its intended mark, other consumers in the large category may have an interest. For example, when Cadillac launched a redesigned Escalade SUV in 2002, it became highly successful with an unintended market segment --

professional athletes, rappers and celebrities. Cadillac, in turn, has started to pursue these trendsetters, by giving them previews of the next-generation Escalade, offering them limited-edition versions etc. (Eldridge 2004). Moreover, large categories may provide a better cushion against damage by competitive marketing actions or exogenous changes (Aaker and Jacobson 1990).

Category Growth Rate Firms that target high-growth categories achieve higher sales and financial performance, leading to enhanced cash flows (Capon et al. 1996). Moreover, competitive reactions to new-product introductions are likely to be less aggressive when the incumbent sales continue to grow at a satisfactory rate, which would be the case when the product innovation increases primary demand (Frey 1988). Likewise, advertising reactions to new-product introductions are less likely in growing versus static categories (Cubbin and Domberger 1988). This lower competitive intensity leads, in turn, to enhanced cash flows. Moreover, investments are preferentially directed toward high-growth categories and away from established businesses in slower growth categories (Wensley 1981) because the expected payoff is better in high-growth categories. Similarly, when the category demand is growing, it is easier for all competitors to acquire customers rapidly, leading to acceleration in cash flows (Cooper 1999; Scherer 1980).

Finally, commitment of marketing resources in emerging growth categories reduces risk in the future. Indeed, investors are likely to reward share gains in growing categories because the returns are expected to grow as the category grows.

Category Concentration A brand's success critically depends on competitive category conditions, including category concentration (Cooper and Kleinschmidt 1993; Capon et al. 1996). Economic theory suggests that in concentrated categories, profit margins are higher. Moreover, companies in concentrated categories are less motivated to engage in price wars, as they dissipate the attractive margins. Thus, increases in category concentration are more

likely to increase cash flows and hence firm value. Finally, faced with only a few competitors, a firm is less likely to be surprised by disruptive innovations that impact the stability of its income streams. Therefore, category concentration will likely reduce the vulnerability of cash flows.

Research Methodology

We use stock-return response modeling to assess the degree to which marketing actions and category conditions improve the outlook on a firm's cash flows and thereby lift its valuation. In essence, stock- return response modeling establishes whether or not the information contained in a measure is associated with changes in expectations of future cash flows and, hence, stock price and returns (see Mizik and Jacobson 2004 for a detailed review).

Stock Return Response Modeling

It is well known that the economic return to a marketing activity such as a new-product introduction is obtained over the long term. Therefore, we may consider a firm's marketing as an intangible asset that influences future cash flows. As such, "the value of a marketing strategy to the firm can be depicted as the net present value of future cash flows generated through the use of this marketing strategy" (Mizik and Jacobson 2003, p. 67).

The stock market valuation of a firm depicts the market expectations of these discounted future cash flows. The efficient market hypothesis (EMH) implies that stock prices follow random walks: The current price reflects all known information about the firm's future earnings prospects (Fama and French 1992). For instance, investors may expect the firm to maintain its usual level of advertising and price promotions. Developments that positively affect cash flows result in increases in stock price while those negatively affecting cash flows result in decreases. In our context, regressing stock returns on changes in the marketing mix

provides insights into the stock market's expectations of the associated long-term changes in cash flows.

Assessing the Impact of Marketing Actions on Stock Returns

The framework for assessing the information content of a measure enjoys a long tradition in finance (e.g. Ball and Brown 1968) and, more recently, in marketing (e.g., Jacobson and Aaker 1993). The latter research stream has sought to assess the stock market reactions to non-financial information including firms' customer-based brand equity (Aaker and Jacobson 2001; Barth et al. 1998), brand extension announcements (Lane and Jacobson 1995) and a shift in strategic emphasis from value creation to value appropriation (Mizik and Jacobson 2003). In the tradition of stock-return response modeling, these studies test for incremental information content, that is the degree to which a series explains stock price movements above and beyond the impact of current accounting measures such as revenue and earnings.

Previous research in marketing has examined the impact of innovations and price promotions on firm value in the automobile industry (Pauwels et al. 2004). Our paper contributes beyond that study in several ways. First, we expand Pauwels et al.'s (2004) analysis of (new-to-the-company) introduction and promotions to the analysis of advertising, new-to-the-market introductions, perceived appeal and quality, and brand and category characteristics. This expanded analysis offers new insights into the investor response to (1) the characteristics of the innovation itself, (2) the marketing support for it and (3) the categories in which it is introduced. Second, our methodology is different: while Pauwels et al. (2004) use a Vector Autoregressive model, we estimate a stock return response model (an established method in finance). This modeling approach allows us to demonstrate that innovation and marketing support for it explain stock returns above and beyond the traditional

variables used in finance. It is important to note that stock return models are based on the efficient market theory and the Fama and French (1992) three-factor model of expected returns. As such, these models have potential to add to finance literature as compared to the VAR modeling approach, which is relatively a-theoretical in this context where finance theory is specific on the role of the financial variables. The VARX model and the stock return response model are two alternative approaches to assess stock return impact. Table 2 provides a comparison of these two research approaches.

--- Insert Table 2 about here ---

Finally, we quantify the relative stock-return impact of pioneering (versus non-pioneering) innovations, of advertising support for the innovation and of promotional incentives for the innovation. This exercise provides managers with actionable insights into the monetary impact of their decisions.

Model Specification

We start with a benchmark model (M1) for stock returns, based on the Capital Asset Pricing Model (CAPM), developed in finance and accounting literature. Fama and French (1992) have proposed that a three-factor model consisting of firm size, market returns and book-to-market ratio explains stock returns. Specifically, smaller firms are expected to outperform larger firms, and stocks with lower market-to-book ratios are expected to outperform stocks with higher market-to-book ratios (Fama and French 1993). Both of these effects imply that riskier stocks are characterized by higher returns. These factors reflect the a priori investor expectations in stock returns that are based on the past operations of the firm, and thus, they are lagged in the model. Jegadeesh and Titman (1993) added momentum as an explanatory factor, which captures the past trend in stock returns. As a result, the typical financial benchmark model (M1) for stock returns is estimated as:

$$RET_{it} = \alpha_0^B + \alpha_1^B ASSETS_{it-1} + \alpha_2^B VBR_{it-1} + \alpha_3^B MNT_{it} + \alpha_4^B EARN_{it} + \alpha_5^B SP500_t + \alpha_6^B DWTR_t + \varepsilon_{i1t} \qquad \text{(M1)}$$

where RET_{it} is the stock return for firm i at time t,[4] $ASSETS_{it-1}$ (firm size at time $t-1$), VBR_{it-1} (market-to-book ratio in logs at time $t-1$), MNT_{it} (momentum in stock returns), $EARN_{it}$ (firm income), and ε_{i1t} is the error term, which is normally and independently distributed. Additionally, financial market characteristics, such as the $SP500_t$ (the S&P 500 Index) and $DWTR_t$ (the Dow Transportation Index), are included as covariates. Finally, we control for quarterly seasonal and holiday dummy variables.

