We investigate the salesforce compensation strategy of a firm selling products in a category that several consumers find technically sophisticated, such as electronics or financial products with legal fine print. Consumers are unable to judge the value difference between a baseline product and a product upgrade with add-on features. While the firm and the salespeople are informed of the value of these features, consumers are uncertain. Thus, consumers have to rely on sales assistance to evaluate alternatives. The salesperson decision variables include selling effort and whether to "oversell" the consumer by overclaiming the value of added features. Because sales revenue depends on both the salesperson’s selling effort and consumers’ valuation of the added features, the salesforce incentive scheme (which can consist of salary, sales commission, or consumer satisfaction-based commission) may induce the short-term oriented salesperson to misrepresent the value of the upgrade. Exaggeration of the value of the added features, however, results in reduced satisfaction levels leading to lower profits for the firm. We show that a salesperson selling products where the value of the upgrade is low prefers to make higher claims when the sales commission rate is sufficiently high. We conjecture that consumers aware of the incentive structure facing the salesperson expect the true value of the add-on feature to be lower than the claimed value. We study the optimal compensation scheme of a firm, which has to communicate her true type and retain its salesforce credibility. We identify the conditions under which a high-upgrade-type firm indicates its true value by altering sales commission rate and satisfaction-based commission rate.

(Consumer Satisfaction; Salesforce Compensation; Signaling; Sales Assistance)

1. Introduction
Consider the following scenario. A consumer wants to purchase a receiver for a home theatre system of a national brand and goes to a major electronics and appliances retailer. There are several available alternatives priced between $199 and $1,000, where the more expensive systems have additional features. After eliminating several alternatives, the consumer is undecided between two options, one of which is more expensive but has additional features such as Digital Signal Processing (DSP) and Advanced Processing (24 bit for Dolby Digital and 32 bit for DSP sound fields). The consumer is uncertain of the benefits of these features and of their match with his requirements. During the process of decision making, where the consumer is evaluating whether he should purchase the more expensive model with the added features, a salesperson volunteers to assist the consumer. After hearing the consumer describe his dilemma, the salesperson recommends the more expensive model. The consumer, wary of the sales pitch, begins evaluating whether to take the salesperson’s advice to
purchase the more expensive model. At this stage, the salesperson informs the consumer that she is compensated on salary only. Another anecdote concerns a consumer deciding between an array of mutual fund options. The financial advisor points out that one of the funds has higher loads and management fees but recommends it anyway. The financial advisor adds that she is also compensated based on consumer satisfaction.

Consumers are increasingly becoming aware of the compensation structure paid to firm employees. In case of insurance related products, the regulation in several countries such as Australia, Norway, France, and the United Kingdom requires that the insurance agent exactly disclose to consumers the fees or commissions he or she receives (e.g., The Economist 1994). Recently, some firms have used the strategy of informing consumers as to how they favor salary and consumer satisfaction over commission in their compensation schemes to the salesforce. The following real-world examples attest to the growing significance of this approach. The salespeople at the major electronics retailer, Best Buy, routinely tell consumers that they are compensated on salary only. PrinSource Financial Center (a subsidiary of Principal Mutual Life Insurance Company) compensates financial planners who consumers talk to on a salary (The Commercial Appeal 1995). In a 1999 advertising campaign, Charles Schwab informed consumers that their agents are not paid on commission. In advertisements for Virgin Financial, Richard Branson, the CEO vaunts that the salespeople are compensated on salary and criticizes competitors who charge commissions (Life Insurance International 1995).

The direct implication of these anecdotes is that salespeople on commission are likely to indulge in overselling, which can lead to exaggerated claims, purchase of product upgrades, add-on features, and unnecessary preventative maintenance. It is the inability of a firm to effectively monitor salespeople all the time that raises this issue. In these contexts, even in the case of firms of high repute, salesforce incentives may cause them to engage in this concept of overselling. For example, a salesperson may convince a less-informed consumer of need to buy a high-end consumer electronic item made by a reputed firm such as Sony, while a low-end product might have well served the purpose.

Consider the traditional salesforce compensation model where the firm (the principal) cannot observe the salesperson’s (the agent’s) effort, and the sales outcome depends on a stochastic realization. In this case, the firm cannot infer the effort of the salesperson based on observed sales. In this context, the optimal effort required by the risk-neutral firm differs from the risk-aversive salesperson’s utility maximizing effort level. Designing of incentive schemes to overcome this “moral hazard” problem has been studied in the literature (e.g., Basu et al. 1985). We consider another important decision on sales assistance made by salespeople: whether to oversell to the consumer. In many situations where the product is technologically sophisticated (most electronics), where the technical or legal language used is unfamiliar (financial products), or the service contains credence properties (auto or home repair), consumers often rely on the salesperson’s assistance to determine the value of various alternatives. For example, the choice of an investment portfolio by a consumer may be influenced by the information provided by the financial advisor. This results in an opportunity for the salesperson to push higher priced alternatives to consumers. In these situations, a major consumer concern is whether the salespeople are pushing unneeded upgrades to them.

We extend the salesforce compensation literature in several important ways. We model the design of optimal compensation packages when salespeople decisions include both the level of product quality to claim to consumers as well as their effort levels. We also show that the firm can use the salesforce compensation package as a signaling mechanism to alleviate consumer uncertainty regarding overselling.

2. Model

We formulate a game with three participants: the firm, the salesperson employed by the firm, and potential consumers. The firm can be a manufacturer or can also be viewed as a retailer. The firm (or the retailer) carries a product line where products are differentiated in terms of added features. The firm delegates to its salesperson to provide sales assistance (Wernerfelt
1994) to the consumer. While in some cases, the value of the upgrade may be apparent, the focus of this model is on situations where novice consumers are unable to judge the value of added features in product upgrades. Thus, consumers rely on sales assistance to acquire attribute information and interpret the value of the added features. As is standard in the literature, the salesperson and the firm do not share common objectives. The objective of the firm is to maximize its profit, whereas the objective of the salesperson is to maximize her utility. Consequently, the salesperson may not spend as much selling effort as desired by the firm. This moral hazard problem has been extensively studied in agency literature (for example, Holmstrom 1979, Grossman and Hart 1983, Basu et al. 1985). We also model the salesperson’s motivation to oversell the consumer to increase her compensation. Overselling refers to the salesperson claiming a higher value to the add-on feature of the upgrade than the real value to the consumer (Chu et al. 1995). The consequence of overselling is that consumers may be less satisfied in the postconsumption period. This, in turn, could reduce the firm’s future profits.

We explicitly model the interface between the salesperson and consumers. Knowledge of the salesperson’s compensation structure could correctly lead the consumers to infer that the salesperson may have engaged in overselling. Hence, the consumer would discount the information provided by the salesperson. The goal of this paper is to study the impact of consumer inferences on the design of incentive schemes. In this section, we begin with the specification of market demand and consumer satisfaction functions. We then discuss the salesperson’s decisions and, finally, the firm’s design of the optimal compensation scheme.

2.1. Market Demand
In our model, we assume that the firm makes two products, where one product is a standard product, while the second one is an upgrade containing an add-on feature and is priced higher. Our definition of product upgrade specifically refers to any product that contains features that are more valuable to consumers than a baseline product. We consider situations where there is information asymmetry about the product upgrade between the salesperson and the consumers. The salesperson knows the value of added feature with certainty, while consumers are uncertain. We assume that the firm has been in the market long enough to establish a reputation. The reputation is achieved by using the standard marketing-mix elements such as advertising campaigns. The firm-level quality perceived by the consumers serves as a baseline in our model.

For ease of analysis, we assume that the value of the product upgrade is either high or low.\(^1\) The firm, thus, can be categorized as being either a high type or a low type. A Bernoulli distribution describes the consumers’ prior belief that the value of the upgrade being high is equal to \(\phi\).

