Delegation and Pay-for-Performance: Evidence from Industrial Sales Force

Mrinal Ghosh
W "H" and Callie Clark Associate Professor of Marketing
University of Arizona
Email: mghosh@email.arizona.edu

Francine Lafontaine
William Davidson Professor of Business
Economics & Public Policy
University of Michigan
Email: laf@umich.edu

and

Desmond (Ho-Fu) Lo*
Assistant Professor of Marketing
Santa Clara University
Email: hlo@scu.edu

April 22, 2011

Preliminary and Incomplete
Please Do Not Cite Without Permission

* Corresponding author

We thank participants at the Marketing Science Conference and in the Economics Department at Kansai University for helpful comments. We also thank our respective institutions for financial support. The usual disclaimer applies.

Delegation and Pay-for-Performance: Evidence from Industrial Sales Force

ABSTRACT

Theory suggests that pay-for-performance incentives need to be aligned with appropriate levels of delegation. Empirical research on the extent of delegation, and on the relationship between delegation and pay-for-performance, remains scarce, however. We offer evidence regarding these in the context of industrial sales forces. Consistent with theory, we find that sales people are given more pricing authority when they have superior local information, but less pricing authority when the need for coordination within the firm is greater. Our data also show that managers give more pricing authority to sales people who are more experienced. Most importantly, we find that sales persons' pay-for-performance is positively and robustly related to the level of delegation of pricing authority. (JEL codes: D22; L14; M31; M52)

1. INTRODUCTION

The allocation of decision rights and the design of compensation schemes are important features of organizational design in firms, reflecting both how firms motivate their employees and coordinate their activities. Theory suggests that companies should centralize authority for coordination purposes when information is publicly available, i.e., symmetric (Acemoglu et al. 2007; Rantakari 2008), whereas they should delegate decisions to a greater extent when the need to adapt to local environment under private information becomes more prominent (e.g., Lal 1986; Aghion and Tirole 1997; Dessein 2002; Mishra and Prasad 2004). At the same time, as mentioned by Prendergast (2002), pay-for-performance can be used to align incentives between employees and employers when performance measures are readily available, and, "uncertainty affects the responsibilities offered to workers, which in turn affects incentives" (p. 1075).

Evidence regarding the extent of delegation of responsibilities and its relationship with performance pay is quite rare, however. Regarding the former, a few authors have examined the allocation of control or decision rights in inter-firm contracts, namely in technology alliances (Lerner and Merges, 1998; Ryall and Sampson, 2009) and in car dealership agreements (Arrunãda, Garicano, and Vázquez, 2001). They have shown that contracting parties allocate fewer decision rights to their partners when valuable assets are potentially threatened by the actions of the partners. Others have considered delegation decisions within firms, in the context of technology adoption (Acemoglu et al. 2007), information-technology decisions (McElheran, 2010) and sales personnel (Frenzen et al. 2010), and consistent with theoretical models of delegation, they have shown that delegation levels vary based on the value of local information – e.g. at the division level – and the value of coordination. As for the relationship between performance pay and delegation, to our knowledge, Nagar (2002) and Wulf (2007) are the only studies to have addressed this question. Specifically, in his survey of retail banking management, Nagar (2002) finds that branch managers who are given more discretion are also paid a greater proportion of their pay in the form of bonus. Similarly, Wulf (2007) finds that the compensation of division managers who have broader authority – i.e. those who are designated as corporate officers rather than local managers – is more sensitive to firm-level performance measures. However, in both these studies, measurement issues make it difficult to infer whether the greater proportion of realized pay that is performance based is the result of greater effort and capacity to affect firm profits on the part of these

managers, or because the firm uses a pay scheme with more high-powered incentives to compensate these individuals (see also Lafontaine and Bhattacharyya 1995, and Lo et al. 2011, on this issue).

In this paper, we use survey data from 261 industrial equipment firms and their sales forces to examine (1) the determinants of the pricing authority accorded to an industrial sales person, where pricing authority is a measure of delegation, and (2) the relationship between pay-for-performance and pricing authority. The context of industrial-equipment sales is especially appealing to investigate these issues for a variety of reasons. First, incentive pay is the norm for sales-force compensation (e.g., John and Weitz 1989; Zoltners et al. 2006, p.2). Second, most firms in the industrial equipment sector confer a *specific* level of pricing discretion to their sales people. In particular, sales people in these sectors usually have the authority to unilaterally offer price discounts off the list price to their customers, up to a certain percentage – say 10% - without having to confer with his/her superior. In our data, this authority ranges from 5% to 30% off the list price. Discounts beyond the authorized level require approval from the supervising manager. This discretionary authority can be different for different sales people within the same organization or sales force. The sales force managers we surveyed agreed to give us data on the percentage pricing discretion given to an individual sales person at each firm, along with several characteristics of the sales person in question. In contrast, the measures of delegation of authority in previous work have been perceptual or categorical (e.g., see Nagar 2002; Colombo and Delmastro 2004; Wulf 2007; Frenzen et al. 2010).

Consistent with the rationale on the effect of superior local information, we find a positive relationship between the extent of asymmetric information – captured by a measure of customer heterogeneity - and the extent of price delegation. Furthermore, in the sales-force context, the level of pricing authority usually is conferred to individual employees, and, contrary to compensation schemes, need not be the same across all members of the sales force. This implies that agent characteristics, in addition to task characteristics, may affect the level of delegation. Consistent with this expectation, we find that price delegation is increasing in a sales person's tenure at the company. Our results also support the prediction that to enhance internal coordination across different functions, sales managers centralize pricing decisions – that is they reduce the sales person's authority – when the environment the firm operates in is more dynamic, e.g., fast technological innovation and unpredictable demand.

