Do Agents Game Their Agents' Behavior? Evidence from Sales Managers

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This paper examines how sales managers, acting as agents of the firm, game the staffing and incentives of their subordinates. Sales managers on a quota's cusp have a unique personal incentive to retain and lower quotas for poor-performing subordinates, allowing me to isolate a manager's interest from the firm's. Using microdata from 244 firms that subscribe to a cloud-based service for processing sales compensation, I estimate that 13-15% of both quota adjustments and retentions among poor performers are explained by managers' incentives around quotas. Although a minority of poor performers are subsequently terminated or transferred, most are retained indefinitely.

The constraints on principals' ability to induce efficient behavior through their economic agents are the defining determinants of economic organization. In the classic principal-agent model, a principal (e.g., a firm) contracts directly with its agents (e.g., the workers). In practice, profit-maximizing principals are far removed from rank-and-file agents. For example, shareholders of publicly traded firms rely on a long chain of intermediary executives and managers to set and monitor workers' employment practices on their behalf. As such, models that invoke a profit-maximizing firm implicitly assume that the interests of their intermediary agents, even if they are not identical to those of shareholders, are sufficiently aligned so that their ultimate employment practices also approximate profit-maximizing behavior.

Although it is well known that agents' incentive plans may encourage activities that are inconsistent with the interests of principals, evidence of such gaming draws almost exclusively from the top and bottom of organizations (e.g., CEOs, rank-and-file workers, and athletes; see Murphy 1999 and Lazear and Oyer 2009 for reviews). Gaming by middle managers is also important because they are the intermediary agents responsible for making rank-and-file employment decisions on behalf of the "Firm." As such, theoretical work has long explored how incentive problems among managers shape firms' boundaries, governance, structure, and practices.

This paper presents evidence that sales managers game the staffing and incentives of their subordinates. Unlike prior empirical work in which managers exhibit a social taste for friends or preferred groups, this paper examines how managers' decisions are governed by their interest in pursuing a formal benchmark:

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meeting a quota. Like salespeople, sales managers are typically assessed by their measured performance (sales) as a percentage of quota, and they have some ability to shift sales into their desired measurement periods. Unlike salespeople, their measured performance is largely assessed by their subordinates' cumulative performance, and so their means for shifting sales also affect their subordinates.

To illustrate a puzzling implication of gaming by intermediary agents, Figure 1 uses data from this study to show that the cumulative sales of the manager's subordinates often just reach the manager's quota. Indeed, for both rank-and-file salespeople and their managers, there are nearly four times as many quotas surpassed within 5% as there are quotas missed within 5%. This figure excludes the 7% of instances in which managers' quotas are the sum of subordinates' quotas, so this pattern cannot be explained by cumulatively aligned quotas alone.

This paper examines two methods by which managers may pull in sales into their desired fiscal year, contrary to the desires of the firm. First, because replacing a salesperson is costly to short-term sales, sales managers can pull in sales by retaining an incumbent poor performer. This activity is costly to firms because retained poor performers consume not only a base pay but also overhead costs. Second, managers can pull in sales by providing poor-performing subordinates with downward quota adjustments. This activity is costly to the firm because downward quota adjustments invite future moral hazard. For this reason, firms typically require managers to provide evidence that this adjustment was due to factors outside of the salesperson's control (rather than poor sales ability or effort).

I test this hypothesis using a novel and uniquely well-suited proprietary data set featuring salespeople working at firms that subscribe to a service for sales performance management that is hosted over the cloud. Data include longitudinal detail on the hierarchical positions, incentive plans, performance, and pay of 7,492 sales managers and their 61,092 immediate subordinates in 244 firms. I distinguish the turnover and quota adjustments of salespeople whose sales are critical for the manager to meet a quota (the quasi-experimental treatment) with salespeople working under managers who would or would not meet a quota anyway (the controls). As such, the identification strategy uses sales of a subordinate's peers as an exogenous source of variation affecting whether a subordinate's sales will be crucial for the manager to meet a quota, and the sales of a subordinate as a "treatment bubble." This allows distortions in subordinates' staffing and incentives to be causally attributed to managers' personal interests, thereby addressing a key challenge for empirical agency research. As a falsification test, I confirm that this local drop in turnover is specific to the manager's quota threshold, and not the threshold of the managers' hierarchical peers (the subordinates' organizational "uncles"). I estimate that 13-15% of quota adjustments and retentions among poor performers are explained by the managers' unique personal interest in meeting a quota.

The goal of this paper is not to provide a cost-benefit analysis of the use of managerial quotas. Rather, it is to explain how managerial quotas can affect workers' staffing and incentives and to provide evidence for the existence and extent of such intermediary gaming. These costs may be thought to substitute for the benefits of delegated authority and managerial quotas, topics for which empirical work has provided less

guidance. It also provides evidence for a particular form of "diminishing returns to bureaucracy," which was first hypothesized by Coase (1937) and has since motivated theoretical work on organizational structures.

1 Sales Management, Weak Monitoring, and Gaming in Sales

1.1 Background

Like rank-and-file salespeople, frontline sales managers typically receive variable pay (commissions and bonuses) that depends on measured performance. In the data, mean annual variable pay is about one-half of base pay for both managers and non-managers.

