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Advertising Spending and Market Capitalization

Amit Joshi and Dominique M. Hanssens

Can marketing expenditures directly affect shareholder value? Yes, finds this study, based on 10 years' data for five PC manufacturers. In the long run, advertising spending improves a firm's market capitalization: investors respond well to aggressive advertising.

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Report Summary

Marketing managers can no longer base their decisions solely on sales or profit response. Shareholder value analysis demands that marketing decision makers evaluate how their actions will affect investor response over the long term. However, the marketing literature to date has focused on the sales or profit response of marketing actions such as advertising spending and new product development, and the goals of marketing have traditionally been formulated from a customer perspective, not a shareholder perspective.

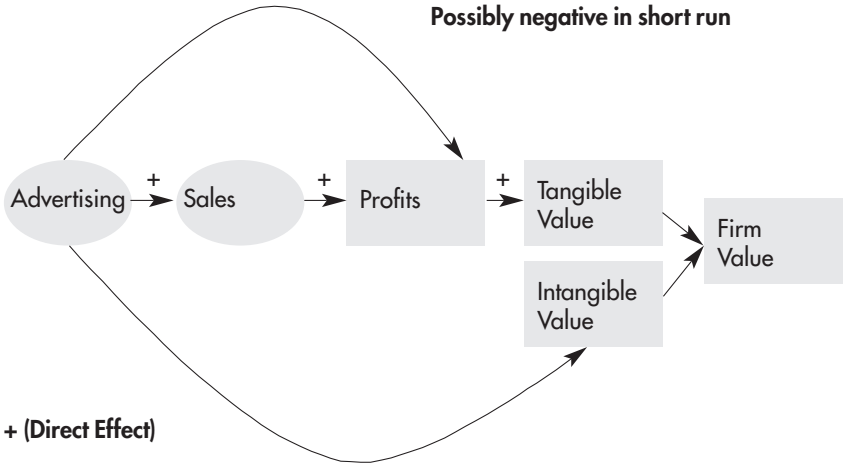
The prospect of justifying marketing expenditures by their effect upon shareholder value presents marketing managers with an exciting opportunity—if they can draw upon evidence that marketing expenditures do indeed exert positive and significant effects on this value. However, until now, there have been no studies of the long-term investor response to marketing actions, in particular the stock price of publicly traded firms.

In this study, Joshi and Hanssens investigate one important aspect of the impact of marketing on investor response: the long-run relationship between advertising spending and market capitalization.

Because advertising affects revenue and profit, and revenue and profit affect market capitalization, advertising can be said to indirectly affect market capitalization. Joshi and Hanssens hypothesize that advertising can have a *direct* effect on valuation, that is, an effect over and above its indirect effect via revenue and profit response. Drawing upon 10 years (1991-2000) of monthly data on revenue, income, market capitalization, advertising, and R&D expenditures for five major personal-computer manufacturers (Apple, Compaq, Dell, HP, and IBM), the authors used multivariate time-series methods to disentangle the long-run and short-run effects as well as the direct and indirect effects of advertising on firm valuation.

The empirical results support the authors' hypothesis that advertising spending has a positive and long-run impact on firms' market capitalization. Investors are willing to pay a premium for aggressive advertisers. ■

Figure 1
Advertising and Firm Valuation



Introduction

The shareholder value principle advocates running a business to maximize return on shareholders' investment. Shareholder value analysis (SVA) is thus becoming a new standard for judging managerial action (Doyle 2000). As measures of short-term accounting profits give way to SVA, it is imperative that all investments made by managers be viewed in the context of shareholder returns. Every investment, be it in the area of operations, human resources, or marketing, may now have to be justified from the SVA perspective. The common yardstick used by most investors in this context is the share price; more generally, the wealth created by a firm is measured by its market capitalization.

This evolution toward SVA presents a great opportunity for marketing. Indeed, traditional accounting, by focusing on short-term profits at the expense of intangible assets, may marginalize marketing. For example, current accounting criteria may dictate that sales training budgets be reduced in order to meet quarterly profits, but this reduction may have a negative impact on the firm in the long run (Cleland and Bruno 1996). In contrast, SVA takes a long-term perspective and encourages managers to make profitable investments.

To capitalize on this opportunity, marketing will have to justify its budgets in shareholder-value terms. This is a difficult task, as the goals of marketing are traditionally formulated in customer-attitude or sales-performance terms. Furthermore, marketing impacts business performance in both tangible and intangible ways. Consequently, marketing budgets are vulnerable, especially advertising spending, as noted in the MAX conference on "Improving Advertising Budgeting" (Donath 1999). While the effects of advertising on sales have been researched in depth (see, e.g., Hanssens, Parsons, and Schultz 2001 for a review), there has been little effort to study the direct impact of advertising on stock price (Figure 1). Thus the primary motivation of our paper is to investigate the impact of advertising spending on firm value above and beyond its effect on sales revenues and profits.

Tangible and intangible effects

Firm value has been classified as tangible and intangible value (Simon and Sullivan 1993). From a marketing perspective, tangible assets include sales and profits, and the impact of marketing instruments on these has been well documented for both the short run (e.g., Blattberg, Briesch, and Fox 1995; Lodish et al. 1995) and the long run (e.g., Nijs et al. 2001; Pauwels, Hanssens, and Siddharth 2002). In modern economies, however, a large part of firm value may reflect its intangible assets, such as brand equity (Chan, Lakonishok, and Sougiannis 2001). Since these intangible assets are not required to be reported in firms' financial statements under the generally accepted U.S. accounting principles, their valuation is complicated further. At the same time, research suggests that non-financial indicators of investments in "intangible" assets, such as customer satisfaction, may be better predictors of future financial performance than historical accounting measures and should supplement financial measures in internal accounting systems (Ittner and Larcker 1998).

Intangible assets may be classified as: (1) market-specific factors, such as regulations, that lead to

imperfect competition, (2) firm-specific factors, such as R&D expenditures and patents, and (3) brand equity (Simon and Sullivan 1993). To date, the finance and marketing literatures have established a relationship between firm value and factors 1 and 2, while very little attention has been given to advertising's impact on firm value through the development of brand equity.

The link between market-specific factors (factor 1 above) and firm value is more relevant to the policy literature and is not considered in this paper. Firm-specific factors (factor 2) have been shown to impact firm value. Research has linked firm value to R&D expenditures (Doukas and Switzer 1992; Chan, Lakonishok, and Sougiannis 2001), discretionary expenditures such as R&D and advertising (Erickson and Jacobson 1992; Griliches 1981; Pakes 1985; Jaffe 1986), and innovation (Bayus et al.; Erickson and Jacobson 2003).

The positive impact of new product introductions (NPI) on firm value has recently been identified by Pauwels et al (2004). Because new product introductions are the manifestation of a successful R&D program, this study advances the literature by linking *successful outcomes* of R&D with firm value, in contrast to earlier studies that only considered R&D expenditures. Further, by studying the impact of rebates, the authors link pricing strategies to firm value as well. Advertising is not considered in this study, however.