Of greatest interest, our data show a strong positive relationship between pricing authority and pay-for-performance, whether we treat the extent to which the firm relies on performance pay as exogenous or endogenous. This result is consistent with the evidence on executive compensation and decision-making authority (Nagar 2002; Wulf 2007) and supports Prendergast (2002)'s conjecture concerning the positive relationship between authority delegation and pay-for-performance. It is also consistent with a model of delegation that takes into account the extent to which the sales person's incentives are aligned with those of the principal via the compensation scheme, as described further below. Moreover, the effects of various job and agent characteristics on pricing authority are attenuated, but not eliminated, when we control for the commission rate. This implies that job and agent characteristics, in conjunction with the extent of pay-for-performance, determine the level of price delegation that firms choose.

The paper is organized as follows. In the next section, we present the theoretical arguments that underlie our empirical analyses. We then describe our empirical context and data collection process, as well as the measures used in our empirical analyses, in Section 3. We formulate our econometric model and present our results in Section 4. Section 5 concludes.

2. DELEGATION AND PAY-FOR-PERFORMANCE

The types of situations where it will be beneficial for the firm to give more discretion to its agent are those where the agent has an informational advantage. In such a context, delegation, or decentralization, is preferred because it allows agents to make better use of their local information (Lafontaine and Bhattacharyya 1995, Alonso et al. 2008).

In industrial sales, sales people are likely to have superior information concerning the needs of the customers in their territories since customers' requirements for and usage of sophisticated equipment and machines tends to vary. Moreover, business/organizational purchasing often involves complex procedures, relationship building, and customer services, which in turn require a high level of *personal* selling from a sales person (Dwyer and Tanner 2009, Chapter 4). In these circumstances, both pricing discretion and pay-for-performance would be important incentive mechanisms for selling and customer servicing purposes, since the sales person must possess a good understanding of the product, but also be competent and trustworthy in initiating, negotiating, and closing the sale without

immediate supervision from his/her manager. Thus, sales people who attend to the needs of more heterogeneous customers and face intense competition from similar products, where the latter requires that they respond rapidly to competing offers, presumably will be given more pricing authority.

On the other hand, firms that sell industrial equipment also may face fast technological innovation and hard-to-predict industry-level demand fluctuation. Such disturbances affect the conditions faced by all members of the sales force, and are exogenous to the sales person's effort. Reacting to such *non-private* information thus is likely to require coordinated effort and decisions. Consequently, managers of sales forces are likely to retain more pricing authority for sales-team or cross-functional coordination purposes within the company in those firms where technological or demand shocks are more common (Acemoglu et al. 2007; Rantakari 2008). We therefore expect sales people pricing authority to be inversely related to the extent of technological or demand volatility faced by the firm.

Another advantage of our setting is that in the market for capital industrial goods, individual customers usually have specific needs, i.e., they require a specific number of machines or computer equipment of a particular type. In essence then, these are markets where we can treat customers as having unit demand: they do not choose quantity based on price but rather send out "requests for proposals" for specific bundles of goods. The consequence of this fact is that we can treat price discounts as affecting the likelihood of closing the sale, and the number of customers served by the firm, but not individual customer decisions on quantity. In turn, this implies that the level of authority delegated to the sales person should be positively related with the commission rate offered by the firm. As we show in our model below, this arises because when a sales person's pay barely depends on sales revenues generated, he/she will offer more price discounts to customers so as to reduce the level of effort needed to close the sale (e.g., Stephenson et al. 1979; Joseph 2001). To curb this "effort-aversion" tendency, firms will choose to keep the level of pricing authority low when sales commission rates are also low. The sales person whose pay is highly dependent on the sales revenues he/she generates will put in more effort and try to keep the discount lower as his/her total compensation go down with the level of discount.

2.1. A Simple Model

In what follows, we adapt a basic model from Dessein (2002) to illustrate some of our discussion above and generate the hypotheses that we bring to the data below. Consider an employer or firm (the principal/she), who produces and sells industrial goods, and its sales person (the agent/he). We assume that customers in this market have unitary demand, i.e. they put out requests for proposals and buy from the seller with the most competitive offer. The latter may or may not be the lowest price seller as sales person effort and support, and interactions between customer current and proposed purchases, can help the customer realize value from the equipment. Because he interacts with customers directly, the sales person learns market conditions and customer needs and valuation, but the principal only knows the distribution of values for its equipment. We assume that the value of the good to customers is drawn from a uniform distribution whose support is [V, 3V] where V is assumed greater than 0.

The firm decides whether to delegate pricing authority to its sales person *before* the latter learns market conditions or customer taste. We assume that the principal is committed to this delegation decision.[1, 2] The sale yields a benefit B(p, v) to the principal, where p is price and v is customer value, which as described above is drawn from a uniform distribution. The benefit to the principal of selling the equipment can be different from the sales revenue generated due to various types of reasons. For example, a given sale might increase the chances that the same customer buys complementary goods from the firm in the future, or some of the customer's competitors may be more or less likely to buy from the firm as a result of this sale, or the terms of the sale may be such that they affect other sales or future business more generally. For simplicity, we assume that the benefit to the firm is greatest if the customer pays exactly his valuation for the good. Specifically, we write the firm's benefit function as $R(p, v) = K - (p - v)^2$ which is maximized at p = v. For the sales person, a sale generates a benefit of u(p, v, b), where b > 0 captures the agent's bias. More specifically, we take the sales person's utility function to be $u(p, v, b) = k - (p - (v - b))^2$. In other words, the sales person's preferred price for the good is below that which maximizes the benefit to the firm. This happens because the

[1] For simplicity, we assume the firm only chooses to delegate or not, and we do not allow for communication. See Crawford and Sobel (1978) and Dessein (2002) for models where communication is feasible.

