The Economics of Sales-Force Contracts

The Incentive and Selection Roles of Pay-for-Performance

Delegation and Pay-for-Performance

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Dual Roles of Performance pay

- Firms use channels intermediaries (e.g., wholesalers & retailers) and/or direct sales force to distribute their products (Anderson and Schmittlein Rand 1984)
- Compensation of direct sales force is enormous ($200 billion in USA 2006) ⇔ Sales compensation is an important issue
- Agency theory is the most widely used framework to explain the choice of compensation schemes
  - Focus on incentive provision to induce unobserved efforts (moral hazard)
- Core prediction: Higher uncertainty will be associated with lower commission rates (classic incentive-insurance trade-off):

$$b^* = \frac{\theta^2}{\theta^2 + \rho c \sigma^2}$$

Overview

- Empirical evidence far from satisfactory (Prendergast JPE 2002)

Context	Number of studies	Number of studies that support the prediction
Salesforce compensation	7	2
Franchising	3	0
Executives compensation	10	3
Crop-sharing contracts	4	1

- We also find mixed evidence in sales force studies in marketing regardless of settings (within vs cross industry; primary or secondary data, experiments, firm-level vs. individual-level)
- Indeed many results suggest a robust positive relationship.

Overview

- Application of agency-framework used in sales force contracts ignores their selection role
  - Attract and retain desired sales people ("Selection")
- Selection effect of sales force compensation observed by
  - Sales management papers (e.g., Oliver 1974) and textbooks (e.g., Zoltners ea 2006)
  - Labor economists (e.g., Lazear 2000; Balmaceda 2009)
- We contend that models ought to simultaneously address the dual roles of sales force contracts in:
  - Selection of "appropriate" agents
  - Provision of incentives
- Test this in the context of industrial sales

Alternative Explanations

- Other explanations explaining the anomalous risk effect
- Incorrect measure of "Uncertainty"
- Theory: exogenous (to agent effort) (Lafontaine & Bhattacharyya JCF 1995)
  - But empirically, people have used endogenous measures
    - e.g., Volatility of sales revenue
- Incorrect measure of "incentive power"
  - Percentage of variable pay to total pay
    - Subject to agent effort

Alternative Explanations

- Endogenous matching (Ackerberg and Botticini JPE 2002)
- Agents, based on their latent risk preference, choose jobs that match their characteristics. E.g., More risk averse agents choose jobs with less variability in output

  → Endogenous matching between uncertainty and risk aversion

  (other dimensions of endog. matching possible)
- Affect empirical testing of risk effect on incentive power

Alternative Explanations

- Claim that negative risk-incentive tradeoff is not manifest because empirical studies regress compensation on uncertainty but not risk preferences
- Create omitted variable bias and inconsistent estimator on the effect of uncertainty on commission rate

$$\text{plim } \hat{\alpha}_1 = \alpha_1 + \alpha_2 \frac{\text{cov}(\sigma^2, \rho)}{\text{var}(r)}$$

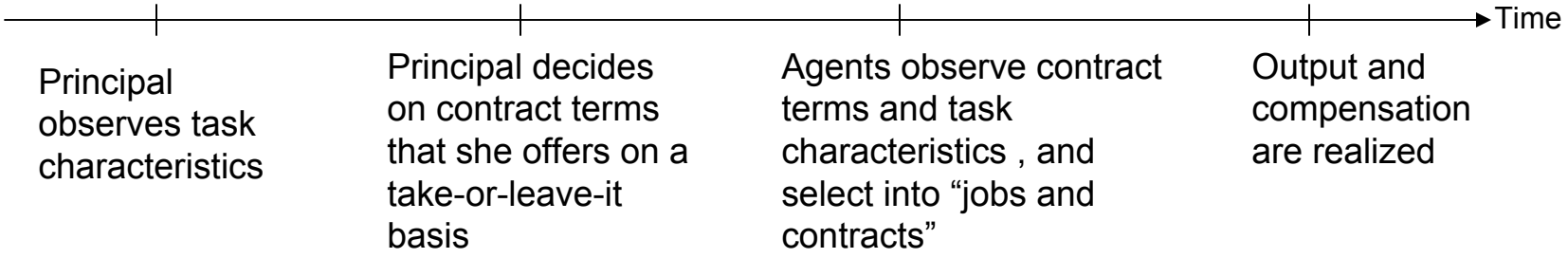
$$\text{plim } \hat{\alpha}_1 > \alpha_1, \text{ given } \text{cov}(\sigma^2, \rho) < 0 \text{ and } \alpha_2 < 0$$

