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The authors investigate whether movement in a firm's stock price, that is, a measure of firm value, is associated with information contained in perceived quality measures. In a model that also allows for the effect of economywide factors and a firm's return on investment, they find a positive relationship between stock return and changes in quality perceptions. These results imply that the quality measure contains information, incremental to that reflected by current-term accounting measures, about future-term business performance. They suggest that managers should convey information to the stock market, such as the brand's quality image, useful in depicting the long-term prospects of the business. By doing so, the stock market will rely less on short-term measures of business performance, and managers will be freer to undertake strategies necessary for ensuring the long-term viability of their firms.

The Financial Information Content of Perceived Quality

Many U.S. firms have lost market share to foreign competitors and some (e.g., in the consumer electronics industry) have been driven out of the market completely. One of the more widespread explanations for U.S. business's loss of competitive vigor relates to U.S. managers' emphasis on short-term financial gains. In contrast, their foreign, in particular Japanese and German, counterparts are said to focus on long-term profitability. The MIT Commission on Productivity (Dertouzos, Lester, and Solow 1988) studied firms in eight major industrial sectors and concluded that an excessive preoccupation with immediate profit, to the extent of sacrificing long-term opportunities, is one factor responsible for U.S. business's loss of competitiveness. Sony founder Akio Morita (1986) is one of many observers who contend that most U.S. corporate managers unduly emphasize short-term profits rather than making products competitive over the long haul.

Many analysts of business performance blame this short-term orientation on the pressure that the U.S. financial markets place on managers for short-term results. The stock market does react, at times dramatically, to current-term accounting profits. Stock prices increase (decrease) following announcements of favorable (unfavorable) quarterly earnings. Studies of decision rules of when to sell stocks highlight "sell when 12-month earnings decline" as one of the best performing rules of thumb. The implication for managers is either get current-term earnings up or lose investor confidence. Managers adopt a current year/current quarter management style in response to the return objectives and incentives of stock market participants. Shareholders replace nonresponsive managers.

Still, the idea that the financial markets induce myopic management behavior, in spite of its widespread popularity, is not without its critics. The corporate entity has an indefinite life. As such, the claims of shareholders trade not just on current-term results but on the future stream of earnings. That is, stock prices are determined by the discounted value of expected future cash flows. The market reacts to current-term results (such as earnings announcements) because they supply not just information pertaining to the current term but also information about future-term prospects as well. As long as a series has a nonzero autocorrelation, then a shock to that series will not dissipate immediately. Current-term results will tend to have future-term implications and, therefore, affect the long-term value of the firm.[1]

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[1]Miller and Rock (1985) depict the change in market value induced by a shock to current earnings as equaling $[1/(1-_{(1}\Phi_{+r)})]$, where ϕ is the autocorrelation of the series and r is the discount rate. The greater the autocorrelation of the series and the lower the discount rate, the greater the market reaction to current-term shocks.

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Hamel and Prahalad (1989) contend that the so-called "short-term orientation of the financial markets" simply reflects market participants' lack of confidence in managers to conceive and deliver on tough goals. They believe (p. 76) that "investors aren't hopelessly short-term, they are justifiably skeptical of top management." In the absence of credible alternative measures, stock market participants rely on current-term financial measures (such as earnings and return on investment [ROI]) as indicators of long-term business prospects.

Indeed, current-term financial measures oftentimes fill a vacuum and come to dominate performance measurement. This reliance on current-term measures can induce a short-run (myopic) management style. Often the strategies that enhance long-term performance, and are essential for long-term competitiveness, diminish current-term earnings. In the absence of convincing indicators of long-term performance, managers may be reluctant to undertake activities that adversely affect current-term financial measures.

Can information about long-term business prospects, incremental to that contained in current-term earnings measures, be monitored and communicated systematically to shareholders? This research focuses on the financial information content of customer perceptions of perceived quality, an intangible widely regarded as a key strategic asset. A host of firms have quality as a focal point of their corporate philosophy—for example, Ford's "Quality Is Job 1" and Asahi Breweries' "quality first" principles. Indeed, Aaker (1989), in a study in which 248 businesses were asked to identify their competitive advantage, found that "quality perception" was the most frequently mentioned response. Although often attributing their long-term success to an emphasis on creating high-quality products and services, many firms have found it difficult to communicate the progress of a strategy based on quality to shareholders. For example, James Houghton (1992), chief executive officer of Corning, indicates that his company's total quality program, which was a major strategic thrust for Corning during the 1980s, was virtually impossible to defend on the basis of its impact on current profitability measures.

We explore whether information contained in perceived quality measures is associated with movements in a firm's stock price. In effect, we test the joint hypothesis that (1) product quality influences long-term business performance, (2) stock market participants realize that product quality influences long-term performance, and (3) measures of product quality contain some information; that is, measurement error (noise) does not dominate the underlying signal. If an effect is found, not only will it provide evidence as to the long-term benefits of perceived quality, but it also will cast doubt on the assumption that shareholders prefer short-term results over investments in assets yielding delayed payoffs. As such, those attempting to justify product quality investments would be encouraged to develop and monitor measures of their progress.

The Need for Indicators of Long-term Business Prospects

The market signaling literature (e.g., Miller and Rock 1985; Narayanan 1985; Stein 1989), indicates that in the presence of asymmetric information about business performance (i.e., managers know more about long-term prospects than do investors) incentives typically exist for myopic management behavior. That is, managers will have a discount rate higher than that justified by cost of capital considerations and therefore will unduly lower the value of investments with long-term paybacks. Stein (1989, p. 664) notes that it is "those investments that are most easily summarized on an accounting statement which are least likely to be sacrificed in the quest for higher stock price." Conversely, investments in intangible assets, such as a brand's equity or quality image, which are more problematic to measure and quantify, are more difficult to disentangle from increased operating expenses. As a result, Stein (1989) posits that managers likely will sacrifice these expenditures in an effort to inflate current-term results. These expenditures may diminish a firm's current-term profits and, in the absence of alternate signals, will be extrapolated by stock market participants to signal lower future-term profits as well.

