MARKETING SCIENCE
Vol 13, No 4, Fall 1994
*Printed in U S A*

# CUSTOMER SATISFACTION INCENTIVES

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Customer satisfaction incentive schemes are increasingly common in a variety of industries. We offer explanations as to how and when incenting employees on customer satisfaction is profitable and offer several recommendations for improving upon current practice. Faced with employee groups (including managers) who may have shorter time horizons than the firm, such systems enable a firm to use customer reaction to monitor implicitly how employees allocate effort between the short and long terms. These systems can be used to encourage employees to make tradeoffs that are in the best interests of the firm.

We derive optimal reward systems for an equilibrium in which the firm maximizes profits, employees maximize their expected utility, and customers choose purchase quantities based on initial reputations, employee efforts (both ephemeral and enduring), and price. The formal model shows how the reliance placed on customer satisfaction in an incentive scheme should depend upon the precision with which customer satisfaction is measured and the extent to which employees focus on the short term. Recommendations for improving upon current practice include: measure customers, former customers, *and* potential customers; measure satisfaction with competitors' products; disaggregate satisfaction to reflect better the performance of employee groups, and, when different customer segments have different switching costs or they vary in the precision with which their satisfaction can be measured, then measure the segments separately and assign different weights in the incentive plan.

Throughout the paper we interpret the formal results based on our experience with actual firms and the current literature. We close with a brief discussion of on-going research at field sites.
**(Competitive Strategy; Measurement; Customer Satisfaction; Incentives)**

*Total Quality, because of its focus on benchmarking customer and consumer satisfaction, is basically an insurance policy for sustaining competitive advantage over the long term.*
*—Edwin Artzt, Chairman and CEO of Procter & Gamble*

*We want to give the best customer service of any company in the world. . . . To maintain our reputation for excellent service, we long ago established high standards for the selection of salesmen and customer engineers.*
*—From Thomas J. Watson, Sr.'s (founder of IBM) business doctrine*[1]

## 1. Introduction

Many American corporations include customer satisfaction or quality in their employee motivation systems. In some cases, the rewards are psychological—management believes

[1] The Artzt quote is from Bemowski (1992). The Watson quote is from Watson, Jr. (1963, pp. 29, 30).



0732-2399/94/1304/0327$01.25

that if employees know that customers are satisfied then these employees themselves will be more satisfied and will work more effectively. In some cases, the rewards are implicit. Management believes that, in the long-run, a satisfied customer is an asset of the firm and that this asset makes the firm more profitable. Management communicates this belief to the employees together with the implication that if the firm is more profitable, the employees will remain employed and, perhaps, earn higher wages.

In other cases, employee compensation is tied directly to customer satisfaction or quality measures. Ernst & Young and the American Quality foundation (1992) report a dramatic increase in the percent of U.S., Japanese, German, and Canadian firms for which quality is the most important criterion for senior management compensation (90% increase over the last three years with projections that quality will be the primary criterion in the majority of firms by 1995). Phillips et al. (1990) observe that both GTE and Montgomery Ward compensate management on customer satisfaction and quality measurements. Mercer (1992, p. 11) reports that 76% of the electric and gas utility companies have specific objectives for employees that include customer satisfaction targets and that customer satisfaction incentive compensation schemes are most common in the 25 largest companies. In our own discussions with Fortune 500 firms in both the manufacturing and service sectors, we have found that top management *and* middle management are extremely interested in the effects that customer satisfaction measures have upon profitability. Many are struggling to design profitable customer satisfaction based management and/or compensation programs.

Why all the attention? How does incorporating measures of customer satisfaction into employee incentive systems increase profitability? This paper offers potential explanations as to how and when incenting employees on customer satisfaction can be profitable and suggests several improvements upon current practice. The proposed explanations are that incenting on customer satisfaction *and* sales overcomes short-term foci and provides managers and workers with incentives to make the short-term/long-term tradeoffs that are best for the firm.

We argue all employees (managers, product designers, service providers, production workers, etc.) allocate their effort between actions that influence current period sales and actions that influence sales in future periods. Unfortunately employees are generally more focused on the short term than the firm would like. In response the firm can collect measures that we call "customer satisfaction." The measures we seek represent a (noisy) current period indicator of future profitability and a (noisy) measure of employee effort directed towards the long-term. The greater the reliance on customer satisfaction in determining the size of bonuses, the more effort that employees will be expected to allocate towards improving profit in the long term. Furthermore, to the extent that firms are unable to determine precisely their employees' effort levels (or tradeoffs), customer satisfaction provides a means to encourage profitable tradeoffs without the firm explicitly measuring employee effort.

We begin with a mathematical model of customer, employee, and firm behavior in an environment in which each actor's actions are affected by the decisions of the other actors. The model is based on our experience in developing customer satisfaction programs, interviews with practitioners in both manufacturing and service firms (including many Fortune 500 firms), interviews with market-research suppliers, and a review of the strategy, quality, marketing, and R&D literatures. We derive the model and characterize the optimal incentive schemes, expected (optimal) employee response, customer behavior and the sales, prices, and profits of the firm. We then use the model to understand what influences the measurement and reward system and how we can improve upon existing systems. The results have both descriptive and normative implications—we explain how firms may profit from measuring customer satisfaction and suggest several improvements upon current practice.

## 2. Relationship with the Literature

We draw from the strategy, quality, marketing, and R&D literature focussing on short-termism and customer satisfaction measures.

In the strategy literature many papers have postulated that (American) corporations have too much of a short-term focus. Managers and workers focus on short-term sales and profit at the expense of long-term profit, discounting future earnings at a higher rate than is optimal for the firm. Indeed this problem is the subject of much popular writing. For example, Wollner (1992) argues, "Consumer shouts for better-quality cars were ignored as prices continued to rise . . . this was an effective short-term strategy with disastrous long-term consequences." The Council on Competitiveness recently sponsored a special report on this issue (Porter 1992). The report offers many explanations for this short-term behavior including labor market imperfections (Becker 1962, Grout 1984), take-over threats (Stein 1988), asymmetric information (Myers 1989, Stein 1989), and commitment problems (Weitzman 1980).

To counter short-termism and to align employee incentives with those of the firm, companies have adopted a number of sophisticated incentive systems. Employees receive bonuses based on stock options, on stock price, on market share, on new customers, on new products, and on other more subjective criteria. However, some systems suffer from severe free-riding problems. For example, while a CEO's actions might have a noticeable impact on stock price, the actions of a single telephone-service representative will be negligible. Presumably, the more directly an employee's actions affect a performance measure, the more responsive employees will be to feedback and incentives based on the measure.

Many papers in the marketing and total-quality-management literatures have focused on the measurement of customer satisfaction. The literature is extensive and diverse. Some papers focus on developing and testing more precise measurement scales while others use these scales and focus on the link from satisfaction (or quality) to future sales, purchase intentions, retention, loyalty, and other surrogates for revenue. Others test intervening variables, explore multiple linkages, and refine the conceptualization of satisfaction in order to develop a causal understanding of satisfaction formation, often in conjunction with behavioral explanations such as expectation-disconfirmation, equity, norms of comparison, and value-prompt disparity. The literature has also seen a normative focus with the development of service-quality measurement systems and barometers that seek to become indicators of firms' (or national economies') performance. In marketing and in the related discipline of total quality management many have argued that satisfaction should be a strategic focus of the firm.

For the reader who wishes to explore these literatures we recommend Anderson and Sullivan (1993), Bearden and Teel (1983), Bolton and Drew (1991a, b), Boulding, Staelin, Kalra, and Zeithaml (1993), Churchill and Surprenant (1982), Cronin and Taylor (1992), Deming (1986, p. 5), Fornell (1992), Fornell, Ryan, and Westbrook (1990), Fornell and Wernerfelt (1988), Fornell and Westbrook (1984), Gale (1992), Hayes (1992), Kordupleski, Rust, and Zahorik (1993), LaBarbera and Mazursky (1983), Oliver (1980), Oliver and DeSarbo (1988), Oliver and Swan (1989), Parasuraman, Zeithaml, and Berry (1988), Rust and Zahorik (1991), Tse and Wilton (1988), Westbrook (1980a, b), Yi (1990), and Zeithaml, Parasuraman, and Berry (1990).

Of course, customer satisfaction measurement is not without its critics. For example, Goodman et al. (1992) argue that customer satisfaction surveys are ineffective if they are not tied to customer behavior. For recent critical reviews see Cronin and Taylor (1992) and Yi (1990).