The Selection Argument

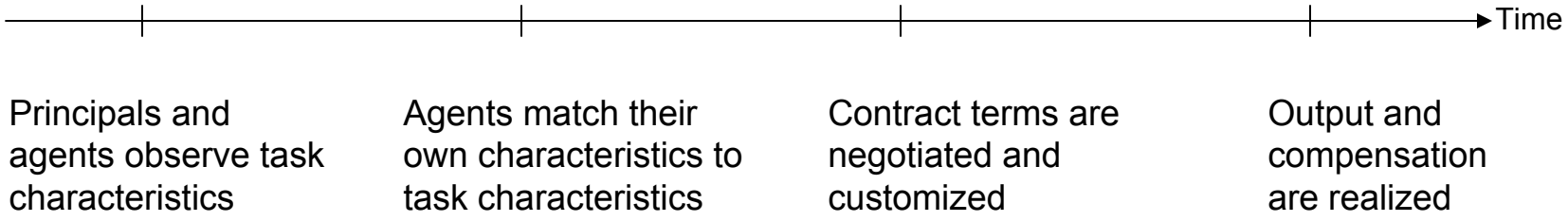
- Agents are heterogeneous in their ability and risk preferences which are unobservable ex ante by the principal
- Ability impacts her productivity
- Risk preferences impact willingness to deal with uncertainty (and thus risk premium paid in compensations)
- Principals would like to select agents who are best suited for the particular task/job characteristics
  - Hallagan (BJE 1978); Brown (RAND 1992); Lazear (AER 2000)
- Principals explicitly choose compensation contracts to entice the right type of agent for the job