[2] Commitment is possible under self-enforcing relational contracts (Baker, Gibbons, and Murphy 1999), which seems to fit our context since the sales persons in our sample are in long term employment relationship with their employer. The average tenure of the sales persons in our data is over four years.

sales person must put in effort for the customer to realize the value v, but the equipment can be sold at a lower price with less effort. The sales person's disregard of the effect of his behavior on the prices at which the equipment can be sold in other territories, or lack of attention toward non-sales functions such as marketing and product development, are also potential sources of agent bias in the sense that they lead the agent to prefer a different price from the one that the firm would choose. Specifically, such horizontal externalities reflect coordination needs within the organization, which may cause an individual sales person to charge a lower price that what the firm would like to offer.[3] Both parties' benefit functions, including the value of b, are common knowledge.

The decision to delegate pricing authority or not is based on a comparison of the firm's expected benefits. Under delegation, the sales person chooses p = v – b, from which the firm obtains

$$E(R^D) = K - b^2. \qquad (1)$$

where the superscript D stands for delegation. If the firm retains control over the pricing decision, it chooses p to maximize its expected benefits:

$$\max_p E(R^{ND}) = \max_p \int_V^{3V} (K - (p - v)^2) \frac{1}{2V} dv, \qquad (2)$$

where the superscript ND stands for non-delegation, and 1/(2V) is the probability density function of v. Rewriting gives

$$\max_p \ (K - \frac{13V^2}{3}) - (p^2 - 4pV),$$

which implies the optimal p, p* = 2V. The firm's maximized expected benefit under full price control then is

$$E(R^{ND}) = K - \frac{V^2}{3}. \qquad (3)$$

Comparing (1) and (3), the firm chooses to delegate pricing authority when

$$E(R^D) > E(R^{ND}) \Leftrightarrow b^2 < \frac{V^2}{3}, \text{ or } b < \frac{V}{\sqrt{3}}. \qquad (4)$$

Equation (4) says that given agent bias, the likelihood of delegation increases with V (equivalently, the variance of v, $V^2/3$). In the context of industrial sales, this translates into the hypothesis that price delegation increases in the value of the sales person's *superior* information concerning market/customer conditions. Conversely, when the variance of

[3] See e.g. Blair and Lafontaine (2005, pp.121-5) for discussions and theory of individual franchisee's bias of charging a lower price than the optimal chain-wide price in the context of business-format franchising.

customer valuation decreases, the firm has a more precise understanding of local market conditions. To reduce the loss caused by agent bias, the firm opts for no delegation. In the extreme case in which v degenerates at a mass point, in other words when the information on market condition/customers becomes public (as is the case, e.g., with information concerning technological change and shifts in industry demand), the firm always keeps control over pricing decisions. Retaining price control benefits the firm in this situation in that it facilitates coordination among different sales people and/or across different functions such as sales, product development, and marketing within the company at large.

From the parties' benefit functions and equation (4), it is clear that under information asymmetry, delegation is more likely when agent bias is smaller, which is likely to be the case for those sales people that the firm chooses to keep on the staff longer. In other words, we expect sales person with longer tenure at the firm to be given greater pricing authority as longer tenure (or retention) implies a better fit between job and agent characteristics. The same prediction would also hold when the sales person is less like to substitute price discounts with sales effort. This will be the case when the sales person has a lower cost of sales effort; in other words, when he is more competent in customizing his sales approach to customer needs and requirements.

Finally, we can introduce performance pay, which, as is well known, helps align the interests of an agent to those of his principal, in our simple model as follows. Suppose the firm shares the sales revenue in the form of a commission to the sales person. The benefit function of the firm now is $R^S(p,v) = (1-\alpha)(K-(p-v)^2)$, where $0<\alpha<1$ is the sharing parameter or commission rate, while the sales person's benefit function becomes $\{k-(p-(v-b))^2 + \alpha(K-(p-v)^2)\}$, which can be rewritten as

$$u^S(p,v,b) = (k+\alpha K)-(1+\alpha)(p-(v-\frac{1}{1+\alpha}b))^2$$
$$\equiv k^S-(1+\alpha)(p-(v-b^S))^2,$$

where agent bias becomes b^S. This b^S is smaller than b since the fraction in front of b is less than one. As can be easily verified, the manager still chooses to delegate under the rule $b^S<V/\sqrt{3}$. Therefore, the manager is more likely to delegate pricing authority under the incentivized compensation for her sales person as performance pay reduces *effective* agent bias.

3. EMPIRICAL CONTEXT AND DATA

An empirical analysis of the firm's decision to delegate pricing authority, and of the relationship between such price delegation and pay-for-performance, requires data not only on individual-level pricing authority and compensation earned by a sales person but also key task and agent characteristics. For that reason, we obtained our data using a mail survey administered to sales managers in firms involved in equipment sales, which are found in four major sectors, namely non-electrical machinery including computer equipment (SIC 35), electrical and electronic machinery (SIC 36), transportation equipment (SIC 37), and instruments (SIC 38). To ensure data quality, a number of steps were taken, including (1) detailed pilot interviews with field sales managers to ascertain the relevance of our issues to their sales contexts, (2) choosing the appropriate survey participants, and (3) constructing appropriate measures of our variables. These steps are described below.

3.1. Pilot Interviews

To better understand the issues firms face in choosing the extent of pricing discretion they grant to individual sales people and designing compensation plans for them, we conducted on-site field interviews with sales managers at 16 firms. Each interviewee was directly responsible for managing the firm's direct sales force. These interviews lasted for an average of about 3 hours each. We also pre-tested our survey instrument during some of these interviews. Insights from this pilot study were then used to refine the questionnaire and generate the final survey instrument.

Regarding compensation plans for industrial sales forces, we learned that, in contrast to executive compensation schemes, which are very individualized, pay plans for sales forces are structured at the level of the sales force or sales group. More precisely, sales people within a particular group/tier, selling similar products to customers with similar profiles, and within similar geographies, are normally offered the same compensation plan, albeit one where the fixed component may be adjusted for cost of living and/or travel to office "dearness" allowances. These sales-force level plans are set to reflect the task environment faced by these employees generally as well as to "attract/retain" the appropriate type of sales person – one whom the manager thinks fits the job requirement on hand (see Lo et al. 2011 for more on this). The managers also noted that the core

components of their sales-force compensation plans were base salary and sales-based commission.