As such, it is tempting to withhold, postpone, or reduce investments in perceived quality (e.g., quality circles, redesign efforts, communication with current and potential customers about quality improvements) because of a lack of effect, or even negative effect, on current-term accounting performance measures. A focus on programs that generate short-term results is often more appealing than nurturing brand assets. Improving the efficiency in operations, for example, in purchasing, manufacturing, promotions, and logistics, typically has a stronger short-term payoff component.

If a firm is to reduce the importance that the stock market places on short-term financial measures, it must provide evidence that a long-term strategy is in place and credible measures are being used to monitor that strategy. Managers wishing to develop and nurture assets that will generate competitive advantage and future-term profits (but may erode current-term performance) must justify these investments to stakeholders and monitor their effects. In most cases, the assets and skills crucial to future success (e.g., a new product capability, brand equity, perceived quality) are intangible and do not appear on a balance sheet. Systematically reporting measures of such assets and skills, perhaps as off-balance sheet entities, would lead to increased attention to long-term investments in people and programs both by management and by shareholders. Indeed, the American Institute of Certified Public Accountants recently has recommended that financial statements include more "soft" information.

Information Content

Beginning with Ball and Brown (1968), an extensive literature in accounting has evolved around testing the "information content" of a series. Information content refers to the association of stock market return to movement in a given series. Market efficiency implies that the price of a stock reflects all available information relating to the profitability of the corporation. That is, the price of a security reflects market expectations of the discounted value of the

firm's future cash flows:

$$P_t = \sum_{\tau=t}^{\infty} \left(\frac{1}{1+r}\right)^{\tau-t} E(X_\tau),$$

where P_t is the with dividend stock price at time period t, X_τ is the net cash flow at period t, and r is the appropriate discount rate for the market expectation of the firm's future cash flows. Favorable (unfavorable) movements in a series affecting cash flow tend to result in an increase (decrease) in stock prices. The percent change in the stock price (i.e., $StkR_{it} = (P_{it} - P_{it-1})/P_{it-1}$) reflects market expectations of the long-term financial impact of a change in a series. As such, relating movements in a series—for example, quality perceptions—to stock return provides insights into market expectations of the long-term effects of the change.

This method of analysis is similar in spirit to "event studies," which link stock return to a specific event or announcements. For example, Horsky and Swynedouw (1987) link stock return to announcements of company name changes, and Chaney, Devinney, and Winer (1991) relate stock return to new product announcements. The "information content" analysis we use differs from event study analysis in that rather than assessing market reaction to a single event, we relate stock return to a stream of events, that is, changes in customer perceptions of product quality.

THE DATA[2]

Empirically investigating the information content of product quality requires matching quality perception data to stock return. We focus not on "actual" quality but rather perceived quality. A good quality reputation is usually based on achieving a high level of quality. Just delivering quality, however, is not enough. Several firms (e.g., Schlitz Beer, which never could recover from a short-lived quality problem in the mid 1970s; Audi, which continues to struggle in part because of the "sudden acceleration problem" that long since has been corrected) have found that perceptions of quality must be created for the firm to realize a competitive advantage (Aaker 1991).

To control for the effect of current-term earnings information, we also require accounting information. The inclusion of accounting information serves two important functions. First, it removes the omitted variable bias that would stem from current-term earnings jointly affecting both product quality and stock return (i.e., firms with higher earnings will see their stock price increase and have more discretionary funds to spend on activities to improve perceptions of quality). Second, inclusion of current-term earnings allows for the testing of incremental information content. At issue is not merely the question of whether changes in perceived product quality supply information about future-term performance, but rather whether changes in product quality perceptions supply information about future-term performance above and beyond the information contained in current-term earnings measures.

A possibility exists that any association of perceived quality with stock return might be reflected better by information contained in other, perhaps more readily accessible, marketing variables. To assess this possibility, our analysis also takes into account the potential information content of advertising expenditures and brand awareness. Although Erickson and Jacobson (1992) provide evidence that the information content of advertising is reflected fully in current-term ROI, its inclusion in the model ensures that we control for its potential long-term effect, which may influence changes in quality perceptions. The inclusion of the awareness (salience) of a brand is important in that there may be a tendency for people to be more positive about brands they know. As such, it would be useful to separate a market reaction associated with quality improvements from one stemming from increases in salience.

Aggregate Quality Perceptions

The product quality measures used in our analysis come from the EquiTrend study of Total Research Corporation. The EquiTrend survey first was undertaken in November 1989 and then continued during January and February for 1991, 1992, and 1993. The survey involved telephone interviews of a nationally representative sample of consumers 15 years of age and older in 1000 U.S. households in 1989 and then for 2000 households for the subsequent waves of the survey. The survey investigated the perceptions and feelings about the quality of 100 major brands in 33 product and service categories.[3]

Consumers were asked to evaluate the quality of each brand on an 11-point scale from outstanding, extraordinary quality (10) to quite acceptable quality (5) to unacceptable, poor quality (0). If they had no opinion about the brand, they so indicated. Total Research Corporation calculates its perceived quality measure as the average perceived quality rating for those respondents who had an opinion about the brand. Although Total Research Corporations views this overall quality measure as "the single most important EquiTrend measure," a primary objective of the survey is to measure brand equity on a dynamic basis. In this context, in addition to its aggregate quality measure, it obtained information pertaining to brand awareness and customer loyalty/satisfaction. As such, the survey provides indicators of three of the four brand equity dimensions (the fourth dimension being brand associations) highlighted by Aaker (1991).