Selection vs. Matching Time Lines

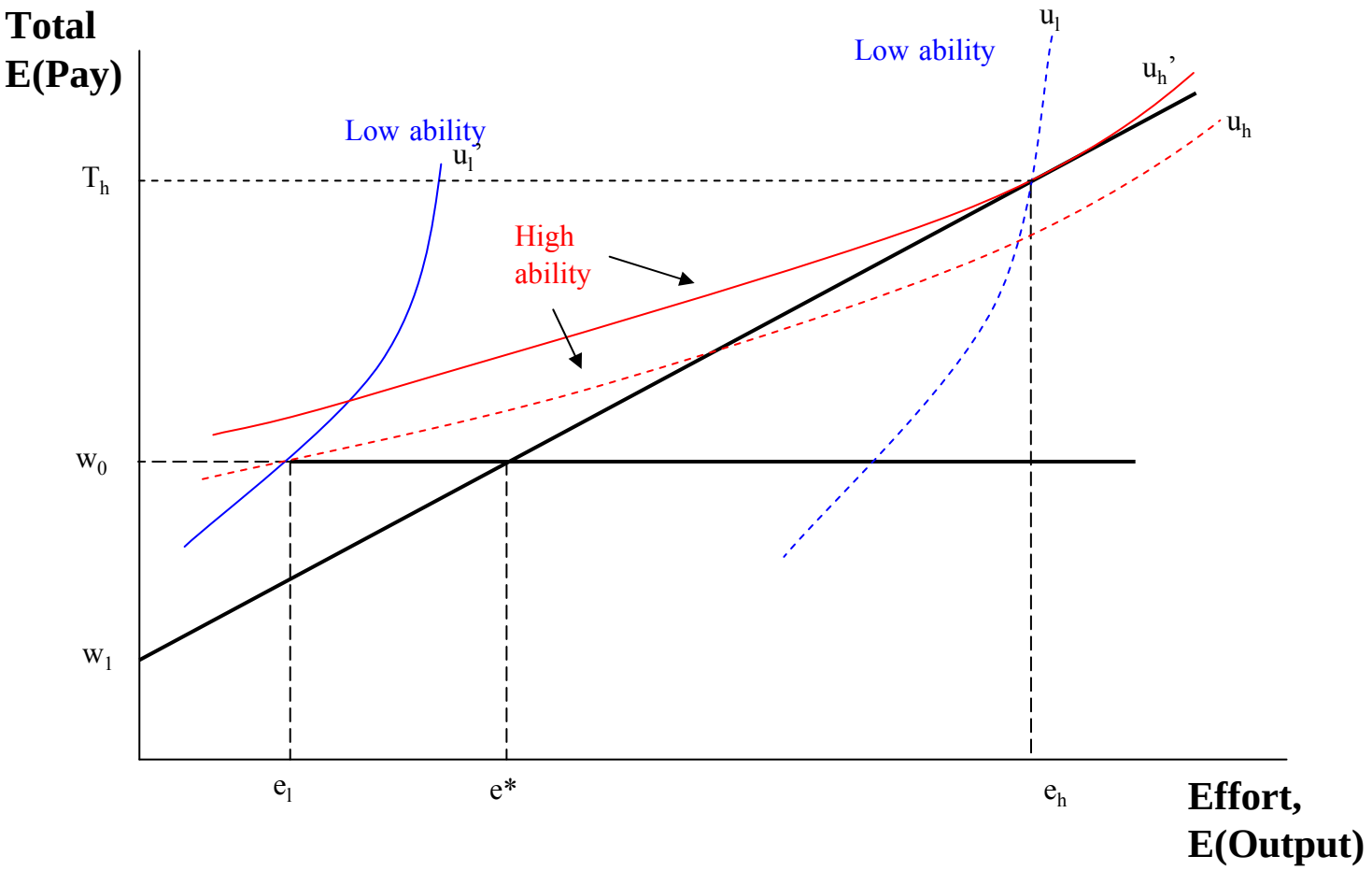
I. Non-customized contracts used for selection



II. Customized contracts used for endogenous matching



Selection on Ability: Risk Neutral Agent



Testable Implications

- Measurement: Using the right measure on uncertainty & incentive power will give the negative risk effect

- Endogenous Matching: Agents, who differ on ability and risk preferences, match themselves to tasks. After accounting for this endogenous match, the link between uncertainty and incentives will be negative

- Selection and Incentive: Principals offer pay schemes to attract the right agent. These pay schemes are based on task characteristics. Agents choose jobs based on the pay schemes and these task/job characteristics

Empirical Context and Data

- Firms with annual sales greater than $100MM, operating in SIC35, SIC36, SIC37, SIC38
- Use direct salesforce. Key informant is sales manager managing a divisional sales force
- 261 completed questionnaires (30% response rate)
- Pilot interviews revealed that pay plans for sales forces:
  - structured at the level of the sales force or sales group
    - Not customized (unlikely executive compensations)
  - reflect the task environment faced by these employees
  - set to attract and retain the right type of sales person
  - typically involve a base salary and sales-based commission

Empirical Context and Data

- The survey questions were designed to be specific to a particular sales person that the sales managers were currently supervising
- To minimize bias in the selection of 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
- Unit of analysis is an individual sales person, with each sales person, or data point, representing a different firm.

Descriptive Statistics

Number of observations = 261

Variable	Mean	Std	Min	Max
Base salary (,000)	82.65	15.06	52.5	118.5
Commission rate (%)	2.39	0.97	0	5.16
Total compensation (,000)	117.17	21.68	73.0	170.0
Sales generated by salesperson (,000)	1,705	1,845	580	24,000
Technological uncertainty	3.88	1.65	1	7
Product demand uncertainty	3.36	1.45	1	7
Customer heterogeneity	3.65	1.38	1	6.67
Monitoring difficulty	3.69	1.19	1	6.25
Firm reputation	4.33	1.35	1	7
Risk aversion	3.46	1.16	1	6.33
Ability	4.76	1.22	2	6.83