Quotas are specific performance thresholds, and rates for commissions and bonuses are typically expressed at intervals of a quota. Quotas are generally set in advance of a measurement period. However, organizations typically instruct managers to adjust subordinates' quotas for reasons outside of the salespersons' control.

For purely compensation purposes, the demarcation of 100% quota is arbitrary because commission and bonus rates could be adjusted. However, firms set quotas to define satisfactory performance. Salespeople who exceed their quotas typically become eligible for progressive bonuses or accelerators that increase the rate at which commissions are paid. Salespeople who consistently exceed their quotas may also receive promotions, transfers, superior leads, or superior accounts. Making quotas and other discrete benchmarks also confers prestige, influence, and symbolic rewards (Larkin 2009). Salespeople who do not meet quotas are typically guaranteed a base pay, which reduces the risk borne by salespeople and provides income to new recruits. Guaranteed income is often temporary and may be drawn from future variable pay. Consistently missing a quota is typically considered grounds for dismissal, whereas terminating a salesperson for performance reasons when that salesperson consistently makes quota may be interpreted as symptomatic of poor communication.

1.2 The Benefits of Quotas

Based on interviews, I find that sales plan designers use quotas for three main reasons. First, quotas concentrate variable pay around marginal effort. Some positions, such as account managers who sell subscription renewals, can achieve much of their quota with relatively little effort. In the classic agency model, this is similar to the result that a firm can capture maximum rents by paying an agent's participation constraint for the first-best effort and terminating the employee otherwise (for a thorough discussion, see Oyer 2000). The firm may have a better understanding of this level of effort than it does the marginal cost of this effort, which is needed under a linear incentive plan.

Second, quotas communicate minimum acceptable performance, and consistently missing a quota is generally understood to be grounds for dismissal. As I describe in the next section, salespeople consume overhead costs and base pay, and so do not generally absorb the full cost of poor performance through low variable pay (as would be the case if the principal were "leasing the firm" to the salesperson). As such,

quotas communicate a threshold under which it is incentive compatible for the firm to replace a salesperson with a new recruit.

Third, managers and plan designers widely believe that quotas have a psychological effect on salesperson sorting and performance. Larkin and Leider (2012) find that people overestimate their future pay under nonlinear pay schemes and that such schemes may elicit sorting and incentive effects that are superior to linear schemes. Heath, Larrick, and Wu (1999) relate quotas to referent points in prospect theory, and Herweg, Müller, and Weinschenk (2010) show that binary payment schemes may be optimal when agents are loss averse. The cost of quotas may be thought of as substituting for these benefits.

1.3 How Quotas Affect the Timing of Sales Activities

Outside of executives and sales, variable pay is often a small or negligible component of compensation. One reason is that pay-for-performance encourages workers to game plans by engaging in activities correlated with performance measures but contrary to the interests of the firm. Examples abound of how misaligned incentives prompt undesired behaviors. At the top of organizations, executives adapt accounting procedures, accrual procedures, and voluntary disclosures to maximize bonus rewards (see, for example, Aboody and Kasznik 2000, Healy 1985, and Yermack 1997). At the bottom of organizations, several studies have shown how seemingly innocuous pay-for-performance schemes have backfired.[1]

Following data availability, the literature has focused strongly on agency problems among top executives and rank-and-file workers. Studies that show managers may forfeit some performance-based pay to benefit their friends or preferred groups offer exceptions. Bandiera, Barankay, and Rasul (2007), in a field experiment on supervisors of fruit pickers, find that introducing a managerial piece rate improved efficiency by leading supervisors to be more selective about whom they recruit and led them to focus effort on assisting the most productive workers. Hjort (2011) finds that ethnic conflict led managers at a Kenyan rose farm to discriminate against workers from a rival ethnic bloc at personal cost. These papers provide evidence that managers get some benefit from hiring and allocating resources to favored individuals and groups, consistent with taste-based discrimination among managers. In these studies, bias occurs despite (not strong enough) incentives rather than because of nonlinear incentives. They also do not feature the same institutional characteristics (long measurement periods, quotas, and ramp-up) that invite the staffing and incentive gaming found in this study.

Empirical work shows that misaligned and nonlinear incentives distort rank-and-file sales activities as well. Using data from an enterprise software vendor, Larkin (2013) finds that accelerating quarterly commissions led salespeople to use discretionary discounts to concentrate transactions into fewer quarters, costing the employer an estimated 6-8% of revenues. Using Compustat data, Oyer (1998) exploits variation in fiscal years by company and within industry to show that manufacturing firms' sales rise in the fourth quarter.

[1] See, for example, Baker (1992); Courty and Marschke (1997, 2003); Ethiraj and Levinthal (2009); Feltham and Xie (1994); Forbes, Lederman, and Tombe (2012); Hertzberg, Liberti, and Paravisini (2007); Kerr (1975); Obloj and Sengul (2012); and Johnson, Reiley, and Muñoz (2011).

He interprets this finding as consistent with the incentive effects of annual quotas, although the firm-level public disclosure data do not permit a direct test or analysis of gaming at any level of the organization. Incentives to boost the size of subscriptions led account managers at Dun & Bradstreet to overstate their clients' historical usage, spurring lawsuits (Roberts 1989). A *Los Angeles Times* investigation found that Wells Fargo executives pressured branch managers, who in turn pressured branch employees, to meet quotas. Superiors were allegedly complicit in unethical activities, including forging clients' activities in order to open new accounts (Reckard 2013).