Our discussions also revealed that the pricing authority or discretion accorded to a sales person is usually chosen after the sales person joins the job. This pricing discretion/authority usually takes the form of giving the sales person unilateral rights to offer price discounts *up to a certain percentage* of the product's list price. The choice of this percentage is based on the manager's assessment of the sales person's ability and skill as well as the particular task environment (e.g., competition intensity) in the sales person's territory. Furthermore this pricing discretion can change over time as the sales person gains experience and the manager obtains more information about the sales person's ability.

These discussions also confirmed that allowing their sales people to offer price discounts did not necessarily mean that the sales person "automatically" drops prices to encourage the sale (i.e. substitutes price discounts for effort). The managers instead indicated that the sales person whose pay depends heavily on commission will be very deliberative about discounting because lower prices also mean that the sales person's own commission pay would be lower

3.2. Selection of Survey Participants and Data Collection Procedure

To obtain quality measures of our key variables, we used a two-stage procedure to reach our survey participants. We first obtained a list of sales managers of manufacturing firms with sales exceeding $100 million in the relevant industrial sectors from two list brokers – the American List Council and Dunn and Bradstreet. The 1470 individuals on these lists were then contacted by phone. To qualify as key informants, they had to meet two criteria: they had to be primarily involved in managing the sales force for their division/firm in a well-defined customer, product, or geographic market; and their firm had to be using a direct sales force rather than contract dealers in those markets. Four telephone calls on average were required to qualify each informant. To elicit cooperation, we offered each manager a customized report summarizing the findings from our survey and comparing their profile to the average patterns in the data. Of the initial 1470 individuals, 869 indicated that they use a direct sales force. In the second stage, we mailed questionnaires to each of these 869 respondents. After two reminders, we had obtained 264 responses. Three of these were discarded for missing data, for a final sample of 261 responses (or a response rate of 30%).

The survey questions were designed to be specific to a particular sales person that these sales managers were currently supervising. To minimize selection bias on the sales person, we asked the sales manager to identify a customer who had procured their company's product over the previous fiscal year (2004) and then identify the sales person who was responsible for making that particular sale. We then requested that the manager give responses pertaining to this and only this sales person. Hence, our unit of analysis is an individual sales person, with each sales person, or data point, representing a different firm.

3.3. Variables and Measurement Issues

In this section, we describe the measures we use for our two main variables of interest, namely pricing authority – our measure of the extent of delegation – and pay for performance. We also describe the many other task or firm, and agent characteristics– as perceived by the sales force manager - that we collected. While some of these are cardinal (e.g. firm size, measured by total sales in the prior fiscal year), many are more difficult to quantify directly. In those cases, we rely on categorical measures, obtained using 7-point Likert scales.

Pricing Authority: Each manager was asked to report the percentage of price discounts off the list price that the sales person is allowed to offer to customers without conferring with the manager. This is our measure of *Price Delegation*. We would like to emphasize the cardinal nature of this measure of delegation, as opposed to the perceptual or categorical measures that have been used in prior studies (e.g. Nagar 2002; Wulf 2000; Frenzen et al. 2010).

Compensation: For each sales person, we obtained measures of their base salary, total compensation, and the sales revenue they generated during the year before our survey. *Base Salary* is the dollar amount of fixed compensation received by this sales person in the previous fiscal year. *Total Compensation* refers to the sum of the base salary and performance-based compensation (e.g., bonus and commissions) received in the same fiscal year. In our data, the proportion of performance-based (i.e. variable) to total compensation is about 30%, similar to the 29% ratio in the John and Weitz (1989) sample, but somewhat lower than Zoltner et al. (2006, p.2)'s estimate of around 40% for a typical sales person in the U.S. We calculate the commission rate as:

$$Commission\ Rate = (Total\ Variable\ Compensation)/Sales\ Revenue$$

where *Sales Revenue* is the amount of sales generated by the sales person in the same

fiscal year, also in US dollars. In the presence of non-revenue-based bonus pay, our measure of *Commission Rate* will overestimate the power of ex ante incentives *at the margin*. However, managers indicated that sales-based commissions rather than bonuses comprise the majority of their sales force' incentive pay. Hence, *Commission Rate* is a good first-order approximation for actual sales-based performance pay, since bonuses are comparatively small in our setting. Recent evidence moreover suggests that much bonus payments are in fact revenue-based (Misra and Nair 2009), in the sense that these are offered for achieving specific sales-revenue targets.

Task/Firm Characteristics: Respondents were asked to assess how difficult the sales person's activities are to supervise (*Monitoring Difficulty*) and the heterogeneity of customer profiles faced by the sales person (*Customer Heterogeneity*). These two variables measure the degree of asymmetric information between the sales manager and the sales person and thus affect sales person's pricing authority. Respondents also told us how many direct competitors they faced in the relevant product category (*Competition*). The intensity of competition should affect the bargaining power of industrial equipment buyers and thus might enter into the firm's decision as to how much pricing flexibility the sales person should be given. *Firm Size* is measured by the previous year's overall sales revenue. Finally, *Product Margin* measures the operating margin for the relevant product line and is used as an instrument variable for *Commission Rate* (see next section).

We asked managers to report two different measures of uncertainty: the pace of product/equipment obsolescence (*Technological Innovation*) and the predictability of product demand at the industry level (*Product Demand Uncertainty*). As mentioned above, when industry-wide disturbances are high, we expect coordination among the sales team and that across various functions such as sales, production, and product development within the company to become more important so the firm can cope with such uncertainty (Williamson 1985, pp.56-57). In other words, sales manager's should retain more pricing authority.