The financial benchmark model (Equation 1) is augmented with marketing variables in order to assess hypotheses on their impact on future cash flows and is expressed in changes, i.e., deviations from past behaviors that are already incorporated in investor expectations, denoted by model M2:

$$\begin{aligned} RET_{it} = Model\_M1 &+ \beta_1 INN_{ijkt} + \beta_2 PION_{ijkt} + \beta_3 \Delta ADV_{ijkt} + \beta_4 \Delta PROM_{ijkt} + \beta_5 \Delta APL_{ijkt} \\ &+ \beta_6 \Delta IQS_{ijkt} + \gamma_1 \Delta SIZE_{kt} + \gamma_2 \Delta GRW_{kt} + \gamma_3 \Delta CONC_{kt} + \varepsilon_{i2t} \qquad \text{(M2)} \end{aligned}$$

The marketing variables for brand j in category k for firm i at time t are INN_{ijkt} (brand innovation level), $PION_{ijkt}$ (brand pioneering), ADV_{ijkt} (brand advertising), $PROM_{ijkt}$ (brand promotions), APL_{ijkt} (brand's perceived appeal) and IQS_{ijkt} (brand's perceived quality) and the symbol 'Δ' denotes the changes. The pioneering variable, $PION_{ijkt}$, has the time subscript 't' to denote the week of introduction of the pioneering innovation. The category characteristics are $SIZE_{kt}$ (category size), GRW_{kt} (category growth rate), and $CONC_{kt}$ (category concentration), and ε_{i2t} is the error term. Next, we include interaction effects, as most of our hypotheses examine whether marketing support for new-product introductions (measured by the *INN* variable) increases stock market return and denote it by model M3:

$$RET_{i,t} = Model\_M2 + \partial_1 INN_{ijkt} \times \Delta ADV_{ijkt} + \partial_2 INN_{ijkt} \times \Delta PROM_{ijkt} + \partial_3 INN_{ijkt} \times \Delta APL_{ijkt} + \partial_4 INN_{ijkt} \times \Delta IQS_{ijkt}$$
$$+ \partial_5 INN_{ijkt} * \Delta SIZE_{kt} + \partial_6 INN_{ijkt} \times \Delta GRW_{kt} + \partial_7 INN_{ijkt} \times \Delta CONC_{kt} + \varepsilon_{i3t} \qquad \text{(M3)}$$

A final extension, model M4, is obtained by adding pioneering interactions effects with advertising and promotion:

$$RET_{i,t} = Model\_M3 + \partial_8 PION_{ijkt} * \Delta ADV_{ijkt} + \partial_9 PION_{ijkt} * \Delta PROM_{ijkt} + \varepsilon_{i4t} \qquad \text{(M4)}$$

It is important to note that the equation is specified both in levels of accounting and finance variables, and in first-differences in the marketing variables. The former factors reflect the *past* operations of the firm, measuring the long-term association with baseline market valuation, while the latter reflect the prospects for *future* cash flows and assess whether there is timely reaction to news (see Fornell et al. 2006 for a similar conceptualization of the level and change effects). As an additional benefit, first differencing assures stationarity of the variables, thus avoiding spurious regression results if the variables are evolving (Granger and Newbold 1986). We conduct a cointegration test for the existence of a long-run equilibrium among the evolving variables.

The models are estimated by pooling the data for 53 brands in all automobile categories, under consideration, into a panel amounting to a total of 53*299=15847 observations. All model variations are estimated with a fixed-effects specification to control for unobserved brand and firm characteristics. Since the model pools information from all the brands, we have multiple observations by firm. Hence, the errors may not be independently distributed, and therefore least squares estimation will provide unbiased estimated but they may not be asymptotically efficient. Specifically, the error term ε_{it} can be written as $\varepsilon_{it} = v_i + e_t + \eta_{it}$ where v_i is the cross-section specific error affecting only the observations for firm i, e_t is the time-specific component peculiar to all observations for week t, and η_{it} affects only the particular observation. Hence, we proceed with a variance-components approach, based on

the estimation of heteroscedasticity under repeated observations (Oberhofer and Kmenta 1974; Greene 2003).

Data and Variable Operationalization

We focus our analysis of the 1996-2002 automobile industry on Chrysler, Ford, General Motors, Honda, Nissan and Toyota, representing about 86% of the U.S. car market. Our data come from four major sources, J.D. Power & Associates (JDPA) for weekly sales and marketing, CRSP and COMPUSTAT for firm performance and TNS Media Intelligence for advertising data.

Sales transaction data from J.D. Power & Associates are available for a sizeable sample of dealerships in the major metropolitan areas in the United States. For the sales promotions, we use data from California dealerships, containing every new car sales transaction in a sample of 1,100 dealerships from October 1996 through June 2002.[5] Each observation in the JDPA database contains the transaction date, manufacturer, model year, make, model, trim and other car information, transaction price, and sales promotions, operationalized as the monetary equivalent of all promotional incentives per vehicle.[6] The vehicle information is aggregated to the brand level, representing a company's presence in a certain category. For example, Chevrolet, GMC and Cadillac are the three General Motors brands in the SUV category. Table 3 clarifies the variables, their definitions, specific data sources, and the temporal as well as the cross-sectional aggregation of each variable. Importantly, we note that a certain brand may experience an innovation at several weeks during a year, because its (sub) models introduce their new versions at different times. We consider 53 brands in six major product categories: SUVs, minivans, mid-size sedans, compact cars, compact pick-ups and full-size pick-ups, as shown in Table 4.[7]

--- Insert Tables 3 and 4 about here ---

A second source of JDPA data is expert opinions on the innovation level of each vehicle redesign or introduction. We obtained these data from Pauwels et al. (2004), and point the reader to that paper for an extensive discussion of those data.