Measure of Incentive Power

- Ex post measures are incorrect
  - E.g., % of variable to total compensation
  - Endogenous to sales effort; effect from random shocks included
- Should use *ex ante* incentive power
- In our data, we have
  - Fixed compensation (base salary)
  - Total compensation (base salary + performance based compensation)

$$\rightarrow \text{Incentive rate} = \frac{\text{total compensation - salary}}{\text{sales revenue}} \times 100\%$$

  - Consistent with other contexts (franchising, trucking, movie distribution, and video rentals, etc) as ex ante incentives

Incentive Effect – Commission Rate

Customer Heterogeneity	**.09****	**.11****	**.06***	**.08****	**.08****	**.07***
	(.04)	**(.04)**	**(.04)**	**(.04)**	**(.04)**	**(.04)**
Firm Reputation	**-.12*****	**-.07***	**-.22*****	**-.17*****	**-.12****	**-.10****
	(.04)	**(.04)**	**(.04)**	**(.04)**	**(.05)**	**(.04)**
Monitoring Difficulty	**-.00**	**-.01**	**-.09**	**-.08**	**-.07**	**-.07**
	(.05)	**(.05)**	**(.06)**	**(.05)**	**(.05)**	**(.05)**
Technological Uncertainty	**-.01**	**.05**	**-.01**	**.03**	**.05**	**.05**
	(.04)	**(.04)**	**(.04)**	**(.04)**	**(.04)**	**(.04)**
Product Demand Uncertainty	**.00**	**.03**	**.01**	**.03**	**.00**	**-.01**
	(.05)	**(.05)**	**(.05)**	**(.05)**	**(.04)**	**(.04)**
Salesperson's Risk Aversion		**-.24*****		**-.18*****	**-.21*****	**-.21*****
		(.05)		**(.04)**	**(.05)**	**(.05)**
Salesperson's Ability			**.29*****	**.25*****	**.23*****	**.22*****
			(.05)	**(.05)**	**(.05)**	**(.05)**

(con't) Incentive Effect – Commission Rate

Control Variables						
Firm Size					.18 (.12)	.20 (.12)
Competition					.09** (.04)	.11** (.04)
Product-line Margin					.02*** (.01)	.02*** (.01)
Engineering Degree					.49*** (.10)	.48*** (.10)
Business Degree					-.15 (.13)	-.14 (.13)
Peer Incentive Rate						.16 (.22)
Constant	2.78*** (.36)	3.09*** (.35)	2.31*** (.33)	2.61*** (.30)	1.12*** (.54)	.47 (.52)
R^2	.07	.14	.18	.21	.33	.31

Selection on Ability – Agent Ability

Incentive Rate	.34***	.43***	.37***	.39***	.47**
	(.06)	(.08)	(.08)	(.08)	(.23)
Base Salary		.007	.010*	.011**	.018
		(.006)	(.005)	(.005)	(.011)
Customer Heterogeneity		.04	.05	.06	.05
		(.04)	(.04)	(.04)	(.04)
Firm Reputation		.41***	.37***	.37***	.39***
		(.06)	(.05)	(.05)	(.06)
Monitoring Difficulty		.32***	.30***	.30***	.32***
		(.08)	(.07)	(.07)	(.08)
Technological Uncertainty		.03	-.03	-.03	-.01
		(.06)	(.06)	(.06)	(.06)
Product Demand Uncertainty		-.02	-.02	-.02	-.00
		(.05)	(.04)	(.04)	(.04)

(con't) Selection on Ability – Agent Ability

Control Variables					
Competition			**-.16*** (.04)**	**-.16*** (.04)**	**-.16*** (.04)**
Firm Size			**.11 (.13)**		
Product-line Margin			**.00 (.01)**		
Engineering Degree			**.27** (.13)**	**.28** (.13)**	**.27 (.18)**
Business Degree			**.85*** (.11)**	**.86*** (.11)**	**.87*** (.13)**
Constant	**3.66*** (.26)**	**-.31 (1.06)**	**-.15 (1.12)**	**-.02 (1.09)**	**-.95 (1.66)**
R^2	**.09**	**.30**	**.46**	**.46**	**.40**