We model the market demand with a simple linear demand function

\[
x = \alpha_0 + \alpha_1 e + \alpha_2 v^E - p + \epsilon_x,
\]

where the intercept \((\alpha_0)\) can be interpreted as a firm’s baseline sales that is increasing with its reputation. The price of the product is denoted by \(p\). The sales demand function captures the positive effect of salesperson’s selling effort \((e)\) and expected value of the add-on feature \((v^E\), where superscript \(E\) denotes the consumer expectation of the product). The error term \(\epsilon_x\) is a normally distributed random variable with mean zero and variance \(\sigma_x\).

In demand function (1), we assume that consumer demand is affected by two actions taken by the salesperson: (1) the effort expended by the salesperson \((e)\), and (2) the extent of overselling by the salesperson \((v^C)\). Here, we use superscript \(C\) to denote claim of the value of the add-on feature. Besides time, we view effort as a surrogate measure for service quality performance indicators such as the dimensions of reliability, responsiveness, assurance, and empathy as measured by the SERVQUAL (Parasuraman et al. 1988) scales. Consistent with prior research using the agency paradigm (for example, see Basu et al. 1985), we also interpret the selling effort \((e)\) as the incremental effort relative to what the agent would expend without incentives.

\(^1\) Note that there is only one firm that can be either a high type or a “ghost” low type.
The second component of the sales response function is the consumers’ expected level of value of the add-on feature \((v^E)\), which depends on the salesperson’s assertion of the value of the additional feature to the consumer \((v^C)\). This situation occurs in several categories such as insurance policies or financial products that typically contain diagnostic information in fine print, auto repair, or technologically sophisticated products like electronics. Because the salesperson knows the value of the add-on feature with more certainty, she needs to decide the level of value \((v^C)\) to be professed to the consumers. We also assume that the salesperson decision on the value claimed is independent of the individual characteristics of the consumers. Note that consumer beliefs about the expected value \((v^E)\) of the add-on feature are based not only on the professed claim \((v^C)\) made by the salesperson. We demonstrate later that the expected level of overselling will also be based on the knowledge of the compensation structure of the salesperson.

2.2. Consumer Satisfaction
Consumer satisfaction is a measure of a summary evaluative response by the consumer. This summary response contains evaluations of both the product (Tse and Wilton 1988) as well as the interaction with the salesperson (Oliver and Swan 1989). Consumer satisfaction is usually considered to be a postpurchase phenomena, but has been conceptualized as either a postconsumption judgment (Tse and Wilton 1988) or a postchoice evaluation (Westbrook and Oliver 1981). We adopt the former view because our model is concerned with categories where consumers form assessments of the add-ons after consumption. Thus, consumers can evaluate the worth of the upgrade only after purchase and consumption. We further assume that the consumers are homogenous in this regard. Firms obtain measures of consumer satisfaction after consumers have had an opportunity to resolve all or part of the uncertainty about the add-ons. In our model, consumers realize the true (and, hence, the extent of exaggeration, if any, by the salesperson) value of the add-on feature before providing consumer satisfaction ratings.

We recognize and allow for the possibility that consumer satisfaction is measured with error, consistent with Hauser et al. (1994). Further, the distribution of consumer satisfaction is conditional on both selling effort and level of overselling. Expected consumer satisfaction \((y)\) increases with the salesperson’s effort but decreases with the overselling:

\[
y = \beta_1 e - \beta_2 (v^C - v) + \varepsilon_y. \tag{2}
\]

In Equation (2), \(v\) is the consumers’ true value for the add-on feature and \(v^C\) is value claimed by the salesperson. Therefore, \(v^C - v\) is the amount of overselling. The last item is a normally distributed random variable with mean zero and variance \(\sigma^2_y\). We further assume that \(\varepsilon_x\) and \(\varepsilon_y\) are independent.

As standard in the agency models (Holmstrom 1979, Grossman and Hart 1983, Basu et al. 1985), it is expensive for the firm to monitor (or cannot legally verify) the salesperson’s effort \((e)\). The firm observes the demand \((x)\) with certainty. Analogously, the firm also cannot observe the level of overselling to the consumer \((v^C)\) but is able to measure the level of consumer satisfaction \((y)\). The accuracy of satisfaction ratings can vary with the firm’s measurement programs. Several firms sporadically conduct satisfaction surveys while others like Xerox survey 40,000 consumers on a monthly basis.

2.3. Compensation Schemes
The firm chooses a compensation scheme to maximize its profit. A salesperson’s compensation \((s)\) is a function of sales and consumer satisfaction \((y)\):

\[
s = s(x, y). \tag{3}
\]

The firm has the option of offering any combination of salary, sales commission, and satisfaction-based commission to maximize profit. Each of these components of the compensation scheme serves different purposes. Salary has been viewed in the literature as an appropriate compensation when the impact of a salesperson’s performance is difficult to tie to sales or when the firm’s objectives are not short-term sales. Sales commissions are considered best to

\[2\] The noninclusion of an intercept term does not alter the analysis.

\[3\] Formulations having sales commission based on sales unit have been adopted in other papers, including Hauser et al. (1994).
motivate salespeople to increase effort in achieving sales. In the context of our model, the sales-based incentives motivate employees to increase time spent with potential consumers and improve presales effort on dimensions enumerated by the SERVQUAL scales. Satisfaction-based incentives, on the other hand, serve the purpose of ensuring that the salespeople would continue to focus on both pre- and postsales effort, such as responding to consumer queries like when to change portfolios or quickly responding to consumer concern, such as making quick payments on insurance claims. In addition, we view both salary and satisfaction-based incentives as mechanisms to improve salespeople performance in providing complete and accurate information about the product or service such as the benefits and risks of alternative investment portfolios or insurance policies.

2.4. Firm’s Problem
We consider two time periods, namely, current and future. We explicitly consider the profit arising from current period purchases by the consumers and use a reduced-form expression to capture the future profit arising from the consumer, which is solely based on consumer satisfaction (see Chu and Desai 1995 for details on the long-term implications of consumer satisfaction). We assume that the satisfaction measure is obtained at the end of the first period. The firm chooses a compensation scheme $s(x, y)$ and price to maximize its total long-term expected profit (which consists of both the current expected profit and future expected profit). The profit function is given by

$$\pi_T = (p - c_T)x - s(x, y) + \theta_1 y,$$  \hspace{1cm} (4)

where subscript $T \in \{h, l\}$ denotes the type of upgrade value, $p$ is price, $c_T$ is the marginal cost, $x$ is demand, $s$ is the compensation paid to the salesperson, and $\theta_1 y$ is future profit related to the stock of consumer satisfaction. Under complete information (where consumers can evaluate the true value of the product upgrade), we assume that $c_h > c_l$, but the difference is sufficiently small so that a firm should prefer $(v_h, c_h)$ to $(v_l, c_l)$. We further assume that given the level of value of the upgrade fixed, a firm’s equilibrium price increases with cost. For analytical implications of these two assumptions, please see the Appendix.

Following Hauser et al. (1994), we let the firm (endogenously) select its price. We use $\theta_1 y$ as a surrogate for discounted future profit as a parsimonious way to model the long-term effect of the salesperson’s action to improve consumer satisfaction. There is growing evidence that there is a positive relationship between consumer satisfaction and outcome measures of interest to the firm such as repurchase intentions, loyalty, and profitability (Anderson and Sullivan 1993, Boulding et al. 1993, Boulding et al. 1999, Anderson et al. 1994).