For the "pioneering" innovation variable, in line with the JDPA (1998) guidelines, JDPA experts rate innovativeness as pioneering or not. An example of level 1 for the premium car category is the 2001 Toyota Prius, the first gasoline-electric hybrid that could function as a versatile family car. Turning to the SUV category, an example of a pioneering innovation is the 1999 Lexus RX300, the first car-based SUV designed to compete in the luxury SUV segment. Table 5 provides specific illustrations of pioneering innovations.

--- Insert Table 5 about here ---

Another important set of JDPA data are the annual surveys on the 'APEAL' and 'Initial Quality' of cars, based on feedback from over 60,000 customers on the experience of the first 90 days of ownership.[8] A third source of data is advertising data from TNS Media Intelligence on monthly advertising expenditures by make and model in each of the six categories.

Stock returns are obtained from the Center for Research in Security Prices (CRSP). For firm-specific information and quarterly accounting information such as book value, revenues and net income, we use the Standard and Poor's 1999 COMPUSTAT database. Additionally, the COMPUSTAT dataset also provides monthly indices of the Construction Cost Index and the Consumer Price Index (CPI). The CPI is used to deflate all monetary variables. Table 6 provides a listing of the brands in the study along with the descriptive statistics for the measures that form the basis of our analysis.

--- Insert Table 6 about here ---

We choose the week as the time interval of analysis because (i) previous stock return modeling studies have demonstrated that a few days suffice for studying product innovation

(e.g. Chaney et al 1991), (ii) weekly return data guard against noisy day-to-day (or even hour-to-hour) day-trading patterns, and (iii) the product innovation variable is available at the weekly level.[9]

Empirical Results

An examination of the correlations among variables indicates that the inter-correlations are modest. Moreover, the variance inflation factors ranging from 1.06 to 1.68 are within the acceptable ranges, suggesting that multicollinearity amongst the variables is not an issue of concern.

--- Insert Table 7 about here ---

We first estimate the benchmark model M1 in equation (1), followed by the focal model equation (2). Compared to the main-effects model M2 in equation (2), the model with all interactions (M3) has a higher adjusted R^2. Model M4, with the additional interaction terms for pioneering, has the highest adjusted R^2 among models M2, M3 and M4. Formally, the likelihood ratio tests outlined in Technical Appendix A1 for statistical relevance of the models (M2, M3 versus M4) indicated that models M2 and M3 were both rejected in favor of model M4 ($p<0.01$). As a result, we proceed by reporting the model M4 with interaction effects for new-to-the-company innovations as well as pioneering interactions for advertising and promotional support. [10]

Accounting and Financial Measures Drive Stock Returns

The stock-return models are statistically significant at $p< 0.05$ for both the benchmark accounting model (F-statistic=7.671), as well as the focal model, including accounting and marketing variables (F-statistic=9.342). Moreover, as shown in Table 8, several included variables have significant parameters. The explained variance ranges from 0.28 to 0.32,

typical of stock return response models (Roll 1988). However, note that stock returns represent the difference of this week's market value over last week's, accounting for dividends. Even small movements in stock returns--for example, driven by marketing mix developments--are influential because they impact the entire future of market value; i.e., their market value impact is permanent.[11]

--- Insert Table 8 about here ---

We discuss, in turn, our main results on the benchmark model versus the focal model (accounting + marketing variables) and the robustness of the implied causality from marketing mix to stock market returns.[12]

As shown in Table 8 (columns 2 and 3), the impact of unexpected changes to income on stock returns is positive and significant. The coefficient of lagged market-to-book ratio on stock returns is negative and significant, confirming that stocks with higher market-to-book ratios (i.e. less risky stocks) have lower returns. These two effects are consistent with the extensive accounting and finance literature (e.g. Fama and French 1992, 1993) that has documented the information content of earnings and market-to-book ratio measures. When a change in earnings occurs, investors view it as containing information not only about changes in current-term results but about future-term prospects as well. This information induces stock market participants to update their expectations about the firm's discounted future cash flows and revise stock price accordingly. In contrast, we find the momentum effect to be insignificant.[13]

New-Product Introductions and Brand Characteristics Drive Stock Returns

Central to this research is the nature of product innovation effects on stock returns (columns 4 and 5 in Table 8). While innovations generally have a positive impact (H1), as expected, this effect is much enhanced when the innovation is pioneering (H2). Indeed, the advent of

innovations dominates all other explanatory variables in our models in terms of t-values. Thus, Wall Street rewards innovations, especially pioneering innovations.

As noted earlier, we test both the main and the interaction effects of marketing support. Advertising has positive and significant effects on stock returns. Advertising support for new-to-the-company innovations as well as pioneering innovations increases the stock market returns of these innovations, in support of hypotheses H3a and H3b. In other words, advertising support for new products has a higher stock-return impact as compared to general-purpose advertising. Overall, our results suggest that the innovation effects are enhanced by advertising support, as investors look beyond the short-run expense of advertising (which reduces immediate profits) and reward the signal of product support that the brand provides by advertising.

Turning to price promotions, we find that the main effect of these incentives on stock returns is not significant. Thus, even though promotions are known to be revenue- and profit-enhancing in the short run, investors do not reward them. More importantly, pioneering innovation effects can be weakened by the use of price promotions, as we find a negative interaction effect for promotions with pioneering innovations, in support of hypothesis H4b. Thus, while advertising support is interpreted as a sign of strength, price promotions may be seen as a sign of weakness by investors judging the pioneering innovation's impact on future cash flows.

With respect to the brand's perceived appeal and quality, we note that main effects are not significant. This is not surprising since when there is no new product nor a change in the existing product, we would not expect any change in the brand's appeal and quality, and in turn, in stock market returns. However, consistent with hypotheses H5 and H6, new-product introductions that enjoy more positive consumer perceptions of quality and product appeal have systematically higher stock returns (Table 8). This impact is substantial and implies that

the appeal/quality of new products introduced over our data period influenced stock market returns. Our analysis suggests that improvements in consumer appraisal in terms of perceived quality, particularly for new products, translate into better investor appraisal of firm performance.