Selection on Agent Risk Aversion

Incentive Rate	**-.31*** (.06)**	**-.28*** (.06)**	**-.32*** (.07)**	**-.30*** (.07)**	**-.20 (.25)**
Base Salary		**.003 (.004)**	**.001 (.004)**	**.002 (.004)**	**.010 (.012)**
Task Characteristics					
Customer Heterogeneity		**.12*** (.05)**	**.10** (.05)**	**.11** (.05)**	**.10* (.05)**
Firm Reputation		**.15*** (.06)**	**.15*** (.06)**	**.15*** (.06)**	**.17*** (.06)**
Monitoring Difficulty		**-.03 (.05)**	**-.04 (.05)**	**-.05 (.05)**	**-.02 (.07)**
Technological Uncertainty		**.26*** (.05)**	**.27*** (.05)**	**.27*** (.05)**	**.29*** (.05)**
Product Demand Uncertainty		**.11** (.05)**	**.10** (.05)**	**.10** (.05)**	**.12** (.05)**

Selection on Agent Risk Aversion

Control Variables					
Competition			**.04** **(.04)**	**.04** **(.04)**	**.04** **(.05)**
Firm Size			**.12** **(.15)**		
Product-line Margin			**.00** **(.01)**		
Engineering Degree			**.29**** **(.15)**	**.29**** **(.15)**	**.28** **(.20)**
Business Degree			**-.52***** **(.13)**	**-.50***** **(.13)**	**-.50***** **(.14)**
Constant	**4.37***** **(.20)**	**1.77**** **(.72)**	**1.71***** **(.76)**	**1.85***** **(.74)**	**.76** **(1.59)**
R^2	**.15**	**.25**	**.31**	**.31**	**.25**

Conclusion – Part 1

- Firms design compensation schemes to both:
  - Incentivize agents based on the job characteristics; &
  - Select the right agent in terms of her ability and risk preferences
- Does not support the endogenous matching argument in our context; Measurement of "Uncertainty" doesn't rectify non-negative risk effect
- The importance of institutional context for discerning the role of contracts
  - In executive compensation and maybe crop-sharing, compensation contracts are customized
  - In franchising and sales force, firms do not customize compensation contracts; but serve as explicit selection devices
- Positive relationship between risk and incentives could be the result of explicit role of contracts in selection

Delegation and Pay-for-Performance

- Allocation of decision rights + pay-for-performance
  - 2 key organization designs that firms use to motivate their employees and to coordinate internal activities
- On allocation of decision rights, theories suggest firms
  - Decentralize authority when adaptation to local information is important (e.g., Aghion and Tirole JPE 1997)
    - Price delegation → permit price discrimination, esp. for skilled sales persons
  - Centralize authority for coordinating internal activities when information is publically available (e.g., Acemoglu ea QJE 2007)
- On performance pay, theories suggests
  - Aligns interest between the firm and the employee (e.g., Prendergast 2002) → +ve related to delegation

Empirical Evidence

- Extent of delegation
  - Inter-firm: technology alliances (Lerner & Merges JIE 1998; Ryall & Sampson Mgt Sci 2009), car dealership (Arrunada ea JLEO 2001)
  - Intra-firm: tech adoption (Acemoglu at QJE 2007), IT decisions (McElheran 2010), sales people (Frenzen ea 2010)
- Relationship between delegation and performance pay
  - Retail banking (Nagar Acct Rev 2002), large public firms (Wulf JIE 2007)
- Evidence matches theories, but may have issues:
  - delegation (perceptual? Catagorical?)
  - incentive pay (ex post?)