Quality Perceptions of Those Who Use the Brand Most Often

The respondents also were asked the last time they personally used each of the product and service categories. For categories they had used in the last three years, they were asked which brand they used most often in that category. This enabled Total Research Corporation to calculate quality perceptions of a brand among people who use the brand most often, a measure labeled "User Satisfaction" in the EquiTrend survey. For example, for Pepsi, the measure represents the quality perception of Pepsi among consumers who drink Pepsi more often than any other carbonated soft drink.

[2]Appendix A provides a listing of each variable used on the analysis.

[3]Some additional brands were included in the later years' surveys. However, only the 100 brands included in all four years were candidates for inclusion in our analysis.

As such, the EquiTrend data provides two quality measures—an aggregate quality rating (Quality) and a quality rating for those using the brand most often ($Qual^{most}$). The availability of these two quality measures enables us to test for a differential effect of the quality perceptions for those using the brand most often versus those who do not, which includes the perceptions of consumers using another brand more often and those consumers who have an opinion about the brand name but who do not use the product category. Although scenarios exist to suggest differing effects, we expect the quality perceptions of both groups to affect long-term business performance and therefore stock price.

We should note, as does Total Research Corporation, that the measure of quality for those using the brand most often, because it is based on far fewer responses than aggregate perceptions (particularly for small market share brands), is subject to concerns stemming from measurement error. This measurement error will bias its estimated association with stock return (as well as other measures) toward zero. As such, although we make use of the $Qual^{most}$ measure, this caveat suggests that the aggregate measure may be more informative regarding the quality image of the brand.

Salience

The salience (i.e., awareness) measure contained in the EquiTrend survey depicts the proportion of consumers who have an opinion about a given brand. Clearly, salience is a more demanding (and for large brands more sensitive) measure of awareness than is brand recognition or recall, two commonly used measures. Salience is also likely to be a sensitive awareness measure for the major brands involved in this research, which are characterized by high levels of recognition and recall.

Stock Return

The stock return data comes from the University of Chicago's Center for Research in Security Prices (CRSP) daily data files covering the NYSE, AMEX, and NASDAQ stock exchanges. CRSP calculates stock return on the basis of dividend distributions and through the change in the market value of the stock [(Market Value of $Stock_t$ + $Dividends_t$ – Market Value of $Stock_{t-1}$)/Market Value of $Stock_{t-1}$].

ROI and Advertising

Standard and Poor's Compustat data tapes provide annual accounting information for companies traded on the NYSE, AMEX, and NASDAQ stock exchanges. We use these data to construct our ROI and advertising expenditure (including both media and promotional expenses) measures. We divide the series by the firm's assets at the beginning of the fiscal year to adjust for size effects. Firms selected for the analysis were required to have a December 31 fiscal year to ensure a temporal correspondence for the accounting data reported across firms in the study.

MERGING THE DATA

Measurement Periods

Although the availability of daily stock return data gives us considerable flexibility in defining the measurement period to link the variables, choosing the periods is not an unambiguous process. At issue is deciding when market participants incorporate information. For this analysis we calculate the stock return for the period up to the month the EquiTrend survey began. We make the assumption that throughout the year the market incorporated information about product quality into the price of the stock. That is, we assume that market participants incorporate information about changes in product quality as they occur and this information will be reflected in the EquiTrend survey results.[4] Table 1 summarizes the measurement dates that we use to link changes in responses across waves of the EquiTrend survey to stock return data.

Table 1
DATABASE MEASUREMENT DATES

Compustat (Fiscal Year Ending)	*EquiTrend*	*CRSP*
Dec. 1989	Wave I: Nov 1989	
Dec. 1990	Wave II: Jan.–Feb. 1991	Nov 1, 1989–Dec. 31, 1990
Dec. 1991	Wave III: Jan.–Feb. 1992	Jan. 1, 1991–Dec. 31, 1991
Dec. 1992	Wave IV: Jan.–Feb. 1993	Jan. 1, 1992–Dec. 31, 1992

By using this time period our stock return measure occurs *immediately prior* to the EquiTrend survey; therefore, it is impossible for the EquiTrend survey to "cause" the changes in stock price. As such, our analysis assesses whether the EquiTrend measures are correlated with information that influences stock prices. Because market participants should make use of information about product quality information (to the extent that it influences expectations of future earnings) as it becomes available, stock prices should reflect information that will be contained in the EquiTrend survey. Our analysis will be biased toward not finding an association between stock return and quality perceptions to the extent that the market has not fully incorporated the information subsequently reported in the EquiTrend survey. However, changing the dates for our stock return measure to include the months up to the end of the EquiTrend survey does not affect our results.

Because our Compustat data is reported on a year-end basis, we have a misalignment for the accounting data for the initial period. That is, we would like to have had accounting data for the period October 31, 1989 through December 31, 1990. However, one would suspect that this misalignment will not substantially affect the results, as the misalignment is only for a two-month basis. Given the substantial overlap with the measure we have, a very large correlation will exist for the 12-month accounting measure we have versus the 14-month measure that would place the data in alignment. Sensitivity analysis—that is, deleting the first year of

[4]We should note that our analysis is not an event study. That is, we do not assess the market reaction to the release of the EquiTrend survey results. In the absence of estimates of market expectations of the EquiTrend results, and given the implausibility that market participants do not make use of other information pertaining to product quality that becomes available between EquiTrend surveys, we are precluded from this type of analysis.