Naturally, such a diverse literature differs in its definition of customer satisfaction. For example, some researchers use transaction-specific or brand-specific measures while others use measures that indicate an overall customer evaluation of all experiences including

transactions, product use, and service received. Furthermore, some limit satisfaction, by definition, to those products or services that the customer experiences while others broaden the concept to include customers' perceptions of the satisfaction they would have received had they experienced a competitor's product or service. Many in the literature are careful to distinguish satisfaction (post-consumption experience) from quality (a characteristic of the product or service) and from value (a notion of quality net of price). For our purposes we do not define satisfaction explicitly. Instead we define it implicitly (Equations 2 and 3) as a measure that indicates the long-term impact of those actions employees take to influence tomorrow's sales. We recognize that the measure may not be perfect and that other intervening variables, exogenous to the model, such as expectations, norms of comparison, and equity, might or might not influence *measured* satisfaction. This allows us to focus on the managerial use of customer satisfaction measures and allows us to formulate a theory that is consistent with a broad range of the behavioral and measurement literatures. The better the measure, the more powerful it will be as an incentive. However, we are careful to formulate a theory that models noise explicitly so that we might explore the impact of imprecision in the measures.

We build upon the following implicit (and sometimes explicit) premises that pervade the literature:

- customer satisfaction is a multi-period issue—a firm (or its employees) takes actions today that affect purchasing behavior in the future;
- customer satisfaction measures are an indicator of future profit potential (more satisfied customers will buy more, buy more often, buy at a higher price, and/or communicate their satisfaction to others).

Based on these premises we explore the beliefs that can be found in the literature and we examine proposals to improve upon current practice. Some of these beliefs are:

- customer satisfaction measures provide a better management tool if the measures are more precise;
- employees who take or influence actions which affect customer satisfaction should be given feedback and/or incentives to guide their actions; and
- a well-designed customer satisfaction system enhances profits.

We now formulate a model that incorporates these premises and examines these beliefs.

## 3. A Model of Firm, Employee, and Customer Behavior

To incorporate the multiperiod premise we abstract to a two-period framework where the first period represents "today" and the second period represents the future impact, "tomorrow." The second period need not be of the same duration as "today." We need only that today's actions affect the future in some discounted manner, that is, some of today's employee actions affect customer utility today and some affect customer utility tomorrow. We focus on a focal firm keeping competition implicit.

*Yesterday and Today: Customer Response*

We assume that customers arrive to the market continuously, thus all of the following discussions of a "customer" refer to the rate of arrival in the interval $dc$. This is for analytical convenience only. For ease of exposition, we present the definitions in the form of discrete customers.

We assume that the firm has been in the market long enough to develop a goodwill reputation for quality, $g$. This reputation includes designed-in quality and customer-service characteristics such as a reputation for excellent technical support. Customers vary in their needs and their perceptions of the products, thus the potential reputation, $\tilde{g}_c$, that any given customer ($c$) perceives in period 1 is equal to the average reputation, $g$, plus heterogeneity "error," $\tilde{e}_{1c}$. That is, $\tilde{g}_c = g + \tilde{e}_{1c}$. For simplicity we assume that

the perceptual variations are independent across periods and customers and are normally distributed with zero mean and positive variance.

Following the total quality management literature, we focus on a group of employees that takes actions together and is rewarded together. For simplicity we assume that the group is motivated properly such that there are no free-riding problems within the group. We focus on the efforts (decisions and actions) of the employee group. (In the final section of the paper we examine characteristics of customer satisfaction measures that might reduce free-riding.)

Some of the effects of that effort are ephemeral—the effort helps to make the sale but does not add to the firm's reputation for quality. For example, high-pressure sales tactics, attempts to serve many customers at once and attempts to sell unnecessary add-ons might be such efforts. We call the component of effort that has short-term impact ephemeral effort (Bennett 1990), and we designate that effort (for customer $c$) by $a_c$. Other components of employee efforts have enduring effects. These efforts do not affect the sale today but add to the customers' satisfaction and hence the firm's reputation for "quality." For example, post-purchase explanations of how best to use a product, support on installation, or recommendations on how to maintain the product over its lifetime all have enduring effects. We call such components of effort enduring effort and designate them (for customer $c$) by $b_c$. In practice, some employee efforts have components that are both ephemeral and enduring, while some ephemeral actions may actually decrease the enduring reputation of a brand. The employee group need not separate efforts into their ephemeral and enduring components, and the firm need not measure these components. We need only that any given action (or decision) can, in principle, be described as having ephemeral and/or enduring components and that the employee group must make tradeoffs between these components. The employee group decides upon actions; our definitions simply help us trace the impact of those actions. A well-designed customer-satisfaction incentive system will motivate the employee group to choose actions such that the allocation of effort between $a_c$ and $b_c$ maximizes the firm's long-term profit.

We interpret employee group broadly. For example, in one firm with which we are working, the employee group consists of managers of telephone representatives; in another firm the employee group is a specialized team that trains retailers on how to use the firm's product to produce the best result for the end customer. Examples of employee groups are interfunctional product-development teams, quality control circles (Lillrank and Kano 1989), sales groups, telephone-service representatives, flight attendants, or brand-management teams.

It is worth noting that $a_c$ and $b_c$ are incremental efforts above and beyond what the employee group would do without incentives. In this way we focus on those efforts that would not occur in the absence of a reward system. The impact of standard efforts on sales are captured by the initial reputations of the firm; the employee group is rewarded for these efforts by a base wage, $\bar{U}$, for each period.

The firm (endogenously) selects its price in the first period, $p_1$, in order to maximize long-term profits. Customers then evaluate the firm's reputation for quality, price, and the ephemeral effort expended by the employee group when deciding how much to purchase.

Let $\tilde{q}_{1c}$ be the quantity the focal firm sells to customer $c$ in period 1, then:[2]

$$\tilde{q}_{1c} = g + a_c - p_1 + \tilde{e}_{1c}. \tag{1}$$

[2] We choose the linear demand function in the belief that the qualitative results are unaffected by this choice. While a linear model allows negative sales for some prices, profit maximization prevents this. $g$, $a$, and $p$ are measured in monetary units. There is a unity multiplier of quantity/\$ for the right-hand side of the equation in order to make equation (1) consistent in units. Although our focus is on customer satisfaction, we keep prices endogenous to ensure that the results are not eliminated by price movements.

Technically, (1), coupled with the continuous time nature of the model, implies that cumulative sales are given by a Brownian process with drift $E[q_{1c}]$ and variance $\sigma_{1q}^2$.

*Tomorrow: Customer Response*

Tomorrow's reputation is a function of today's reputation and the enduring effort expended by the employee group. For simplicity we model tomorrow's reputation as $g + b_c + \tilde{e}_{2c}$. The employee group chooses ephemeral and enduring efforts for the first period. In reality, tomorrow will be like today, and the employee group will make both types of efforts. To focus on the short-term vs. long-term tradeoffs, we take the second period as an ending period with no effort. However, the firm does set a profit-maximizing price, $p_2$, in period 2. "Today" represents those periods in which the employee group must make tradeoffs between ephemeral and enduring efforts. In reality, the ending period need never actually occur, a firm might face a succession of periods, like "today," in which both ephemeral and enduring efforts occur. The ending period is the most parsimonious manner to examine rewards based on today's enduring effort.

The customer utility function and response in period 2 is analogous to that in period 1. The customer will purchase quantities:

$$\tilde{q}_{2c} = g + b_c - p_2 + \tilde{e}_{2c} \tag{2}$$

and cumulative sales will be a Brownian process with drift $E[q_{2c}]$ and variance $\sigma_{2q}^2$.

*The Firm's Measures*

It is often too expensive or too difficult for the firm to observe the effort allocated by each employee group to each customer. Even if the firm could do so, it might choose not to because (1) such measures may be viewed as too intrusive or may be proscribed by law and (2) the employee group may have customer-specific knowledge that enables it to make better allocation decisions (as long as the rewards are set appropriately).

We assume the firm can measure sales volume and customer satisfaction. Total customer satisfaction is a measure over customers of the benefit they receive from enduring actions by the employee group. As defined above, a firm's total reputation for quality in period 2 depends both upon its initial reputation and the enduring efforts expended by the employee group. Future sales are related to this measure, but depend upon other variables as indicated by Equation 2. We recognize that customer satisfaction is measured with error. From the firm's perspective this error, $\tilde{e}_s$, is additive. We assume that the error in aggregate satisfaction is normally distributed with variance $\sigma_s^2$:

$$\tilde{s} = \int_c f(b_c)dc + \tilde{e}_s. \tag{3}$$

The increasing, concave function, $f(\cdot)$, recognizes explicitly that variables exogenous to the model (e.g., expectations, norms of comparison, equity) might intervene between employee effort and the survey measure of customer satisfaction. Specifically, we allow $f(\cdot)$ to have other arguments as long as the arguments do not vary by customer.