Agent Characteristics: We asked respondents to rate the ability level (*Sales Person's Ability*) of the sales person and to report the number of years that individual has worked in the company (*Sales Person' Experience*). As pricing authority could be sales-person specific, sales person's tenure and ability would affect his/her manager's delegation decision. Respondents indicated their sense of the sales person's risk preference over compensation volatility (*Sales Person's Risk Aversion*) and we use it as a control variable in some of our regressions. We further asked about the sales person education, specifically

whether the sales person has an engineering degree, and the dummy variable is used as an instrumental variable for *Commission Rate* (see next section).

The questions we used to elicit all the above information are listed in Table 1. Summary statistics for all the resulting variables are shown in Table 2.[4] Finally, to give a better sense of the extent of variation in the level of pricing authority delegation, we show the distribution of this variable in Figure 1.

4. ECONOMETRIC METHOD AND RESULTS

Our goal in this section is to examine the determinants of the extent of delegation of pricing authority in industrial sales forces, and assess the relationship between the delegation decision and the choice of compensation.

4.1. Methodology

As described earlier, the compensation plan for sales persons is usually set *at the time* of employment and is the same for all the individuals engaged in the same type of sales job within the firm. The delegation of pricing authority in industrial sales forces, in contrast, is more often conferred to sales people by their managers *after* an individual sales person has started his/her job, and further modified when appropriate in the course of one's career within the firm. These facts imply that the commission rate can be taken as "pre-determined" in our econometric specifications. Consequently, we begin our empirical analyses by estimating:

$$\text{Log}(\textit{Price Delegation}_i) = \alpha + \beta\ \textit{Commission Rate}_i + \boldsymbol{x}_i'\gamma + \boldsymbol{z}_i'\varphi + \text{u}_\text{i},$$

where *i* denote for sales person (and implicitly the firm, as we have data relating to one individual per firm), $\boldsymbol{x}_i$ and $\boldsymbol{z}_i$ are vectors of task/firm and agent characteristics respectively. We use the log of price delegation as our dependent variable as this yields

[4] We carried out several analyses to rule out response bias in our perceptual measures. First, given our survey procedure, it is possible that informants strategically chose customers and/or sales agents. To test this, we assessed two customer-side measures – the profitability of the customer to the firm and the firm's satisfaction with this customer relationship, and the two sales person characteristics – ability and experience, for distribution bias. The data exhibited large variation along these measures and it does not seem as though the manager-informants strategically chose to report on their most profitable customers or their most able sales people. Second, informants might have inferred a sales person's ability based on her total compensation or revenue generated. The pair-wise correlations between *Sales Person's Ability* and *Total Compensation* and *Sales Revenue* generated by the sales person are 0.10 and -0.02, both insignificant at the 0.05 level.

well-behaved error terms.[5] We introduce most of our explanatory variables linearly as most of them are indices with limited variation, but use the log of *Firm Size*, *Competition*, and *Experience* to reduce the effect of outliers. While we believe that commission rate can be treated as pre-determined in our analyses, one might also expect this variable to be correlated with u_i either because there are variables that the sampled firms use to determine commission rates that are unobserved to us, and these also affect the decision to delegate pricing authority, or because *Price Delegation*$_i$ and *Commission Rate*$_i$ are simultaneously decided by company officials at the commencement, or during the period, of employment, yet our regression equation does not model this simultaneity.

We adopt an instrumental-variable approach to address these potential issues. The two excluded instruments we use for *Commission rate* are whether the sales person has an *Engineering Degree* and *Product-line Margin* at the firm level. *Commission rate* is expected to be positively correlated with both variables. In industrial-equipment sales, having an engineering degree can be seen as an indicator that agent effort is especially valuable, and thus agency theory would imply that the agent should be given higher powered incentives (higher commission rate). Higher profit margins for a product category at the firm level makes it possible for firms to set higher commission rate level, *ceteris paribus*, and thus could also be a good instrument for the latter. At the same time, there is no *a priori* reason to expect that sales agents with engineering degrees should be granted more pricing authority, or that the firm's product-line profit margin should be correlated with the extent of pricing authority granted to an individual sales person. The validity of our instruments is confirmed by our first-stage partial F statistics, and by the over-identification tests (Hansen J statistics) (see Tables 3 and 4).

4.2. Results

We begin our empirical analyses by examining the relationship between delegation and task/firm characteristics only, first without controlling for the power of incentives under which the sales person operates (Column 1 of Table 3) and then with commission rate as another factor affecting the level of pricing authority in Columns 2 and 3. In column 2, we treat the commission rate as pre-determined and simply include it among our regressors. In column 3, we use the linear optimal-weighted general method of moments (GMM) (Cameron and Trivedi 2005, p.187; see also Stata 2009, p.741 and pp.747-749)

[5] Our results, nonetheless, are robust with the specification using the raw measure of price delegation as dependent variable, or that under log-log formulation.

with the two variables mentioned above (*Product Margin* and *Engineering Degree*) as excluded instruments. Finally, in the last three columns of Table 3, we reproduce the same analyses and add agent characteristics to the set of factors that can affect the level of delegation of pricing authority. We find that our results are quite robust across these different specifications.

Focusing for now on the effect of task/firm characteristics on price delegation, Column 1 shows that managers delegate more pricing authority to their sales people when the latter's activities are more difficult to monitor, involve more heterogeneous customers, and when they face more competition. *Monitoring Difficulty* has the largest effect (0.104) among task/firm characteristics that are measured on 7-point Likert scales. These results are consistent with the notion that sales persons' price discretion can be used to adapt to local customer needs and/or respond to price negotiation in a more expeditious fashion.

The fact that the coefficients for both technological innovation and product demand uncertainty are significant and negative is consistent with our expectation that when the uncertainty is exogenous to the sales person's selling effort, pricing authority is expected to be more centralized to improve coordinated responses to such uncertainty. The effect of *Technological Innovation* (-0.060) is almost twice that of *Demand Uncertainty*, which may due to the fact that the firms in our data manufacture and market sophisticated and high-tech industrial equipment such that innovation affects these markets most. The control variable *Firm Size* impacts delegation in a positive way.