A few marketing papers have dealt with the link between brand-related intangible assets and firm value. These include studies on the stock-market reaction to the changing of a company's name (Horsky and Swyngedouw 1987), to new product announcements (Chaney, Devinney, and Winer 1991), to changes in perceived quality (Aaker and Jacobson 1994), brand extensions (Lane and Jacobson 1995), and to changes in brand attitude (Aaker and Jacobson 2001). Furthermore, linkages between advertising and brand-related intangible assets, including perceived quality (Moorthy and Zhao 2000) and brand attitude (Berger and Mitchell 1989), have been well established. Based on the results of these studies, we may expect advertising to have an indirect impact on firm value (through the increase in sales and profits), as well as a direct effect (by building brand-related intangible assets).

Capital market efficiency

Most of the studies mentioned above use the "event study" methodology, which tracks stock prices/market capitalizations around a time window surrounding the concerned event(s). As such, none of these studies is concerned with the long-run impact of the change on stock prices. The event window considered in most studies is small, typically a few months. This methodology is appropriate if the efficient capital markets (ECM hereafter) hypothesis holds. The ECM hypothesis (Fama 1970) states that current stock prices contain all available information about the future expected profits of a firm. Future profit expectations are the only drivers of the stock price (and therefore the market capitalization) of a firm, and hence stock prices may be modeled as a random walk, in which changes in these expectations are incorporated immediately and fully. However, more recent work in finance and strategy suggests that the ECM hypothesis may not always hold (Merton 1987), because investors do not always have all of the information. In particular, researchers have questioned the appropriateness of assuming *immediate* dissemination of all available information. In marketing, Pauwels et al. (2004) demonstrate that marketing activities contain information about firm value that cannot be captured in the short run alone. This finding motivates the use of long-run or persistence models instead of event windows to study the impact of intangible assets on firm value.

In conclusion, while there is some evidence for a relationship between marketing activities and financial performance, this relationship has not received adequate attention. Specifically, no studies have directly studied the long-run effects of advertising expenditures on firm value. If the

ECM hypothesis holds, we would find no long-run effects, since the impact of advertising would be fully contained in the next period's stock price. The fact that some studies suggest that marketing actions do indeed have some long-run effects on firm value indicates that there can be an effect buildup beyond the short run.

In this study, we use persistence modeling (vector-autoregressive, or VAR, modeling) (Dekimpe and Hanssens 1995a) to study the long-term effect of advertising expenditures on market capitalization. The use of VAR models allows us to investigate long-run investor response to advertising while recognizing the endogeneity of discretionary expenditures (such as advertising and R&D) with profits, and hence with firm value. We begin with the development of hypotheses, which are divided into two categories for ease of exposition.

Hypothesis Development

Customer response effects

Extensive prior research on the short-term effects of advertising on sales provides an empirical generalization that the short-term elasticity on own brand sales is positive but low (Leone and Schultz 1980). This generalization is supported in the literature survey of Aaker and Carmen (1982) and by the meta-analysis of Assmus, Farley, and Lehmann (1984). The latter study reports an average short-term elasticity of .22, though others report an even smaller magnitude of about .10 (Sethuraman and Tellis 1991). On the other hand, advertising elasticities have been shown to be higher for new products (Parsons 1975). Hence we propose our first hypothesis:

H1: Advertising will have a positive impact on sales revenue.

Research in marketing and strategy has demonstrated the positive impact of new product introductions on sales (Morbey and Reithner 1990; Nijs et al. 2001). Furthermore, since product innovation requires research and development, it has also been established that R&D expenditures have a positive impact on the *market value* of the firm (Doukas and Switzer 1992; Cockburn and Griliches 1988). Geroski, Machin, and Van Reenen (1993) propose two possible effects of innovation. In the short run, new products derived from R&D increase sales and profitability, which gives the firm temporary market power. This is called the "product effect." In the long run, innovation itself transforms a firm's capabilities, thereby providing it with a competitive advantage. This is called the "process effect."

However, the "product effect" of R&D expenditures and innovation involves risk. New products are the manifestation of a successful R&D program, but their commercial success can only be judged correctly in the long run, depending on the evolution of demand. In that sense, R&D expenditures can be considered a pathway for gaining comparative advantage (Erickson and Jacobson 1992). Taking this into account, we propose:

H2: R&D expenditures will have a positive long-run impact on sales revenue.

Investor response effects

Advertising seeks to differentiate a firm's products from those of its competitors, thereby creating brand equity for its products (Aaker 1991). We hypothesize that this equity, which is created through marketing activity and is ostensibly directed at customers and prospects, can *spill over* into investment behavior as well. For example, in a recent study, Frieder and Subrahmanyam (2001) find that investors favor stocks with strong brand names, even though these powerful brands did not generate superior short-run returns. The authors acknowledge that "individual investors may believe, correctly or not, that they can expect greater appreciation potential in the stock of companies whose products are recognized brand names." Overall, their results indicate that brand awareness and perceived brand quality in consumer products

may spill over into demand for stocks of companies with brand-name products.

Research in behavioral decision theory provides support for the spillover effect. Heath and Tversky (1990) find that individuals prefer to bet in areas where they feel confident and have knowledge about the uncertainties involved compared to more ambiguous areas. Such a preference could carry over to investment decisions, in that investors may prefer to hold branded stocks, for which the flow of public information is higher. Further support is provided by Huberman (2001), who finds that investors often invest in the familiar, while ignoring principles of portfolio theory. Insofar as advertising generates familiarity (MacInnis and Jaworski 1989), we would expect that heavily advertised stocks are more attractive investment options.

Advertising can also signal a firm's financial well-being or competitive viability. Numerous signaling mechanisms can influence investor behavior. Among the more recent research on this effect is Mathur and Mathur (2000) on the stock market's reaction to the announcement of "green" marketing strategies and Mathur, Mathur, and Rangan (1997) on the celebrity-endorsement effect on firm valuation. The latter study finds that Michael Jordan's much-publicized return to NBA basketball resulted in an average increase in the market-adjusted values of his client firms of almost 2%, or over $1 billion in market capitalization. Thus, advertising in various forms may serve as a signal of future earnings potential. In a study of the impact of environmental friendliness on firm value, Gifford (1997) found that merely establishing a pro-environment practice was insufficient to increase firm value; firms had to *advertise* this fact to the investment community before it translated into increased financial returns. In this case, advertising provides information that does not necessarily impact the *sales* of the firm but has a direct effect on its stock price. Similarly, Mizik and Jacobson (2003) find that value creation (e.g., R&D) alone does not enhance firm value and that value appropriation (e.g., through advertising) is necessary for that to occur.

Further evidence in favor of signaling effects is provided by Chauvin and Hirschey (1993), who report that data on advertising and R&D spending appear to help investors form expectations concerning the size and variability of future cash flows. Although their analysis is restricted to short-run effects, the results point in the direction of a positive impact of advertising on firm value.