2.5. Salesperson’s Problem
The firm employs a salesperson who is compensated to sell the firm’s products. As earlier defined, the salesperson gets a total compensation $s(x, y)$. The salesperson makes decisions on the amount of selling effort to expend and the level of overselling. The salesperson’s behavior can be described through the utility function and two conditions, namely, the individual rationality (IR) and the incentive compatibility (IC) condition. The salesperson’s utility function is given by

$$U = 1 - \exp[-r(s - e^2 + \theta_2 y)].$$  \hspace{1cm} (5)

Therefore, the utility function is constantly risk averse with $r$ the measure of risk aversion. The salesperson derives positive utility from compensation ($s$), but a negative utility from expending effort. Note that we allow the salesperson to potentially benefit from consumer satisfaction ($\theta_2$). The level of $\theta_2$ is likely to vary across industries. For example, in the financial product markets where the consumer interacts with a broker on a regular basis, the level of loyalty to the salesperson may be high. Therefore, the salesperson can reap considerable benefits from repeat business as well as from word-of-mouth referrals leading $\theta_2$ to be high. On the other hand, in the real estate market, the salesperson is less likely to derive long-term benefits from a consumer resulting in a low $\theta_2$. The utility function we assume in Equation (5) is concave with respect to compensation and convex with respect to selling effort. Therefore, the salesperson has decreasing marginal utility from compensation and increasing marginal cost by spending effort.
Both assumptions are standard in the agency literature. The particular forms of functions we use are also consistent with the literature. We assume that there is no disutility from overselling itself (other than its long-term economic consequences).

The IR condition requires that the expected utility a salesperson expects to receive should be at least as large as her reservation utility (denoted by $R_0$). The reservation utility can be interpreted as the surplus a salesperson can receive in other employment opportunities:

$$EU \geq R_0. \quad (6)$$

The IC condition requires that a salesperson behave in her best interest. In other words, she maximizes her utility by spending an optimal level of effort and choosing an optimal level of overselling:

$$(e^*, v^C) = \arg \max_{e, v^C} EU. \quad (7)$$

The salesperson has a choice of either overselling or not overselling. We assume that the salesperson has no incentive to engage in underselling. Therefore, if a firm sells a high-value upgrade, the salesperson will always state the true value to consumers. Consequently, if a salesperson claims a low value of the add-on feature, the consumers should correctly infer that the true value is low with a probability of one. This assumption can be expressed into the following beliefs:

$$\tau(v^C = v_h | v_h) = 1, \quad \tau(v_l | v^C = v_l) = 1, \quad (8)$$

where $\tau$ denotes the probability of belief. Clearly, if the value of the add-on feature is low, there may be an incentive for the salesperson to overclaim. Note that, suppose consumers believe such a claim, the demand will be higher. However, the firm as well as the salesperson will be hurt due to a lower satisfaction rating, resulting in lower future earnings. Often, the time horizon of the salesperson is shorter than that of the firm. The short-term orientation or higher discounting by the salesperson implies a lower $\theta_2$. Therefore, the positive impact of higher sales may outweigh lower compensation from lower consumer satisfaction. In that case, the salesperson has an incentive to falsely claim high-value of the upgrade when the true value of the add-on feature is low. Given such an incentive, rational consumers cannot separate a true high value from a false one. In this context, the firm with a high-value upgrade has to develop a compensation scheme that ensures that truthful statement about value is fully consistent with the salesperson’s objective to maximize her profit.

3. Model Analysis

3.1. Benchmark Model: No Asymmetric Upgrade-Value Information

We begin with a simple model where we assume that the consumers are perfectly informed about the value of the upgrade. Without asymmetric information about the worth of the add-on feature, a firm with upgrade value $v$ sets a compensation scheme to maximize its expected profit (4) subject to IR condition (6) and IC condition (7). Because consumers know the value of the upgrade with certainty, the firm’s only concern is to induce an optimal level of selling effort. This problem is formally defined as follows:

(P1) \[ \max_{p,s} E\pi_T = (p - c_T)Ex - Es(x, y) + \theta_Ey \]

such that $EU \geq R_0$ and

$$e^* = \arg \max EU,$$

$$v^C = v.$$

Similar to other literature (e.g., Thevaranjan and Joseph 1998), we restrict our attention to only linear
compensation contracts: \(^5\)

\[
s(x, y) = \psi_0 + \psi_x x + \psi_y y \quad (\psi_x \geq 0, \psi_y \geq 0),
\]

where \(\psi_0, \psi_x, \) and \(\psi_y\) represent salary, sales-based commission rate, and satisfaction-based commission rate, respectively.

**3.1.1. Salesperson’s Optimal Decisions.** Because consumers know the value of the upgraded product, the salesperson’s claim becomes a trivial issue (\(v^c = v\)). Because the salesperson’s utility function (5) is constantly risk averse and both uncertainty variables (\(\varepsilon_x\) and \(\varepsilon_y\)) are independently and normally distributed, utility maximization problem (7) is equivalent to the following problem:

\[
e^* = \arg \max E u = \arg \max \psi_0 + \psi_x E x + (\psi_y + \theta_2) E y - e^2
- \frac{r}{2} [\psi_x^2 \sigma_x^2 + (\psi_y + \theta_2)^2 \sigma_y^2].
\]

We solve the above problem (10) through first-order condition and obtain the following result:

\[
e^* = \frac{\alpha_1 \psi_x + \beta_1 (\psi_y + \theta_2)}{2}. \tag{11}
\]

The above expression indicates that the salesperson puts more selling effort under conditions when consumers’ sales response is more sensitive to selling effort and when the sales commission rate is high. Second, selling effort increases when it is more effective in increasing consumer satisfaction (\(\beta_1\)) through selling effort, and when the consumer satisfaction-based commission rate is high. Note that when the salesperson is compensated on salary only, the salesperson expends effort only to increase consumer satisfaction for a higher future profit.

**3.1.2. Firm’s Optimal Decisions.** To satisfy the IR condition (6), while incurring the lowest cost, the firm always sets the salary such that the constraint is binding. Therefore,

\[
E u = \psi_0 + \psi_x E x + (\psi_y + \theta_2) E y - e^2
- \frac{r}{2} [\psi_x^2 \sigma_x^2 + (\psi_y + \theta_2)^2 \sigma_y^2] = R, \tag{12}
\]

where \(R = \ln(1 - R^0)/(-r)\). Substituting Equations (10)–(12) into the firm’s objective function in (P1), we can derive the first-order conditions with respect to \(p, \psi_x, \) and \(\psi_y\). From the first-order conditions, we can then solve firm’s optimal decisions as follows (for the derivation, please see the Appendix):

\[
\psi_x^* = \frac{\alpha_0 \alpha_1 + \alpha_2 (v_T - c_T) + 2 \beta_1 (\theta_1 + \theta_2)}{(4r\sigma_x^2/\alpha_1) + (4 - \alpha_1^2)(\alpha_1/2 + (\beta_1^2/(2\alpha_1))(\sigma_y^2/\sigma_y^2))},
\]

\[
\psi_y^* = \frac{\sigma_y^2 \beta_1 \psi_x^* - \theta_2}{\sigma_y^2}, \tag{14}
\]

\[
p^*_T = \frac{\alpha_0 + \alpha_2 v_T + c_T}{2} + \frac{\alpha_1 \psi_x^* + (\psi_y^* + \theta_2) \beta_1}{2}, \tag{15}
\]

where \(\psi_x^*\) and \(\psi_y^*\) are the optimal sales commission rate and satisfaction-based commission rate of the firm with upgrade value type \(T\) (high or low). For the rest of this paper, optimal decisions given by Equations (13)–(15) will be referred to as the “complete upgrade-value information” solution. The firm is unable to reach the full information solution because it cannot monitor the risk averse salesperson’s behavior. Equation (14) indicates an interesting relationship between sales-based and satisfaction-based commission rates. Because the salesperson is risk averse, the firm has to compensate for the risk the salesperson undertakes. With both sales-based and satisfaction-based commissions available to induce the salesperson’s effort, it is optimal for the firm to combine these two mechanisms for a smaller total risk premium. Because the risk premium paid to the salesperson increases with the variance of corresponding measure (either sales or consumer satisfaction), a higher weight should be allocated to the measure with the smaller variance. Therefore, if the realization of consumer satisfaction is quite noisy, a firm should compensate its salesperson with large sales commission and small satisfaction-based commission. Another implication is that each type of commission rate increases with its effectiveness in inducing the salesperson’s selling effort. For example, given all else equal, if selling effort has a larger impact on the expected demand (or a larger \(\alpha_1\)), then the firm should offer a higher sales commission rate.