Research Context & Questions

- Salespeople selling industrial equipment/machinery
- Data obtained from 261 firms through questionnaire
- Research questions
  - What determines sales people's pricing authority?
  - What is the relationship between sales people's pricing authority and their commission rate?
- Relies on a simple model adapted from Dessin (RES 2002) to generate hypotheses

Summary of Findings

- On factors that affect delegation, we find
  - a positive relationship between the extent of asymmetric information and the extent of price delegation
  - delegation is increasing in a sales person's tenure at the company
  - less delegation when the environment the firm operates in is more dynamic, e.g., fast technological innovation and unpredictable demand
- Performance pay and delegation, we find
  - a strong positive relationship, whether we include agent characteristics, and control variables
  - the effects of various job and agent characteristics on pricing authority are attenuated, but not eliminated, when we control for performance pay

Theoretical Framework

- We adapt a basic model of Dessein (2002)
  - An employer or firm (the principal/she) produces and sells industrial goods + a sales person (the agent/he)
  - Customers have unitary demand, i.e. they put out requests for proposals and buy from the seller with the most competitive offer but not necessarily the lowest price
  - Similar to differentiated auctions
- Sales person effort, and interactions between customer current and proposed purchases, can help the customer realize value from the equipment
- Because he interacts with customers, the sales person learns market conditions and customer needs while the principal only knows the distribution of values
- Value of the good to customers is drawn from a uniform distribution on[V, 3V], with $V > 0$

Theoretical Framework

- The sale yields a benefit R(p, v) to the principal, where p is price and v is customer value
- The benefit to the principal of selling the equipment can be different from the sales revenue for several reasons:
  - a sale might increase the chances that the same customer buys complementary goods from the firm in the future
  - some of the customer's competitors may be more, or less, likely to buy from the principal as a result of this sale
  - the terms of the sale may affect other sales or future business opportunities
- 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 $p = v$

Theoretical Framework

- For the sales person, a sale generates a benefit of u(p, v, b), where b > 0 captures the agent's bias: $u(p, v, b) = k - (p-(v-b))^2$
- The sales person's preferred price for the good is below the one that maximizes the benefit to the principal, since the sales person
  - must put in effort for the customer to realize the value v, but the sale can be achieved with less effort at a lower price
  - may disregard the effect of his behavior on the prices at which the equipment can be sold in other territories
- Coordination needs within the organization, which need not be internalized by the individual sales person, can lead them to charge a lower price than what the firm would like

Theoretical Framework

- Agent bias is lower if the sales person is
  - More capable, e.g., skilled, engineering degree
    - Recall the *selection function of commission rate* on capable sales people

- For simplicity, we assume
- the firm/principal only chooses to delegate or not, and we do not allow for communication
- the principal can commit to this decision
- Both parties' benefit functions, and the value of b, are common knowledge

Theoretical Framework

- Under delegation, the sales person chooses $p = v - b$, so the firm obtains in expectation

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

where D indicates delegation

- If the firm retains control over the pricing decision, it chooses p to maximize its expected benefits, where:

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

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

Theoretical Framework

- Maximizing this with respect to p yields $p^* = 2V$, such that the maximized benefit under non delegation is

  $$E(R^{ND}) = K - V/3$$

- The principal chooses to delegate if $E(R^D) > E(R^{ND})$, i.e. iff $b^2 < V^2/3$
- Implications are that, all else equal, the likelihood of delegation:
  - increases with increases in the variance of $V(=V^2/3)$

    => the likelihood of delegation increases with the informational advantage of the agent
  - decreases with increases in agent bias, b (which we relate to tenure, business/engineering degree)
  - increases with reduction in agent cost of effort (ability)

Theoretical Framework

- Introducing performance pay leads to better aligned incentives
- Suppose for simplicity that the principal pays a share of revenue, i.e. a*p for unitary demand
- The agent's benefit from a sale is now

  $u_s(p, v, b, a) = k - (p-(v-b))^2 + ap$

  from FOC, optimal p, $p^*=v-(b-a/2)$: higher than $(v-b)$
- The firm chooses to delegate iff

  $(b-a/2)^2 < V^2/3$, where the new bias $(b-a/2) < b$
- Thus delegation occurs more often when the agent is paid a share of the sale