Category Characteristics

Category size and category growth rate have significant interaction effects. Thus, we obtain insights about the category conditions that either enhance or reduce innovation effects on stock returns. As such, they may be of interest to managers for selecting categories for new-product introductions. First, new-product introductions have a larger stock return impact in large versus small categories. Among all of the category characteristics, the category growth rate has the strongest influence on stock returns from new-product introductions. This finding is consistent with the forward-looking nature of investment behavior, i.e. investors reward firms that target high-growth rate categories with new-product introductions as they offer the potential of higher sales and financial performance. Moreover, the returns from innovating grow as the category grows; such growth tends to be rewarded all the more by investors. [14]

Robustness Test of Endogeneity

Our central hypothesis is that marketing-mix activity such as product innovation and advertising improves the outlook on cash flows and hence improves stock returns, above and beyond the known impact of other important variables such as the firm's net operating income. However, one could also construct an argument in favor of the reverse effect; e.g., firms' innovations and advertising levels are based, in part, on their observed stock returns (Markovitch et al. 2005).

Under the reverse causation scenario, innovations and advertising levels are endogenously determined. Therefore, we tested for the presence of endogeneity using the Hausman-Wu test (Davidson and MacKinnon 1993). The procedure is implemented as follows for each potentially endogenous variable: In the test equation, we include both the variable and its instruments, which are derived as the forecasts from an auxiliary regression linking the variable to the other control variables. A $\chi 2$-test on the significance of these instruments then constitutes the exogeneity test. None of these tests revealed any violation of the assumed exogeneity of the right-hand-side variables (using a significance level of $p < 0.05$), indicating that our specification is robust to this issue.

Managerial Implications

In order to better appreciate the managerial meaning of these results, we juxtapose the consequences of the four variables largely under managerial control: new-product introductions, the pioneering status of the new-product introduction, advertising support, and promotion support. The first two variables are related to innovation characteristics (value creation), while the next two involve marketing support (value communication). Therefore, the comparison of these effects may provide valuable input for resource-allocation decisions in the new-product process (Mizik and Jacobson 2003). Specifically, we calculate the stock-return impact of: (i) a new-product introduction by itself, (ii) introducing a pioneering innovation, (iii) increasing advertising support for a new-product introduction by $ 1 million, and (iv) increasing promotional incentives for a new-product introduction by $1000.

---Insert Table 9 about here ---

Table 9 reports the effect sizes. While a new-product introduction generates modest valuation gains of up to 0.19 %, the gain generated by a pioneering new product is much higher at 4.78%. By comparison, Chaney, Devinney and Winer (1991) found a stock-market impact for

new-product announcements (not necessarily pioneering products) of about 0.75%. By distinguishing between pioneering and non-pioneering introductions, our study extends these findings: The impact of introducing a pioneering innovation on firm value is about 24 times higher than that of introducing a non-pioneering innovation. Evidently, these numbers do not capture the full cost and time investment of developing pioneering (and non-pioneering) innovations, but companies may compare our reported findings with their internal data on project costs to help decide the extent to which they should aim for pioneering innovations.

Second, an incremental outlay of $1 million in advertising support of an innovation generates up to 1.36% in valuation gains, but up to 2.76% gains for a pioneering innovation. Note that these gains occur in addition to the direct sales and profit impact of such advertising support. The reverse is true for promotional support for new-product introductions and pioneering innovations, as these are either insignificant or negative in terms of firm value impact. These effects are important, considering that both product innovations and sales incentives occur frequently in the automobile industry. As such they can account for substantial up- or downward movements in car manufacturers' stock prices.

Concluding Remarks

This paper has investigated the impact on stock returns of new-product introductions and the associated marketing investments. We postulated several hypotheses in this regard, centered on the role of marketing mix in enhancing, accelerating and/or stabilizing cash flows for the firm. These hypotheses were tested using stock-return response modeling on six years of weekly automotive data.

We conclude, first, that new-product introductions have positive effects on firm value. These are by definition post-launch effects, above and beyond any valuation impact of the investments in R&D that the auto companies engage in and communicate to their shareholders

prior to launch. However, while investors typically view product innovations favorably, they particularly reward innovations that are pioneering, i.e. new to the market. Also, the firm-value impact of new-product introductions is higher in larger, high-growth categories. All these factors increase the extent to which new-product introductions create firm value.

Second, the firm value impact of new-product introductions is higher when they are backed by substantial advertising investments. In other words, *communicating* the differentiated added value to consumers yields higher firm-value effects of innovations, especially for pioneering innovations. In contrast, promotional incentives do not increase firm-value effects of new-product introductions, as they may signal an anticipated weakness in demand for the new product.

This study has several limitations that provide interesting avenues for future research. First, we analyzed only one industry, albeit one in which product innovation, advertising and consumer incentives are a major part of the marketing mix. A validation of our results in other industries is an important area for future research. Second, we did not consider specific launch strategy or innovation-process measures, both of which have been researched extensively in past literature. Third, our focus is on post-launch effects of innovations, including pioneering innovations on stock-market returns. Data on the development costs of innovation, particularly pioneering innovations, would enable a direct assessment of the stock-return impact of pre-launch effects of innovation. Fourth, we do not have data on advertising copy and hence we leave the issue of advertising copy and effectiveness of new-product advertising to future research. Finally, we leave the issue of investigating the presence or absence of threshold effects of advertising on stock market performance for future research.

In conclusion, the marketing literature to date has provided a number of insights on the benefits and risks of product innovation for consumers and firms. Our research adds an important dimension to this knowledge: The investor community rewards innovative firms by

their willingness to pay a premium in valuation, and this premium is higher for innovation leaders, i.e. those with pioneering innovations.

Staying ahead in the innovation race and continuing to invest in enhanced consumer value relative to competitive offers are thus key imperatives from an investor standpoint. Moreover, while innovations have a positive impact on firm value, the impact may turn out to be negative if the firm fails to manage innovation strategically. First, an innovation that is similar to existing products (i.e. is not a pioneering innovation) cannot be highly differentiated, and therefore, will not provide enough competitive advantage to strongly increase stock market returns. Second, if a firm does not invest in communicating the differentiated value provided by its innovation through advertising, this could undermine the firm value impact of the innovation. The stakes of the innovation thus remain high in the automobile industry (The Economist, 2004, p.22), as "the old car firms must reinvent themselves to seek profit, not just market share. Otherwise new, nimbler competitors will take advantage of technological change to do the job for them."