\(^5\)It is important to note that the efficiency of signaling depends on the form of the contract. The quantitative results will be different in that the signaling will be more efficient if the contract is nonlinear.
Equation (15) indicates that price increases with the value of the upgrade. Therefore, without uncertainty, a high-upgrade firm charges a higher price for the add-on feature than a low-upgrade firm does. This is obvious as consumers value the add-on feature and, hence, demand increases with the level of feature improvement. From Equations (13) and (14), we can further infer that the high-upgrade firm also offers higher commission rates (both sales-based and satisfaction-based). Compared to a low-upgrade firm, a high-upgrade firm offers high commission rates, because inducing extra selling effort from the salespeople is more valuable due to the larger margin. We summarize the above discussions as follows:

\[
(\psi_{x,h}^*, \psi_{y,h}^*, p_{y,h}^*) > (\psi_{x,l}^*, \psi_{y,l}^*, p_{y,l}^*). \tag{16}
\]

### 3.2. Salesperson’s Credibility and Compensation Schemes: Asymmetric Information

In this section, we analyze the impact of the alternative compensation packages on the salesperson’s selling effort and incentive to overclaim the value of the upgrade. According to Equation (8), a salesperson always tells the true value when she sells a high-upgrade product. When a salesperson sells a low-upgrade product, she has the option to either reveal the true value of the feature or to make a higher value claim. From IC condition (7), a salesperson for a low-upgrade firm reveals the truth if, and only if, she expects a lower utility from making a higher claim. Thus,

\[
\begin{align*}
\text{Max } EU(v^C = v_x | v_i) & \leq \text{Max } EU(v^C = v_y | v_i). \tag{17}
\end{align*}
\]

Using the expressions from the sales response function (1), the satisfaction response function (2), and the salesperson utility function (10), the above condition can be simplified to

\[
\psi_x \leq \frac{\beta_2}{\alpha_2} (\psi_y + \theta_2). \tag{18}
\]

Therefore, if a firm offers a compensation scheme satisfying condition (18), the salesperson prefers not to claim higher value on the add-on feature.

Equation (18) yields the condition under which the low-upgrade firm’s salesperson reveals the true value. First, not surprisingly, a lower sales commission rate \((\psi_s)\) leads to a smaller marginal benefit to the salesperson to overstate value. Second, the more effective it is to increase sales revenue through value claim \((\alpha_2)\), the larger the marginal value to the salesperson and the higher the value stated. \(\alpha_2\) is likely to be high in some product categories such as stock recommendations, where the discrepancy between the consumers’ knowledge and that of the broker is high. Thus, heavier reliance would be placed on the claim made by the seller. Alternatively, in product categories such as car insurance, consumers are more likely to form judgements independent of the seller leading to low sensitivity to value claimed. The third implication of Equation (18) is that the more sensitive consumer satisfaction is to value overclaimed \((\beta_2)\), the larger the marginal cost to the salesperson and, consequently, lower the value claimed. It is easy for a consumer to evaluate (at least in the medium term) the value of a mutual fund against the professed claim. Here, sensitivity to overclaims is likely to be high. Alternatively, in products containing higher levels of credibility properties (e.g., car repair) the sensitivity to overclaims may be low. Fourth, the higher the consumer satisfaction-based commission rate \((\psi_y)\), the higher the marginal cost to overstating value. Consequently, salespeople are less likely to overclaim. Thus, we can conclude that a salesperson is more likely to exaggerate the value of a product upgrade when she is on a higher sales commission rate. Further, a salesperson is less likely to exaggerate when she is on a larger consumer satisfaction-based commission rate.

We now compare the salesperson’s incentives to make high-upgrade claims under three types of frequently observed compensation schemes: salary only, salary plus sales commission, and salary plus sales and satisfaction-based commissions. Under a compensation scheme with salary only, compensation \(s\) is a constant and independent of sales \((x)\) or the consumer satisfaction level \((y)\). Therefore, the salesperson’s marginal benefit when upgrade-value expectation \((v^F)\) is increased is zero. But, the marginal cost is positive as the value overstatement leads to a lower level of consumer satisfaction and, hence, decreased future utility. As a result, the salesperson has no incentive (actually a disincentive) to exaggerate upgrade value. In contrast, under a sales commission \((\psi_s)\), increased expected valuation leads to
higher expected sales and higher expected compensation. Therefore, the marginal benefit from higher $v^E$ is positive. Because the marginal cost of overstating remains the same as under the salary-only scheme, we should observe a higher level of upgrade value stated under sales commission. Finally, if a salesperson is also compensated on consumer satisfaction-based commission, the marginal cost of overstating value not only arises from the loss of future value (as in the previous two cases), but also from the decrease in current compensation through lower commission arising from lower (expected) consumer satisfaction. This reduction in satisfaction-based commission acts as a partial deterrent to overstate value. Therefore, when compared to the case with salary plus sales commission, salespeople have a lower incentive to overstate upgrade value.

When consumers are informed of the compensation schemes, they must correctly infer the incentives of the salesperson to exaggerate the value of the upgraded product. Thereafter, they must discount claims accordingly. We reiterate that the “true” upgrade value is not known to consumers, and the measure $v$ as the upgrade value level exaggerated is a mere modeling convenience. Thus, while consumers realize that they must discount claims under schemes with sales commission, they do not know the exact extent to which they must do so. Given the above inferences, we make the following conjecture:

1. A salesperson’s upgrade claim will be more heavily discounted with any scheme based on sales commission.
2. A salesperson’s upgrade claim will be less heavily discounted when compensation is based on satisfaction ratings.

3.3. Optimal Compensation Scheme Under Asymmetric Upgrade Information

We now examine the firm’s optimal compensation scheme where the consumers are uncertain about the value of the upgrade. In this case, the salesperson with the low-upgrade product may have an incentive to pretend that he is selling a high-upgrade product. The high-upgrade firm then stands to lose as consumers’ expected value is lower than the true value. The question then arises as to how the high-upgrade firm should retain her salesperson’s credibility, and signal its value by distorting its compensation scheme from the complete upgrade-value information solution $(\psi^*_x, \psi^*_y, p^*_h)$.

The standard methodology for addressing this question is to model the firm-salesperson-consumer interactions as a sequential game of incomplete information and look for a perfect Bayesian equilibrium. In this game, the firm moves first to set a salesperson compensation scheme. The salesperson moves second to decide her selling effort and the add-on value claim. Consumers move last and decide whether or not to purchase the product. A salesperson employed by the low-upgrade firm needs to decide whether to tell the truth or make a higher value claim. The salesperson makes the decision by comparing the increased sales commission due to a higher claim and decreased utility due to lower consumer satisfaction. The consumers make the purchase decisions based on the posterior assessment of the probability of dealing with the salesperson of a high-upgrade firm.

In §3.3.1 we begin by identifying the conditions under which both the high- and low-upgrade-value firms will offer the complete upgrade-value information compensation schemes. If these conditions hold, it is better off for the low-value firm not to mimic the high type. Thus, the salesperson of the low-upgrade firm will not make exaggerated claims. If the conditions do not hold, the low-upgrade value firm has an incentive to mimic the high-upgrade firm. The salesperson of the low-type firm, therefore, has an incentive to overclaim value. Because the consumers cannot correctly identify the true type, the salesperson’s claims are not credible. Therefore, the high-upgrade firm needs to retain its salesperson’s believability. We characterize two alternative approaches the high-upgrade firm can take to retain credibility. The first approach is discussed in §3.3.2. We demonstrate that the high-type firm formulates its compensation scheme by reducing sales commission rates and increasing satisfaction-based commission rates. Even if the low-value firm adopts the

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6 One issue is that the firm may not commit to the advertised compensation scheme and replace the contract with a different one that it does not publicize. The Wheeler-Lea Amendment of 1938 governed by the Federal Trade Commission regulates the
same scheme, it cannot successfully mimic the high type because the firms’ salesperson is better off by revealing the low value of the add-on feature.