We include *Commission rate* in Columns 2 and 3, treating it first as predetermined in Column 2, and then addressing the possibility that it might be correlated with the error term in Column 3.[6] However, it is important to note that, based on the typical Hausman test (Cameron and Trivedi 2005, p.276), we cannot reject the null hypothesis that *Commission Rate* is exogenous (p=0.31). As a result, we focus our discussion of results on Column 2. Nonetheless, our IV results in Column 3 are qualitatively very similar.

When we control for commission rate, we find first and foremost that the effect of performance pay on price delegation is positive and significant. Because of the semi-log nature of the regression, the estimate of 0.144 means that a 1 unit (i.e., 1%) increase in commission rate leads to 14.4% increase in the discounts (which are themselves stated as

[6] Using the standard overidentification test, we cannot reject the null that our excluded instruments – *Engineering Degree* and *Product-line Margin* – are uncorrelated with the error term in our delegation equation. At the same time, these instruments are highly correlated with *Commission rate* – as the large partial F-statistics (>10) of the first-stage regressions show (Stoke et al. 2002). Therefore, our instruments satisfy the two key criteria of being valid instrumental variables. Table 4 lists the full results for the first-stage regressions corresponding to models 3 and 6 in Table 3.

percentage reductions from list prices) that a sales person can offer his/her customers. This result shows that sales people receiving more performance pay – presumably because the task characteristics warrant it – are also more likely to be given more pricing authority. Second, we find that the signs of the coefficients for task/firm characteristics remain the same after *Commission Rate* is included, but their magnitudes are attenuated and the effect of *Firm Size* becomes insignificant. This suggests that commission rates, which capture the power of incentives in this setting, are associated with job/agent characteristics, as one would expect from both theory, and empirical analyses of performance pay schemes (e.g., Lazear 2000; Ackerberg and Botticini 2002; Lo et al. 2011). Nonetheless, the effect of performance pay does not completely mediate the direct effect of firm/task characteristics on price delegation.

As sales managers have discretion to grant different levels of pricing authority to different sales persons, in Columns 4-6, we add individual sales person characteristics to each of our delegation regression equations. Here again, we find that we cannot reject the hypothesis that the *Commission Rate* is exogenous (p=0.24). Thus we base our discussion of results on those shown in Columns 4 and 5. However, as before, our IV results in Column 6 are qualitatively similar.

Controlling for individual characteristics does not affect our main results above. First, price delegation is still more likely when local conditions are more difficult to monitor and competition is more intense. Second, managers centralize pricing authority when exogenous uncertainty – viz. technological pace and product-demand unpredictability – is high. Similar to Column 1, the coefficient of *Firm Size* is only weakly significant in Columns 4.

As for agent characteristics, both sales person's experience and perceived ability are positively related to price delegation, whereas more risk-averse sales people are given less pricing authority. When *Commission Rate* is included in Column 5, the effects of all task and agent characteristics are attenuated. That the inclusion of *Commission rate* has the largest impact on the effects of Sales Person's *Ability* and *Risk Aversion* – which are no longer significant – is as one would expect in our setting where delegation is more flexibly determined than the pay scheme, since more capable and less risk-averse sales people are expected to be attracted to jobs that entail higher commission rates (Lazear 2000; Ackerberg and Botticini 2002; Lo et al. 2011).

In summary, our data from companies that manufacture and sell industrial equipment broadly support our predictions. On the one hand, pricing authority is more likely when

sales people have superior local information and face more intense competition, and when they are more experienced. On the other hand, executives tend to centralize pricing authority when the need of internal coordination – under higher exogenous uncertainties – becomes more important. Finally, pay-for-performance is robustly and positively related to delegation.

5. CONCLUSION

Despite considerable theoretical interest in decision allocation and its relationship with incentive pay, evidence on these issues remains rare. Using a primary data set on industrial-equipment sales, this paper bridges this gap by investigating the determinants of pricing authority offered to field sales people by their business-unit/divisional managers, and the relationship between sales persons' performance pay and their pricing authority. Our context and micro-data are appealing to investigate these issues since price delegation and pay-for-performance are commonly used, and task and agent characteristics in these industries vary.

We showed that managers delegate more pricing authority when their sales people have superior local information and when they have been working for the firm longer. On the other hand, when market uncertainty – be it on the technological or demand side - is high, the sales agent receives less pricing authority. Furthermore, we find strong evidence of a positive relationship between pricing authority and pay-for-performance. This result is consistent with the idea that sales persons can be given more authority to discount price when their own compensation is greatly affected by this decision. The inclusion of commission rate attenuates but does not eliminate the effects of task/firm and sales person's characteristics on the level of pricing authority. This implies that both monetary incentives and non-monetary factors impact the allocation of such authority within sales organizations.

References

Acemoglu, Daron, Philippe Aghion, Claire Lelarge, John Van Reenen, and Fabrizio Zilibotti (2007), "Technology, Information, and the Decentralization of the Firm," *Quarterly Journal of Economics*, 122(4), 1759-1799.

Ackerberg, Daniel and Maristella Botticini (2002), "Endogenous Matching and the Empirical Determinants of Contract Form," *Journal of Political Economy*, 110(3), 564-591.

Aghion, Philippe and Tirole, Jean (1997), "Formal and Real Authority in Organizations," *Journal of Political Economy*, 105, 1-27.

Alonso, Ricardo, Wonter Dessein, and Niko Matouschek (2008), "When Does Coordination Require Centralization," *American Economic Review*, 98(1), 145-179.

Arrunãda, Benito, Luis Garicano, and Luis Vázquez (2001), "Contractual Allocation of Decision Rights and Incentives: The Case of Automobile Distribution," *Journal of Law, Economics, and Organization*, 17(1).

Baker, George, Robert Gibbons, and Kevin Murphy (1999), "Informal Authority in Organizations," *Journal of Law, Economics, and Organization*, 15, 56-73.

