Arun Gopalakrishnan 2011 Ackoff Doctoral Student Fellowship Proposal

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Feb 28, 2011

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The effect of Compensation Structure on Agent Decision Making under uncertainty in a multi-period setting: a Normative and Experimental Analysis

Motivation

Even in the digital age, many firms continue to rely on a sales force for a majority of their revenue, due to the need for relationship selling. For example, chemical companies, real estate property developers, and industrial component manufacturers maintain direct sales forces that provide a human interface to customers, acting as agents of the firm. While in some cases the role of the sales agent is limited to that of generating product awareness and facilitating distribution, in other cases firms find in their best interest to empower sales agents with ability to conduct price negotiations. This practice would be consistent with the prescriptions of prior agency-theoretic work such as that by Lal (1986), who shows that the firm does weakly better to delegate pricing if the agent possesses superior market information unavailable to the firm that enables him to extract greater consumer surplus.

How should firms optimally compensate agents when they have pricing discretion? The extant theoretical literature on sales force compensation (BLSS 1985, Lal 1986, Ghosh and John 2000, Misra et al) argues that optimal compensation plans in such cases should be complex functions of volume and price. In practice, however, several Fortune 500 industrial firms continue to compensate sales forces with a high percentage of fixed base salary (as much as 70-80% of total compensation being fixed), with a capped upside potential.

What could account for the discrepancy between a largely fixed compensation combined with price delegation, which creates a moral hazard problem where the agent may negotiate easier target quotas with the firm, or lower pricing to the bottom end of the price band to increase the probability of getting sales? The objective of this research is to investigate this issue. We suggest that a major reason prior theoretical research on sale force compensation provides a poor descriptive account of actual practice is that current results are based on a highly simplified view of both the principal and the agent's problem as it arises in natural settings, where sales evolve over time and a multiplicity of cues are available to gauge a sales person's effort.

The purpose of this research is to take a first step toward gaining such a broader view of both how sales force compensation schemes might optimally be designed for more complex, multi-period, environments and how sales agents' behavior is affected by such plans. The approach will be both theoretical and empirical. I will first derive a set of theoretical results for optimal firm and agent

behavior for a specific multi-period sales problem where the sales person faces a fixed inventory with disposal costs. I will then test the predictions of the normative model using data from a controlled laboratory experiment.

Our Model and Hypotheses

We propose examining a world with market uncertainty, and asymmetric information favoring the sales agent over the firm, in a multi-period setting (with a finite number of time periods and customers the agent can interact with in the given time). By breaking down the agent's decisions into multiple periods, as opposed to considering an aggregate sales response function, we can introduce a richer set of signals and constraints that will differentially influence the agent's price setting behavior over time. Firms that incorporate additional signals to the compensation plan may therefore be able to achieve more profitable outcomes than following agency theory prescriptions, primarily by lowering the amount of variable compensation while obtaining the desired amount of pricing effort.

For example, one such signal would involve tying compensation to the number of customers the agent interacts with (observable from travel expense reports). This may reduce the incentive for the agent to seek low margin high volume sales from a small number of customers, and cause them to spread their bets across more customers. Combining this with another constraint fixing the total available inventory for the agent to sell, the firm can create incentives that align agent behavior to firm interests, but with incentives that are less volatile since they are tied to the agent's effort rather than outcomes (which are influenced by a multitude of factors outside the agent's control, including the firm's competition).

We want to consider how additional signals and factors being incorporated into the compensation plan may allow firms and agents to behave rationally, and yet reconcile the seemingly contradictory practices of price delegation and the lack of theoretically predicted sales contracts.

We anticipate using a Dynamic Programming approach to model the agent's decision making under a variety of alternative compensation plans in a setting with N time periods (equivalent to customer meetings), and an inventory *C* of a product to sell. We assume all the products are homogeneous.

The dynamic program will generate a series of hypotheses on the behavior of the rational agent and firm, and will be validated through a lab experiment where subjects will be provided the opportunity to set prices in multiple periods in order to maximize their income under various compensation plans. This will provide empirical evidence to a set of falsifiable hypotheses, that can help explain sales compensation practices at various Fortune 500 firms.

Timeline and Expenses

Develop and refine dynamic programming model and hypotheses: March – May 2011

Design and run experiments to validate directionality of model predictions: June – Sep 2011

Analyze results, and write up results in paper: Oct – Dec 2011

Expenses will include cost of running experiments in the Behavioral Lab [redacted]) since monetary incentives will be provided to subjects to replicate incentives in sales contracts.

Expenses will also be incurred in conference travel and registration, to present ideas and solicit feedback, as well as to purchase relevant books and software necessary to the research.

References

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