Equation (3) is a simple conceptual model. However, for technical reasons[3] we need to assume that employees observe both sales and satisfaction measures for one customer

[3] We need this technical assumption to avoid the "Mirrlees existence problem" (Mirrlees 1974, Shavell 1979, Innes 1990). An assumption of a normal distribution allows highly negative (but low probability) outcomes. With such negative outcomes the possibility exists to induce any employee behavior with very large fines for very poor outcomes. If employees can observe outcomes as they go along, they can avoid such very large fines by modifying their behavior An alternative approach would have been to bound the extent to which measured satisfaction can differ from employee expectations by truncating the tail of the error distribution (although this would breach one of the assumptions guaranteeing the optimality of the linear contract).

$c$ before moving on to the next customer. While at first glance this assumption might seem extreme, all we really need is that the employee group is aware of how well they are satisfying customers so that there is a reasonable limit to the disparity that can exist between the expectations of the employee group and measured satisfaction at the end of the period:

$$\tilde{s} = \int_c [f(b_c) + \tilde{e}_{sc}]dc. \tag{3'}$$

Note that we can relate (3') to (3) by recognizing that $\tilde{e}_s = \int_c \tilde{e}_{sc}dc$.

Because period 2 is an ending period, there is no need in our model for a customer-satisfaction measure in period 2. In practice, there are multiple intermediary periods (weeks, quarters, years) in which both sales quantities and customer satisfaction are measured and in which employees are rewarded on both measures. In our model these intermediary periods are treated as if they were merged into period 1.

*The Reward System*

To encourage employees to make the tradeoffs that are best for the firm, the firm rewards the employee group based upon the sales-quantity and customer-satisfaction measures. In period 1, the firm pays a reward of $w_1(\tilde{q}_1, \tilde{s})$. The functional form and the parameters of the function are chosen to maximize profit. In the ending period, period 2, the firm rewards only measured sales quantity; it pays a reward of $w_2(\tilde{q}_2)$.

It is convenient to think of $w_1$ and $w_2$ as monetary rewards; however, they need not be. Any set of rewards that the employee group values and for which the firm must pay would be appropriate including trips to sales conferences, company picnics, and awards banquets (Feldman 1992). For example, 3M, located in a cold climate, rewards some employees with a close, reserved parking spot. For simplicity we assume that the amount that the firm pays is equal to the amount that the employee group receives. The employees also receive a fixed compensation as remuneration for the minimum effort expended in order to retain employment. We address below whether such compensation affects the structure of the rewards.

*The Employees' Motivations*

In deciding how to allocate ephemeral and enduring efforts the employees act in their own best interests. For example, one electric utility rewarded its telephone-service operators on the number of calls answered per hour. In some instances they just selected waiting calls and hung up immediately. When the rewards were switched to percent of time that the operator is on-line with a customer, some operators found it rewarding to place customers on hold while taking allowed breaks. This does not make the employees evil; rather it recognizes that the objectives of the firm and the objectives of the employees are often not identical. The telephone operators simply optimized against the incentives that the system provided. It is the firm's responsibility to design an incentive system that results in consistency between the firm's and the employees' objectives so that, when acting in their own best interests, the employees take actions that also benefit the firm (Deming 1986).

Incremental effort is costly to employees and becomes more costly as total effort increases. To model this phenomenon we approximate the employee group's cost of effort using a quadratic cost function. Ephemeral and enduring effort are measured on the same scale—that is, employee costs are $\int [a_c^2 + b_c^2]dc$. In practice, deciding upon the scale with which to measure such efforts is an important decision.

Short-termism implies that employees discount rewards in the second period more than firms. There are a number of reasons why employees discount the future more. Any combination of these reasons is sufficient; all need not apply. In addition to those

set forth in the Council-on-Competitiveness report, we offer the following: (1) The employees may not have a life-time employment contract, thus the employees know that there is some likelihood that they will not be around to collect the rewards. (2) The employees may serve customers well and the customers may come back to the firm, but the employees may not get credit for those customers. For example, consider an employee working in a rest-stop McDonald's on the highway leading to Cape Cod. While it is important to the McDonald's Corporation that rest-stop customers are treated well, it is less important to the employee because repeat business is infrequent. (3) Employees may fear that the firm will change the reward system in the ending period. Finally, (4) the firm may have access to a capital market that allows it to borrow at a better rate than employees. To capture these effects we normalize the discount factor of the firm to 1.0 and assign a positive discount factor of $\delta < 1$ to the employee group.

The employee group must deal with uncertainty in how enduring efforts affect customer satisfaction and with uncertainty in sales volume "today" and "tomorrow." Because of this uncertainty we must model employee risk preference. We do so with a von Neumann-Morgenstern utility function that exhibits constant absolute risk aversion.[4] Such functions have proven to be good approximations in a variety of fields.[5] In terms of a reward system, constant absolute risk aversion implies that the employees' reactions to $w_1$ and $w_2$ do not depend upon the fixed salary.

Putting all of these arguments together, the employees maximize incremental utility, $U(\cdot)$, given by equation 4 where $r$ is the measure of risk-aversion:

$$U(\cdot) = 1 - e^{-r(w_1+\delta w_2-\int[a_c^2+b_c^2]dc)}. \tag{4}$$

Recall that the rewards based on sales quantity and customer satisfaction are above and beyond the base compensation for normal efforts in the two periods of the employment agreement. The employees have the opportunity to work for other employers or not to work at all. They only will work if the expected compensation net of effort and risk costs is valued at least at $(1 + \delta)\bar{U}$ for the two periods. Similarly, the employees may choose to quit at any time in which case they receive compensation less than their accumulated effort costs for the period in which they quit. If they quit before the second period begins they receive compensation, $\bar{U}'$, which is less than $\bar{U}$.

Faced with reward systems $w_1$ and $w_2$, the employee group seeks to maximize $U(\cdot)$ by choosing efforts, $a_c$ and $b_c$, for each customer.

*The Firm's Objective*

Finally, the firm chooses the reward system to maximize its total expected profits ($\bar{}$ indicates expected value): $\pi = p_1\bar{q}_1 + p_2\bar{q}_2 - \bar{w}_1 - \bar{w}_2$. Recall that the firm's discount rate is normalized to one. We have also assumed that costs are zero with little loss of generality (prices may be thought of as margins).

*Summary*

The following actions summarize the formal model:

- Both the firm and the employee group observe initial reputations.
- The firm announces prices and reward systems for both periods.
- As customers arrive sequentially and continuously during the first period, the employee group allocates both ephemeral and enduring efforts to each customer (max-

[4] Employees are constantly risk averse if the choices among risky alternatives do not depend upon changes in their wealth. Constant absolute risk aversion implies negative exponential utility. See Keeney and Raiffa (1976, p. 167).

[5] See Currim and Sarin (1984), Eliashberg (1980), Farquhar (1977), Hauser and Urban (1979), and Roberts and Urban (1988) for empirical applications and tests. See Lilien, Kotler, and Moorthy (1992, pp. 14–15) for a review of applications to salesforce compensation.

imizing expected employee utility). Based on these efforts, the initial reputation, and the price, the customers purchase the amount of the product that is best for them. While the enduring efforts do not affect the value of the product in period 1, customers do observe the result of these efforts (after purchasing the product) and these efforts do affect purchasing in period 2. The employee group observes a customer's sales and satisfaction.

- The employee group may adjust both ephemeral and enduring efforts at any time during the period, perhaps based upon the outcomes (sales and/or satisfaction) from previous customers.
- At the end of the first period, the firm measures sales volume and customer satisfaction and rewards the employee group accordingly.
- In the second period, customers return to the market and make decisions based upon the firm's reputation and the employee group's enduring efforts. The customers buy the quantity that is best for them.
- The firm measures second period sales quantity and pays employees accordingly.

## 4. Optimal Behavior and Equilibrium

We focus on that component of customer satisfaction that is an indicator of enduring employee effort. We do this by setting $f(\cdot)$ to the identity function. (A more general $f(\cdot)$ complicates the proofs but does not change the conceptual results.) Without loss of generality we normalize $g$ to 1.0.

*Optimal Contracts Are Linear, Optimal Employee Behavior Is Constant Effort*

In principal, the firm's reward system could depend upon the complete history of sales and satisfaction. Fortunately, our mathematical formulation implies constant effort for two reasons. First, because the employee group reacts to uncertainty independently of wealth (constantly risk averse utility), any previous losses or gains are irrelevant. Second, because the marginal cost of effort is not a function of total effort in the period, it can be viewed as a separable sum (integral) across customers. Thus, the reward system can be written as a sum of the rewards for the observed outcomes (sales and satisfaction) for each customer (Holmstrom and Milgrom [HM] 1987, theorem 4). Furthermore, wealth independence and the concavity of the cost function imply that the optimal actions are constant over time, that is, $a_c^* = a^*$ *and* $b_c = b^*$ for all customers $c$ (HM, theorem 5) where * indicates optimal. By a change of variables, an optimal reward system is then a linear combination of "account balances" (HM, theorem 7). In our case, the account balances are the sales quantities and *total* satisfaction (summed across customers).