Salespeople describe several additional practices used to shift credit across measurement periods. Salespeople may boost sales figures by enticing distribution channels to place large orders to keep as inventory, a practice referred to as "channel stuffing." Salespeople may delay closing deals until future measurement periods, a practice referred to as "sandbagging." Salespeople and managers may exchange credit for sales across measurement periods. Salespeople and managers may misrepresent the quality of their territory in order to reduce sales forecasts used as the basis of their quotas or territories. Sales managers can provide incentives, called "SPIFs," directly to salespeople at downstream firms that sell their products.

Although rewards and job security provide incentives for salespeople to meet their quotas, employer ratcheting (i.e., the practice of raising quotas based on past performance) and weak marginal incentives discourage salespeople from slightly exceeding quotas. Murphy (2000) shows that firms that set managerial quotas according to internal standards (such as a budget or past performance) have less-variable bonuses and smoother earnings than those that use external standards that cannot be gamed. Leone, Misra, and Zimmerman (2006) find evidence of dynamic sales quota ratcheting in a Fortune 500 firm. They note that quotas rise with over-performance more readily than they fall with underperformance. Asymmetric ratcheting further compresses incentives around meeting quota by weakening the benefits of missing quotas (because quotas are unlikely to fall) and by weakening incentives to exceed quotas (because quotas are likely to rise).

1.4 How and Why Firms Monitor Sales Activities

Sales functions devote considerable resources to identifying and retaining salespeople who exceed quotas. In the data, turnover is 47% per year, and sales performance is highly skewed.[2] However, in many cases, it is difficult for the firm to attribute sales numbers to the skill of a salesperson, rather than to exogenous factors such as the quality of the product, territory, or market conditions. As such, managers who accumulate private knowledge of workers' abilities play a large role in identifying and retaining high performers.

Three-tier agency theory also incorporates supervisors who enjoy private knowledge of agents' activities. Because this information gives supervisors and their agents an opportunity to engage in collusion and politicking, firms may establish bureaucratic rules and monitoring to discourage such gaming (Milgrom

[2]The sales industry often cites the "80-20 rule," the rule of thumb that 80% of sales are made by 20% of the sales force. In the data, this rule only slightly exaggerates the variation in sales performance at most firms. Prior to controlling for tenure, about 25% of salespeople are responsible for 75% of sales at the median firm.

1988; Milgrom and Roberts 1990; Tirole 1986, 1992). In the discrimination literature, managers may have a taste for working with members of a certain group (Becker 1957).

In contrast, this study uses meeting a quota as the manager's interest and examines how managerial gaming emerges from poor information and misaligned incentives around timing. In sales hierarchies, information regarding salesperson ability and exogenous "luck" is rarely observed or communicated perfectly. Rather, managers and their subordinates learn with experience how difficult it is to sell a given product in a given territory, whereas other functions (potentially sales operations, the CFO, or marketing) use past performance, subjective reports, or other sources of information to produce forecasts. One purpose of these forecasts is to set quotas, making subordinates' reports potentially unreliable. As a result, managers are typically given discretion over not only staffing but also incentives (such as quota adjustments), job assignments (such as territories), and so on. Although managers' incentive plans encourage them to build productive sales teams, nonlinearities in those plans also provide an incentive to use staffing and incentive adjustments to shift sales across measurement periods.

As such, sales organizations also rely on a variety of reporting practices to reduce information asymmetries, maintain incentive alignment, and discourage gaming. Customer relationship management (CRM) tools allow salespeople to report progress on their sales pipeline and share information regarding how clients' purchasing decisions are made. These too may be gamed; interviewees report that subordinates may misrepresent the status of intermediary sales activities to avoid interventions by managers, whose desired closing date for sales may conflict with their own, or to prevent others from expropriating their client relationships and accounts.

Some firms use subjective bonuses or promotions to reward managers perceived to be acting primarily on the interests of the firm (Cappelli and Conyon 2011). Some firms restrict managers' staffing, incentive, and pricing decisions, requiring large decisions to be reviewed by sales operations or superiors. Indeed, the effort and expense that firms dedicate to designing plans, monitoring activities, and improving coordination suggest that hierarchical coordination is indeed costly.

2 Data

Before discussing hypotheses and results regarding how managers may game subordinates' staffing and incentives, I first introduce the data.

Data come from a firm that provides on-demand (over the cloud) sales performance management (SPM) software. Using software accessed by the web, the service providers' clients input the personnel records and compensation plans of their firm's salespeople and sales managers. The clients' salespeople and managers log in to report credited transactions and also to track their progress toward quotas or other benchmarks. The service is designed to make incentives and real-time performance transparent to salespeople and their managers, to calculate and automate compensation, to enable monitoring, to produce an audit trail, and

to promote flexibility in adapting compensation plans. Technologically, the service competes with general spreadsheet software (such as Microsoft Excel), dedicated single-site SPM software, and other providers of hosted SPM software. It should not be confused with customer relationship management (CRM) software, such as Salesforce.com, which is designed to manage client relationships and sales pipelines.

Data include how transactions are credited to 7,492 sales managers and their 61,092 immediate subordinates in 244 client firms. Table 1 reports available data. Position and parent position identifiers allow the construction of longitudinal organizational hierarchies, which also determine crediting rules, performance monitoring, permissions, and other key features within the SPM software. The most common job titles among workers with one level of subordinates are territory manager, sales director, regional director, regional manager, sales engineer manager, and regional vice president.