Figure 1: Conceptual Framework

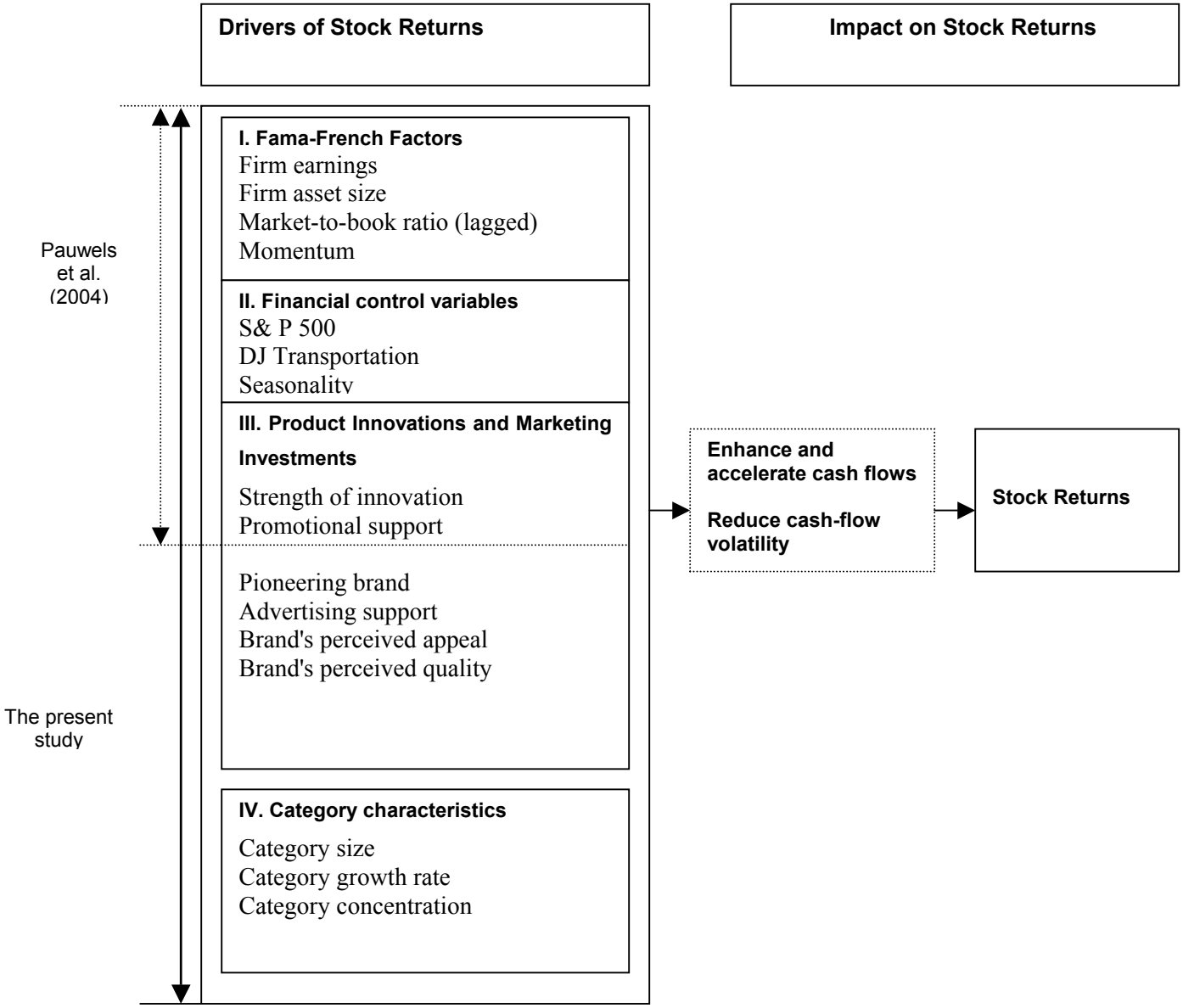

Table 1 Marketing Drivers of Stock Returns

	Hypotheses	Support
H1	New-to-the-company innovations increase stock market returns.	Supported
H2	Pioneering (new-to-the-world) innovations have a higher stock return impact than non-pioneering innovations.	Supported
H3a	Advertising support for new-to-the-company innovations increases the stock market returns of these innovations.	Supported
H3b	Advertising support for pioneering innovations increases the stock market returns of these innovations.	
H4a	Promotional support for new-to-the-company innovations decreases the stock market returns of these innovations.	Not supported
H4b	Promotional support for pioneering innovations decreases the stock market returns of these innovations.	Supported
H5	Perceived appeal of new-product introductions increases stock returns.	Supported
H6	Perceived quality of new-product introductions increases stock returns.	Supported

Table 2 Comparison of stock-return models and VARX

Approach	Representative Studies	Substantive Issue	Advantages	Disadvantages
A. Stock Return Response Modeling	Aaker and Jacobson 1994 Aaker and Jacobson 2001 Mizik and Jacobson 2003 Srinivasan et al. 2006	Perceived Quality and stock returns Brand attitude and stock returns Financial implications of shifts in strategic emphasis Marketing mix (new products, advertising and promotions) and stock returns.	Based on the Fama and French (1992) three-factor model of expected returns. Provides insights into the market's expectations of the long-term value prospects associated with changes in marketing strategy. Takes into account the dynamic properties of stock returns.	Requires detailed marketing data at the brand or SBU level. Marketing measures have to reflect information that is available to market participants, since the stock market reacts to public information. Depends on the validity of the efficient market hypothesis.
B. Vector Autoregressive Modeling	Pauwels et al. 2004 Joshi and Hanssens 2005	New product introductions, sales promotions and firm valuation Advertising and firm valuation	Provides a flexible treatment of both short-term and long-term effects. Robust to deviations from stationarity. Provides a forecasted, expected baseline for each performance variable. Allows for various dynamic feedback loops among marketing and stock performance variables.	Requires detailed marketing data at the brand or SBU level. Requires time-series over a long horizon. Relatively a-theoretical: Typically does not impose theoretical restrictions.