These results greatly simplify the analytical burden of our model. While the exact linearity of the reward system depends upon the technical assumptions, linearity is a good approximation to a variety of reward systems. More importantly, this result is consistent with the principle of simplicity that pervades the total-quality-management literature (Deming 1986, chapter 11; Lillrank and Kano 1989, p. 22). By matching the analytical model to current practice and intuition, we are able to investigate the implications of changes in the values of parameters such as the precision of the measurements or the relative magnitudes of the firm's and the employees' discount factors. Many concepts from the formal agency theory literature become immediately available and relevant to the customer-satisfaction literature clarifying debates that pervade management practice, academic literature, and the popular press.

*Equilibrium—Customers, Employees, and the Firm*

Based on our discussions with both managers and employee groups attempting to implement customer satisfaction systems, it is reasonable to assume that the employee

group chooses its effort allocation, $a^*$ and $b^*$, based on the prices and reward systems chosen by the firm, $p^*$ and $w^*$. ($p$ and $w$ are shorthand notations for the vectors $\{p_1, p_2\}$ and $\{w_1, w_2\}$, respectively.) In turn, the firm selects its best price based on the reward system, where the reward system implies employee efforts and the resulting demand curves. Analytically, we first find the employees' optimal efforts based on a candidate set of prices and rewards. We then find the firm's optimal price based on a candidate set of rewards. Finally, the firm selects the parameters of the reward function to maximize profit.

We begin with a candidate set of rewards, $\hat{w}$. By linearity and constancy, we can write the candidate reward functions as:

$$\hat{w}_1 = \alpha_1 + \beta_1\tilde{q}_1 + \eta\tilde{s}, \qquad \hat{w}_2 = \alpha_2 + \beta_2\tilde{q}_2. \tag{5}$$

Because the employee group's utility function is constantly risk averse and the uncertainty is normally distributed, the certainty equivalent, *c.e.*, is equal to the mean utility minus a risk premium ($r/2$ times the variance). Rearranging terms yields:

$$c.e. = (\alpha_1 + \delta\alpha_2) + (\beta_1\bar{q}_1 + \delta\beta_2\bar{q}_2) + \eta\bar{s} - (a^2 + b^2) - (r/2)(\beta_1^2\sigma_{1q}^2 + \eta^2\sigma_s^2 + \delta^2\beta_2^2\sigma_{2q}^2). \tag{6}$$

Maximizing this, using (1) and (2), gives

$$a^*(\hat{w}) = \beta_1/2, \qquad b^*(\hat{w}) = \delta\beta_2/2 + \eta/2. \tag{7}$$

Note that these effort levels are independent of prices.[6]

To ensure employee participation, the rewards that the firm must pay should at least compensate employees for both the incremental costs incurred and the risk undertaken. Therefore, the expected incremental rewards, beyond $2\bar{U}$, that the firm must pay must be valued in both periods by employees as sufficient to compensate them for costs and risk. That is:

$$E[\hat{w}_1] + \delta E[\hat{w}_2] = \hat{a}^2 + \hat{b}^2 + (r/2)(\beta_1^2\sigma_{1q}^2 + \eta^2\sigma_s^2 + \delta^2\beta_2^2\sigma_{2q}^2),$$
$$E[\hat{w}_2] = (r/2)\beta_2^2\sigma_{2q}^2. \tag{8}$$

Note that equation (5) allows us to adjust $\alpha_1$ and $\alpha_2$ so that employees receive an expected net salary which they value as $(1 + \delta)\bar{U}$ for the two periods and $\bar{U}'$ in the second period.

Given these rewards (and the conditions set forth), the firm maximizes expected profits,

$$\pi = p_1\bar{q}_1 + p_2\bar{q}_2 - E[\hat{w}_1] - E[\hat{w}_2],$$

by substituting in equations (1), (2), (5), (7), and (8), and solving for the equilibrium prices and rewards:

$$\pi = p_1(1 + \beta_1/2 - p_1) + p_2(1 + \delta\beta_2/2 + \eta/2 - p_2) - \{E[\hat{w}_1] + \delta E[\hat{w}_2]\} - (1 - \delta)E[\hat{w}_2]. \tag{9}$$

We select rewards to assure the employee group chooses to remain employed in both periods.

Finding the optimal reward parameters is now a matter of calculus—substituting, differentiating with respect to the parameters of interest, setting the derivatives equal to zero, and solving simultaneously.

[6] In general, the candidate prices influence efforts because the marginal sales quantities are a function of prices. If the implied efforts were a function of price, profit maximization would need to take this into account. However, in our case the linearity of rewards and demand assures that the cross partials, e.g., $\partial^2 q_1/\partial p_1 \partial a$, vanish. Furthermore, the variances, and hence the risk, are not a function of price. If the cross partials did not vanish, the same basic calculations would apply, but the algebra would be more complex

## 5. What Affects the Reward System?

We begin with the question of whether a firm has incentives to institute a customer satisfaction incentive system. That is, are such systems profitable? We then probe how employee characteristics affect incentive systems. For example, if employees are more future-oriented, how would this affect the weight that a firm should place on customer satisfaction? We also examine how the precision of satisfaction measures affects the reward system. Our method of analysis is straightforward but tedious. After solving implicitly for the optimal rewards, prices, and profits, we use the implicit function theorem and the envelope theorem to determine how the optimal contracts change as functions of the parameters. We state the results in the text, but the proofs are in the appendix.

### *Do Firms Have Incentives to Include Measures of Customer-Satisfaction in Reward Systems?*

PROPOSITION 1. *If satisfaction can be measured costlessly, the firm earns incremental profits by rewarding on sales quantity and customer satisfaction as opposed to just sales quantity.*

Proposition 1 reflects the fact that a customer satisfaction system gives the firm more options and that the firm finds it in its interest to use these options. Customer satisfaction enables the firm to reward enduring efforts now rather than later and customer satisfaction carries information about enduring efforts.

To understand the proposition suppose that the firm rewarded on sales alone. Then the employee group would discount the future more and, from the firm's perspective, ignore the long-term implications of its actions. We have seen examples where employees facing strong sales pressure focused on selling business rather than servicing clients. On the other hand, if the firm puts too much emphasis on customer satisfaction, employees might sacrifice profit potential. For example, the head of customer service at a major airline reported to us that when the airline put too much customer satisfaction pressure on gate employees, they gave out free-flight vouchers with too little concern for future revenue implications.

Employee short-termism is only one explanation for the profitability of customer satisfaction. The proof for Proposition 1 survives even when $\delta = 1$ because customer satisfaction provides an additional measure of the employee group's enduring effort; the firm uses this information to reward the employee group. This measure augments the information that the firm obtains (tomorrow) from tomorrow's sales.

Proposition 1 says simply that it is possible to select parameters for the reward functions such that the resulting increase in (net) revenue exceeds the cost of the rewards. It is an empirical question whether the increase in profit justifies the cost of measuring satisfaction. However, given the growing popularity of customer-satisfaction programs and the willingness of firms to continue programs once they have begun, we suspect that the increased profit exceeds the measurement cost in at least some instances.

### *Do Changes in the Short-Term Focus of Employees Affect the Reward System?*

We recall discussions with the head of the power-train division of a major automobile manufacturer and with the president of one of the leading consumer-packaged goods firms. Both managers felt that part of their job description was to help set policies that affected the education and attitudes of the work force. A short-term perspective is one such attitude.

PROPOSITION 2. *If the employee group values the future more ($\delta$ is larger), then the firm needs to reward less on customer satisfaction when maximizing profit.*

It is a common belief that American workers are less future-oriented than workers in other countries. If this is true, then Proposition 2 suggests that American firms can counteract short-termism if they place greater reliance on satisfaction in their employee incentives.

For example, if lifetime employment or employee empowerment increases $\delta$, then Proposition 2 suggests that the firm would need to reward less on customer satisfaction. Besides lifetime employment, there are many actions a firm can take to affect how employees value the future. A strong corporate culture that respects employees might encourage them to act in the firm's best interests because they believe they will share in the long-term rewards. For example, Thomas J. Watson's first credo was "our respect for the individual." (Watson 1963, p. 13). Watson (p. 32) reports that "more than one branch manager has worked overnight in his shirtsleeves to help get a customer's salary checks out on time." 3M's *intrepreneurship* program (Katauskas 1990, Mitsch 1990) makes research grants available to employees, encourages them to spend 15% of their time on personal research projects and sets up the successful innovator with a new-product team. In a visit to 3M the head of R&D described to us how 3M uses a variety of awards (including lifetime achievement awards) to tie employees to 3M. Procter & Gamble evaluates managers on profit, volume, and *people* (Barlett 1989). When determining annual raises at least one major university weights course ratings more for untenured faculty than they do for tenured faculty.[7] These techniques all encourage employees to focus on the future.