Table 2
CORPORATIONS INCLUDED IN ANALYSIS

AMR	American Express	AT&T	Avon
BIC	Chrysler	Citicorp	Coke
COMPAQ	Kodak	Exxon	Ford
GTE	Gillette	Goodyear	Hershey
Hilton Hotels	IBM	Kellogg	MCI
Marriott	Mattel	MacDonald's	Merrill Lynch
Pepsi	Polaroid	Reebok	Rubbermaid
Sears	Texaco	United	VF Corp
Volvo	Wendy's		

Descriptive Statistics

	Mean	*Standard Deviation*	*Median*	*10 Percentile*	*90 Percentile*
Stock Return	.103	.437	.150	−.511	.600
Quality	6.80	.685	6.83	5.96	7.76
$Qual^{most}$	8.00	.621	8.03	7.28	8.62
Salience	.753	.174	.778	.453	.952
ROI	.064	.065	.056	−.004	.149
Adv	.068	.073	.0348	.009	.205

data and using only observations in which all three databases are in alignment—confirms our supposition that the two-month misalignment for the accounting data in 1989 does not affect our results.

Selecting Firms for Analysis

The first aspect of our selection process involved obtaining a match between the EquiTrend, CRSP, and Compustat samples. Of the 100 brands included in the EquiTrend sample, 45 were from companies with a December fiscal year covered by Compustat (as well as CRSP) for the period 1989–1992. The 55 brands not reported on included privately held companies (e.g., Levi Strauss, Macy's, Mars), foreign companies not traded on U.S. stock exchanges (e.g., Daimler Benz, Nestlé), companies taken over during the period (e.g., Kraft General Foods, Nabisco), and firms with a noncalendar year fiscal year (e.g., Apple Computer, Campbell Soup). Of the 45 remaining brands/companies, 11 more were deleted from the analysis on the basis of our view that the brand represented too insignificant a portion of the companies' business. For example, the Aquafresh and Theragram brands were not included in the analysis because they represented such a small part of, respectively, Smithkline Beecham's and Bristol Myers Squibb's revenues that it would be virtually impossible to isolate an effect when related to the corporate-level stock return measure. As a result of this screening, a total of 34 brands remained in the data base.

The fact that a given brand may be associated with only a fraction of a firm's profits, and therefore stock price, limits the ability to detect an effect. That is, though estimates will be unbiased, the impact of other elements of the corporation induces additional noise into the system and, as such, reduces statistical power. We hope to limit the noise and increase power by selecting brands that account for a relatively significant proportion of firm earnings. Detecting an effect would indicate that we have a sufficient signal to noise ratio; however, failure to detect an effect could stem from either absence of an effect or insufficient signal.

This argument assumes that the corporate stock return measure is an error-ridden indicator of the profitability of the "central" brand. Another way of viewing the problem is that to the extent that the brand-level measures differ from the corporatewide measures, our brand-level explanatory variables will be subject to measurement error. This creates a bias toward finding no association. Once again, caution must be exercised in interpreting an empirical finding of no association. Finding a significant association would suggest that the information content in the measures overcomes the underlying noise in the data.

Table 2 lists the firms included in our study and descriptive statistics for the variables. Clearly, our sample is not representative of the population of U.S. firms. In particular, it deals exclusively with major brands—for example, the mean salience for the brands is approximately 74%. Although this fact limits the generality of our results, some universality can be expected. Furthermore, brands in our sample are among the most important in the country and, as such, are of importance in their own right.

MODELING THE DATA

The Unanticipated Component of a Series

The efficient markets hypothesis posits that stock return will be uncorrelated with any information observed in a previous period; that is, stock prices follow a random walk. Market participants incorporate all available information into the current price of the stock. As such, only unanticipated variables should exhibit an association with stock return. An extensive literature in this area has concluded that the manner in which stock prices react to information is in close correspondence with this hypothesis. The key consideration is the extent to which a measure deviates from its expected value.

Table 3
FIRST ORDER AUTOREGRESSIVE TIME SERIES MODELS

	R2	Regression Std. Error	#obs*
Equation 3.1:			
$ROI_{it} = .016 + .005*YR91 - .004*YR92 + .682*ROI_{it-1} + \xi_{it}$ (.011) (.013) (.013) (.080)	.42	.053	102
Equation 3.2:			
$Quality_{it} = .087 + .075*YR91 + .078*YR92 + .980*Quality_{it-1} + \xi_{it}$ (.148) (.036) (.036) (.022)	.96	.149	102
Equation 3.3:			
$Qual^{most}_{it} = 3.09 - .070*YR91 + .083*YR92 + .613*Qual^{most}_{it-1} + \xi_{it}$ (.56) (.102) (.102) (.069)	.45	.422	102
Equation 3.4:			
$Salience_{it} = .0166 + .046*YR91 - .037*YR92 + .979*Salience_{it-1} + \xi$ (.002) (.003) (.003) (.016)	.98	.027	102
Equation 3.5:			
$Adv_{it} = -.0001 + .0003*YR91 + .005*YR92 + .995*Adv_{it-1} + \xi_{it}$ (.002) (.003) (.003) (.016)	.98	.011	83

Standard errors in parentheses

*The number of observations in Table 3 differs from the total number of observations (i.e., 136—34 firms for 4 years) because the use of a lagged value in the Table 3 analysis necessitates the deletion of the first year of data for each firm. The advertising equation has fewer observations because not all firms reported advertising expenditures for all years.

Two basic approaches have been used in obtaining measures of the unanticipated components of series (Cornell 1983). One approach uses survey data of market expectations; unanticipated measures are defined as the difference between the actual value and the survey measure. In the absence of survey measures, or because of problems associated with obtaining accurate estimates of market participants' expectations, the other widely used approach, based on forecasts from time series models as a proxy for expectations, is used: The difference between the actual and predicted values, that is, the regression residual, serves as an estimate of the unanticipated component.

Because survey measures of stock market participants' expectations of product quality are unavailable, we use the latter approach. Table 3 reports the results from estimating a first-order autoregressive model pooling the 102 time series and cross-sectional observations for each series; that is, a model of the form $X_{it} = \phi*X_{it-1} + \xi_{it}$. To allow for economy-wide differences across years, the model also includes categorical (dummy) variables to capture yearly differences.