An additional link between advertising expenditure and firm value is provided in the literature on customer lifetime value (CLV). Rust, Lemon, and Zeithaml (2001) relate advertising expenditures to CLV and argue that higher advertising can increase CLV through the improvement in brand equity. CLV, in turn, has been shown to be positively associated with firm value by Gupta and Lehmann (2003).

While the studies above provide evidence that advertising may have a direct and positive effect on market capitalization, we do not know its possible magnitude. In the short run, advertising will likely work through the indirect route, i.e., increasing market capitalization through lifting sales and profits. The direct effect is expected to appear only in the long run, when advertising succeeds in differentiating a firm's products in the minds of consumers and investors. Based on the arguments above, we propose:

H3: Advertising will have a positive long-run effect on market capitalization.

Model and Data

Model specification

The relation between profits (P) and valuation has been examined extensively in the finance literature (valuation $\propto$ P). Furthermore, sales revenue (R) and profits are expected to be monotonically related (R $\propto$ P). On the other

hand, the direct relationship between advertising (A) and valuation is more ambiguous. Not all advertising is effective. Furthermore, even effective advertising can reduce profit in the short run, since the advertising budget is a direct expenditure against current revenue. Last, there could be a *branding effect* of an ad campaign by itself, over and above the additional cash flows generated by the advertising, which could impact the intangible assets of a firm.

The last two relations need to be studied in the long run because their impact lasts well beyond the accounting period in which the advertising money is spent. In so doing, we must recognize that company value, sales, profits, and advertising expenditures can all have feedback effects on one another. For example, a higher profit in a period may lead to increased advertising budgets, which in turn may boost sales and future profits. To disentangle these effects, we use a VAR model in which the advertising and performance variables are jointly endogenous.

Alternative cross-sectional measures of the market value of the firm may be used. Among the most familiar is the market-to-book value ratio (MBR), defined as the market value of the firm normalized by the replacement cost of its tangible assets. MBR provides an appealing market-based view of investor expectations about the firm's future profit potential. Further-more, from a marketing perspective, a MBR value greater than 1 indicates that intangible assets contribute to overall firm value.

Aside from valuation, profits, sales, and advertising expenditures, we include a feedback equation for R&D expenditures, as previous studies have consistently concluded that stock prices react favorably to R&D spending (e.g., Griliches 1981; Pakes 1985; Jaffe 1986).

Since the variables Advertising (A), Sales Revenue (R), Profit (P), and R&D expenditures (RD) can all be jointly endogenous with firm value (MBR), a VAR model in differences with J lagged periods is:[1]

$$\begin{bmatrix} \Delta MBR_t \\ \Delta R_t \\ \Delta P_t \\ \Delta A_t \\ \Delta RD_t \end{bmatrix} = \begin{bmatrix} \pi^1_{11} & \pi^1_{12} & \pi^1_{13} & \pi^1_{14} & \pi^1_{15} \\ \pi^1_{21} & \pi^1_{22} & \pi^1_{23} & \pi^1_{24} & \pi^1_{25} \\ \pi^1_{31} & \pi^1_{32} & \pi^1_{33} & \pi^1_{34} & \pi^1_{35} \\ \pi^1_{41} & \pi^1_{42} & \pi^1_{43} & \pi^1_{44} & \pi^1_{45} \\ \pi^1_{51} & \pi^1_{52} & \pi^1_{53} & \pi^1_{54} & \pi^1_{55} \end{bmatrix} \begin{bmatrix} \Delta MBR_{t-1} \\ \Delta R_{t-1} \\ \Delta P_{t-1} \\ \Delta A_{t-1} \\ \Delta RD_{t-1} \end{bmatrix} + \ldots + \begin{bmatrix} \pi^J_{11} & \pi^J_{12} & \pi^J_{13} & \pi^J_{14} & \pi^J_{15} \\ \pi^J_{21} & \pi^J_{22} & \pi^J_{23} & \pi^J_{24} & \pi^J_{25} \\ \pi^J_{31} & \pi^J_{32} & \pi^J_{33} & \pi^J_{34} & \pi^J_{35} \\ \pi^J_{41} & \pi^J_{42} & \pi^J_{43} & \pi^J_{44} & \pi^J_{45} \\ \pi^J_{51} & \pi^J_{52} & \pi^J_{53} & \pi^J_{54} & \pi^J_{55} \end{bmatrix} \begin{bmatrix} \Delta MBR_{t-J} \\ \Delta R_{t-J} \\ \Delta P_{t-J} \\ \Delta A_{t-J} \\ \Delta RD_{t-J} \end{bmatrix} + \begin{bmatrix} u_{MBR,t} \\ u_{R,t} \\ u_{Pt} \\ u_{A,t} \\ u_{RD,t} \end{bmatrix} \quad (1)$$

This representation combines market-response and decision-response effects. Consider the partitioned coefficient matrix for the first lag in this model:

$$\begin{bmatrix} \pi^1_{11} & \pi^1_{12} & \pi^1_{13} & \vdots & \pi^1_{14} & \pi^1_{15} \\ \pi^1_{21} & \pi^1_{22} & \pi^1_{23} & \vdots & \pi^1_{24} & \pi^1_{25} \\ \pi^1_{31} & \pi^1_{32} & \pi^1_{33} & \vdots & \pi^1_{34} & \pi^1_{35} \\ \ldots & \ldots & \ldots & \vdots & \ldots & \ldots \\ \pi^1_{41} & \pi^1_{42} & \pi^1_{43} & \vdots & \pi^1_{44} & \pi^1_{45} \\ \pi^1_{51} & \pi^1_{52} & \pi^1_{53} & \vdots & \pi^1_{54} & \pi^1_{55} \end{bmatrix}$$

In this matrix, the top-left partition represents the market-response coefficients for firm value, sales revenue, and profit, respectively. The (3 x 2) matrix in the top-right corner shows the direct response effects of advertising and R&D on firm value, revenue, and profit. The bottom-right partition captures firm-specific decision rules between advertising and R&D spending. Finally, the bottom-left matrix measures performance feedback effects. For example, an increase in next-period advertising spending due to higher sales revenue would be captured by the coefficient π^1_{42}.

Furthermore, if some or all variables are cointegrated, the VAR model is expanded to a vector-error correction (VEC) model (Equation 2).[2]