*Does Better Measurement Lead to More Profits?*

An advantage of the formal model is that it clarifies how improved satisfaction measures and better behavioral understanding of these measures affect profits. Intuitively we expect that precision increases a firm's ability to use customer-satisfaction information. Formally,

PROPOSITION 3. *If satisfaction is measured with greater precision (decreased $\sigma_s^2$), then (a) the firm should place a greater weight on measured satisfaction and (b) the firm earns higher profits.*

Proposition 3 reflects the fact that one can reward risk-averse employees more heavily on more precise measures since this exposes them to lower risk costs. Proposition 3 explains some of the efforts over the past few years by both academics and practitioners to obtain more precise measures. Furthermore, by understanding better the causal structure and the intervening variables researchers can specify the function, $f(\cdot)$, more precisely so that satisfaction measures serve their dual role (in our model) of indicating future sales potential (Equation 2) and indicating the amount of enduring effort that employees allocate (Equation 3).

To get an idea of current levels of precision, we analyzed data that are used by a major financial services firm in their customer-satisfaction system. In this data, customer satisfaction correlated significantly (0.01 level) with the change in purchase intentions, but the correlation was not perfect (0.22 for satisfaction with the financial services representative, 0.33 for satisfaction with the firm, and 0.28 for overall satisfaction). In personal correspondence, Eugene Anderson and Claes Fornell report comparable numbers for the Swedish satisfaction barometer. We want to emphasize that Proposition 3 deals with the benefits rather than the costs of increased precision. When improved methods and better theoretical understanding of customer-satisfaction measures improve precision without increasing measurement costs, then Proposition 3 quantifies the value that firms obtain from academic efforts. When increased precision comes from methods with significant marginal costs, such as increased samples sizes, then it is an empirical question as to

[7] Personal correspondence from an anonymous colleague.

whether the increased costs are justified. Our model provides a formal method to evaluate questions such as the optimal sample size, but specific answers depend upon estimated parameters.

*Summary*

If measured customer satisfaction is an indicator of employee efforts which generate future sales, then the firm is more profitable if it rewards employees based on customer satisfaction. When firms are attempting to maximize profits a greater weight should be placed on customer satisfaction when:

- employees are more short-term oriented, and
- customer satisfaction is measured more precisely.

## 6. Pitfalls and Remedies

In this section we use the formal model to suggest changes to current practice and/or to clarify debated issues.

Xerox (Menezes 1991) asks 40,000 customers each month how satisfied they are with the products and services that Xerox provides; *Consumer Reports* bases automobile repair ratings on the averages over consumers who own those cars; *PC Magazine* (May 26, 1992) reports service and reliability ratings for personal computer vendors while acknowledging (p. 114) that "machines based on new CPUs [technologies] did better than machines based on older technologies." (This biases ratings in favor of newer entrants who have an installed base of only later-technology machines.) Even in our own course evaluations we measure those students who have selected to take our elective courses. Each of these examples places weight only on a firm's customers, not on those potential customers who considered the firm's products or services and rejected them or on customers who no longer do business with the firm. In contrast, we have seen proprietary examples in both the manufacturing and service sectors where firms measure both their own customers' satisfaction and the satisfaction that customers of their competitors perceive they would have had had they purchased the focal firm's product or service. Which practice is right—limiting the definition of satisfaction to the focal firm's customers or broadening it to include the potential satisfaction of non-customers?

*Should Non-Customers Be Measured?*

One argument in favor of measuring non-customers is that limiting the sample to current customers introduces a *selection* bias into the measures. If there is a positive relationship between customer satisfaction and likelihood of purchasing, measuring only the satisfaction of current customers will positively bias the measures; satisfaction scores will be large if the firm serves well a niche of customers with like tastes. For example, Fornell (1992) and Griffin and Hauser (1993) report that small niche brands tend to have larger average satisfaction scores (when satisfaction is measured only among the firm's own customers), while large market-leader brands tend to have lower scores. Both authors hypothesize that this is a result of larger-share brands serving a more heterogeneous market while the niche brands serve a more homogeneous market.

A related argument concerns the use of sample averages rather than total satisfaction.[8] Employees might avoid serving new customers who are difficult to satisfy if they know that the new customer will lower their average satisfaction score. Indeed, one service manager told us that the best way to improve average satisfaction is to get rid of dissatisfied customers. This averaging effect applies only when non-customers are ignored. If

[8] One might approximate total satisfaction with volume-weighted scores, i.e., scores proportional to sales volume times the sample average.

customers and non-customers are measured, total satisfaction differs from the sample average only by a constant scaler.

The argument against measuring non-customers is that customers can be measured more precisely—they are easier to locate and have more experience upon which to base evaluations. Non-customers have perceptions, not experience, and lost customers have experience that is out of date. This argument is consistent with research on expertise (Alba and Hutchison 1987) and consideration-set measurement (Howard and Sheth 1969, Silk and Urban 1978). Because reductions in precision lower profitability (Proposition 3), some firms and market research suppliers appear to believe that the cost of reducing precision exceeds the benefit of reducing selection bias.

We now analyze this issue with the formal model.

In equation (3) satisfaction, $\tilde{s}$, represents the aggregate satisfaction of customers summed over all customers including those to whom the firm sells and those who choose competitive products and services. For analytical simplicity our model is continuous; all customers buy, but in varying amounts. To capture the notion of "*the firm's customers*," we replace that measure with an average over only those customers who purchase above a certain amount of the focal firm's product. We denote this set by $q_f$ and call the new average satisfaction measure $\tilde{s}_a$. We assume customers in the complement set (to $q_f$) satisfy their needs with competitors' products and services. Specifically[9] ($|q_f|$ is the measure of $q_f$):

$$\tilde{s}_a = \frac{1}{|q_f|} \int_{c \in q_f} b_c dc + \tilde{\epsilon}_a. \tag{10}$$

PROPOSITION 4. *If satisfaction, averaged over just the firm's customers, is used in the linear reward rather than total satisfaction for the firm's customers summed across all of the customers in the market then (a) sales volume and total satisfaction decline, and (b) the firm earns less profit.*

The intuition behind Proposition 4 is that satisfaction, averaged over only customers, distorts the reward system and the employees' allocations of effort. The employees find it attractive to allocate more effort to relatively few customers. In fact, if there were no weight at all on sales volume and measurement variance was independent of sample size, then all of the employees' efforts would be allocated to only one customer. This reduction in the number of customers degrades profit. Note that Proposition 4 is more than a statistical sampling result. Proposition 4 suggests that the "wrong" measures cause the employee group to distort their effort allocations thus causing the firm to earn less profit.

Let us now examine the precision argument. Current practice seems to be either to ignore non-customers or to treat customers and non-customers alike. The formal model suggests that we can improve current practice by weighting customers and non-customers differently.

To keep the analysis simple we consider an ex ante segmentation into "customers" and "non-customers." Let $\tilde{s}_c$ be satisfaction as measured over the firm's customers and let $\tilde{s}_n$ be satisfaction (with the focal firm) as measured over non-customers (i.e., the competitors' customers). Let $\sigma_c^2$ and $\sigma_n^2$ be the corresponding variances. If the firm's customers' satisfaction can be measured more precisely, then we have the following relationships among the measurement variances:

$$\sigma_c^2 < \sigma_s^2 < \sigma_n^2, \qquad \sigma_s^2 = |q_f|\sigma_c^2 + (1 - |q_f|)\sigma_n^2. \tag{11}$$

PROPOSITION 5. *Given a segmentation into customers and non-customers, if the firm can measure the satisfaction of its customers more precisely than it can measure the*

[9] Technically, we allow the employee group to observe $\tilde{s}_a$ after each customer producing an equation (10′) analogous to (3′).

*satisfaction of non-customers, and if it rewards differentially on the two measures, then (a) the weight placed on satisfaction of customers is greater than the weight placed on non-customers, (b) a non-zero weight is placed on non-customer satisfaction, and (c) profits improve.*

Proposition 5 is important because it suggests that current practice can be improved. However, we know of no firms that reward differentially on the two measures. Note that Proposition 5 differs from Proposition 4 because it addresses explicitly the precision of the measures rather than any misallocation of effort that results from the wrong measure. The difference may be subtle, but as the propositions suggest, it is possible to improve firm profits.