Data begin in January 2008 and end in October 2011, although not all firms are represented throughout this period. Data include 1,020,998 worker-months, and no one firm represents more than 13% of workers or worker-months. Data are proprietary. The disclosing company replaced company and person names with identifiers, and provided primary NAICS and governance codes. Table 2 provides descriptive statistics.

Data include 156 million credited transactions. Each transaction includes a time stamp, the credit applied to salespeoples' quotas, and commissions (if applicable). Quota attainments are updated in real time and made visible to workers and managers via the software's virtual dashboard. Because calculated pay may be automatically linked to payroll, forecasts, and audit reports, it is unusually incentive compatible to enter plans and transactions accurately.

The data allow a large number of workers' pay and performance to be tracked longitudinally and in a fashion that is reliable and standardized across firms. Because data come from an on-demand SPM service, they largely avoid the selection dilemmas presented by data from single firms that opt in as research sites, helping to address the external validity concerns of single-firm studies. The data do not include education, demographics, or other characteristics sometimes available in empirical personnel research.[3]

The data treat turnover events as any severance in employment for the purpose of record keeping within the SPM software. As such, turnover events include quits, layoffs, and fires. Turnover events also include internal job transfers to a position not covered by the SPM software, but do not include transfers to a position covered by or added to the SPM software. For example, a salesperson who transfers within sales or who is promoted to sales manager is likely to remain in the data (and therefore not be counted as a termination). However, a salesperson transferring out of sales would drop out of the data and be counted as a turnover event. Data include 38,159 turnover events and 15,695 internal transfers. Turnover is highly periodic with measurement periods.

The data do not provide a reason for turnover (e.g. a termination or quit). This isn't necessarily a problem because turnover is well defined, but the reason for the turnover can be unclear. Presumably, a firm could encourage a worker to quit or could discourage a worker from quitting (e.g., by offering a retention

[3]A code book is available upon request.

bonus). The empirical strategy is agnostic to the circumstance, but rather examines turnover as a function of the manager's specific incentive to retain.

3 Effect of Managerial Quotas on Subordinate Staffing

3.1 Staffing Hypothesis

Developing a sales team is among a sales manager's chief responsibilities. This responsibility involves recruiting, training, assisting, and disciplining subordinates (ONET 2010). Because managers' performance is measured primarily through the cumulative sales of their subordinates, their plans give them an incentive to build productive teams. However, quotas affect incentives for the timing of staffing decisions.

The intuition follows. Hiring and training new salespeople consumes time. In sales settings involving complex products or services, the typical applicant for a sales position is intensively screened, recruits receive training, and trained recruits are given several months to develop skills and establish a sales pipeline beginning with initial leads and ending with a purchase order (and potentially installation, renewal, and support). Salespeople refer to this time period as the ramp-up period. The sales industry often uses twice the length of the sales cycle as a heuristic for the ramp up time. For business-to-business sales, which constitute the majority of sales in these data, interviewees suggest that a typical ramp-up time would be 6 to 12 months. As I will show, this claim is consistent with the data.

For this reason, replacing a poor-performing but experienced salesperson with a new recruit is an investment involving the substitution of present sales with greater expected future sales as the new recruit is hired and ramped up. As such, retaining a poor performer is a way for managers to pull in sales from future measurement periods. Therefore, being on the cusp of an annual quota encourages managers to retain poor-performing subordinates who would otherwise be replaced.[4]

The key dependent variable is the turnover of poor-performing subordinates (i.e., those in the bottom quartile of sales for their job, given their tenure). The key independent variable is whether the manager has a specific personal interest in retaining a poor-performing subordinate. To isolate that interest, I examine managers who are expected to make an annual quota if and only if they retain a poor-performing subordinate in the fourth quarter of the fiscal year. Formulaically:

$$\Pr(T_i|Q_i^H \geq 100\% > Q_i^L) > \Pr(T_i|Q_i^H < 100\%, Q_i^L < 100\%) \tag{1}$$

$$\Pr(T_i|Q_i^H \geq 100\% < Q_i^L) > \Pr(T_i|Q_i^H \geq 100\%, Q_i^L \geq 100\%) \tag{2}$$

where $\Pr(T_i)$ denotes the probability that poor-performing subordinate i turns over in the fourth fiscal

[4]Note that these features make sales very different from Bandiera, Barankay, and Rasul's (2007) fruit pickers living on a farm. In their setting, recruitment costs were negligible, the difficulty of the task was relatively well known and homogeneous, workers required minimal training to be ramped up, and there were no quotas. These features depart from the complex sales settings that distort incentives among sales managers.

quarter, Q_i^H is the manager's expectation of his total annual quota attainment if the subordinate is retained, and Q_i^L is the manger's expectation of his/her total quota attainment if the subordinate turns over (which I will assume is Q_i^H minus subordinate i's contribution). Formally, Hypothesis 1 is that poor-performers who work under managers on the cusp of an annual quota will have lower turnover than poor-performers who work under managers who are far below or far above a quota.

Although Equation (1)'s prediction that managers push out sales by replacing poor performers when they are far below quota may be counterintuitive, interviews suggest that this practice is common when the manager's job is secure and marginal incentives are weak. Interviewed sales managers referred to the general practice of concentrating losses (and potentially making staffing changes or work reorganizations) in a single measurement period as "taking a bath."