The second approach (discussed in §3.3.3) available to the high type is to reduce both sales commission and satisfaction-based commission rates. We show that the low-upgrade firm does not mimic this scheme because the high-upgrade firm’s deviation (from the complete information scheme) further decreases the low-upgrade firm’s mimicking incentive.7 In §3.3.4, we discuss the conditions under which each of these two approaches is more efficient for the high-upgrade firm. In §3.3.5, we examine the efficiency of alternative signaling instruments such as dissipative advertising and money-back guarantees.

3.3.1. Complete Upgrade-Value Information Solution As an Optimal Compensation Scheme. In this section, we identify two conditions where the low-type firm prefers not to mimic the high type and offers the complete upgrade-value solution. For the rest of this paper, we will use Figure 1 to illustrate the intuition of many of the key results. In Figure 1, sales commission rate ($\psi_x$) is the vertical axis and satisfaction-based commission rate ($\psi_y$) is on the horizontal axis. Salesperson’s effort function (Equation (11)) is represented by the parallel dotted lines labeled as “Iso-Effort Lines.” Each line contains pairs of commission rates leading to identical level of optimal effort from the salesperson, with top lines indicating higher effort. In Figure 1, there are two bold and solid lines. One represents Equation (14),

$$\frac{\psi_x \sigma_y^2}{\alpha_1} = \frac{(\psi_y + \theta_2)\sigma_y^2}{\beta_1},$$

which shows the optimal combination of these two commission rates. We denote this line FH, where point H ($\psi_{x,h}^*, \psi_{y,h}^*$) and L ($\psi_{x,l}^*, \psi_{y,l}^*$) are complete upgrade-value information scheme of high-upgrade firm and low-upgrade firm, respectively. Another solid line (FBN) represents Equation (18),

$$\psi_x = \frac{\beta_2}{\alpha_2} (\psi_y + \theta_2),$$

where $\psi_{x,N} = \psi_{x,h}, \psi_{y,B} = \psi_{y,h}^*$. As discussed earlier, if the high-upgrade firm’s complete upgrade-value information compensation scheme satisfies

$\psi_{x,h}^* = \frac{\beta_2}{\alpha_2} (\psi_{y,h}^* + \theta_2)$

(Equation (18)), then the low-upgrade firm cannot conceal its true type as its salesperson will tell consumers the truth (a claim of low value is believed to be truth as assumed in Equation (8)). Thus, with any compensation schemes not above line FBN, the salesperson of the low-upgrade firm prefers to reveal the truth. Therefore, if point H happens to be below or on this line, the high-upgrade firm is able to achieve the separation from the low-upgrade firm at its complete upgrade-value information scheme. From Figure 1, we can easily find a sufficient condition for the existence of this type of costless separation: the second line has a larger slope

$$\left( \frac{\beta_2}{\alpha_2} \geq \frac{\alpha_1 \sigma_y^2}{\beta_1 \sigma_y^2} \right).$$

This condition requires that (1) the ratio between the impact of value fulfillment on satisfaction and the impact of upgrade value on sales be sufficiently large, (2) the ratio between the impact of selling effort on satisfaction and impact of selling effort on sales be sufficiently large, and (3) the ratio between the variance of satisfaction and variance of demand be relatively small. As elaborated in §3.3.3, we find that all three situations ensure a sufficiently large satisfaction-based commission rate and sufficiently small sales commission rate.

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[Note that the salesperson’s incentive-compatible selling effort (given by Equation (11)) only depends on commission rates (both sales based and satisfaction based). When a low-type firm mimics in both types of commission rates, its salesperson will also mimic efforts of the high-type firms’ salesperson.]

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7 Note that the salesperson’s incentive-compatible selling effort (given by Equation (11)) only depends on commission rates (both sales based and satisfaction based). When a low-type firm mimics in both types of commission rates, its salesperson will also mimic efforts of the high-type firms’ salesperson.
Recall that in the complete upgrade-value information scheme, the high-upgrade firm offers higher commission rates than the low-upgrade firm (see Equation (16)). If firms of different upgrade values offer different compensation schemes, consumers can infer the upgrade type by analyzing the compensation schemes. Therefore, to pretend to be like a high-upgrade firm, the low-upgrade firm has to deviate from its own complete upgrade-value information strategy \((\psi_1^*, \psi_2^*, p_1^*)\). The intuition is straightforward. Under the high-upgrade firm’s complete upgrade-value information scheme, if the sales commission rate is sufficiently small and the satisfaction-based commission rate is sufficiently high, the salesperson of the low-upgrade firm prefers to claim their product as low value. Therefore, if the low-upgrade firm mimics the high-upgrade firm by offering \((\psi_1^*, \psi_2^*, p_1^*)\), it stands to lose because its salesperson will tell consumers the truth. In equilibrium, the firm of either upgrade type offers their own complete upgrade-value information schemes and uncertainty about upgrade value is resolved.

To see the second condition, note that if point \(H\) is beyond line \(FBN\)
\[
\left(\psi_{z,h}^* > \frac{\beta_2}{\alpha_2} (\psi_{y,h}^* + \theta_2) \right),
\]
the low-upgrade firm’s salesperson prefers to overclaim value of the add-on feature. By mimicking the high-upgrade firm, the low-upgrade type’s expected profit changes from \(\pi_1^*\) to \(\pi_1(\psi_1^*, \psi_2^*, p_1^*; v_h)\), which denotes the low-upgrade firm’s profit when mimicking the high-upgrade firm’s complete upgrade-value information scheme and being perceived as a high-upgrade firm by the consumers. By mimicking the high-upgrade firm’s strategies, the low-upgrade firm is able to increase its sales revenue through a higher expected value. This mimicking incentive increases with \(\alpha_2\). Another benefit from mimicking is the increase in selling efforts due to higher commission rates. This benefit increases with \(\alpha_1\) (through

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A detailed analysis on the low-upgrade firm’s mimicking cost is available from the authors.
sales revenue) and $\beta_1$ (through satisfaction). The mimicking incentive decreases with risk parameter $r$ and variance $\sigma_x$ and $\sigma_y$ due to larger risk premium associated with increased commission rates. Note that the firm has to compensate the salesperson for these risks to guarantee participation.

On the other hand, by mimicking, the low-upgrade firm loses profit due to decreased consumer satisfaction $(\theta_2 \beta \mathbf{v})$, where $\mathbf{v} = v - v_i$. Moreover, the low-upgrade firm has to compensate its salesperson’s loss of utility from low satisfaction to ensure their participation $(\theta_2 \beta \mathbf{v})$. When the total amount of loss due to low satisfaction $(\theta_2 + \theta_1) \beta \mathbf{v})$ is sufficiently large so that $\pi_r(\psi_{x,h}, \psi'_{y,h}, p^*_h; v_h) < \pi^*_l$, the low-upgrade firm prefers to reveal its true value by selecting its own complete upgrade-value information scheme. In equilibrium, both types of firms offer their complete upgrade-value information compensation schemes, and by examining the compensation schemes, consumer uncertainty disappears. We summarize the above discussions in Proposition 1.

**Proposition 1.** It is optimal for the high-upgrade firm to offer complete upgrade-value information compensation scheme to the salesperson if

$$\frac{\beta_2}{\alpha_2} > \frac{\alpha_1 \sigma_y^2}{\beta_1 \sigma_x^2} \text{ or } \pi_r(\psi_{x,h}, \psi'_{y,h}, p^*_h; v_h) \leq \pi^*_l.$$  

### 3.3.2. Retaining the Salesperson’s Credibility.

When neither condition in Proposition 1 holds, a low-upgrade firm has an incentive to mimic a high-upgrade firm’s complete upgrade-value information compensation scheme and the low-upgrade firm’s salesperson will make an overclaim. Consequently, consumers cannot judge the true value of the add-on feature based on the salesperson’s value claim. Recall that our model considers the case where the salesperson is responsible for selling the baseline product as well as the upgrade with add-on features. There are three possible situations: (1) when the quality of both products is certain, (2) when the quality of one is certain but there is quality uncertainty of the other, and (3) when the quality of both products is uncertain. When both the products the salesperson sells have benefits easily discernable to the consumers (no quality uncertainty), then the firm should compensate this salesperson with the full quality information scheme.