*Should All Customers Be Treated Equally?*

Even if we consider only the firm's customers it is not clear that we should reward efforts to all customers equally. Consider three *WordPerfect* customers. Aleksas is very satisfied with *WordPerfect* and is unlikely to switch. Bjorn is less satisfied with *WordPerfect* and believes he would be more satisfied with *Microsoft Word*—he might switch if the relative level of service provided by *WordPerfect* or *Word* changes. Jody is a dissatisfied *WordPerfect* user who has switched to *Word*—it would take a tremendous effort to switch her back to *WordPerfect*. Clearly, the marginal returns to *WordPerfect* for providing Bjorn with superior service exceeds the marginal returns for providing Aleksas and Jody with superior service. This does not imply that it is optimal to ignore Aleksas or Jody, rather, we should design an incentive system to reflect the different marginal returns to employee effort directed at different customer groups.

It is common practice to use *top-box* reward systems, which reward employees based on the number (or proportion) of customers who responded with the highest possible satisfaction ratings. Such systems reward service to Aleksas but not to Bjorn or Jody. Another common practice is to penalize only the *bottom box*. For example, Xerox has as its goal for 1993 that 100% of its customers be at least "somewhat satisfied" (Menezes 1991). Such systems reward service to Jody but not to Bjorn or Aleksas. Both *top box* and *bottom box* reward systems adopt strategies which overlook the relative switching probabilities and the consequent marginal returns to effort. More formally,

PROPOSITION 6. *If customers can be segmented by the marginal effort it takes to attract or retain them, then the firm can improve its profits by using a weighted, rather than unweighted, satisfaction score.*

A particularly stark example of this occurs when some customers are tied to a firm by switching costs. (For example, see Borenstein 1991 and Weiss and Anderson 1992.) We model switching costs by assuming that $\ell < 1$ customers are tied to the firm while $1 - \ell$ are not.

PROPOSITION 7. *If customers can be segmented by switching costs, then (a) the firm can improve its profits by placing different weights on the sales and satisfaction of customers with different switching costs, and (b) satisfaction receives the highest weight when the absolute values of the switching costs are small.*

The intuition behind Proposition 7 is simple. If switching costs vary, then there are greater returns to having employees focus on the customers who can be induced to switch more easily. This is true whether a priori the switching costs favor or hurt the focal firm. For such an incentive system to work, however, the employees must be able to identify the status of each customer and to disaggregate effort to customer segments.

Proposition 7 is important because it supports our intuition that the incentive system should focus on customers that are more likely to be affected by employee effort. Existing

practice may be improved by investigating customer switching costs when designing incentive systems.

*Should We Measure Satisfaction with Competitors' Products?*

Puritan-Bennett's spirometry division satisfied their current customers, large clinics and hospitals, quite well. (Spirometers measure lung capacity.) But in 1990 a competitor, Welch-Allyn, introduced a product that better satisfied the needs of general practitioners. Customers were satisfied with Puritan-Bennett's product, but general practitioners were more satisfied with the Welch-Allyn product. Once the opportunity was identified Puritan-Bennett responded quickly with an improved product that satisfied both their current customers and the potential general practitioner market. The product increased total sales five-fold (Hauser 1993).

The American Society of Quality Control suggests that approximately half of the corporate boards surveyed evaluate management performance with *relative* customer satisfaction (Ryan 1992). One reason might be that relative satisfaction (focal firm vs. competition) might be a better indicator of tomorrow's sales. For example, Griffin and Hauser (1993) report that satisfaction with the focal firm's product alone had negligible correlation with sales. When satisfaction with the firm's product versus the competitors' products was considered the correlation with sales exceeded 0.80.

Another reason, which we can explore here, is that measuring the customer satisfaction of competitive products might help a focal firm understand better those components of satisfaction that are related to employee effort versus those aspects of satisfaction that are related to changes in the industry. Define measures, $\tilde{s}$ for the focal firm and $\tilde{S}$ for the competitors or a non-equivalent benchmark (Vaziri 1992). These measures might have a positive correlation that is not related to employee efforts. For example, new technologies or process improvements enable every firm to provide improved products and services. We have also seen negative correlations, in part, because customers' perceptions of customer satisfaction are themselves relative. Customer satisfaction with a product depends upon the industry standards or the relative performance of alternative product offerings. An increase in satisfaction with a competitor's product might reduce satisfaction with the focal firm's offering.

When $\tilde{s}$ and $\tilde{S}$ are correlated, it is possible to use $\tilde{S}$ to obtain more precise measures of the effort levels performed by the focal firm's employees (Holmstrom 1979). Suppose that we reward based on satisfaction relative to a competitor: $\tilde{s} - \zeta\tilde{S}$. We again use the impact of information in the reward system to derive the following practical result.

PROPOSITION 8. *If satisfaction with the competitor's product can be measured costlessly, it should be incorporated into the incentive system whenever the correlation between the measures, $\tilde{s}$ and $\tilde{S}$, is non-zero.*

Naturally, the optimal weight, $\zeta^*$, depends upon solving simultaneously the full first-order conditions. However, to understand the intuition of Proposition 8, suppose that $\rho$ represents the correlation between the satisfaction measures, then the variance of the relative measure is $\sigma_{\tilde{s}}^2(1 + \zeta^2 - 2\rho\zeta)$. The precision will increase (variance decrease) whenever $\rho$ and $\zeta$ are of the same sign and $|\zeta| < 2|\rho|$. A smaller correlation means a weaker signal implying a smaller weight for competitive satisfaction.

*Should All Employees Be Measured Against the Same Index?*

Efficient-market theory suggests that a firm should be valued by its stock price and that the market ensures that the stock price contains all publicly available information about the long-term value of the firm. If this is true, any action that raises the stock price should be in the interests of the firm. Hence, if employees own sufficient stock, then one might argue that all of their actions should be consistent with the interests of the firm.

Because employees share the costs and rewards of their actions, self-monitoring and mutual monitoring should develop (Russell 1985). Indeed, corporations such as Avis, Du Pont, Pepsico, Polaroid, and Wendy's each have extensive employee-ownership programs[10] designed to provide such motivation (Scholes and Wolfson 1990). Employee stock ownership plans (ESOPs) are now in place at more than 11,000 companies covering 11.5 million employees (Rosen 1990). Results have been mixed. The U.S. General Accounting Office reports that employee ownership combined with employee participation and management commitment has had a positive impact on performance in some cases but not in others (Klein and Hall 1988, Rosen 1990).

While stock-based measures contain information about the effectiveness of the top corporate officers, they are much less informative about other employees (Scholes and Wolfson 1990). In a $2 billion company, there is very little a single assembly-line employee can do that will have a noticeable positive impact on the stock price. Indeed, personal agendas will be much more salient to the employee than any stock-price impact. Because such employees benefit from the actions of other employees without taking (costly) actions themselves, the stock-price incentive may not be sufficient to encourage employees to make personal sacrifices. For example, members of a software development group at a major computer company told us that they were rewarded based on customers' satisfaction with the entire computer system. They felt that since they had such a relatively small impact on the overall computer system, the measures had little impact on their behavior and simply introduced more uncertainty into their incentive systems. That firm is in the process of developing measures that can be disaggregated so that the link between the satisfaction measure and employee effort is stronger.

In our analysis customer satisfaction is an indicator of employee effort directed at improving future sales potential. If satisfaction is a better indicator of an employee group's enduring efforts, then the noise in the model, $\sigma_s^2$, is smaller, implying that more weight should be placed on customer satisfaction (Proposition 3). Thus, if satisfaction can be disaggregated so that it relates better to an employee group's enduring efforts, then we have the following result.

COROLLARY. *If the firm uses disaggregate measures of satisfaction, matched to the enduring efforts of each employee, to enhance precision (reduce $\sigma_s^2$) relative to aggregate measures, the firm (a) will weight the disaggregate measures more than it would have weighted the aggregate measure and (b) profits will increase.*

In the field, we have observed that a number of firms use methods such as the House of Quality and the voice of the customer (Hauser and Clausing 1988, Roberts 1992) to develop customer-need-specific measures of satisfaction that can be linked to the efforts of employee groups. See McLaurin and Bell (1993) for an example at Weyerhaeuser.

*Summary*

Our formal analysis justifies some existing (but not universal) practices and suggests new ones. Specifically, customer satisfaction measures are more effective and profitable if:

- customers *and* non-customers (potential customers, past customers, and competitors' customers) are measured,
- the difference in measurement precision for customers and non-customers is reflected in the reward functions,
- greater weight is given to customers with lower switching costs,

[10] Avis is 100% employee-owned and advertises that employee-owners work harder to meet customer needs; Pepsico and Wendy's allocate 10% of an employee's pay in options; 20% of Polaroid's stock is owned by its employees; Du Pont gave every employee 100 shares.