3.2 Staffing Identification Strategy

The identification strategy relies on a manager becoming aware that his progress toward meeting an annual quota after the third quarter will place him on the cusp of the quota. The strategy uses the manager's expected quota attainment without the poor performer as a source of quasi-exogenous variation and uses the predicted fourth-quarter sales of the poor performer to create a treatment bubble of managers whose quota attainments depend on retaining the subordinate. That is, the quota attainment entering the fourth quarter is neither (i) so low that the manager will miss quota even if a poor-performing subordinate is retained nor (ii) so high that the manager will meet quota even if the subordinate turns over. The key assumption is that whether the manager is on the cusp of a quota (rather than being below or above) is exogenous to other reasons affecting whether a subordinate turns over.

To execute the identification strategy, let

$$Q_i^H = Q_i^L + \hat{Y}_i \tag{3}$$

where Q_i^L is the manager's expected quota attainment minus the contribution of salesperson i, and $\hat{Y}_i$ is the contribution of salesperson i. I estimate these by

$$Q_i^L = \sum_{f=1}^{9}(y_j^f + y_i^f) + \hat{y}_j^{10} + \hat{y}_j^{11} + \hat{y}_j^{12} \tag{4}$$

$$\hat{Y}_i = \hat{y}_i^{10} + \hat{y}_i^{11} + \hat{y}_i^{12} \tag{5}$$

where f denotes fiscal month, y_i denotes actual sales for salesperson i, y_j denotes actual sales for the manager's subordinates except i, and hats denote predicted sales (which I estimate below). In Equation (4),

$\sum_{f=1}^{9}(y_j^f + y_i^f)$ is the quota attainment of the sales manager entering the fourth quarter, which is taken from the actual data and would have been readily visible to managers via the software's dashboard.[5] Equation (4) assumes that Q_i^L is this value plus the predicted (not actual) sales of the manager's other subordinates.[6] Equation (5) gives the fourth-quarter contribution of subordinate i.

To estimate predicted sales, I use an OLS spline regression for the total monthly business credited as a function of tenure and a worker fixed effect. I do this for each standard job classification within a firm. The regression takes the form

$$\ln(y_{it}) = \underbrace{\beta_0 + \beta_1 M_{3it} + \beta_2 M_{6it} + \beta_3 M_{9it} + \beta_4 M_{12it} + \beta_5 M_{13it}}_{\text{month spline terms (ramp up)}} + \underbrace{\alpha_i}_{\text{worker f.e.}} + \varepsilon_{it} \tag{6}$$

where y_{it} is salesperson i's total credited business in month t,[7] M_3, M_6, M_9, M_{12}, and M_{13} are the month spline terms, and α_i is an individual fixed effect. The month spline terms respectively denote months into the first, second, third, fourth, and future quarters. Spline terms equal zero for months prior to their respective quarters and equal three for months following their respective quarters. I perform this regression separately for 834 standard job category-firm combinations that collectively feature 71,001 employment spells and 679,523 employee-months with credited transactions.

Table 3 presents these regressions at the industry (rather than firm-job) level of aggregation. The worker fixed effect α_i estimates worker-invariant characteristics and the residual ε_{it} represents the idiosyncratic noise affecting measured performance in a given month. The distributions of α_i, ε_{it}, and the difference between the logged actual sales and the predicted values are approximately normal with mean zero. Predicted sales are strictly positive, following from exponentiating the logged dependent variable. In addition to providing the predicted values needed to compute Q_i^L and Q_i^H, the regression also serves two other key purposes.

First, Table 3 provides strong evidence supporting the claim of the hypothesis that productivity rises as salespeople are ramped up. Sales typically rise rapidly among new recruits and decelerate, presumably as salespeople develop skills and a pipeline. For this reason, replacing an incumbent poor performer with a new recruit involves the substitution of present sales for higher expected future sales.

Second, the regression is also used to define poor performers. As shown earlier, Table 2 reports variation in workers' mean performance α_i controlling for tenure. The hypothesis concerns workers who are revealed to be low ability by sustained low performance; for the remainder of the paper, I denote workers in the bottom quartile as "poor performers." Intuitively, these are the workers who have the bottom-quartile credited sales

[5] For managers with large teams, the size of $\sum_{f=1}^{9}(y_j^f + y_i^f)$ will be relatively large compared with $\hat{y}_j^{10} + \hat{y}_j^{11} + \hat{y}_j^{12}$. Intuitively, when teams are small, a single salesperson has a greater impact on the manager's quota.

[6] Although actual sales are available, the independent variable of interest is the manager's expectations, and actual sales aren't realized until after the fourth quarter and the manager's decisions. The manager may also have private information regarding how turnover would affect his other subordinates, potentially introducing measurement error in the independent variable.

[7] Specifically, y_{it} is the logged sum of the salesperson's split order credit—the credit value of transactions multiplied by the share credited to the individual salesperson. The split order credit is the elemental unit of measured performance.

for workers of their job and tenure. Although this method may misclassify some workers as low ability, it may offer a better approximation of the supervisor's beliefs. Because poor performers have higher turnover, workers with bottom-quartile α_i values represent 25% of workers but only 18% of worker-months.