Blair, Roger and Francine Lafontaine (2005), *The Economics of Franchising*, New York, NY: Cambridge University Press.

Cameron, A. Colin and Pravin K. Trivedi (2005), *Microeconometrics: Methods and Applications*, New York, NY: Cambridge University Press.

Colombo, Massimo G. and Marco Delmastro (2004), "Delegation of Authority in Business Organizations: An Empirical Test," *Journal of Industrial Economics*, 52(1), 53-80.

Crawford, Vincent P. and Joel Sobel (1982), "Strategic Information Transmission," *Econometrica*, 50(6), 1431-1451.

Dessein, Wouter (2002), "Authority and Communications in Organizations," *Review of Economic Studies*, 69(4), 811-838.

Dwyer, F. Robert and John Tanner, *Business Marketing: Connecting Strategy, Relationships, and Learning*. New York, NY: McGraw-Hill/Irwin.

Frenzen, Heiko, Ann-Kristin Hansen, Manfred Krafft, Murali K. Mantrala, and Simone Schmidt (2010), "Delegation of Pricing Authority to the Sales Force: An Agency-Theoretic Perspective of its Determinants and Impact on Performance," *International Journal of Research in Marketing*, 27 (1), 58-68.

John, George and Barton Weitz (1989), "Sales force Compensation:: An Empirical Investigation of Factors Related to Use of Salary Versus Incentive Compensation," *Journal of Marketing Research*, 26, 1-14.

Joseph, Kissan (2001), "On the Optimality of Delegating Pricing Authority to the Sales Force", *Journal of Marketing*, 65(Jan.), 62-70.

Lafontaine, Francine and Sugato Bhattacharyya (1995), "The Role of Risk in Franchising," *Journal of Corporate Finance*, 2, 39-74.

Lal, Rajiv (1986), "Delegating Pricing Responsibility to the Sales force", *Marketing Science*, 5(2), 159-168.

Lazear, Edward P. (2000), "Performance Pay and Productivity," *American Economic Review*, 90(5), 1346-1361.

Lerner, Josh, and Robert Merges. (1998) "The Control of Technology Alliances: An Empirical Analysis of the Biotechnology Industry," *Journal of Industrial Economics*, 46: 125-156.

Lo, Desmond, Mrinal Ghosh, and Francine Lafontaine (2011), "The Incentive and Selection Roles of Sales Force Compensation Contracts," forthcoming, *Journal of Marketing Research*.

McElheran, Kristina S. (2010) "Delegation in Multi-Establishment Firms: The Organizational Structure of I.T. Purchasing Authority," Working paper # CES 10-35, Center for Economic Studies.

Mishra, Birendra and Harikesh Nair (2009), "The Dynamic Consequences of Incentive Schemes: Evidence from Sales force Compensation," mimeo.

Nagar, Venky (2002), "Delegation and Incentive Compensation," *The Accounting Review*, 77(2), 379-395.

Prendergast, Canice (2002), "The Tenuous Trade-Off between Risk and Incentives," *Journal of Political Economy*, 110(5), 1071-1102.

Rantakari, Heikki (2008), "Governing Adaptation," *Review of Economic Studies*, 75(4), 1257-1285.

Ryall, Michael D., and Rachelle C. Sampson (2009) "Formal Contracts in the Presence of Relational Enforcement Mechanisms: Evidence from Technology Development Projects," *Management Science*, 55: 906-925.

Stata (2009), Stata Base Reference Manual, Release 11, Vol 1, College Station, TX: Stata Press.

Stephenson, P. Ronald, William Cron, and Gary Frazier (1979), "Delegating Pricing Authority to the Sales Force: The Effect on Sales and Profit Performance", *Journal of Marketing*, 43(2), 21-28.

Stoke, James H., Jonathan H. Wright, and Motohiro Yogo (2002), "A Survey of Weak Instruments and Weak Identification in Generalized Method of Moments," *Journal of Business and Economic Statistics*, 20(4), 518-529.

Williamson, Oliver (1985), *The Economic Institutions of Capitalism*, New York, NY: Free Press.

Wulf, Julie (2007), "Authority, Risk, and Performance Incentives: Evidence from Division Manager Positions Inside Firms," *Journal of Industrial Economics*, 55(1), 169-196.

Zoltners, Andris A., Prabhakant Sinha, and Sally E. Lorimer (2006), *The Complete Guide to Sales Force Incentive Compensation: How to Design and Implement Plans that Work*, New York, NY: AMACOM

TABLE 1: DESCRIPTION OF VARIABLES

Variables Used in Main Regressions	
Price Delegation	This sales person has authority to offer customers price discounts of up to ___ % off the list price without conferring with his/her supervisors.
Monitoring Difficulty†	It is not possible to supervise the sales person's activities closely.
Customer Heterogeneity†	Our product can be used in manufacturing / administrative / operational activities that vary widely from customer to customer.
Competition	What is the number of competitors for this product-line/equipment?
Firm Size	Total firm or SBU revenues for the year (sales revenue in US dollar millions)
Technological Innovation†	The machine/equipment in this product category becomes obsolete very fast.
Product Demand Uncertainty†	The total demand in this product category is very predictable (reverse coded).
Sales Person's Experience	Number of years this sales person has been working in your company.
Sales Person's Ability†	This sales person has a high degree of competence in tailoring his/her sales approach to the specific situation on hand.
Sales Person's Risk Aversion†	In my opinion, this sales person would be willing to sacrifice some "top-end" variable pay to assure himself/herself of a steady compensation (i.e. base salary).
Base Salary	What was the total fixed compensation (i.e. base salary) that was received by this sales person in the last fiscal year?
Total Compensation	What was the total compensation (base salary plus performance based compensation - commissions, quotas etc.- that is based on a fixed formulae) received by this sales person in the last fiscal year?
Sales Generated by Sales Person	What was the total revenue, in US dollars, generated by this sales person in the last fiscal year?
Excluded Instrumental Variables	
Engineering Degree	Does this sales person have a degree in engineering or technical sciences (e.g., B. Engg?) (Yes/No)
Product-line Margin	What is the operating margin as % of sales that your company earns for this product line?