- *relative* satisfaction (satisfaction with our product vs. that with competitors' products) is measured, and
- satisfaction measures are disaggregated to reflect better the impact of each employee's enduring actions.

The actual costs of the measures, their relative precision, and their actual correlations are necessary to address questions such as how many customer segments, what sample sizes, and what level of disaggregation is optimal.

## 7. Summary, Future Directions, and Implications for Field Research

Many firms now use or are considering systems in which promotion, awards, or compensation depend upon measures of customer satisfaction (or quality). Furthermore, much research in a variety of literatures focuses on the tradeoffs that managers and workers make between short-term (ephemeral) actions and decisions and long-term (enduring) actions and decisions. In this paper we seek to provide a formal structure to explore some of these issues.

In particular, we define enduring effort as that component of actions and decisions that affects long-term sales, and we define satisfaction (or quality) as that measure which is an indicator of the amount of enduring effort that is expended. We recognize explicitly that such measures are noisy, and we address the implications of that noise. Using well-established premises and a simple model that isolates the essential phenomena, we provide an explanation of why customer satisfaction incentive systems enhance long-term profits. Our propositions suggest that well-designed systems provide the right signals to employee groups so that employee groups, acting in their own best interests, make the tradeoffs among ephemeral and enduring efforts that are in the long-term interests of the firm. On the other hand, poorly-designed systems decrease long-term profits. We use the model to explore current practice and to suggest improvements. We also demonstrate how the model can be used to explore the interaction of customer satisfaction incentive systems with other management issues such as life-time employment and employee empowerment.

Only formal extensions can establish the true generality of our analyses. Extensions to different demand and cost functions, s-shaped effort-to-satisfaction mappings, other forms of risk aversion, oligopolies, and heterogeneity that is not independent across periods each provide interesting technical challenges. Some of these can be analyzed in the context of the optimal linear contracts used here. Others may need to use linear contracts as robust approximations to optimal non-linear contracts. Explicit consideration of intervening variables such as expectations and explicit modeling of more complex causal structures should prove fruitful. Satisfaction measures have been evaluated as indicators of future sales potential; such measurement research might be extended to explore satisfaction as an indicator of enduring efforts.

Our corollary suggests that when satisfaction measures are disaggregated properly to employee groups, satisfaction incentives reduce the free-riding problems inherent in ESOPs and in incentive systems based on aggregate satisfaction. However, some free-riding problems may still exist within or between employee groups. We have only begun to address this problem.

The mathematical structure might also apply to other relationships where repeat business is important to profit but the enduring efforts of an agent are not readily observable. For example, franchisors might provide incentives to franchisees, manufacturers to distributors and retailers, and parent companies to subsidiaries. Naturally, any analysis would be modified to address specific issues that arise in these relationships.

Another challenge is the notion of an internal customer. Many firms reward upstream employees for satisfying downstream employees, presumably as surrogates for the final customer. While our structure begins to address this issue, it does not take into account

potential distortions due to gainsharing between upstream and downstream employees nor does it take into account benefits to the downstream employees that are not in the interest of the firm. We are currently investigating incentive systems to address this problem. Under the proposed incentive system, internal customers would make an interim selection from a menu of contracts after observing the efforts of the upstream employees. In doing so, they signal the level of enduring effort expended by those employees. Upstream employees are then rewarded based on this signal.

Perhaps the most interesting extensions are empirical. We have made a number of recommendations for practice. These remain to be tested. It would also be useful to have a census of current practice. We predict that customer satisfaction systems can be profitable if the enhanced profit exceeds measurement costs. Comparisons of a firm's satisfaction asset versus the firm's value (stock price) could yield insight on this hypothesis.

Aspects of our theory have been applied at both a financial-services firm and a $2 billion manufacturing firm. At the financial-services firm a team of telephone representatives has been identified and trained to service a set of profitable accounts. While the employees do not receive explicit customer satisfaction bonuses, customer satisfaction measures influence evaluations. Both sets of measures are relative, include customers and non-customers, and are disaggregated through voice-of-the-customer analyses. The firm will track effort allocations, sales, revenue, profits, and other measures. At the manufacturing firm two test/control quasi-experiments are underway—one in the U.S. and one in Europe. In the test cells a set of employees have been trained to undertake tasks directed at improving customer satisfaction. Effort allocations, sales, reservation prices, revenues, profits, and other measures are being tracked. The measures are relative, include customers and non-customers, and are disaggregated. To uncover the longer-term impacts of the proposed reward systems, one would have to track these measures over time.[11,12]

[11] Ronit Bodner (MIT) analyzed the initial data from the financial services firm and suggested numerous references. Funding was provided by the International Center for Research on the Management of Technology. We benefitted from comments by our MIT colleagues and the member companies Our thanks to managers at the unnamed financial services firm and the manufacturing firm, to managers at a number of Fortune 500 firms, and to professionals at a number of market research and quality consulting firms for providing us with insight on corporate practice. Earlier versions of this paper were presented at the TIMS Marketing Science Conference in London, the ORSA/TIMS Conference in San Francisco, the ICRMOT pro-seminar series, the MIT Marketing Group Workshop, the AMA Educators' Conference (Executive Program) in Boston, the University of Florida's Winter Retreat, and internal seminars at member companies and at consulting firms. Eric Anderson, Eugene Anderson, Claes Fornell, Josef Mazanec, Roland Rust, Hermann Simon, the Area Editor, and two anonymous reviewers each provided detailed comments on earlier drafts. Cover art copyright, New Vision Technologies, Inc.

[12] This paper was received March 1993 and has been with the authors 5 months for 2 revisions. Processed by Robert Meyer, Area Editor.

## Appendix: Proofs of Propositions 1–7

*Profit Equation.* By substituting (7), $p_1^* = (2 + \beta_1)/4$, and $p_2^* = [2 + \eta + \delta\beta_2]/4$ into $\pi = p_1\bar{q}_1 + p_2\bar{q}_2 - \hat{w}_1 - \hat{w}_2$ we get:

$$\pi = \left[\frac{2+\beta_1}{4}\right]^2 + \left[\frac{2+\eta+\delta\beta_2}{4}\right]^2 - \left[\frac{\beta_1}{2}\right]^2 - \left[\frac{\delta\beta_2+\eta}{2}\right]^2 - \tfrac{1}{2}r[\beta_1^2\sigma_{1q}^2 + \eta^2\sigma_s^2 + \delta^2\beta_2^2\sigma_{2q}^2]$$

$$- \tfrac{1}{2}(1-\delta)r\beta_2^2\sigma_{2q}^2 + \text{constants.} \quad \text{(A1)}$$

PROPOSITION 1. *If satisfaction can be measured costlessly, it is better to reward on both satisfaction and volume than on volume alone.*

PROOF. By optimality, it is weakly better to have the option of regulating both $\beta_1$ and $\eta$. As the following results will show, $\eta$ is not a constant function of the parameters and therefore zero at most on sets of zero

measure (in parameter space). Since the parameters of the model satisfy the second order conditions, there is a unique optimum. Thus a non-zero $\eta$ implies the improvement is non-zero. □

To prove the rest of the propositions we need some preliminaries. The first order conditions are:

$$\frac{\partial \pi}{\partial \eta} = [-(3 + 8r\sigma_s^2)\eta - 3\delta\beta_2 + 2]/8 = 0$$

$$\frac{\partial \pi}{\partial \beta_1} = [-(3 + 8r\sigma_{1q}^2)\beta_1 + 2]/8 = 0$$

$$\frac{\partial \pi}{\partial \beta_2} = [-3\delta\eta - (3\delta^2 + \{1 - \delta + \delta^2\}8r\sigma_{2q}^2)\beta_2 + 2\delta]/8 = 0. \tag{A2}$$

Using the implicit function theorem on the first and third of these we know that $d\eta/d\phi$ is given by:

$$\frac{d\eta}{d\phi} = -\left[m_{11}\frac{\partial^2 \pi}{\partial \eta \partial \phi} + m_{12}\frac{\partial^2 \pi}{\partial \beta_2 \partial \phi}\right] \tag{A3}$$

where $\{m_{ij}\}$ is the inverse of $\{\partial^2\pi/\partial u_i \partial u_j\}$, $(u_1, u_2) = (\eta, \beta_2)$, and $\phi$ is an arbitrary parameter. If $|M|$ is the determinant of this inverse, these reduce to:

$$|M|m_{11} = -(3\delta^2 + \{1 - \delta + \delta^2\}8r\sigma_{2q}^2)/8$$

$$|M|m_{12} = 3\delta/8 \tag{A4}$$

From the second order conditions we know $|M| > 0$.