3.3 Staffing Results

To test Hypothesis 1, I test whether fourth-quarter turnover among poor-performing subordinates whose managers are on the cusp of a quota (i.e., $Q_i^L < 100\% < Q_i^H$) is lower than those under managers who are sufficiently far below or above quota (i.e., $100\% < Q_i^L < Q_i^H$ or $Q_i^L < Q_i^H < 100\%$). To test the specific hypothesis that turnover is delayed for a month rather than foregone, I also test whether the turnover of quota-critical poor performers in month 13 is higher than non-quota-critical poor performers.

Consistent with Hypothesis 1, Table 4 shows that monthly turnover is 5.6% when the manager reaches the quota threshold only if the subordinate's credited transactions are counted. This rate is substantially lower than the 18.6% rate when the manager does not meet quota and the 22.2% rate when the manager would meet quota anyway. Both differences are significant with $p < 0.01$. These results provide evidence that managers forego terminating poor performers late in the measurement period when these subordinates are needed for the manager to meet quota.

Table 4 also shows that month 13 turnover among poor-performing subordinates is substantially higher among subordinates working under managers who would meet a quota only if the subordinate were retained, compared with managers who did not meet quota or would have met quota anyway. I did not find evidence of a significant spike in turnover from month 14 on. Taken together, these results provide evidence that managers forego or delay terminating poor performers until the following fiscal year, if doing so in the current year would reduce their likelihood of making an annual quota.

The result is specific to poor performers. Most non-poor performers make their quotas, suggesting that their performance is sufficient to avoid termination.[8]

Table 5 shows transfer rates among poor performers. This table serves two purposes. First, it shows that transfer rates to treatment bubble managers are particularly high in the middle of the fiscal year, which would be a threat to identification. Second, it shows how transfers differ by managerial quota attainment. Transfers, although rarer than turnovers, are also punctuated around fiscal years. The outgoing transfer rate in the fourth quarter for treatment bubble managers is 4% higher than it is for managers above quota and 9.7% higher than it is for managers below quota.[9]

To provide an estimate for how much turnover among poor-performing salespeople is foregone because the manager is near a quota threshold, I restrict the sample to the poor-performing salespeople whose sales

[8]The data are generally consistent with this account. Only 31% of quotas among poor performers are met, and the median variable pay of poor performers (including team incentives) is only 4% of fourth-quarter salary. In contrast, 60% of quotas among non-poor performers are met, 80% of non-poor performers receive variable pay in the fourth quarter, and the median variable pay among non-poor performers is 60% of base salary. For this reason, the primary incentive for improving performance among non-poor performers may be increasing variable pay, whereas the primary incentive among poor performers may be avoiding dismissal.

[9]Note that this rate is quarterly, not monthly.

are not necessary for their managers to meet quota. Then I perform a logistic regression predicting the likelihood that a subordinate will turn over as a linear function of the manager's and subordinate's quota attainment. I compare this predicted likelihood with the actual turnover rates among salespeople whose sales were necessary for their managers to meet quota. I estimate that total actual fourth-quarter turnover among poor performers is 15% (s.e.: 1%) less than it would be if turnover among these quota-critical salespeople followed the same linear trend.

Next, I follow poor-performing workers who were unexpectedly retained into the next fiscal year and track their employment outcomes. About 20% of poor performers had their terminations delayed until the beginning of the next fiscal year and 80% were foregone indefinitely. About 8% of those retentions were transfered at the beginning of the next fiscal year.

Ideally, I would also examine turnover rates by whether the manager receives a bonus for meeting quota. For technical reasons, not all managers who receive bonuses for meeting a quota can be identified. Although results suggest that poor-performing subordinates have particularly high retention rates when under managers on the cusp of a quota associated with a discrete bonus, the thinning statistical power defies strong claims.[10]

To examine turnover rates in greater detail, Figure 2 presents fourth-quarter turnover rates within 5% bins of the expected quota attainments when the subordinate turns over (Q_i^L) and when the subordinate is retained (Q_i^H). Fourth-quarter turnover of poor performers drops sharply when the model predicts that the manager will barely make quota.

3.4 Threats to Validity

One concern is that retaining poor performers is also more likely to be consistent with the interest of the firm, among managers who are on the cusp of a quota. For example, if managers are more likely to be on the cusp of a quota when a firm is on the cusp of analysts' forecasts, and the firm has a specific interest in meeting forecasts, then the firm may also want to pull in sales.

To check against this explanation, as well as a variety of other explanations that may operate at the industry, firm, or divisional level, I perform a falsification test against effects and common shocks up to the level of the manager's peers. To do so, I compare the turnover rates of subordinates with the quota attainment of their manager's peer. Intuitively, if managers are thought of as the "parent" position in the organizational hierarchy, subordinates may be compared with the quota attainment of the manager filling their "uncle" position.

Figure 3 presents two series of data. The hollow markers show the turnover rates at the uncle's quota attainment levels for the universe of their "niece/nephew" subordinates. The solid markers show turnover when I restrict the sample to subordinates outside the treatment bubble of the parent position. The hollow

[10]The available data require that the firm set up a formal automated rule that distributes a bonus based on the marginal sale that meets quota, and that at least one manager sharing that plan name met quota. The 95% confidence interval for the turnover rate of poor performers under treatment bubble managers with a bonus is 2-4%.

series shows that the turnover among poor performers in the neighborhood of the uncle's quota exhibits a small dip, which is not as pronounced as it is around the parent's quota. Turnover within 10% of the uncle's quota is 2.4% (with a standard error of 0.3%) lower than it is within 50% of the uncle's quota. The restriction introduced in the solid markers eliminates statistically significant effects in the neighborhood of the uncle's quota threshold, suggesting that the dip among the hollow markers is caused by the correlation in the uncle's and parent's quota attainment.