Table 3 Data and Variable Definitions

Variable	Definition	Source	Level of Aggregation	
Dependent Variable			**Temporal**	**Cross-Sectional**
Stock Returns (RET_{it})	$RET_{it} = \frac{(MarketValue_{it} + Dividends_{it} - MarketValue_{it-1})}{MarketValue_{it-1}}$	CRSP	Weekly	Firm-level
Financial Variables				
Firm Assets ($ASSETS_{it-1}$)	Firm assets represents the assets of firm i in week t-1	COMPUSTAT	Quarterly	Firm-level
Firm Income (INC_{it})	Firm income, scaled by dividing by firm assets, is the earnings of firm i in week t	COMPUSTAT	Weekly (Quarterly data allocated in proportion to the retail sales level in each week of the quarter as in Pauwels et al. 2004)	Firm-level
Market-to-Book Ratio (VBR_{it-1})	Market-to-book ratio is the ratio of the firm i's market value to book value in week t-1	CRSP	Weekly	Firm-level
Momentum (MNT_{it})	Momentum is calculated as the difference in the stock price of firm i in week t and the stock price of firm i in week t-26	CRSP	Weekly	Firm-level
S&P500 ($SP500_t$)	The S&P 500 index in week t	CRSP	Weekly	U.S. Stock Market Index
DWTR ($DWTR_t$)	The Dow Jones Transportation Index in week t	CRSP	Weekly	U.S. Stock Market Index
Seasonal and Holiday Variables ($SEAS_{l,t}$)	It is set =1 for one week prior to, during the week of the event, and one week following the event, and=0 otherwise, around the following holidays: Labor Day weekend, Memorial Day weekend and the end of each quarter		Weekly	U.S. Market
Marketing Variables				
Product Innovation (INN_{ijkt})	First, the brand innovation variable for brand j in category k for firm i at time t is defined as the maximum of the innovation variable for all vehicle model transactions in that week, as in Pauwels et al. (2004). Second, in step 2, we define INN_{ijkt} as a dummy variable that is set equal to 1, if there is an innovation (as obtained in step 1) in a given week, 0 otherwise	JDPA Expert opinions; JDPA weekly transactions data	Week of Introduction	Brand-level (aggregated up from the model level as described in Column 2)
Pioneering Innovation ($PION_{ijkt}$)	A dummy variable indicates whether the JDPA experts rate innovations as pioneering (=1) or not. This variable is set to 1 in the week of introduction of the pioneering innovation and is set to 0, otherwise	JDPA Expert Opinions	Week of Introduction	Brand-level

Variable	Definition	Source	Level of Aggregation	
Marketing Variables (continued)			**Temporal**	**Cross-sectional**
Advertising Support (ADV_{ijkt})	Advertising expenditure in 1000's of dollars for brand j in category k for firm i at time t, scaled by firm assets	TNS Media Intelligence	Monthly data is allocated to weekly data assuming uniform spending patterns	Brand-level
Promotional Support ($PROM_{ijkt}$)	The monetary equivalent of promotional incentives for brand j in category k for firm i at time t; the brand-level calculated by the market share weighted average of the incentives for all models of brand j in category k, scaled by firm assets	JDPA weekly transactions data	Weekly	Brand-level (aggregated up from the model level as described in Column 2)
Brand's Perceived Appeal (APL_{ijkt})	The brand level measure is calculated as the market-share weighted average of the perceived appeal rating of the models for brand j in category k at time t. This is a customer-driven measure of "things gone right," which measures customer perceptions on the design, content, layout and performance of their new vehicles during the first three to seven months of ownership	JDPA survey data for the 'APEAL' measure; JDPA weekly transactions data.	Weekly	Brand-level (aggregated up from the model level as described in Column 2)
Brand's Perceived Quality (IQS_{ijkt})	The brand level measure is calculated as the market-share weighted average of the perceived quality of the models for brand j in category k at time t. This survey, based on feedback from over 60,000 customers on the experience of the first 90 days of ownership, measures number of problems by each brand and is a measure of "things gone wrong." Hence, the latter IQS measure is negatively signed to obtain the perceived quality metric above.	JDPA Initial Quality Survey for the 'APEAL' measure; JDPA weekly transactions data.	Weekly	Brand-level (aggregated up from the model level as described in Column 2)
Category Variables				
Category Size ($SIZE_{kt}$)	Category size is the total sales in week t for category k scaled by the firm's revenue share from the category*	JDPA weekly transactions data	Weekly	Category-level
Relative Category Growth Rate (GRW_{kt}).	The metric of interest is obtained as the ratio of category growth rate of category k to total growth rate for all auto sales, to obtain a measure of relative attractiveness of a category *	JDPA weekly transactions data	Weekly	Category-level
Category Concentration ($CONC_{kt}$).	Category concentration is the sum of the market share of the top-three brands within the category k in week t, measured as a percentage*	JDPA weekly transactions data	Weekly	Category-level

* This scaling is necessary since the effect of any category-level variable is likely proportional to the importance of that category to the firm. For example, if a firm obtains 10% of its revenues from one category and 90% of its revenue from another category, the category-level variables should be multiplied by 10% for the first category and 90% for the second category.

Table 4 Brands of the Six Leading Car Manufacturers

Category	Brands	Chrysler	Ford	General Motors	Honda	Nissan	Toyota
Sport Utility Vehicles	15	Dodge, Jeep	Ford Lincoln	Chevrolet, Cadillac, GMC, Oldsmobile, Buick	Honda Acura	Nissan Infiniti	Toyota Lexus
Minivans	9	Dodge, Chrysler	Ford Mercury	Chevrolet, Oldsmobile	Honda	Nissan	Toyota
Premium Mid-size Cars	9	Chrsyler	Ford Mercury	Chevrolet Oldsmobile, Buick	Honda	Nissan	Toyota
Premium Compact Cars	8	Chrsyler	Ford	Chevrolet, Pontiac Saturn	Honda	Nissan	Toyota
Compact Pick-ups	6	Dodge	Ford	Chevrolet, GMC		Nissan	Toyota
Full-size Pick-ups	7	Dodge	Ford Lincoln	Chevrolet, GMC, Cadillac			Toyota

Table 5 Examples of Pioneering Innovations

Category	Pioneering Innovation	Description
Compact Car	2001 Toyota Prius	First gasoline-hybrid
Truck	2002 Chevrolet Avalanche	Unique convertible cab system to transform from a 5-passenger sport-utility into a standard cab pick-up
Truck	2002 Lincoln Blackwood	Introduced as a cross between a luxury SUV and a pick-up truck
SUV	1999 Lexus RX 300	First car-based SUV in the luxury segment
Minivan	1999 Honda Odyssey	First introduced the hideaway or 'magic seat'