In both systems of equations 1 and 2, $[u_{MBR}, u_R, u_P, u_A, u_{RD}]' \sim N(0, \Sigma_u)$, and the order of the system, J, is decided by minimizing the Schwartz-Bayes Information Criterion (SBIC).[3]

$$\begin{bmatrix} \Delta MBR_t \\ \Delta R_t \\ \Delta P_t \\ \Delta A_t \\ \Delta RD_t \end{bmatrix} = \begin{bmatrix} \alpha_{MBR} & 0 & 0 & 0 & 0 \\ 0 & \alpha_R & 0 & 0 & 0 \\ 0 & 0 & \alpha_P & 0 & 0 \\ 0 & 0 & 0 & \alpha_A & 0 \\ 0 & 0 & 0 & 0 & \alpha_{RD} \end{bmatrix} \begin{bmatrix} e_{MBR,t-1} \\ e_{R,t-1} \\ e_{P,t-1} \\ e_{A,t-1} \\ e_{RD,t-1} \end{bmatrix} + \sum_{j=1}^{J} \begin{bmatrix} \pi_{11}^j & \pi_{12}^j & \pi_{13}^j & \pi_{14}^j & \pi_{15}^j \\ \pi_{21}^j & \pi_{22}^j & \pi_{23}^j & \pi_{24}^j & \pi_{25}^j \\ \pi_{31}^j & \pi_{32}^j & \pi_{33}^j & \pi_{34}^j & \pi_{35}^j \\ \pi_{41}^j & \pi_{42}^j & \pi_{43}^j & \pi_{44}^j & \pi_{45}^j \\ \pi_{51}^j & \pi_{52}^j & \pi_{53}^j & \pi_{54}^j & \pi_{55}^j \end{bmatrix} \begin{bmatrix} \Delta MBR_{t-j} \\ \Delta R_{t-j} \\ \Delta P_{t-j} \\ \Delta A_{t-j} \\ \Delta RD_{t-j} \end{bmatrix} + \begin{bmatrix} u_{MBR,t} \\ u_{R,t} \\ u_{P,t} \\ u_{A,t} \\ u_{RD,t} \end{bmatrix} \quad (2)$$

The addition of the error-correction terms {*e*} in Equation 2 implies that in every period there is a partial adjustment toward restoring the underlying, temporarily disturbed equilibrium. That is, the system partially corrects for the previously observed deviations, and the coefficients α reflect the speed of that adjustment.

All variables except firm profits are taken in natural logarithms. This enables us to interpret response effects as elasticities, which facilitates comparisons between equations. However, some firms incur losses (negative profits) in certain time periods in the sample. Although logarithms can still be taken using an additive constant, this is an arbitrary data adjustment that biases the elasticity interpretation, and therefore we prefer to measure profits in levels.

Our analysis comprises five parts. First, we test for evolution of all of the variables in our study. A priori, we expect to find the performance variables to be evolving, following random-walk theory and extant marketing literature (Dekimpe and Hanssens 1995b). If evolution is found, we test for the presence of cointegration, or long-term coevolution. For example, profits and advertising expenditures may both be evolving, but if advertising budgets were set in function of profits, we would expect a long-run relationship between the two variables. Depending on the outcome of these tests, VAR or VEC models are estimated subsequently.

Next, impulse response functions (IRFs) are derived from the VEC or VAR models. The IRFs trace the over-time impact of a unit shock

Figure 2
Log (MBR) by Firm

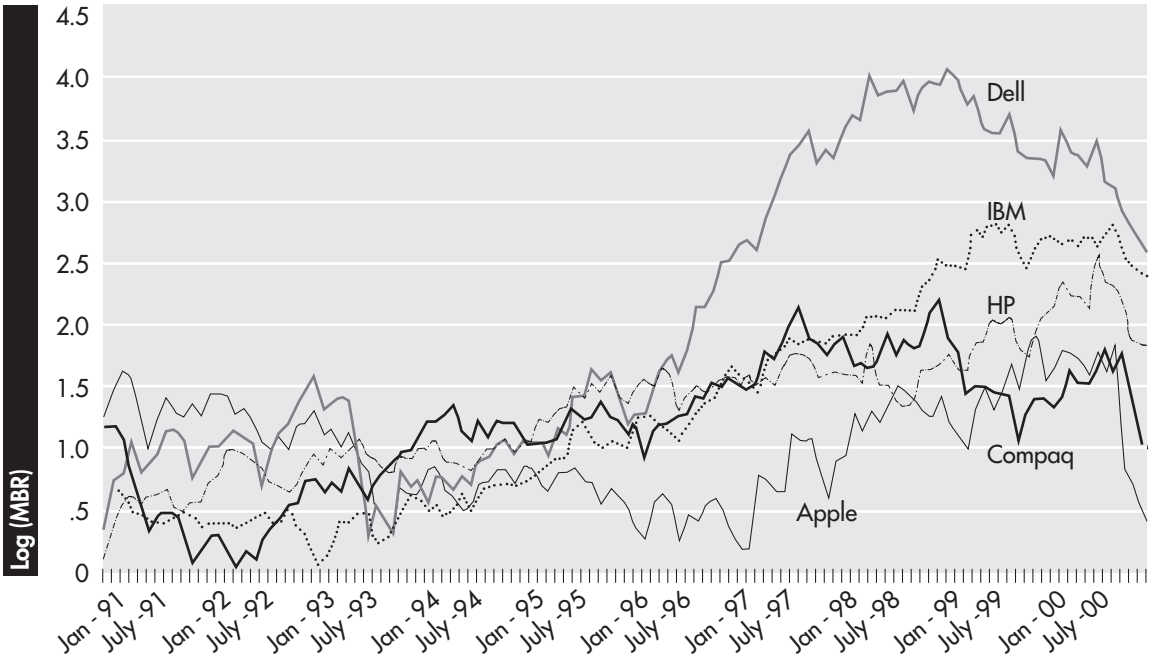
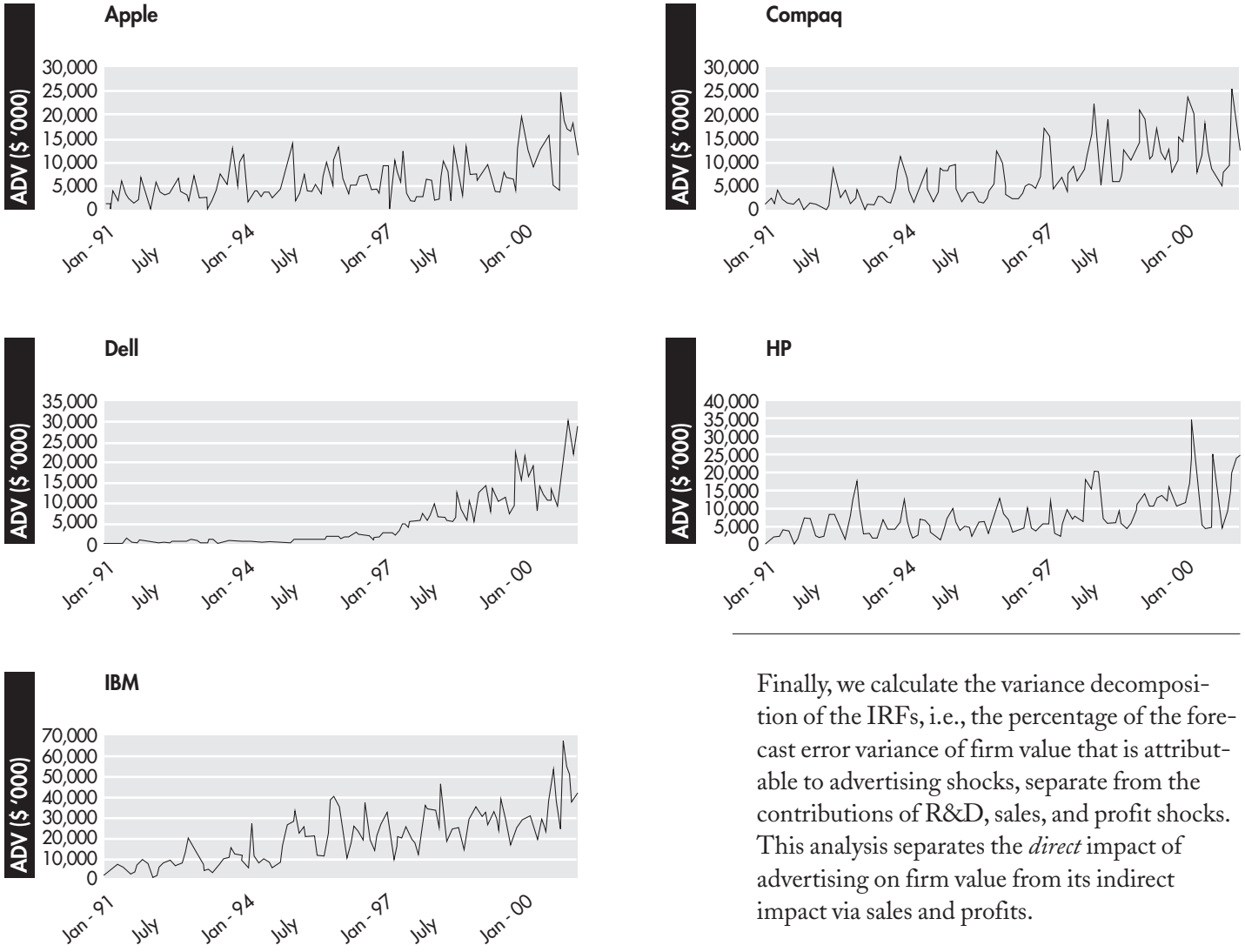