Results show that turnover among poor performers is lower late in annual measurement periods when poor performers' credited transactions would affect whether the manager would meet quota, and greater in the following month. More broadly, results suggest that managers delay terminating poor performers until the following fiscal year when doing so is likely to affect their perceived likelihood of making quota. By showing that the parent position's quota attainment predicts turnover net of the uncle position's quota attainment, I rule out common shocks at the level of industry, firm, or division within the firm (at the next level of the organizational hierarchy).

A second potential concern is the assumption that $\hat{y}_i$ is independent of $\hat{y}_j$. This is unlikely to be the case. Turnover among i may reduce performance among j, particularly if peers become demoralized or if they were coordinating sales. Alternatively, turnover among i may raise performance among j if part of i's sales pipeline is recovered (although this is notoriously difficult). Furthermore, a manager's private information regarding the status of the pipeline can introduce measurement error into Q_i^L and Q_i^H. However, the power of the test is that it occurs at an interval, and so measurement error would lead to attenuation bias, reducing the likelihood of finding a significant result. Although the sales regressions represent noisy measures of future sales, they may represent a better approximation of the manager's expectation of sales.

A third potential concern is that poor performers may be assigned endogenously to managerial performance immediately prior to the fourth quarter. Because individuals have unique identifiers that span positions, this can be examined directly. However, Table 5 shows that transfers in the middle of the fiscal year are relatively infrequent and not significantly different when the manager is on the cusp of a quota.

4 Effect of Managerial Quotas on Subordinates' Incentives

4.1 Incentives Hypothesis

The second hypothesis concerns the alignment of subordinates' incentives with managers' interests. In particular, I examine whether subordinates are more likely to receive quota adjustments in the fourth quarter when the manager is in the neighborhood of reaching a quota.

Quota adjustments allow firms to adapt incentives to unforeseen circumstances. Otherwise, salespeople who are far below their quota for reasons unrelated to their prior effort may suffer from weak marginal incentives late in measurement periods, prompting them to quit or to hoard sales until the next measurement period. To discourage salespeople from hoarding nearly closed deals, firms typically instruct managers to

reduce quotas only for reasons affecting measured performance that are outside a worker's control.

Although firms may boost immediate marginal incentives by adjusting quotas for all subordinates late in measurement periods, in practice, adjustments are not routine. The perception that adjustments are endogenous to performance, rather due to exogenous circumstances, invites future moral hazard and could harm morale. Salespeople may ratchet effort and misrepresent forecasts early in the fiscal year in anticipation of downward adjustments. Salespeople may also "sandbag" sales, that is, nearly complete sales early in the fiscal year and then close them opportunistically. Subordinates may also interpret downward adjustments as favoritism, entitlements, or managerial opportunism. These beliefs may impair the firm's or the manager's ability to commit to future quota adjustments only for exogenous and pre-defined circumstances (Foss 2003).

Although a quota adjustment is a relatively interpretable and standardized outcome variable, quota adjustments are arguably not the main way in which managers shift subordinates' incentives. Managers may also shift incentives by changing subordinates' implicit commission rates. For example, discretionary bonus pools may be distributed through targeted commissions and bonuses, through incentives for channels, through rewards for selling a certain product or to a certain client (bounties), through tournaments, or through other means. For salespeople greatly exceeding their quotas, a downward adjustment can boost marginal incentives by moving the salesperson to a higher commission rate tier.

4.2 Incentives Results

To test the hypothesis that managers' quotas affect their subordinates' incentives, I test whether subordinates are more likely to have their quotas adjusted just prior to the end of the fiscal year when the manager's sales are projected to be near a quota.

I run six logistic regressions to evaluate the likelihood of quota adjustments over months of the fourth quarter, as a function of the manager's and subordinate's expected quota attainment. The manager's expected quota attainment is Q_i^H above; it is the actual quota attainment at the end of the third quarter plus the sum of the predicted attainment of the subordinate. The subordinate's expected quota attainment is sales as a percentage of quota; it is the actual quota attainment at the end of the third-quarter plus the expected fourth-quarter quota attainment. These regressions take the form

$$\ln\left(\frac{\hat{p}}{1-\hat{p}}\right) = \hat{\beta}_0 + \mathbf{X}'_m\hat{\beta}^m + \mathbf{X}'_s\hat{\beta}^s \tag{7}$$

where $\hat{p}$ is the logit-estimated probability for the outcome of interest, $\mathbf{X}'_m$ is a dummy vector indicating the 5% quota attainment bin of the manager, and $\mathbf{X}'_s$ is a dummy vector indicating the 5% quota attainment bin of the subordinate. This regression is performed for the six outcomes of interest corresponding to {Upward Adjustment, Downward Adjustment} × {Month 10, Month 11, Month 12}.