Empirical Context and Data

- Firms with annual sales greater than $100MM, operating in SIC35, SIC36, SIC37, SIC38
- Use direct salesforce. Key informant is sales manager managing a divisional sales force
- 261 completed questionnaires (30% response rate)

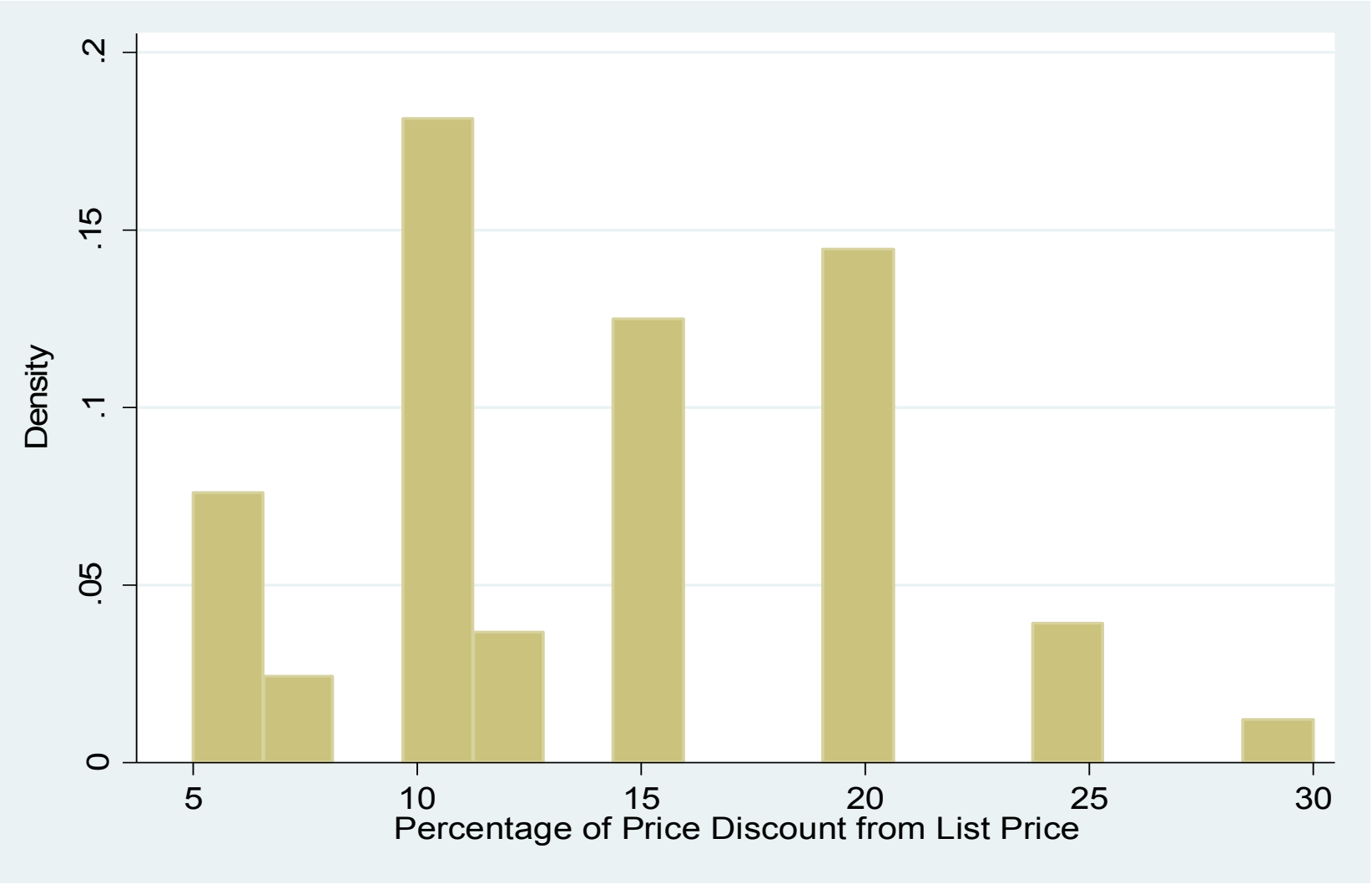
Empirical Context and Data

- Pilot interviews revealed that
  - Pricing delegation 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
  - Levels are chosen after employee joins, based on manager's perception of the salesperson and task environment
  - Can change over time (perhaps as the manager learns about the sales person cost of effort or bias)
  - The managers expect sales persons whose pay depends heavily on commission to be very deliberative about discounting because lower prices also mean that the sales person's own commission pay is lower