Figure 3
Total Advertising Expenditures by Firm



to any endogenous variable on the other endogenous variable. Following Dekimpe and Hanssens (1999), we use generalized IRFs (or simultaneous shocking) to ensure that the ordering of variables in the system does not affect the results. Given a VAR model in differences, the total shock effect at lag k is obtained by accumulating the lower-order IRFs. Following Nijs et al. (2001), we determine the duration of the shock (maximum lag k) as the last period in which the IRF value has a $|t|$-statistic greater than 1.

Finally, we calculate the variance decomposition of the IRFs, i.e., the percentage of the forecast error variance of firm value that is attributable to advertising shocks, separate from the contributions of R&D, sales, and profit shocks. This analysis separates the *direct* impact of advertising on firm value from its indirect impact via sales and profits.

Data

We obtained 10 years (1991-2000) of monthly data on revenue, income, market capitalization (MBR), advertising, and R&D expenditures for five major personal-computer manufacturers, Apple, Compaq, Dell, HP, and IBM. These five competitors accounted for 70% of the PC desktop market and almost 80% of the portable-computer market at the end of 2000. The personal-computer industry underwent major changes during our sample period, the 1990s, in terms of both primary demand evolution and the relative standing of participants (figures 2 and 3). Dell emerged as the leading contender in the industry, while Apple struggled (Figure

Table 1
Unit-Root Test Results

Apple

	ADF Stat	5% Critical Value	Unit Root?
MBR	–2.37	–3.44	Yes
Revenue	–2.07	–3.44	Yes
Profits	–1.96	–3.44	Yes
Advertising	–3.01	–3.44	Yes
R&D	–1.61	–3.44	Yes

Compaq

	ADF Stat	5% Critical Value	Unit Root?
MBR	–2.42	–3.44	Yes
Revenue	–2.45	–3.44	Yes
Profits	–4.17	–3.44	No
Advertising	–2.92	–3.44	Yes
R&D	–2.29	–3.44	Yes

Dell

	ADF Stat	5% Critical Value	Unit Root?
MBR	–1.06	–3.44	Yes
Revenue	–3.03	–3.44	Yes
Profits	–2.58	–3.44	Yes
Advertising	–2.67	–3.44	Yes
R&D	–4.47	–3.44	No

HP

	ADF Stat	5% Critical Value	Unit Root?
MBR	–2.66	–3.44	Yes
Revenue	–1.99	–3.44	Yes
Profits	–1.57	–3.44	Yes
Advertising	–2.47	–3.44	Yes
R&D	–3.05	–3.44	Yes

IBM

	ADF Stat	5% Critical Value	Unit Root?
MBR	–2.63	–3.44	Yes
Revenue	–3.14	–3.44	Yes
Profits	–3.84	–3.44	No
Advertising	–2.29	–3.44	Yes
R&D	–2.89	–3.44	Yes

2). This variability in performance and marketing efforts over time provides a unique opportunity to study the long-term impact of advertising on valuation.

Data on income, MBR, sales, and R&D expenditures were obtained from the COMPUSTAT and I\B\E\S databases. The I\B\E\S database covers stocks traded on the major U.S. stock exchanges. Following standard practice, we use the closing stock prices on the last Friday of each month to compute the firm's monthly market capitalization.

Firm-specific information and accounting data are obtained from the COMPUSTAT database. This database provides quarterly values for income and R&D expenditures, which were allocated evenly to months. Data on monthly advertising expenditures were provided by Competitive Media Reporting (CMR). The monthly Consumer Price Index was used to deflate all variables.

The monthly value of the S&P 500 index is included as an exogenous variable that controls for economic fluctuations and changes in the investment climate. Since the firms in our analysis were constituents of the S&P 500, we adjusted the index by removing the market capitalization associated with these firms. The "adjusted" index is therefore truly exogenous with our variables.[4]

Results

Augmented Dickey-Fuller tests were used to verify the presence of unit roots in the data. MBR was found to be evolving, as predicted by the finance literature. In addition, sales revenues and advertising expenditures were also found to be evolving, in line with the empirical generalizations described in Dekimpe and Hanssens (1995b). Table 1 provides the details of the unit-root test results.

The estimated VAR models in differences, with the appropriate lags determined by the SBIC, showed a good fit, with R^2 ranging from .102 to .259 in changes and .811 to .984 in levels (see Table 2). Model adequacy was verified by performing portmanteau tests on the residuals,

Table 2
Model Fit and Residual Analysis

	Fit Statistics		Portmanteau Test	
	R^2 (in changes)	R^2 (in levels)	Q- Stat	Probability
Apple	.1021	.8119	91.09	<.0003
Compaq	.1613	.9146	117.57	<.0001
Dell	.2593	.9807	135.82	<.0001
HP	.1655	.9498	67.38	<.0001
IBM	.1438	.9842	84.40	<.0001

Table 3
Customer Response Effects

	Advertising Elasticity	*t*-Statistic	R&D Elasticity	*t*-Statistic
Apple	.269	1.68**	–.005	.65
Compaq	.108	1.70**	.304	1.65**
Dell	.006	.87	.132	1.72**
HP	.019	.78	.008	.98
IBM	.145	1.65**	.074	1.63*

* Significant at $p < .10$ for a one-tailed test
** Significant at $p < .05$ for a one-tailed test

also shown in Table 2. The results indicate that the model residuals are white noise.