Table 6 Characteristics of the Six Leading Car Manufacturers 1996- 2002**

Characteristic	Chrysler	Ford	General Motors	Honda	Nissan	Toyota
Brands	Dodge, Jeep Chrysler	Ford Lincoln Mercury	Chevrolet, Cadillac GMC, Buick, Saturn	Honda Acura	Nissan Infiniti	Toyota Lexus
US Market Share	15%	21%	28%	8%	4%	10%
Market Capitalization	48310	52475	41770	36100	15360	119140
Market Capitalization to Book Value	1.91	2.36	1.90	2.29	1.51	2.16
Quarterly Firm Earnings ($ M)	845	1612	988	559	-108	1079
Quarterly Firm Revenue ($ M)	29120	39520	43355	12792	13065	26780
Stock Market Returns (%)	0.199%	-0.077%	0.086%	-0.063%	0.102%	0.165%
Brand Advertising (yearly in $M)	660	720	1430	250	290	400
# of New-product Introductions (Levels 1-5)	67	113	93	42	24	56
Sales Promotions per Vehicle ($)	640	390	640	25	200	120

Notes:

- For stationary variables, the values reported above are the sample mean of the time series whereas for evolving variables, the values reported above are the end-of-the-observation period values of the time series. Hence, as an example, the market capitalization to book value ratio is the end-of-the observation period value for these firms, while sales promotions per vehicle represent the $ value. The only exception is new product introductions where we report the total number of new product introductions.
- The interpretation of the numbers in the above table is as follows, illustrated with Chrysler:
  US Market Share: The average market share of Chrysler is 15% over the duration of the sample.
  Market Capitalization: The end-of-the-observation period value of market capitalization of Chrysler is $ 48.30 billion.
  Market Capitalization to Book Value: The end-of-the-observation period value of market capitalization to book value of Chrysler is 1.91.
  Quarterly Firm Earnings: The end-of-the-observation period value of quarterly firm earnings of Chrysler is $ 845 million.
  Quarterly Firm Revenues: The end-of-the-observation period value of quarterly revenues of Chrysler is $ 29.12 billlion.
  Stock Returns: The average stock return of Chrysler is 0.199% over the duration of the sample.
  Brand Advertising: The average yearly brand advertising expenditure for Chrysler is $660 million over the duration of the sample.
  New-product Introductions: The total number of new product introductions for Chrysler in all categories – SUV, Minivan, Premium compact, Premium Mid-size, Compact Pick-up and Full-size Pick up – is 67.
  Sales Promotions: The average sales promotions of Chrysler per vehicle is $ 640 over the duration of the sample.

Table 7 Inter-Correlations Among the Variables

	RET	EARN	ASSETS	VBR	MNT	DWTR	SP500	INN	PION	ADV	PROM	APL	IQS	SIZE	GRW	CONC
Stock Return	1.000															
Earnings	0.251	1.000														
Firm Size	0.014	0.000	1.000													
Market-to-Book	0.092	-0.015	0.007	1.000												
Momentum	0.163	0.016	0.018	0.007	1.000											
Dow Transportation	0.101	-0.029	-0.03	0.001	0.019	1.000										
S&P 500	0.106	0.030	-0.018	0.012	0.033	0.327	1.000									
Innovation	0.163	0.001	0.011	0.001	-0.028	-0.009	-0.010	1.000								
Pioneering	0.171	-0.028	0.031	0.004	0.001	-0.025	-0.026	0.007	1.000							
Advertising	0.084	0.000	-0.018	0.001	-0.010	-0.037	0.015	0.171	0.106	1.000						
Price Promotions	-0.006	0.002	0.012	-0.006	-0.010	0.011	-0.013	-0.004	0.003	-0.021	1.000					
Brand's Appeal	0.102	-0.007	-0.006	-0.007	-0.005	-0.012	-0.016	0.101	0.102	0.008	0.016	1.000				
Brand's Quality	-0.196	-0.009	0.010	-0.001	-0.020	-0.010	-0.01	0.008	0.018	0.002	0.014	0.581	1.000			
Category Size	0.033	0.045	0.050	0.021	-0.017	0.055	0.07	0.016	-0.011	-0.103	0.058	-0.009	-0.018	1.000		
Category Growth	0.001	0.001	0.000	0.000	-0.001	0.042	0.023	-0.003	0.002	0.001	0.018	-0.009	-0.006	-0.002	1.000	
Concentration	0.018	0.012	-0.009	-0.017	0.001	0.002	-0.025	-0.001	0.004	0.039	0.016	-0.007	-0.006	0.060	-0.002	1.000

Correlations are presented as Pearson correlation coefficients and are modest.

Table 8 Drivers of Stock Returns

Variables	Estimate	Standard Error	Estimate	Standard Error
	Benchmark Model M1 (Accounting Performance)		Focal Model M4 (Accounting + Marketing Performance)	
Number of Observations	15847		15847	
Accounting Performance Variables				
Accounting Earnings	0.0759**	0.038	0.0862**	0.420
Firm-Specific Risk Factors				
Lagged Firm Size	0.0121	0.0110	0.0110	0.0100
Lagged Market-to-Book Ratio	-0.0245**	0.0112	-0.0224*	0.0086
Momentum	0.3216	0.2945	0.3435	0.2078
Economy-Wide Factors				
Dow Transportation Index	0.0001	0.0000	0.0001	0.0000
S&P 500	0.0007*	0.0001	0.0006*	0.0001
Product Innovations and Marketing Investments				
Innovation			0.0191*	0.0030
Pioneering			0.4775*	0.1861
Advertising			0.2186*	0.0415
Advertising x Innovation			0.2556*	0.0915
Advertising x Pioneering			0.5198*	0.1054
Price Promotions			0.3903	0.2853
Price Promotions x Innovation			-0.2610	1.5162
Price Promotions x Pioneering			-0.0630**	0.0315
Brand's Appeal			0.0003	0.0040
Brand's Quality			0.0010	0.0012
Brand's Appeal x Innovation			0.0111*	0.0040
Brand's Quality x Innovation			0.0141**	0.0061
Category Characteristics				
Category Size			-0.1660	0.2260
Category Size x Innovation			0.0389*	0.0134
Category Growth Rate			0.0661	0.0560
Category Growth Rate x Innovation			0.0378*	0.0061
Concentration			0.0176	0.0062
Concentration x Innovation			0.0062	0.0154
R-squared	0.281		0.316	

Note: The marketing variables are first-differenced; the estimated model also includes the seasonal dummies and the brand-specific and firm-specific fixed coefficients which are not displayed in the interest of space; *-Significant at p=0.01; ** - Significant at p=0.05.