Key Measures

- Price Delegation: 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 his manager
- Commission rate: derived from information about total compensation, base salary, and sales generated by the sales person. (If bonuses, commission rate overestimated – however sales managers indicated commission are the bulk of variable pay; if accelerating commission rate, then comm rate underestimate)
- Task/Firm Characteristics
- Agent Characteristics

Figure 1: Price Delegation



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

Econometric Specification

$$\text{Log(Price Delegation}_i) = \alpha + \beta \text{ Commission Rate}_i + x_{1i}'\gamma + x_{2i}'\varphi + u_i$$

- Price delegation is positive: natural log
- Regressors: commission rate, task/firm characteristics, agent characteristics, control variables
- Commission is pre-determined → RHS
- Since we have cross-sectional data, our results only indicate correlations

Empirical Results – Delegation

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
Commission Rate		0.140***	0.159***		0.112***	0.141***
		(0.03)	(0.03)		(0.03)	(0.03)
Base Salary			0.003			0.005*
			(0.00)			(0.00)
Monitoring Difficulty	0.106***	0.090***	0.100***	0.097***	0.106***	0.106***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Customer Heterogeneity	0.032*	0.025	0.024	0.013	0.008	0.008
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Log (*Competition*)	0.206***	0.186***	0.181***	0.233***	0.192***	0.192***
	(0.05)	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)
Technological Innovation	-0.068***	-0.061***	-0.057**	-0.084***	-0.078***	-0.078***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Product Demand Uncertainty	-0.038*	-0.035*	-0.029*	-0.031*	-0.023	-0.023
	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
Log (*Firm Size*)	0.069*	0.050	0.036	0.052	0.020	0.020
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Product Line Margin	0.005	0.002	0.003	0.004	0.003	0.003
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Empirical Results - Delegation

Agent Characteristics						
Log (*Sales Person's Experience)*				**0.169*** (0.04)**	**0.65*** (0.04)**	**0.186*** (0.04)**
Sales Person's Ability				**0.039 (0.02)**	**0.027 (0.02)**	**0.020 (0.02)**
Sales Person's Risk Aversion				**-0.053** (0.02)**	**-0.034* (0.02)**	**-0.028 (0.02)**
Engineering Degree				**0.125* (0.06)**	**0.066 (0.06)**	**0.087 (0.06)**
Business Degree				**-0.018 (0.05)**	**-0.018 (0.05)**	**0.004 (0.05)**
Constant	**0.384 (0.57)**	**0.591 (0.52)**	**0.509 (0.51)**	**0.511 (0.53)**	**0.595 (0.50)**	**0.467 (0.49)**
R^2	**0.26**	**0.33**	**0.33**	**0.34**	**0.38**	**0.40**
F-statistic	**11.43*** (p=0.00)**	**16.77*** (p=0.00)**	**15.28*** (p=0.00)**	**15.51*** (p=0.00)**	**17.10*** (p=0.00)**	**15.26*** (p=0.00)**

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Conclusion – Part 2

1. Individual-level data on actual sales people's pricing authority and ex ante incentive intensity
2. Provide a much-needed evidence on theory testing
   - ✓ Pricing authority increases in asymmetric/local information, e.g., monitoring difficulty
   - ✓ Managers retain more pricing authority (or centralize) under rapid technological innovation and volatile industry demand
3. Link agent characteristics to price delegation
   - ✓ Experience, Engineering degree
4. Incentive pay positively relates to pricing authority
   - ✓ Selection on perceived ability, engineering degree, risk aversion
   - ✓ Both monetary and non-monetary factors matter