The second situation arises when the salesperson sells both types of products (one product with sure benefits and one product with uncertain benefits). This situation is similar to the case where there is quality uncertainty regarding both products. Because it is the relative difference between the qualities of the two products that the consumers cannot assess, they have to rely on the salesperson’s assistance in both cases. While the salesperson should reveal the truth in selling the products of sure benefits, in the second and third situations, the salesperson has the incentive to overclaim the benefits of upgrade or underclaim the benefits of the baseline (based on whichever is uncertain) to consumers. Regardless, the firms still need to use the compensation scheme to signal the credibility of its salespeople.

One option the high-type firm has is to signal its salespeople credibility to the consumers. To signal its type, the high-upgrade firm could distort the sales commission rate downward and increase satisfaction-based commission rates. To reduce the low-upgrade firm’s incentive of mimicking the high type, the high-upgrade firm could incur a cost with the distortion. Essentially, the distortion should be such that if it mimics the compensation structure $\pi_r(\psi_{x,h}, \psi'_{y,h}, p^*_h; v_h)$, the low types’ equilibrium information profits are lower than its complete upgrade-value information profits ($\pi^*_l$).

Following the standard signaling paradigm, in any equilibrium, if the two types of firms offer different compensation schemes, the consumers can infer the true upgrade type via knowledge of the compensation scheme. This type of equilibrium is called separating equilibrium. This paper is analogous to the Chu and Chu (1994) paper in that both papers involve two players signaling to a third player (the consumer).

The high-upgrade firm can retain its salesperson’s credibility by deviating its compensation scheme from the complete upgrade-value information solution to satisfy condition (18). Because any compensation scheme below line FBN (see Figure 1) satisfies condition (18), the high-upgrade firm’s problem is to search for the one that maximizes its profit while retaining
its salesperson’s credibility.

\[
\pi_n^{S1} = \max_{s,p} E \pi_h \tag{19.1}
\]

such that

\[
Eu \geq R, \tag{19.2}
\]

\[
e^* = \frac{\alpha_1 \psi_x + \beta_1 (\psi_y + \theta_2)}{2}, \tag{19.3}
\]

\[
\sigma^C = v_h, \tag{19.4}
\]

\[
\psi_x \leq \frac{\beta_2}{\alpha_2} (\psi_y + \theta_2). \tag{19.5}
\]

The individual rationality condition (19.2) ensures the salesperson’s participation. Condition (19.3) ensures that the salesperson’s effort maximizes her utility. The separating constraint (19.5) guarantees that the salesperson should tell the true value of the add-on feature. The low-upgrade firm, which knows that its salesperson will not overclaim if it mimics the high-upgrade firm, is better off offering its own complete upgrade-value information scheme. In essence, the high-upgrade firm reformulates the compensation scheme so that the salesperson prefers to tell the truth. As a result, the salesperson’s credibility is directly retained. It can be demonstrated that there is a unique solution for this type of separating equilibrium (S1 in Figure 1). The analysis leads to the following proposition.

**Proposition 2.** (1) The high-upgrade firm can retain its salesperson’s credibility and prevent the low-upgrade firm’s salesperson from overclaiming value of the upgrade by setting a lower sales commission rate and higher satisfaction-based commission rate.

(2) Both equilibrium price and the salesperson’s selling effort decrease with the deviation.

Proposition 2 indicates that, compared to the complete information scheme, a high-upgrade firm offers higher satisfaction-based commission rate and lower sales-based commission rate to retain the salesperson’s credibility. Under this scheme, the salesperson finds it advantageous to reveal the truth. Consumers correctly infer that the salesperson is trustworthy.

The firm’s deviation in compensation scheme also results in a decrease in the salesperson’s selling effort. Recall that the optimal amount of effort that a firm wants depends on cost of effort paid through compensation and benefit of effort on sales and consumer satisfaction. As we have shown earlier, to generate any given level of selling effort from the salesperson, the firm’s most efficient solutions should satisfy

\[
\frac{\psi_x \sigma_y^2}{\alpha_1} = \frac{(\psi_y + \theta_2) \sigma_y^2}{\beta_1}.
\]

In Figure 1, we designate one Iso-Effort line to each level of selling effort. The intersection between an Iso-Effort line and line FH represents the most efficient solution that induces a particular level of selling effort. Now that a high-upgrade firm limits its decisions only to those under which the salesperson will tell the truth (under line FBN), the firm forces itself to adopt inefficient solutions. Hence, the salesperson’s selling effort becomes more costly to the firm. As a consequence, the resulting equilibrium level of selling effort decreases with the deviation in compensation schemes. Reduced selling effort also leads to a decline in the demand function. As an adjustment, the high-upgrade firm has to reduce price as well. Therefore, both selling effort and price decrease with this type of distortion in compensation scheme. Clearly, the high-upgrade firm incurs a cost to retain the credibility of its salesperson.

### 3.3.3. Upgrade-Value Signaling

We now discuss a second signaling strategy that the high-type firm can use. The low-upgrade firms’ objective in mimicking a high-upgrade firm is to be (mistakenly) perceived as the high type. With high perceived value \((v_h)\) and low cost \((c_l)\), the low-upgrade firm can enjoy a profit margin even larger than the high-upgrade firm \((v_h\) and \(c_h\)). Under this circumstance, the low-upgrade firm will find the selling effort more profitable than the high-upgrade firm does. Therefore, by mimicking the high-upgrade firm, the low-upgrade firm cannot only increase perceived value, but also raise the salesperson’s selling effort with larger commission rates. The increase in selling effort makes the increase in value perception more profitable. Without increased effort, the positive change in add-on value perception will be less attractive to the firm. Thus,
to signal the type, the high-upgrade firm may distort commission rates downward to reduce the low-upgrade firm’s incentive of mimicking. As before, the high-upgrade firm has to incur a cost with the distortion.

By offering such a separating equilibrium \((\psi_{y,x,h}^{S_2}, v^{S_2}_{y,x,h}; p^{S_2}_{h})\), the low-upgrade firm should earn less than \(\psi_{y,x}^*\) its profit under the complete upgrade-value information scheme. Therefore, the signal becomes credible only when the low-upgrade firm finds it more profitable admitting its true type than by mimicking. We focus on the compensation scheme that achieves least-cost separation, i.e., separation with the minimal signaling cost. Similar to problem (P2), we can define the high-upgrade firm’s problem (P3) to solve the least-cost separating equilibrium:

\[
\pi_{h}^{S_2} = \max_{\pi_h} E\pi_h \tag{20.1}
\]

such that

\[
E\pi \geq R, \tag{20.2}
\]

\[
e^{\pi} = \frac{\alpha_1 \psi_{y} + \beta_1 (\psi_{y} + \theta_2)}{2}, \tag{20.3}
\]

\[
v^C = v_{h^*}, \tag{20.4}
\]

\[
\pi_1(\psi_{y,x,h}^{S_2}, \psi_{y,h}^{S_2}, p_{h}^{S_2}; v_{h^*}) \leq \pi_1^*. \tag{20.5}
\]

Problem (P3) is similar to (P2), except for the separating constraint (20.5). The separating constraint (20.5) guarantees that the low-upgrade firm will not mimic the high-upgrade firm. In this type of separating equilibrium, the high-upgrade firm distorts its price and compensation scheme from the complete upgrade-value information scheme sufficiently enough to prevent the low-upgrade firm from mimicking. As a result, the high-upgrade firm can credibly signal its true type.\(^{10}\) We now summarize the results on the signaling properties in Proposition 3 and discuss the intuition.