In keeping with the development of our hypotheses, the substantive results are presented in two categories.

Table 4
Investor Response Effects

Firm	Elasticities	*t*-Statistic
Apple	.015	1.58*
Compaq	.009	1.43*
Dell	.033	.93
HP	.005	1.39*
IBM	.011	.81

* Significant at $p < .10$ for a one-tailed test

Customer response effects

The accumulated advertising and R&D elasticities are given in Table 3. The advertising elasticities have the expected magnitude for all of the firms under study and are statistically significant for three of the five firms. Furthermore, all significant IRFs were found to be persistent. Hence, for Apple, Compaq, and IBM, advertising spending has a persistent, positive impact on sales revenue, and H1 is partially supported.

The results also support H2. The positive sign of the R&D elasticities is as predicted, and the small magnitude is attributable to the uncertainty and the long gestation period generally associated with R&D. Further, the R&D elasticities are persistent for Compaq, Dell, and IBM. Hence, a shock to R&D expenditure has a long-term impact on firm sales revenue.

Investor response effects

Next, we examine the total effect of advertising on market capitalization. Table 4 shows the accumulated advertising elasticities on MBR. Note that these values combine the direct and the indirect effects of advertising on firm value over time.

The effect of an advertising shock accumulates over 8, 6, and 7 periods for Apple, Compaq, and HP respectively (or, the IRFs for these three firms are significant for 8, 6, and 7 periods, respectively). Since changes in advertising spending are typically not reported to investors, they are informed only through actual exposure. This explains why the effect of a change in advertising is not absorbed in stock price instantly. Instead, there is a long-run effect beyond the first period, consistent with our expectation, and hence we find partial support for H3.

Apple, Compaq, and HP have positive and significant investor response elasticities, ranging from .005 to .015. The elasticities for Dell and IBM are positive but not significantly different from zero. For IBM, the advertising elasticities may be insignificant because of the

Table 5
Forecast Error Variance Decompositions*

Period	Apple MBR	Adv	Compaq MBR	Adv	HP MBR	Adv
1	87.481	.596*	92.971	1.435	97.772	.953
2	83.571	2.038	90.315	2.856	84.369	2.010
3	80.287	3.670	84.583	3.241	81.189	3.134
4	78.733	4.587	83.875	4.542	80.905	3.124
5	78.488	4.651	83.489	5.338	80.849	3.248
6	78.442	4.679	83.433	5.452	80.840	3.266
7	78.440	4.679	83.330	5.676	80.831	3.285
8	78.438	4.681	83.327	5.677	80.828	3.288
9	78.438	4.681	83.308	5.716	80.828	3.289
10	78.438	4.681	83.307	5.717	80.827	3.290

* Read: If MBR for Apple is projected 1 to 10 periods into the future, only .596% of the forecast error variance in the first forecast period is explained by shocks to advertising expenditures. This percentage grows to 4.681% of the variance by the tenth forecast period. In contrast, 87.481% of the forecast error variance in period 1 is explained by momentum (variance in past values of MBR). This percentage declines to 78.438% of the variance by period 10.

large size and scope of the company's operations. Indeed, the PC division of IBM accounts for only 11% of its revenue, in contrast with 78% for Apple and 63% for Compaq. As a direct marketer, Dell derives around 88% of its revenue from catalog and other one-to-one marketing (source: company interview in *Tell Me Now*, June 5, 2003, www.tellmenow.com.au/newsletter_0503.html). Thus media advertising for Dell may play a lesser role in driving its overall revenue and, by extension, its firm value.

Variance decomposition

To measure the direct impact of advertising on firm value relative to other factors, we examine the forecast error variance of firm value (forecast error variance decomposition, FEVD). The FEVD calculates the contribution of the various covariates to the forecast variance of MBR. The results are presented in Table 5. This analysis is only meaningful for firms with significant elasticities from the IRF analysis.

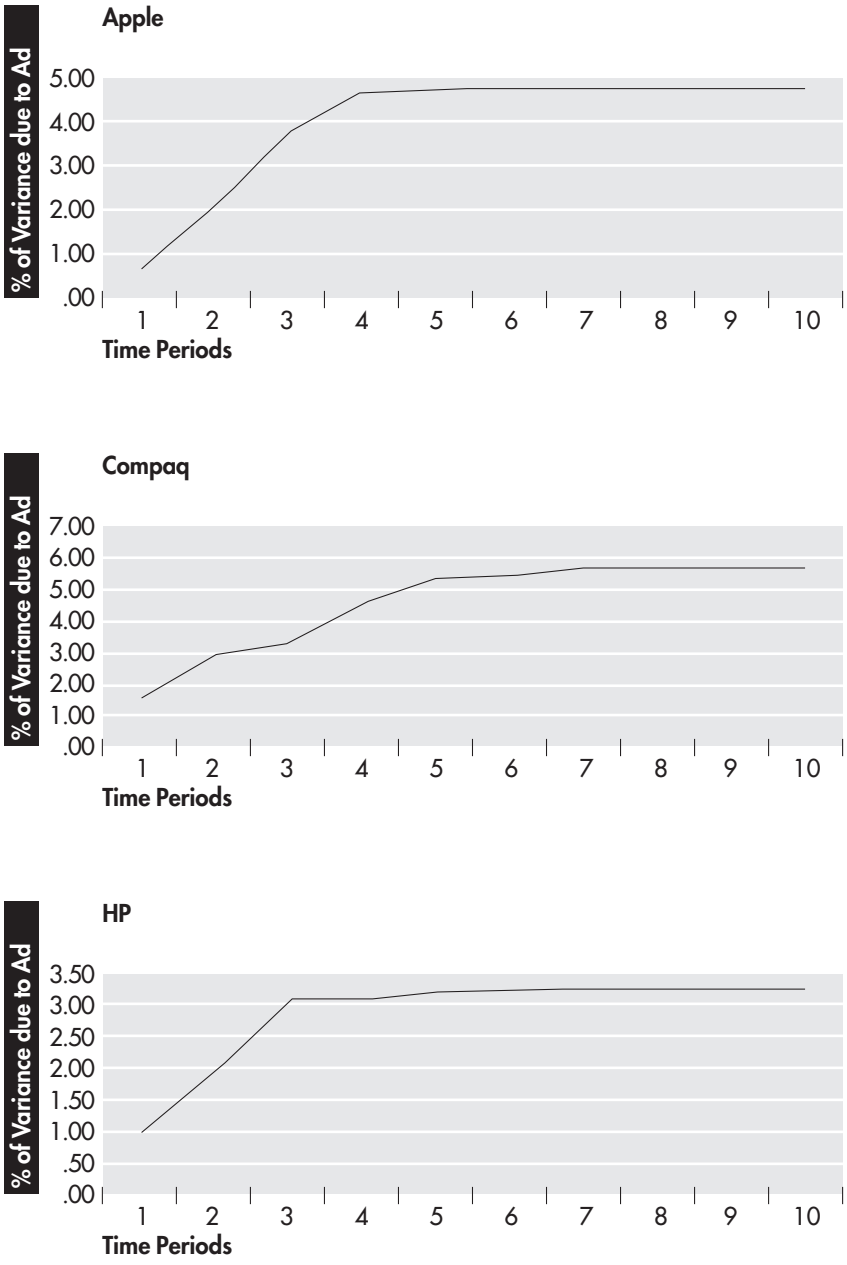
Table 5 shows that advertising expenditures initially have a small impact on MBR. In the first few periods after the impulse, firm value is largely determined by past value, as predicted by the random-walk model. However, the impact of advertising increases over time (Figure 4). Thus, for Apple, advertising explains only .569% of the forecast error variance in period 1 but 4.68% of the variance by period 8. Unlike the IRFs, the variance decomposition does not involve simultaneous shocking, and hence the percentages represented here indicate the impact of advertising on firm value *over and above* the impact of sales and profits.[5] In conclusion, we find that, in this evolving market, advertising shocks often increase firm value in the long run, and beyond the impact that may be expected from advertising's effect on revenues and profits.