We find that a random walk approximates the time series properties of quality, salience, and advertising. For each of these three series, we could not reject the hypothesis that the series had a unit root, that is, the first-order autoregressive coefficient is indistinguishable from 1.00. The autoregressive coefficient for ROI, .682, being significantly different from 1.00, is consistent with (1) the premise that ROI is mean reverting and (2) estimates of the autocorrelation of ROI reported elsewhere (e.g., Jacobson 1990). The fact that the estimated autocorrelation of $Qual^{most}$ (.613) is significantly less than that of Quality (.980) suggests two different interpretations. One explanation is that quality perceptions for those using the brand most often are less persistent than aggregate quality perceptions. The other interpretation is that, as previously discussed, the $Qual^{most}$ measure is subject to greater measurement error because it is based on far fewer observations than aggregate perceptions. This measurement error induces a downward bias in the estimated autoregressive parameter.

Assessing Information Content

Having estimated the time series models for each series, we then relate the time series residuals generated from the autoregressive models in Table 3 (i.e., estimates of the unanticipated component of the series) to stock return. Our basic model is

$$Stkr_{it} = \beta_0 + \beta_1*x_{it} + \varepsilon_{it},$$

where $Stkr_{it}$ is the stock return of firm i for time period t, and x_{it} is the time series residual (i.e., unanticipated component) for series X_{it}.

Some of the factors reflected by the error term ε_{it} may be specific to a particular firm. As such, we can express the error term as $\varepsilon_{it} = \alpha_i + \eta_{it}$, where α_i is an unobserved firm-specific factor and η_{it} is a white-noise error term. This structure of the error term induces a block diagonal variance-covariance matrix, which requires the use of generalized least squares (GLS). Although both ordinary least squares (OLS) and GLS estimation generate consistent coefficient estimates, the reported standard errors from OLS estimation

Table 4

THE INFORMATION CONTENT OF QUALITY PERCEPTIONS
GENERALIZED LEAST SQUARES RESULTS*

	R2	Regression Std. Error	#obs*
Equation 4.1:			
$Stkr_{it} = -.229 + .582*YR91 + .415*YR92 + 2.146*roi_{it} + .694*quality_{it} - .118*salience_{it} + \varepsilon_{it}$	.46	.397	102
(.055) (.071) (.071) (.590) (.212) (1.136)			
Equation 4.2:			
$Stkr_{it} = -.246 + .631*YR91 + .464*YR92 + 1.774*roi_{it} + .757*quality_{it} - .566*salience_{it} - 1.875*advi_{it} + \varepsilon_{it}$	.49	.401	83
(.060) (.077) (.077) (.611) (.259) (1.248) (3.244)			
Equation 4.3:			
$Stkr_{it} = -.229 + .582*YR91 + .415*YR92 + 2.132*roi_{it} + .639*quality_{it} + .072*qual^{most}_{it} - .090*salience_{it} + \varepsilon_{it}$	.46	.394	102
(.055) (.071) (.071) (.586) (.219) (.075) (1.128)			

Correlation Matrix

	Stkr	roi	quality	salience	$qual^{most}$	adv
Stkr	1.00					
roi	.29	1.00				
quality	.24	.07	1.00			
salience	.01	.10	–.08	1.00		
$qual^{most}$	.12	.03	.26	–.05	1.00	
adv	.01	.18	.09	.10	.13	1.00

standard errors in parentheses

*Differing sample sizes and/or GLS transformation make it inappropriate to compare summary diagnostic statistics (e.g.,R^2) across equations, because the dependent variable is not identical across equations. However, because the estimated GLS transformations are nearly identical across equations, we include regression summary statistics in the table.

programs will be biased. The GLS model not only generates consistent standard errors but is also asymptotically efficient. Maddala (1977) details the procedures for obtaining estimates of the GLS transformation used to model panel data with a block diagonal variance-covariance matrix—that is, the random effects model.

EMPIRICAL ANALYSIS OF INFORMATION CONTENT

Our first model involves relating stock return to unanticipated ROI, quality, and salience, that is, the residuals from Equations 3.1, 3.2, and 3.4 of Table 3. The model also includes annual dummy variables to capture the effect of economywide economic factors on stock performance. General economic factors tend to make the total stock market rise and fall and thus affect the performance of all stocks.

Equation 4.1 of Table 4 reports the results of this estimation.[5] We find that economywide effects (i.e., the coefficients for YR91 and YR92) are statistically significant, reflecting the fact that stocks performed better in 1991 and 1992 than in 1990. The significance of unanticipated ROI indicates that the performance of an individual stock does not depend solely on economywide factors; rather it also depends on firm-specific financial performance, which is depicted in part by the accounting ROI measure. The significant coefficient indicates that the market reacts favorably to those firms with an increase in ROI. This finding of a positive effect is consistent with an extensive literature on the information content of accounting information and "earnings surprises" (Lev 1989).

The magnitude of the ROI effect (2.146) is not out of line with the ROI response coefficient reported in other studies. For example, Jacobson (1987) estimates (on the basis of an analysis of 241 firms for the period 1964–1982, or 4338 total observations) the effect of an ROI shock on stock return to be 3.19. Using an ROI measure based on market value of assets rather than book value of assets, Kormendi and Lipe (1987) report (on the basis of analysis of 145 firms for the period 1947–1980) a mean earnings response coefficient of 3.38 and a median response coefficient of 2.50. The correspondence of our estimated earnings response coefficient to estimates generated from larger samples suggests that our sample of 34 firms has properties representative of a broader range of firms.

The market reaction to current-term ROI changes does not mean that investors are short-term oriented. Rather, as discussed previously, the market reaction is consistent with the premise that market participants are concerned with future-term profitability and that a change in ROI supplies a signal of future-term prospects. As evidenced by its time series model, a change in ROI tends not to dissipate immedi-

[5]Consistent with efficient markets, we cannot reject the hypotheses that the residuals from Equation 4.1 approximate white noise (i.e., stock return is serially uncorrelated) and that the anticipated components of the series (i.e., the predicted values from the autoregressive models) are unrelated to stock return.

ately; rather, it persists over several time periods. The market reaction to ROI reflects the fact that it provides information about future-term profits.