†Measured using 7-point Likert scales (1= totally disagree; 7= totally agree)

TABLE 2: DESCRIPTIVE STATISTICS

Variables	Mean	St. Deviation	Minimum	Maximum
Price Delegation[#]	13.98	6.04	5	30
Monitoring Difficulty	3.74	1.24	1	6
Customer Heterogeneity	3.67	1.54	1	7
Competition[#]	8.96	4.84	2	40
Firm Size[#]	1627.66	5915.46	102	83000
Technological Innovation	3.64	1.57	1	7
Product Demand Uncertainty	3.36	1.45	1	7
Sales Person's Experience[#]	4.07	2.66	1	15
Sales Person's Ability	4.70	1.32	2	7
Sales Person's Risk Aversion	3.36	1.28	1	7
Base Salary	82.60	15.62	52.5	118.5
Total Compensation	117.00	21.72	73	170
Sales Generated by Sales Person	1707.20	1848.32	580	24000
Commission Rate	2.39	0.97	0	5.16
Engineering Degree	0.54	0.50	0	1
Product-line Margin	13.97	8.75	-15	45

[#] Summary statistics are for the raw data. In our econometric models, these variables are transformed by natural logarithm.
Number of observations = 261.

TABLE 3: DETERMINANTS OF PRICE DELEGATION

Dependent Variable: Log(*Price Delegation*)

	Models on Task Characteristics only			**Full Models**		
	OLS	**OLS**	**IV[i]**	**OLS**	**OLS**	**IV[i]**
Independent Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Commission Rate		0.144***	0.217**		0.125***	0.2224*
		(0.03)	(0.08)		(0.03)	(0.09)
Task/Firm Characteristics						
Monitoring Difficulty	0.104***	0.089***	0.081***	0.098***	0.090***	0.084***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Customer Heterogeneity	0.031	0.024	0.021	0.017	0.013	0.010
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
Log (*Competition*)	0.215***	0.189***	0.176***	0.224***	0.193***	0.169**
	(0.05)	(0.05)	(0.05)	(0.06)	(0.05)	(0.06)
Log (*Firm Size*)	0.072*	0.051	0.040	0.055*	0.042	0.032
	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)
Technological Innovation	-0.066***	-0.060***	-0.058***	-0.079***	-0.077***	-0.075***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Product Demand Uncertainty	-0.036*	-0.034*	-0.033**	-0.025	-0.028	-0.029*
	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)
Agent Characteristics						
Log (*Sales Person's Experience)*				0.160***	0.159***	0.159***
				(0.05)	(0.04)	(0.04)
Sales Person's Ability				0.047*	0.027	0.013
				(0.02)	(0.02)	(0.03)
Sales Person's Risk Aversion				-0.053**	-0.031	-0.013
				(0.02)	(0.02)	(0.02)
Constant	0.387	0.598	0.704	0.539	0.628	0.699
	(0.57)	(0.51)	(0.50)	(0.53)	(0.50)	(0.49)
R^2	0.25	0.33	0.31	0.32	0.38	0.41
F-statistic	11.70***	18.37***		15.41***	18.56***	
	(p=0.00)	(p=0.00)		(p=0.00)	(p=0.00)	
Chi^2-statistic			156.21***			249.02***
			(p=0.00)			(p=0.00)
Endogeneity Test (Hausman Test) for *Commission Rate*			Not endog.			Not endog.
			(p=0.31)			(p=0.24)
Relevance Test (Partial First-stage F-statistic)[ii]			14.86***			14.25***
			(p=0.00)			(p=0.00)
Overidentication Test (Hansen J-statistic)[iii]			0.021			0.076
			(p=0.88)			(p=0.78)

Number of observations = 261. All models include industry fixed effects. * significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors of coefficient estimates in parentheses; for test statistics, p-values in parentheses.

[i] Excluded instruments: Engineering Degree and Product-line Margin.

[ii] Partial F-statistic ≥10 indicates that the instruments are valid (Stock et al. 2002) in the sense that they are highly correlated with Commission Rate.

[iii] To test the null hypothesis that the excluded instruments are uncorrelated with the error term.

TABLE 4: FIRST-STAGE RESULTS FOR IV REGRESSIONS

Dependent Variable: *Commission Rate*

	Model 3 in Table 3	**Model 6 in Table 3**
Monitoring Difficulty	0.087*	0.059
	(0.05)	(0.05)
Customer Heterogeneity	0.031	0.021
	(0.03)	(0.03)
Log (*Competition*)	0.253**	0.278**
	(0.11)	(0.11)
Log (*Firm Size*)	0.123**	0.082
	(0.06)	(0.05)
Technological Innovation	-0.062	-0.039
	(0.04)	(0.04)
Product Demand Uncertainty	-0.045	-0.012
	(0.04)	(0.04)
Log (*Sales Person's Experience*)		0.034
		(0.08)
Sales Person's Ability		0.114***
		(0.04)
Sales Person's Risk Aversion		-0.173***
		(0.03)
Excluded Instruments		
Engineering Degree	0.597***	0.525***
	(0.12)	(0.11)
Product Margin	0.024***	0.022***
	(0.01)	(0.01)
Constant	-1.514	-0.752
	(1.19)	(1.14)
R^2	0.21	0.28
F-statistic	6.21***	8.84***
	(p=0.00)	(p=0.00)
Partial F-statistics	14.86***	14.25***
	(p=0.00)	(p=0.00)

Number of observation = 261. All models include industry fixed effects.
* significant at 10%; ** significant at 5%; *** significant at 1%.
Robust standard errors of coefficient estimates in parentheses; for test statistics, p-values in parentheses.

FIGURE 1 – The Extent of Pricing Authority Delegation