Empirical validation

To check the validity of our model, we carried out two tests. The first test checks for the presence of structural breaks in the data. Since the data span a period of 10 years, structural breaks in one or more of the series could occur. If some of the series in our sample were composed of two stationary series separated by a structural break, the resulting series could appear to be evolving (Perron 1990). To guard against this, we carried out rolling-window unit-root tests (Smith and Taylor 2001; Pauwels and Hanssens 2004), in which a suitably long window of observations is selected (40 in this case), and the window is moved along the length of the series (120 for our dataset). All of the Dickey-Fuller (DF) statistics so obtained are then compared to the critical values to check for the presence of breaks. The rolling-window unit-root tests found no evidence of structural breaks in the data.

Second, we test for the possible effect of temporal aggregation in our series. While the market capitalization (MBR) and advertising series were available at the monthly level, sales, R&D, and profit series were only available quarterly. Using all series at the quarterly level causes a degrees-of-freedom problem, unless the data can be pooled across firms (Bass and Wittink 1975). Thus we re-estimated our VAR

Figure 4
Forecast Error Variance Decomposition



model in quarterly panel form, with 40 x 5 = 200 observations.

The poolability of the model was tested using the Chow F Test, extended to a system of equations (Chow 1960):

$$F = \frac{(RRSS - URSS)/r}{URSS/d},$$

where *RRSS* is the restricted (pooled model) sum of squared residuals, *URSS* is the sum of squared residuals in the unrestricted model (trace of the variance-covariance matrix), *r* is the number of linearly independent restrictions, and *d* is the number of degrees of freedom for the unrestricted model. For a model with firm-specific intercepts and fixed response effects, this test yields an *F*-value of 2.27, which is below the critical value of 2.4 at the 95% confidence level. Hence we conclude that the model is partially poolable, with firm-varying intercepts and common slopes (Equation 3).[6]

The R^2 in changes for the panel VAR model is .237, and the R^2 in levels is .939. The optimal number of lags, determined by the SBIC criterion, is 2. Further, the residual portmanteau test indicates that residuals are white noise. The most important confirmatory result is that the advertising elasticity of *MBR* is significant and positive (.007, *t*-statistic = 1.82).[7] Thus our generalized estimate of the long-run advertising effect on firm valuation is .007, and both the structural-break test and the temporal-aggregation test validate the results of our model.

Market Capitalization Projections

The estimated advertising elasticities may be used to project the change in market capitalization for various changes in the advertising level of firms with significant effects. These forecasts quantify the impact of advertising spending on firm value. Indeed, even though the elasticities are small in magnitude, they can translate into a substantial impact on market capitalization.

Table 6 shows the change in market valuation for a 100% increase in advertising spending. In projecting the market valuation figures, we adjusted for the increased advertising spending as well as for the effects due to the subsequent reduction in firm profits (and hence market value). Compaq and HP achieve gains in market value that exceed the loss from the implied reduction in profits in all the four years

$$\begin{bmatrix}\Delta Q_t\\ \Delta R_t\\ \Delta A_t\\ \Delta P_t\\ \Delta RD_t\end{bmatrix} = \left[\gamma + \beta_{Compaq} + \beta_{Dell} + \beta_{HP} + \beta_{IBM}\right] + \begin{bmatrix}\pi^1_{11} & \pi^1_{12} & \pi^1_{13} & \pi^1_{14} & \pi^1_{15}\\ \pi^1_{21} & \pi^1_{22} & \pi^1_{23} & \pi^1_{24} & \pi^1_{25}\\ \pi^1_{31} & \pi^1_{32} & \pi^1_{33} & \pi^1_{34} & \pi^1_{35}\\ \pi^1_{41} & \pi^1_{42} & \pi^1_{43} & \pi^1_{44} & \pi^1_{45}\\ \pi^1_{51} & \pi^1_{52} & \pi^1_{53} & \pi^1_{54} & \pi^1_{55}\end{bmatrix}\begin{bmatrix}\Delta Q_{t-1}\\ \Delta R_{t-1}\\ \Delta A_{t-1}\\ \Delta P_{t-1}\\ \Delta RD_{t-1}\end{bmatrix} + \ldots + \begin{bmatrix}\pi^J_{11} & \pi^J_{12} & \pi^J_{13} & \pi^J_{14} & \pi^J_{15}\\ \pi^J_{21} & \pi^J_{22} & \pi^J_{23} & \pi^J_{24} & \pi^J_{25}\\ \pi^J_{31} & \pi^J_{32} & \pi^J_{33} & \pi^J_{34} & \pi^J_{35}\\ \pi^J_{41} & \pi^J_{42} & \pi^J_{43} & \pi^J_{44} & \pi^J_{45}\\ \pi^J_{51} & \pi^J_{52} & \pi^J_{53} & \pi^J_{54} & \pi^J_{55}\end{bmatrix}\begin{bmatrix}\Delta Q_{t-J}\\ \Delta R_{t-J}\\ \Delta A_{t-J}\\ \Delta P_{t-J}\\ \Delta RD_{t-J}\end{bmatrix} + \begin{bmatrix}u_{Q,t}\\ u_{R,t}\\ u_{A,t}\\ u_{P,t}\\ u_{RD,t}\end{bmatrix} \quad (3)$$

of the simulation, while Apple gains in two of the four years. Overall, firms realize a net gain in market value by doubling their advertising spending in 10 of the 12 years projected. The results derive from the opposing forces of cost increases (profit reduction), revenue and profit enhancement, and brand-equity gains.