Does perceived quality supply incremental information to that contained in ROI about future-term business performance? The fact that the estimated coefficient for unanticipated quality (.694) is significant at above the 1% level indicates that the quality measure provides useful and nonoverlapping information about the future-term prospects of the firm. Indeed, the low correlation (.07) indicates that little overlap exists between the information contained in the unanticipated ROI and quality measures. Current-term improvements in quality perceptions are not reflected in current-term profitability. This lack of association can be explained in part by the widely discussed (e.g., Fisher and McGowan 1983) deficiencies (noise) in the ROI measure, which limit the power of tests to detect underlying relationships, and in part because current improvements in quality can be costly and, as such, adversely effect current-term ROI.[6] However, the significant association of quality with stock return implies that quality improvements affect stock market participants' expectations of future-term profitability.

Indeed, the information content of quality appears considerable. The standardized regression coefficient for unanticipated quality (.23) compares with that of unanticipated ROI (.25). Even to those acknowledging that market participants make use of nonfinancial information, the relative explanatory power of perceived quality has to come as a surprise given the emphasis analysts and past research studies have placed on the information content of earnings.

Because Equation 4.1 includes salience (awareness), we can reject the hypothesis that the quality/stock return association arises from the joint impact of salience on both variables. The salience measure appears to contain little, if any, information content. The coefficient for salience is small (–.118) and statistically insignificant. This lack of association suggests that either market participants do not consider increases in awareness to be associated with increases in future-term profitability (perhaps in part because increases in salience sometimes involve negative information) or the noise in the series dominates the information contained in the salience measure.

The Role of Advertising

Equation 4.2 of Table 4 investigates whether advertising can explain away the association between quality and stock return. The results, which are based on fewer observations than are used in Equation 4.1 because the Compustat database does not report the advertising expenditures for all the firms in our sample, indicate that the association of stock return with quality does not stem from a joint association with advertising. The coefficient for quality (.757) in Equation 4.2 remains statistically significant (indeed, in close correspondence to that reported in Equation 4.1) even after allowing for the effects of advertising. It is the coefficient for the unanticipated advertising that is insignificant. The insignificance of the advertising term does not necessarily mean that the market fails to react to advertising expenditures. Rather, our results show the market to react to advertising expenditures to the extent that they influence current-term ROI. That is, consistent with Erickson and Jacobson's (1992) study, we find no incremental information content in advertising above that reflected in current-term ROI.

Differential Effects

To test the hypothesis of differential effects, (i.e., that the quality perceptions of those using the brand most often have a different effect on stock return from the quality perceptions of those not using the brand most often [$Qual^{nmost}$]), we include the $Qual^{most}$ measure into the analysis along with the quality measure. Under the null hypothesis, the coefficient for $Qual^{most}$ should be insignificantly different from zero in a model that also includes the aggregate quality measure. This can be noted by considering a model of the form

$$(1) \qquad Stkr = \beta^*Quality + \varepsilon.$$

Equation 1 can be reexpressed, given that Quality is the weighted average of $Qual^{nmost}$ and $Qual^{most}$ (with weights P and (1–P), respectively), as

$$(2) \qquad Stkr = \beta^*[P^*Qual^{nmost} + (1–P)^*Qual^{most}] + \varepsilon.$$

Rearranging terms enables us to reexpress Equation 2 as

$$(3) \qquad Stkr = \beta^*[P^*(Qual^{nmost} – Qual^{most}) + Qual^{most}] + \varepsilon.$$

Noting that $Quality = P^*(Q^{nmost} – Q^{most}) + Q^{most}$ and substituting yields

$$(4) \qquad Stkr = \beta^*[(Quality – Q^{most}) + Q^{most}] + \varepsilon$$

or

$$(5) \qquad Stkr = \beta^*(Quality – Q^{most}) + \beta^*Qual^{most} + \varepsilon.$$

Equation 5 can be estimated as

$$(6) \qquad Stkr = \beta_1^*(Quality – Qual^{most}) + \beta_2^*Qual^{most} + \varepsilon.$$

Under the null hypothesis of no differential effects, β_1 should be insignificantly different from β_2. Equation 6 also can be expressed as

$$(7) \qquad Stkr = \beta_1^*Quality + (\beta_2 – \beta_1)^*Qual^{most} + \varepsilon$$

and estimated as

$$(8) \qquad Stkr = \beta_1^*Quality + \delta^* Qual^{most} + \varepsilon.$$

Under the null hypothesis of no differential effects, δ should be insignificantly different from zero. The test based on Equation 8 ($\delta = 0$) is identical to the test based on Equation 6 ($\beta_2 = \beta_1$).

Equation 4.3 of Table 4 reports the results of this test of the differential effects hypothesis. The coefficient for the aggregate quality measure (.639) remains significantly related, at the 1% level, to stock return. The positive coefficient for $Qual^{most}$ (.072), that is, the estimate of δ, suggests

[6]The benefits from quality improvements can outweigh their costs even in the short run and as such generate a positive relationship between quality and ROI. Jacobson and Aaker (1987), with the advantage of a substantially larger sample size than that used in this analysis, report statistically significant results consistent with quality having a positive impact on current-period ROI.

that the improvements in the quality perceptions of those using the brand most often might generate a greater effect.[7] However, the coefficient estimate is insignificantly different from zero. As such, we cannot reject the null hypothesis of no differential effects.