Table 9 Impact of Marketing Mix on Stock Returns

Impact of…	Effect on Stock Returns
New-product introductions	0.19%
Pioneering innovations	4.78%
Advertising support for new-product introductions	1.36%
Advertising support for pioneering innovations	2.76%
Promotional support for new-product introductions	n.s.

Note: The numerical simulations examine the impact of a. introducing a new product, b. introducing a pioneering innovation, c. increasing advertising support by $ 1 million, and d. increasing promotional support per vehicle by $1000; n.s. denotes that the estimate is not significant.

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Appendix A1: Tests for Alternative Models

a. Are marketing effects needed in the model? To test whether incorporating marketing variables is necessary at all in the stock returns model, we test the joint hypothesis H_0: $\beta_1=\beta_2=\beta_3=\beta_4=\beta_5=\beta_6=\gamma_1=\gamma_2=\gamma_3=\delta_1=\delta_2=\delta_3=\delta_4=\delta_5=\delta_6=\delta_7=\delta_8=\delta_9=0$. We obtain the maximum log-likelihood value L_1. Applying the likelihood ratio test, we compute the likelihood ratio=-2 ($L_1 - L^*$) and check to see if it exceeds the critical value of $\chi^2_{0.95,18}$ = 28.868. If this nested model were rejected, this result would indicate that the stock return response model must incorporate marketing effects. If, on the other hand, we fail to reject the nested model, the result would indicate that marketing variables are not needed in the stock return model.

b. Are interaction effects with innovations needed in the model? To test whether incorporating interaction effects is necessary at all in the stock returns model, we test the joint hypothesis H_0:$\delta_1=\delta_2=\delta_3=\delta_4=\delta_5=\delta_6=\delta_7=\delta_8=\delta_9=0$. We obtain the maximum log-likelihood value L_2. Applying the likelihood ratio test, we compute the likelihood ratio=-2 (L_2 - L^*) and check to see if it exceeds the critical value of $\chi^2_{0.95,9}$ =16.919. A likelihood ratio test, as outlined in point *a.* above, is conducted to assess which model fits best the data.

c. Are additional pioneering interactions effects with advertising and promotions needed in the model? To assess this, we test the joint hypothesis H_0:$\delta_8=\delta_9=0$. We obtain the maximum log-likelihood value L_3. Applying the likelihood ratio test, we compute the likelihood ratio=-2 (L_3 - L^*) and check to see if it exceeds the critical value of $\chi^2_{0.95,2}$ =5.991. Once again, a likelihood ratio test, as outlined in point *a.* above, is conducted to assess which model fits best the data.

Endnotes

[1] A good example of these inter-temporal effects in the car industry is a "lease pull ahead" program. Analysts at car manufacturers keep track of the patterns of lease expirations. When they spot a month in the future with an unusually large volume of lease returns, they offer some of those lessees the option to return the car ahead of time coinciding with a period of lower expected lease returns or offer a promotional extension of the lease term. Furthermore, it is a common practice to target lease programs to terms coinciding with an expected "valley" in lease returns. By seeking a stable flow of lease returns, manufacturers aim to generate a stable flow of new leases.

[2] Specifically, we are interested in the extent to which a new automobile model introduced is different from current offerings of the firm and those in the market. We do not consider specific innovations in processes or components.

[3] Within the context of the automobile industry, there are six categories based on the accepted industry classifications: SUVs, minivans, mid-size sedans, compact cars, compact pick-ups and full-size pick-ups.

[4] As we used Friday closing prices to obtain weekly measures of RET, our data for this dependent variable encompass 299 weekly observations, identical to those for the independent variables.

[5] With the exception of price promotions, all the other variables come from national sources. In the auto industry, typically, promotions are planned and executed at the national level, and they are advertised nationally through TV networks. As such, the price promotions data from California are quite representative of the price promotions of other U.S. regions.

[6] Moreover, this dataset is at the detailed 'vehicle' level, defined as every combination of model year, make and model (e.g., 1999 Honda Accord, 2000 Toyota Camry), body type (e.g., convertible, coupe, hatchback), doors (e.g., 2-door, 4-door, 4-door extended cabin), trim level (e.g., for Honda Accord, DX, EX, LX, etc.), drive train type (e.g., 2WD, 4WD), transmission type (i.e., automatic, manual), cylinders (e.g., 4 cylinder, V6), and displacement (e.g., 3.0 or 3.3 liters).

[7] For reasons of parsimony, we restrict our attention to those brands that together account for at least 80% of the share of the category under consideration.

[8] The perceived appeal and quality variables are aggregated to the brand level as the market-share weighted average of the perceived appeal rating of the models for brand *j*. This allows us to incorporate the effects of changes in the vehicle model-mix on firm valuation. For instance, if market conditions cause a drop in sales of full-size SUVs relative to mid-size SUVs, the product lines of General Motors and Ford becomes less attractive relative to those of Toyota and Nissan.

[9] Moreover, the validation tests of the model estimated with monthly data find that the substantive results remain robust to temporal aggregation. These results are available upon request from the first author.

[10] Unit-root tests reveal evolution in performance variables, but stationarity for marketing variables including new-product introductions, sales promotions and advertising. A cointegration test for the existence of a long-run equilibrium among these evolving variables produced a negative result.

[11] To see this, one can transform back to levels to verify that most of the variance in market value is explained by last-week's market value.

[12] One could also construct an argument in favor of a random coefficients model, using tests to detect such departure from the constant-parameter assumption. As such, we tested for this using the variation of the Lagragian multiplier test proposed by Hsiao (2003, p. 147-149). A $\chi 2$-test (using a significance level of $p < 0.05$) did not reveal departure from the assumption of fixed coefficients.

[13] Note that previous research has found mixed results on momentum and that the sign of the effect depends on the time period considered (one week in our case): it is negative for one week up to one month (Fama 1965; Jegadeesh 1990; Kaul and Nimalendran 1990; Lehmann 1990), positive for 3-12 month periods (Jegadeesh and Titman (1993) and negative for long horizons such as 3-5 years (DeBondt and Thaler 1985).

[14] We also tested for nonlinear effects by running the Ramsey's RESET test, which is an F test of differences of R2 under linear versus nonlinear assumptions, to test whether power transforms need to be added to the model. The F-test results were insignificant using a significance level of 0.05, and hence, we conclude that nonlinear effects are not indicated.