PROPOSITION 2. $d\eta^*/d\delta < 0$.

PROOF. (a) (A3) gives:

$$\frac{d\eta^*}{d\delta} = -\frac{\partial^2 \pi}{\partial \eta \partial \delta} m_{11} - \frac{\partial^2 \pi}{\partial \beta_2 \partial \delta} m_{12}.$$

Direct calculation reveals that:

$$\frac{\partial^2 \pi}{\partial \eta \partial \delta} = -3\beta_2/8$$

$$\frac{\partial^2 \pi}{\partial \beta_2 \partial \delta} = [2 - 3\eta - (6\delta + \{2\delta - 1\}8r\sigma_{q2}^2)\beta_2]/8$$

using $\eta > 0$, $|M| > 0$, and substituting $\beta_2$ from the first-order conditions we see (after some calculation) that $d\eta^*/d\delta < 0$. The profit impact depends upon the net effect of customer satisfaction as a means to pay today for enduring effort and customer satisfaction as a source of information about future sales. □

PROPOSITION 3. (a) $d\eta^*/d\sigma_s^2 < 0$. (b) $d\pi^*/d\sigma_s^2 < 0$.

PROOF. (a) Using (A1) and $|M| > 0$:

$$\frac{d\eta^*}{d\sigma_s^2} = -\frac{\partial^2 \pi}{\partial \eta \partial \sigma_s^2} m_{11} < 0.$$

(b) By invoking the envelope theorem, we show this by direct differentiation of (A1). □

PROPOSITION 4. *If rewards are linear in $\tilde{s}_a$, rather than $\tilde{s}$, then $q_f$, $\tilde{s}$, and $\pi$ are lower.*

PROOF. Fix a finite cutoff quantity For all $j \in \mathbb{R}^+$, if the employee group puts effort levels $\bar{a}j^{-1/2}$, $\bar{b}j^{-1/2}$ on a set of customers with measure $j$ and zero on the remaining $(1 - j)$, the effort costs are $\bar{a}^2 + \bar{b}^2$. The employee group's valuation of expected pay is: $\beta_1(\bar{a}j^{-1/2})j + \eta(\bar{b}j^{-1/2})j + \delta\beta_2(\bar{b}j^{-1/2})j$ plus terms not involving $(\bar{a}, \bar{b}, j)$ and its risk costs are $\frac{1}{2}r\sigma_s^2 j^{-1}$ plus terms not involving $(\bar{a}, \bar{b}, j)$. For any level of effort cost, the employee group can maximize expected pay, less the cost of risk, by letting $j$ go to zero. This will reduce $q_f$, $\tilde{s}$ and $\pi$. □

PROPOSITION 5. *If the satisfaction of a segment with measure $h$ can be measured with variance $\sigma_h^2$ and the satisfaction of the remaining $1 - h$ customers can be measured with variance $\sigma_{1-h}^2 > \sigma_h^2$, then profits improve if a greater weight is placed on $\tilde{s}_h$ and a non-zero weight is placed on $\tilde{s}_{1-h}$.*

PROOF. The optimality of a linear scheme in two measures follows directly from Holmstrom and Milgrom. By Proposition 3, a greater weight should be placed on the measure with least variance, and by Proposition 1,

no weight should be zero except on a set of measure zero. Strict improvement follows from the second-order conditions. □

PROPOSITION 6. *If it takes less effort to get equivalent sales from each customer in a segment of measure $l$ than from the remaining customers (measure $1 - l$), then the firm can improve its profits by rewarding the sales and satisfaction for each segment differently.*

PROOF. The optimality of a linear scheme in two sets of measures follows directly from Holmstrom and Milgrom. Let the purchase quantities for customers in each segment be defined as (where $\tau < 1$):

$$\tilde{q}^{l}_{1c} = 1 + \tilde{e}_{1c} + a^{l}_{c} - p_1$$

$$\tilde{q}^{1-l}_{1c} = 1 + \tilde{e}_{1c} + \tau a^{1-l}_{c} - p_1$$

$$\tilde{q}^{l}_{2c} = 1 + \tilde{e}_{2c} + b^{l}_{c} - p_2$$

$$\tilde{q}^{1-l}_{2c} = 1 + \tilde{e}_{2c} + \tau b^{1-l}_{c} - p_2.$$

Allowing the employee group to discriminate between customers in the different segments and the firm to charge differential weights results in the following profit function:

$$\pi = p_1[l\tilde{q}^{l}_{1c} + (1-l)\tilde{q}^{1-l}_{1c}] + p_2[l\tilde{q}^{l}_{2c} + (1-l)\tilde{q}^{1-l}_{2c}] - l[a^{2}_{l} + b^{2}_{l}] - (1-l)[a^{2}_{1-l} + b^{2}_{1-l}]$$

$$- \frac{r}{2l}[\beta^{2}_{1,l}\sigma^{2}_{1q} + \eta^{2}_{l}\sigma^{2}_{s} + \delta^{2}\beta^{2}_{2,l}\sigma^{2}_{2q}] - \frac{r}{2(1-l)}[\beta^{2}_{1,1-l}\sigma^{2}_{1q} + \eta^{2}_{1-l}\sigma^{2}_{s} + \delta^{2}\beta^{2}_{2,1-l}\sigma^{2}_{2q}]$$

$$- (1-\delta)[\alpha_2 + \beta_{2,l}q^{l}_{2c} + \beta_{2,1-l}q^{1-l}_{2c}].$$

As the parameter $\tau$ does not drop out of the first order condition with respect to $\eta_{1-l}$ it will affect the optimal incentive weights (except at most on sets of zero measure). Strict improvement follows from the second-order conditions. □

PROPOSITION 7. *If consumers in segments $l$ and $1 - l$ have different switching costs then their satisfaction should be weighed differently and the higher the switching costs the lower the weights.*

PROOF. Since the second part of the proposition implies the first we only prove the second part. In a two period model, higher switching costs mean that first period sales are more valuable because they make second period sales easier to achieve. This can be captured by scaling first period profits. The relative preference for first or second period profits is represented by the rate at which profits are discounted in the second period. Discounting the firm's profits more in the second period increases $\delta$ (recall that $\delta$ represents the employee group's discount rate given that the firm's discount rate is normalized to one) and by Proposition 2, an increase in $\delta$ reduces the weight given to customer satisfaction in the incentive scheme. □

PROPOSITION 8. *If satisfaction with the competitor's product can be measured costlessly, it should be incorporated into the incentive system whenever the correlation between the measures, $\tilde{s}$ and $\tilde{S}$, is non-zero.*

PROOF. By direct application of the Holmstrom (1979, p. 84) result that more information, beyond that obtainable with $\tilde{s}$, improves the ability of the firm to design an incentive system. □

COROLLARY. *If the firm uses disaggregate measures of satisfaction, matched to the enduring efforts of each employee, to enhance precision (reduce $\sigma^2_s$) relative to aggregate measures, the firm (a) will weight the disaggregate measure more than it would have weighted the aggregate measure and (b) profits will increase.*

PROOF. By assumption $\sigma^2_s$ decreases, thus the corollary follows directly from Proposition 3. □

**List of Symbols**

| | |
|---|---|
| $a$ | ephemeral effort (can vary by customer) |
| $b$ | enduring effort (can vary by customer) |
| $c$ | representative customer (actually integration over $dc$) |
| $e$ | error term of variable. Subscripts indicate which variable. |
| $g$ | the firm's initial reputation |
| $h$ | measure of segment in Proposition 5 |
| $j$ | measure of segment in Proposition 4 |
| $\ell$ | fraction of customers who are loyal (higher switching costs) |
| $l$ | measure of segment in Proposition 6 |
| $M(m_{ij})$ | matrix (elements of), in Appendix |
| $p$ | price |
| $\tilde{q}$ | quantity sold |

| | |
|---|---|
| $r$ | coefficient of risk-aversion |
| $\tilde{s}(\tilde{S})$ | measured satisfaction (of competitor or other benchmark) |
| $U(\cdot)$ | employee utility |
| $U$ | base wage |
| $w$ | payment to employee group ($\hat{}$ indicates candidate rewards) |
| $\alpha$ | constant parameter in incentive system |
| $\beta$ | sales volume parameter in incentive system |
| $\delta$ | employees discount factor |
| $\eta$ | satisfaction parameter in incentive system |
| $\pi$ | profits |
| $\rho$ | correlation |
| $\zeta$ | weight on competitive satisfaction (or other benchmark) |
| $\sigma^2$ | variance (subscripts indicate specific variances) |
| $\phi$ | arbitrary parameter in Appendix |
| $\tau$ | scale for effort of the non-loyal customers (Proposition 6 in Appendix) |

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