**Proposition 3.** (1) The high-upgrade firm can also signal its upgrade-value type by decreasing rather than increasing commission rates from the complete upgrade-value information solution.

(2) Equilibrium commission rates still satisfy condition

\[
\psi_{y,x,h}^{S_2} = \frac{\sigma_y^2}{\sigma_y^2} \frac{\beta_1}{\alpha_1} \psi_{x,h}^* - \theta_2, \tag{20.6}
\]

(3) Price in this separating equilibrium is higher than the complete upgrade-value information equilibrium price.

Proposition 3(1) indicates that the high-upgrade firm should signal its true type by decreasing rather than increasing commission rates from the complete upgrade-value information scheme. When the low-upgrade firm is perceived as high-upgrade type but has low costs, it desires more selling effort than the high-upgrade firm does. Hence, increasing commission rates can be beneficial to the low-upgrade firm that mimics even though it is costly to the high-upgrade firm. On the other hand, when the high-upgrade firm distorts commission rates downward, the mimicking cost that the low-upgrade firm incurs will be much larger as the compensation scheme will be further away from its desired solution. In essence, with a smaller amount of selling effort resulting from reduced commission rates, the benefit of mimicking quickly diminishes. Thus, downward distortion in commission rates is less costly than upward distortion. Because we are only seeking the least-cost signaling strategy, in equilibrium, the high-upgrade firm should distort its commission rate downwards.

Both commission rates and price prove to be efficient signaling instruments. That is, for every extra unit of loss incurred by the high-upgrade firm, the low-upgrade firm will have to incur more than a unit of loss to mimic. Note that if the high-upgrade firm has a number of signaling instruments available, it should choose the most efficient combination (Milgrom and Roberts 1986, Srinivasan 1991). Proposition 3(2) indicates that the most efficient path of distortion is to decrease the commission rates along line FH. The intuition is as follows. For any compensation scheme satisfying

\[
\psi_{y,h} = \frac{\sigma_y^2}{\sigma_y^2} \frac{\beta_1}{\alpha_1} \psi_{x,h} - \theta_2,
\]

the high-upgrade firm’s signaling efficiency through two commission rates are equal

\[
\frac{\partial \pi_h / \partial \psi_x}{\partial \pi_h / \partial \psi_y} = \frac{\partial \pi_h / \partial \psi_{y,mimic}}{\partial \pi_h / \partial \psi_y}.\]

Suppose we take a small downward deviation in sales commission rate. Then, the efficiency of signaling through sales commission rate decreases, and

\[\text{Vol. 49, No. 5, May 2003}\]
becomes smaller than the efficiency of signaling through satisfaction-based commission rate. Therefore, it is better for the high-upgrade firm to switch the signaling mechanism to satisfaction-based commission rate. The path of distortion can, thus, be illustrated by the steps connecting H and S2 in Figure 1. The high-upgrade firm constantly alternates, decreasing these two types of commission rates until the low-upgrade firm prefers not to mimic. (Note that the size of distortion in each step in infinitesimal, but we draw big steps in Figure 1 for the clarity of demonstration.) Thus, the least-cost separating equilibrium should be on line FH.

The high-upgrade firm also distorts its price upward in the separating equilibrium. The intuition is similar to that earlier discussed. When a low-upgrade firm mimics, it expects to achieve a favorable position of high-upgrade-value type and low cost. The benefit associated with this favorable position is large enough to cover the firm’s profit loss due to expected consumer dissatisfaction. Thus, what attracts the low-upgrade firm to mimic is higher margins and larger sales. Compared to the high-upgrade firm, as the mimicking low-upgrade firm enjoys a greater margin, it prefers to charge a lower price to achieve higher sales. To reduce the low-upgrade firm’s benefits from greater margin, the high-upgrade firm distorts the price upward to reduce the sales volume. The distortion makes the mimicking less profitable. Clearly, the high-upgrade firm also incurs a cost from the distortion. However, with a smaller margin as compared to a low-upgrade firm, a high-upgrade firm’s loss is smaller than the loss that a low-upgrade firm incurs. Therefore, price increase is also an efficient signaling instrument.

3.3.4. Least-Cost Separation. In Propositions 2 and 3, we have discussed two different types of (costly) separating equilibriums. When the high-upgrade firm directly retains the salesperson’s credibility by increasing the satisfaction-based commission rate and decreasing the sales commission rate, it earns equilibrium profit \( \pi^1_h \) and incurs signaling cost \( \pi^2_h - \pi^1_h \). On the other hand, when the high-upgrade firm signals its type by reducing both sales-based and satisfaction-based commission rates, it earns equilibrium profit \( \pi^2_h \) and incurs signaling cost \( \pi^3_h - \pi^2_h \). To define the least-cost separation equilibrium, we need to compare the cost of these two types of signaling instruments. Based on earlier discussion, the least-cost separating equilibrium can be defined as follows:

\[
(\psi^S_{x,h}, \psi^S_{y,h}, p^S) = \begin{cases}
(\psi^S_{x,1}, \psi^S_{y,1}, p^S_1) & \text{if } \pi^S_1 > \pi^S_2, \\
(\psi^S_{x,2}, \psi^S_{y,2}, p^S_2) & \text{otherwise.}
\end{cases}
\]  

(21)

In the equilibrium, consumers update their belief that the upgrade offered by a firm is of high value according to value claimed by the salesperson and commission rates. More specifically, we can describe the posterior probability (denoted by \( \tau \)) as follows:

1. \( \tau(v = v_h | v^C = v_1) = 0; \)
2. If \( \psi^S_{x,h} \alpha_2 \leq (\psi^S_{y,h} + \theta_2)\beta_2 \), then \( \tau(v = v_h | v^C = v_h) = 1; \)
3. If \( (\psi^S_{x,h}, \psi^S_{y,h}) \neq (\psi^S_{x,1}, \psi^S_{y,1}) \), then \( \tau(v = v_h | \psi^S_{x,h}, \psi^S_{y,h}, v^C = v_h) = 1; \)
4. Otherwise \( \tau(v = v_h) = \phi \).

The amount of distortion in the compensation scheme necessary to achieve the separation depends on the low-upgrade firm’s loss in future profit due to mimicking (lower consumer satisfaction). For expositional convenience, we arbitrarily classify the level of loss as either high, medium, or low. As earlier stated, if the future profit loss is high, the high-upgrade firm can achieve the separation with the complete upgrade-value information scheme.

If the future profit loss is at the medium level, the high-upgrade firm will achieve type-two separating equilibrium (lower sales-based and lower satisfaction-based commission rates). Finally, if the future profit loss is small, the high-upgrade firm will achieve type-one separating equilibrium (smaller sales commission rate and larger consumer satisfaction-based commission rate). We explain the intuition for the last two results as follows.

The high-upgrade firm’s signaling cost in type-one separating equilibriums is equal to \( \pi^1_h - \pi^3_h \). When the low-upgrade firm’s future profit loss due to mimicking is in the medium range, it takes only a small amount of distortion in compensation schemes to...
achieve the type-two separation. Therefore, the signaling cost with second type of separating equilibrium \( (\pi_h^* - \pi_h^{S2}) \) is smaller than \( \pi_h^* - \pi_h^{S1} \). As a result, type-two separating equilibrium is the least-cost separating equilibrium. On the other hand, if the low-upgrade firm’s future profit loss due to mimicking is small, it takes a large amount of distortion in compensation schemes to achieve the type-two separation. Therefore, the signaling cost with the second type of equilibrium \( \pi_h^* - \pi_h^{S2} \) is larger than \( \pi_h^* - \pi_h^{S1} \). As a result, type-one separating equilibrium becomes the least-cost separating equilibrium.