Table 6
Market Valuation Simulations

Apple

	Current MV*	MV Increase with Double Advertising	MV Loss Due to Reduced Profits	Net Gain
1997	$1.5 B	$22.6 M	$27.2 M	No
1998	$3.7 B	$56.2 M	$45.3 M	Yes
1999	$12.7 B	$191.8 M	$53.6 M	Yes
2000	$3.7 B	$56.8 M	$80.6 M	No

Compaq

	Current MV	MV Increase with Double Advertising	MV Loss Due to Reduced Profits	Net Gain
1997	$35.6 B	$335.2 M	$41.5 M	Yes
1998	$57.8 B	$543.7 M	$54.2 M	Yes
1999	$36.6 B	$343.6 M	$60.4 M	Yes
2000	$19.8 B	$185.9 M	$52.3 M	Yes

HP

	Current MV	MV Increase with Double Advertising	MV Loss Due to Reduced Profits	Net Gain
1997	$53.0 B	$243.8 M	$44.0 M	Yes
1998	$55.5 B	$255.6 M	$33.2 M	Yes
1999	$76.9 B	$354.1 M	$60.7 M	Yes
2000	$50.6 B	$232.9 M	$56.1 M	Yes

* Market valuation

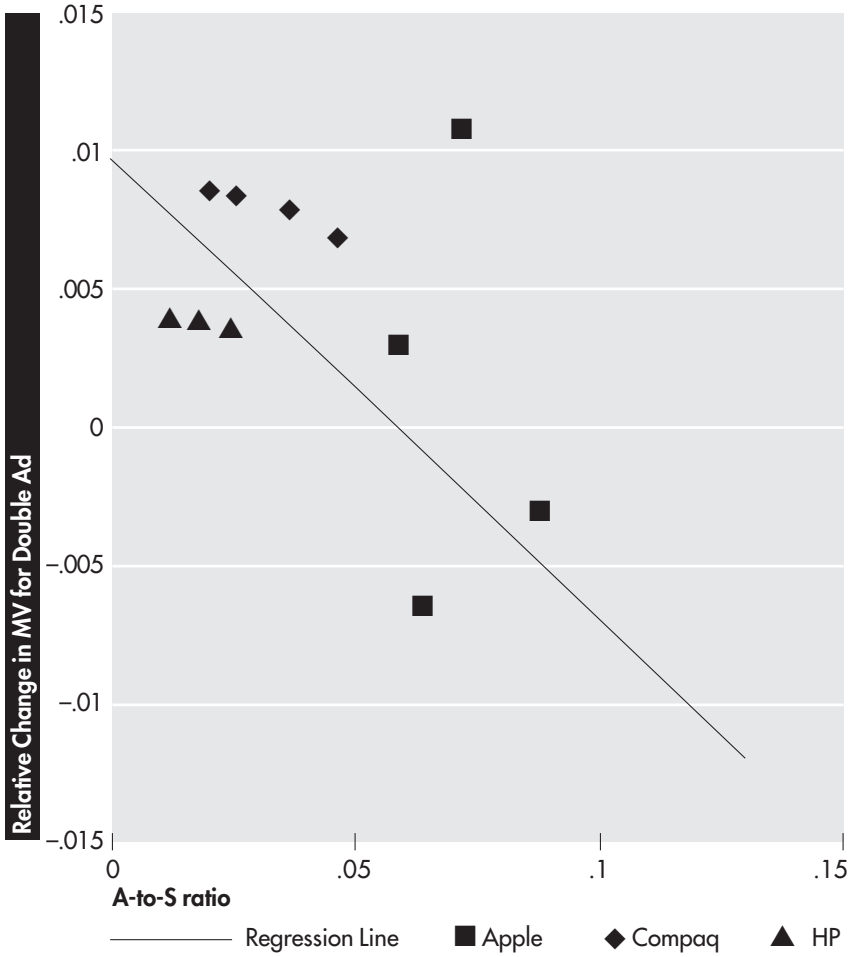
The decreasing-returns effect may be illustrated by examining the firms' advertising-to-sales (A/S) ratios. Figure 5 shows the projected net gains in market value against the firms' A/S ratios prior to doubling their advertising spending and the regression line between the two. As expected, advertising's impact on firm value decreases as the A-to-S ratio increases (the R^2 of the regression is .5). Thus an A-to-S ratio beyond .06 in our example does not provide net gains in market value, as exemplified by the results for Apple in 1997 and 2000. The only exception is Apple in 1999, where the firm has net positive change in firm value at an A-to-S ratio of .072. This result is conceptually similar to the finding that firms that buy market share may lose firm value in real terms (Montgomery and Wernerfelt 1991).

Conclusions and Further Research

This study has provided conceptual and empirical evidence of a relationship between advertising expenditures and the market value of firms. The results show that there is an investor response effect of advertising *over and above* its expected effects through revenue and profit sales increases. The pooled estimate of the investor response elasticity is .007.

Several of this study's limitations help set an agenda for future research. First, we have only studied one industry, PC manufacturers. A replication of the model in other industries and time periods will provide further cross-validation of the results. Second, this work may be

Figure 5
Market Valuation and the A/S Ratio



extended to the differential impact of advertising media on market valuation. Third, our dataset was limited: As in most valuation studies, revenue and profit data are *aggregated* to the firm level, i.e., they are not broken down by division. When applied to *tracking* stocks, where there is a closer match between the product category and the corporate identity, our approach may reveal higher advertising-to-market-value elasticities. Similarly, our advertising data did not include a breakdown of spending on product advertising versus brand-image advertising.

Nevertheless, our results succeed in linking advertising directly to firm value, and thus they underscore the importance of building intangible assets. The direct relationship between advertising and firm value provides managers with a new, more comprehensive metric of advertising effectiveness, firm value. Even though its investor-response elasticity is small in magnitude, advertising can change the market capitalization of firms to the tune of hundreds of millions of dollars.

Our findings open up several areas for further research. Among these, the presence of a long-run effect of advertising on the market value of a firm, possibly through the creation of brand equity, suggests that any action that grows brand equity may affect firm value. Thus, order of entry, distribution intensity, or even choice of media may be hypothesized to affect the brand equity of a firm and thereby its market value. Another area of interest is the possible relationship between the quality of advertising execution and its impact on firm value. Anecdotally, Apple is highly regarded for its advertising campaigns. Its "1984" advertisement was rated the "Best Ever Super Bowl Ad" by ESPN and won a CLIO award (CLIO is the world's largest advertising competition). Between 1990 and 1998, various Apple advertisements won 23 CLIO awards in various categories, compared to 1, 0, 7, and 11 awards for Compaq, Dell, HP, and IBM respectively. Future research should examine to what extent such differences in perceived advertising quality influence the investor community. ■

Notes

1. In a time-series context, we know from the finance literature that MBR will have a random-walk component, so the VAR models will be specified in differences (Δ) or a mixture of levels and differences. In what follows, we assume the former.

2. The model given here is valid when there exists one cointegrating equation in the system.

3. These systems may be augmented by exogenous vari-

ables in practice. For ease of exposition, exogenous variables are not shown in equations 1 and 2.

4. We also estimated the models using the full S&P 500 and obtained similar results.

5. Cholesky decomposition was used to estimate FEVD. The results are not sensitive to the ordering of the variables.

6. In Equation 3, the β_j's represent (5 x 1) company-specific dummy variables. Thus, β_{Compaq} is 1 when variables correspond to Compaq and 0 otherwise. γ is the common intercept term.

7. Significant at $p < .05$ for a one-tailed test.

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