We should note, as discussed previously, that downward bias may be present in the estimated effect of $Qual^{most}$. Because the measure in some cases is based on the responses of only a few individuals, the measurement error in this variable is likely to be greater than that of other variables in the analysis. Measurement error is one explanation for the fact that the correlation of stock return with $Qual^{most}$ (.12) is half as large as stock return's correlation with quality (.24). Of course, the hypothesis that market participants' expectations of future profitability depend equally on the responses composing aggregate quality perceptions provides another explanation for the failure to reject the differential effects hypothesis. Although the results perhaps suggest that the market places greater importance on the perceptions of those consumers using the brand most often, they do not quantify accurately the extent of the differential.

SHOULD FIRMS PROVIDE INFORMATION ABOUT PRODUCT QUALITY TO INVESTORS?

Does Product Quality Influence Stock Return?

The results presented in Table 4 show a positive correlation between stock return and information contained in the EquiTrend perceived quality measure. Obviously, we cannot state with certainty that changes in customer perceptions of perceived quality cause changes in stock return. Although we can rule out salience, advertising expenditures, and ROI, another variable may jointly affect both series. From the perspective of signaling the stock market, this issue is not central. The fact that a correlation exists is sufficient. The product quality measure contains information correlated with factors viewed by investors as affecting long-term business performance. Improved perceived quality "signals" enhanced future-term performance.

An event study approach (e.g., examining the stock market reaction to quality perception announcements) would have an advantage over the methodology we employ in examining the causal link between product quality and stock return. Roughly speaking, our analysis makes use of a one-year announcement data/event window. Given the length of this interval, a variety of changes occur over this period that might jointly influence both stock return and quality perceptions. Event study analysis, typically having a narrower window (e.g., just the day of the announcement), can limit the number of simultaneous influences. Although any response still may reflect a signaling as opposed to a causal effect, the use of a narrower window will increase the likelihood that the market response arises from the information contained in the announcement as opposed to other information.

An event study approach, however, has a different set of limitations. In particular, one must come up with an estimate of market expectations of quality perceptions prior to the announcement. Using, for example, last year's announcement as a measure of market expectations is seriously flawed in that it assumes that market participants have not updated their expectations on the basis of other information made available over the year.

Is There a Need for Firms to Supply Product Quality Information?

There are two opposing views as to whether a firm should supply product quality information. One view depicts market participants as obtaining equally accurate information about customer perceptions of product quality from other sources besides firm announcements. As such, there would be little need for the firm to provide such information. Under this view, the stock market will not react to the firm's release of product quality information because investors are already aware of it and have incorporated its implication into the price of the stock. The opposite perspective depicts investors as oblivious to other sources of information pertaining to customer perceptions of product quality. Available signals of product quality may be too inaccurate to provide useful information. Obtaining accurate assessments of customer perceptions may prove too costly given the expected return. Under this view, investors will have a substantial reaction to a product quality announcement because all the information will be used to reformulate expected future earnings.

Our results can reject the hypothesis that investors are totally unaware of the information contained in product quality measures. As discussed previously, it is impossible for the EquiTrend measures to cause changes in our stock return measures because the end date for the stock return measure occurs temporally prior (by several weeks) to the start of the EquiTrend survey. As such, the significant association we find between stock return and the EquiTrend measure indicates that market participants make use of information correlated with product quality but is supplied in a more timely fashion by other sources.

Although the results suggest that product quality information is relevant to investors, they cannot address the issue of the incremental information content supplied by explicit product quality measures. However, some insights can be gained from studies assessing the market reaction to the release of other types of information. These studies show that market participants do react to a variety of corporate announcements. For example, the market reaction to quarterly earnings announcements is well established (*Business Week* 1990; Hagerman, Zmijewski, and Shah 1984). Although investors form expectations of firm performance, these expectations may differ from realized results or those projected by the firm. The firm has access to superior information, and supplying this information provides useful information to investors.

To the extent that market expectations differ from the results implied by the firms' announcements, the market reaction can be considerable. Consider, for example, the effect of three announcements that took place in mid-December 1993. Kodak's stock dropped $7.25 (nearly 12%) after its chairman indicated that analysts' 1994 earnings expectations were above what the company would achieve. Eagle

[7] Estimating the equivalent Equation 6 variant of the test yielded an estimated coefficient for β_2 of .712 with a standard error of .211.

Hardware stock lost $6.675 (approximately 26%) following an announcement that comparable store sales would be below historical levels because of cannibalization by its new stores. Xerox shares gained $5.625 (roughly 7%) after announcing it was taking steps (e.g., eliminating jobs and shutting down facilities) to improve productivity. This gain came even though the restructuring would result in current-term charges greater than expected current-period net income.

We believe the same market signaling phenomenon should exist with respect to product quality. Managers are likely to be (or should be) closely attuned to perceptions about their brands. Supplying this information can influence investor expectations. Exploring the feasibility of this proposal is a direction for further research.

CONCLUSION

Tom Peters (1987, p. 488) observes, "Our fixation with financial measures leads us to downplay or ignore less tangible nonfinancial measures, such as product quality, customer satisfaction, order lead time, factory flexibility, the time it takes to launch a new product, and the accumulation of skills by labor over time. Yet these are increasingly the real drivers of corporate success over the middle to long term." Our results suggest that claims that the financial community downplays nonfinancial measures may be overstated. The EquiTrend product quality measure contains information, incremental to that provided by accounting ROI, associated with stock price movements. Investors can learn about changes in product quality, which in turn affect their stock appraisals. Indeed, for our sample of firms and the time period under consideration, we observe the surprising finding that the explanatory power of the product quality measure compares to that of ROI. At least for the firms in our sample, the stock market is not constraining the ability of firms to invest in product quality.

The observed association between stock return and information contained in the quality measure finding is noteworthy considering the measurement error in the data caused by, for example, linking specific *brand* data to *corporate* stock return. This measurement error reduces the likelihood of finding an association. The strength of the underlying signal in the data overcomes the noise in the measures. A direction for further research would involve assessing whether the information content of perceived quality holds across different types of firms, for example, less visible companies than those included in our sample.