3.3.5. Alternative Signaling Instruments. To reassure the consumer that the salesperson will not try to cheat to get them to buy extras, a firm may consider alternative signaling instruments such as dissipative or uninformative advertising (Milgrom and Roberts 1986). Another possibility is to offer a returns policy such as a money-back guarantee (Moorthy and Srinivasan 1995). We examine as to whether or not these signaling instruments are appropriate, and if they are, will they be employed as part of the least-cost signal? Dissipative advertising, by definition, does not affect the demand but merely adds to the fixed cost. Consequently, dissipative advertising as a signaling instrument does not have a “single-crossing” property. That is, for each dollar that a high-type (upgrade-value) firm spends on dissipative advertising, it costs only $1 for a low-type firm to mimic. In contrast, as we have shown in §§3.3.2 and 3.3.3, for every extra unit of loss incurred by the high-upgrade-value firm through distortions in sales or satisfaction-based commission rates, the low-upgrade value firm will have to incur more than one unit of loss to mimic. Therefore, the compensation scheme proves to be more efficient than dissipative advertising. (For additional details on relative efficiency of signals, see Srinivasan 1991.)

A money-back guarantee is a return policy for a period that normally ranges up to 30 days. During this period, the consumer may return the product for a full refund. (In view of the moral hazard problem—the inability to monitor the effort expended by the consumer in maintaining the product—these policies have a short expiration.) A consumer who has been upgraded to buy an advanced product with features may take a considerably longer time to figure out that they, indeed, do not use such features. In the case of services such as insurance, it may take years before the consumer recognizes the overprovision. Therefore, money-back guarantee cannot be an effective signal. In summary, the reformulating compensation scheme can be a superior method to reassure consumers of the credibility of salespeople, even when other instruments such as uninformative advertising and money-back guarantees may be available.

4. Conclusion

In this paper, we examine the role of a salesperson’s incentive to oversell by making an exaggerated claim of the value of an add-on feature in a product upgrade. The firm can neither monitor the effort expended nor the value claimed by the salesperson. When the salesperson compensation derives a larger fraction of compensation based on sales commission, there is an incentive to falsely claim higher value about the add-on feature. Any scheme based on consumer satisfaction mitigates this problem. Lower consumer satisfaction arising from unfulfilled value claims (recognized after consumption) affects current and future earnings of the salesperson. Therefore, when incentivized on consumer satisfaction, a salesperson’s incentive to exaggerate upgrade value is reduced.

A natural issue that arises is whether the firm can develop a compensation scheme that signals the worth of the upgrade to consumers and eliminates the scope for the salesperson to make false claims. A high-upgrade firm can offer a scheme that prevents the low-upgrade firm from profitably mimicking the scheme. Such a scheme automatically eliminates the incentive for the salesperson to exaggerate value. The high-upgrade firm essentially decreases the variable compensation arising from sales commission as well as consumer satisfaction to achieve this result. Alternatively, the firm can also provide the appropriate incentive for the salesperson sufficient incentive to truthfully reveal the value of the add-on feature in the upgrade. In that case, there is no incentive for any low-upgrade firm to mimic the high-upgrade firm, because consumers correctly know the true value. A
scheme that lowers sales commission rate and raises consumer satisfaction rate achieves this objective.

Essentially, our model underscores the importance of weighing the satisfaction score to incent the salesperson to engage in truthful selling. Not doing so raises the specter of false claims by an aggressive salesforce. A case in point is the example of Prudential. The firm’s salesforce has been litigated for erroneous and misleading assertions while selling insurance and investment instruments. Not coincidentally, the salesforce was heavily compensated on sales commissions (New York Times 1997). In future research, other incentive schemes such as sales contests (e.g., Kalra and Shi 2001) may result in the overselling need to be investigated.

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Appendix: Complete Upgrade-Value Information Strategy
By substituting Equations (10)–(12) into the firm’s objective function in (P1), we can rewrite the firm’s objective function as

\[ E \pi_T = (p-c_T)(\alpha_0 + \alpha_1 e + \alpha_2 e^2 - p) - R + (\theta_1 + \theta_2) \beta e - e^2 \]

where

\[ e = \alpha_1 \psi_v + \beta_1 (\psi_p + \theta_2) \]

from (11).

We can then obtain the first-order conditions

\[ \frac{\partial E \pi_T}{\partial \psi_v} = \alpha_0 + \alpha_1 e + \alpha_2 e^2 - 2p + c_T = 0, \quad \text{(A1)} \]

\[ \frac{\partial E \pi_T}{\partial \psi_p} = \alpha_1 (p-c_T) - 2e(\psi_p, \psi_v) - \psi_v r \sigma^2_p \]

\[ = 0, \quad \text{(A2)} \]

\[ \frac{\partial E \pi_T}{\partial \theta} = \beta_1 (p-c_T) - 2e(\psi_p, \psi_v) - (\psi_v + \theta_2) r \sigma^2_p \]

\[ = 0. \quad \text{(A3)} \]

We can now solve the optimal commission rates and prices from Equations (A1)–(A3):

\[ \psi_{\pi_T}^* = \frac{\alpha_0 + \alpha_1 (\alpha_2 v_T - c_T) + 2 \beta_1 (\theta_1 + \theta_2)}{2 \alpha_2} \]

\[ = \frac{\alpha_0 + \alpha_1 (\alpha_2 v_T - c_T) + 2 \beta_1 (\theta_1 + \theta_2)}{4 \alpha_2} \]

\[ \psi_{\theta}^* = \frac{\alpha_1 \beta_1}{\alpha_2}, \quad \psi_{\pi_T}^* - \theta_2, \quad \text{(A4)} \]

\[ \psi_{\pi_T}^* = \frac{\alpha_0 + \alpha_1 (\alpha_2 v_T - c_T) + 2 \beta_1 (\theta_1 + \theta_2)}{4 \alpha_2} \]

\[ \psi_{\theta}^* = \frac{\alpha_1 \beta_1}{\alpha_2}, \quad \psi_{\pi_T}^* - \theta_2, \quad \text{(A5)} \]

\[ p_T^* = \frac{\alpha_0 + \alpha_2 (\alpha_2 v_T - c_T) + \alpha_1 \psi_{\pi_T}^*}{2} + \frac{\alpha_2}{2} \psi_{\pi_T}^* + (\psi_{\psi_v}^* + \theta_2) \beta_1. \quad \text{(A6)} \]

Assumption 1 (in §2.4). Under complete upgrade-value information (where consumers know the value), we assume that \( v_T > c_T \), but the difference is sufficiently small so that a firm prefers \( (v_T, c_T) \) to \( (v, c) \).

Implication: Equations (A4)–(A6) imply that equilibrium profit depends on firm’s type \( T \) only through \( \alpha_2 v_T - c_T \). Therefore, under complete upgrade-value information, a firm prefers \( v_T \) to \( v \) if and only if \( \alpha_2 v_T - c_T > \alpha_2 v - c_T \). With this condition, from (A4)–(A6) we can further conclude that \((\psi_{\pi_T}^*, \psi_{\theta}^*, p_T^*) > (\psi_{\pi_T}^*, \psi_{\theta}^*, p_T^*)\).

Assumption 2 (in §2.4). Under complete upgrade-value information, we assume that given the level of value fixed, a firm’s equilibrium price increases with cost.

Implication: Assumption 2 implies that \( p'(v_T, c_T) > p'(v, c) \). In other words, if a firm offers a product or service with upgrade value \( v_T \), then its equilibrium price should be higher if the firm incurs higher cost and vice versa. Substituting level of value and cost into (A6), we can solve corresponding equilibrium price under high and low cost. To sustain Assumption 2, it is necessary that

\[ \frac{(c_T - c)}{2} \left[ 1 - \frac{(\alpha_1^2/2)(\alpha_1 + (\beta_1/\alpha_1)(\sigma^2_1/\sigma^2_2))}{(4\alpha_2/\alpha_1) + (4 - \alpha_1^2)(\alpha_1/2 + (\beta_1/2\alpha_1)(\sigma^2_1/\sigma^2_2))} \right] > 0. \quad \text{(A7)} \]

References


Commercial Appeal, The. 1995. For insurance, baby boomers do the calling. (November 24) 6B.

Economist, The. 1994. Life insurance: But not as we know it. (October 19) 95.


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