Current-term performance measures (e.g., ROI) will not reflect the long-term effects of several marketing variables. It would be useful to isolate these variables because they can provide insights into future-term performance prior to outcome measures (e.g., ROI and perceived quality). Another useful research direction would involve enhancing the power of the tests undertaken in our analysis. For example, we did not detect an association between salience and stock return. Further research could explore whether this lack of association stemmed from low power in our tests caused by a lack of sufficient variation in our sample or whether there is a need to separate salience changes associated with positive events from those caused by negative events.

The observed association between stock return and perceived product quality should be encouraging to those attempting to justify investments in product quality, especially when tough questions are raised about "the bottom line." A challenge for American business is to focus on these long-term goals and communicate such strategies in a way that shareholders can appreciate. The stock market, once given reliable indicators of this information, will react and rely less on short-term measures of business of performance. In turn, managers will be freer to undertake strategies ensuring the long-term viability of their firms.

Appendix A
VARIABLE DEFINITIONS

Variable	*Definition*
StkR	Stock return (Market Value of $Stock_{it}$ + $Dividends_{it}$–Market Value of $Stock_{it-1}$)/Market Value of $Stock_{it-1}$).
ROI	Return on investment (Net $Income_{it}$/ $Assets_{it-1}$)
roi	Unanticipated ROI
Adv	Advertising (Advertising $Expenditures_{it}$/ $Assets_{it-1}$)
adv	Unanticipated Adv
Quality	Quality perception of brand for those consumers aware of the brand
quality	Unanticipated Quality
$Qual^{most}$	Quality perceptions of brand for those consumers who use brand most often
$qual^{most}$	Unanticipated $Qual^{most}$
Salience	Proportion of consumers having an opinion about the brand
salience	Unanticipated Salience
YR91	Categorical variable taking on the value of 1 if year=1991, 0 otherwise.
YR92	Categorical variable taking on the value of 1 if year=1992, 0 otherwise.

Data Sources

Stock return data: Center for Research in Security Prices, daily file
Accounting data: Standard and Poor's Compustat annual industrial file
Awareness and Quality data: EquiTrend study of Total Research Corporation

REFERENCES

Aaker, David A. (1989), "Managing Assets and Skills: The Keys to Sustainable Competitive Advantage," *California Management Review*, 31 (Winter), 91–106.

———— (1991), *Managing Brand Equity*. New York: The Free Press.

Ball, Ray and Phillip Brown (1968), "An Empirical Evaluation of Accounting Income Numbers," *Journal of Accounting Research*, 6 (Autumn), 1231–41.

Business Week (1990), "Staying Cool on News of 'An Earnings Surprise'" (January 29), 100.

Chaney, Paul K., Timothy M. Devinney, and Russell S. Winer (1991), "The Impact of New Product Introductions on the Market Value of Firms," *Journal of Business*, 64 (October), 573–610.

Cornell, Brad (1983), "Money Supply Announcements and Interest Rates: Another View," *Journal of Business*, 56 (January), 1–24.

Dertouzos, Michael L., Richard K. Lester, and Robert M. Solow (1988), *Made in America: Regaining the Productive Edge*. Cambridge, MA: The MIT Press.

Erickson, Gary and Robert Jacobson (1992), "Gaining Comparative Advantage Through Discretionary Expenditures: The Re-

turns to R&D and Advertising," *Management Science*, 38 (September), 1264–79.
Fisher, Franklin M. and John J. McGowan (1983), "On the Misuse of Accounting Rates of Return to Infer Monopoly Profits," *American Economic Review*, 73 (March), 82–97.
Hagerman, Robert L., Mark E. Zmijewski, and Pravin Shah (1984), "The Association Between the Magnitude of Quarterly Earnings Forecast Errors and Risk-Adjusted Stock Returns," *Journal of Accounting Research*, 22 (Autumn), 526–40.
Hamel, Gary and C.K. Prahalad (1989), "Strategic Intent," *Harvard Business Review*, 67 (May–June), 63–76.
Horsky, Dan and Patrick Swyngedouw (1987), "Does It Pay to Change Your Company's Name? A Stock Market Perspective," *Marketing Science*, 6 (Fall), 320–25.
Houghton, James (1992), "Leadership's Challenge: The New Agenda for the 90's," paper presented at the 1992 International Strategic Management Conference.
Jacobson, Robert (1987), "The Validity of ROI as a Measure of Business Performance," *American Economic Review*, 77 (June), 470–78.
———— (1990), "Unobservable Effects and Business Performance: Response to Comments," *Marketing Science*, 9 (Winter), 92–95.
———— and David A. Aaker (1987), "The Strategic Role of Product Quality," *Journal of Marketing*, 51 (October), 31–44.
Kormendi, Roger and Robert Lipe (1987), "Earnings Innovations, Earnings Persistence, and Stock Returns," *Journal of Business*, 60 (July), 323–45.
Lev, Baruch (1989), "On the Usefulness of Earnings: Lessons and Directions From Two Decades of Empirical Research," *Supplement to the Journal of Accounting Research*, 27, 153–92.
Maddala, G.S. (1977), *Econometrics*. New York: McGraw-Hill.
Miller, Merton H. and Kevin Rock (1985), "Dividend Policy Under Asymmetric Information," *Journal of Finance*, 40 (September), 1031–51.
Morita, Akio (1986), *Made in Japan*. New York: Dutton Press.
Narayanan, M.P.(1985), "Managerial Incentives for Short-Run Results," *Journal of Finance*, 40 (September), 1469–84.
Peters, Tom (1981), *Thriving on Chaos*. New York: Alfred A. Knopf.
Stein, Jeremy C. (1989), "Efficient Capital Markets, Inefficient Firms: A Model of Myopic Corporate Behavior," *Quarterly Journal of Economics*, 103 (November), 655–69.