Table 6 shows logistic regression results predicting downward adjustments in months 10, 11, and 12. To provide intuition, the y-axis of Figure 4 provides the regression's probability estimates for downward

and upward adjustments. The x-axis shows the manager's and subordinate's expected quota attainments, holding the others constant at their mean.

Before a discussion of the main results, some trends deserve note. First, downward adjustments are more common than upward adjustments. Upward adjustments, although potentially bad for morale, may adjust for an exogenous circumstance that boosts performance measures (e.g., a product launch) or may be implemented as a penalty (e.g., because too many clients canceled sales). Second, the probability that quotas are adjusted downward in months 10 and 11 declines slightly as the manager's expected quota attainment increases. This slight downward trend may be because when a manager has a high quota attainment, it suggests that the subordinate's peers are doing well, and that the subordinate is responsible for poor sales and should not be awarded a downward quota adjustment. Third, the probability that quotas are adjusted downward in months 10 and 11 are more sensitive to the quota attainment of the subordinate. One explanation is that managers interpret greatly surpassed quotas as a signal that the quota is already too low (consistent with ratcheting models). Fourth, quota adjustments in months 10 and 11 are more likely to place subordinates in the neighborhood of ultimately reaching their quota, rather than far above or far below. Fifth, quota adjustments are both more rare and less sensitive to the manager's and subordinate's quota attainment in the 12th fiscal month than they are in the 10th and 11th fiscal months. Last, in addition to these general trends, subordinates throughout the distribution receive both downward and upward quota adjustments, including downward adjustments for salespeople expected to surpass their quotas and upward adjustments for salespeople expected to miss their quotas. This trend may be because adjusting one subordinate's quota may also require adjusting comparable peers' quotas as well, in the interest of fairness.

Table 6 and Figure 5 lend support to the main prediction. The likelihood that a subordinate receives a quota adjustment is significantly lower ($p < 0.05$) in each of the six 5% intervals of the manager's quotas between 75-90% and 110-125%, compared with the interval 100-105%, for both fiscal months 10 and 11. The jump in the probability of an adjustment in the neighborhood of quota attainment does not appear in the 12th fiscal month. I do not find evidence that upward adjustments are more likely in the neighborhood of either a subordinate's or a manager's quota threshold.

To provide intuition for the overall magnitude of gaming, I restrict the sample to workers whose managers are not within 10% of making quota, reestimate the likelihood of receiving a downward quota adjustment as a linear function of the manager's ultimate quota attainment, and compare the estimated likelihood of receiving a quota adjustment with the actual likelihood of receiving a quota adjustment among workers whose managers were within 10% of the quota threshold. These estimates suggest that 13% (s.e.: 1%) of downward quota adjustments in months 10 and 11 are explained by the jump in quota adjustments among managers within 10% of making quota.

Subordinates appear to be more likely to get a quota adjustment even if their managers just miss a quota. One interpretation is that quota adjustment is a blunt instrument for boosting sales. Channel stuffing, discounting, credit trading, sales hoarding, and reallocating effort (both in quantity and toward

deals near completion) may offer more immediate and precise ways of pulling in sales.

5 Conclusion

This study examines the imperfect ability of organizational hierarchies to motivate intermediary managers to act on the organization's behalf. It does so by exploiting the institutional features that (i) sales managers have a unique interest in the marginal sales that meet their quotas, (ii) managers' quota attainments are determined by the cumulative sales of their subordinates, and (iii) managers can affect the timing of sales through staffing and incentive decisions affecting subordinates. Because an incumbent poor performer with accumulated job-specific skills and an established sales pipeline is likely to be more productive in the short term than a new recruit, sales managers may pull in sales by retaining poor performers. Because incentives for salespeople far below quota are weak, adjustments that make quotas within reach allow managers to boost immediate sales while risking future moral hazard and disillusionment as adjustments become expected and viewed as entitlements.

This study makes three main contributions.

First, for empirical personnel research, this study contributes a new type of data set and strategy for identifying the interests of individuals within organizational hierarchies. This study uses a subordinate's peers as a source of exogenous variation that governs whether the manager is on the cusp of a quota, with the interests of a manager identified within the resulting treatment bubble. I execute this strategy with data created by on-demand sales performance management software. As a result, this study introduces standardized, reliable, longitudinal microdata across many firms. The data also mitigate the habitual selection issues and external validity concerns of studies in which participating firms opt in.

Second, this study contributes a theory for the delegation of authority in organizational hierarchies, inspired by the institutional details of managing sales. Using a firm-supervisor-worker model, I hypothesize that firms use managerial incentives to make terminating low-ability workers incentive compatible, since a firm cannot fully contract on a worker's ability or the difficulty of the selling environment. I explain how the solutions offered by agency theory are used to mitigate the costs of gaming in sales management.

Third, this study contributes well-identified evidence of a specific failure of agency intermediation. Although both classic and recent theoretical work emphasizes misalignment of managerial incentives in determining the structure of the firm, there has been scant evidence that misaligned incentives propagate within organizational hierarchies. As such, this study corroborates the classic hypothesis that the interests of managers, who are the intermediary agents responsible for performing the activities of the firm, are inconsistent with profit maximization.

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TABLE 1— Data and Variables

Unit	Variables
Firm	NAICS code, fiscal calendar, hierarchy*
Person	Person ID, salary*, target compensation*, compensation plan name, region, position name, position ID, parent position ID, job title
Transactions	Order ID, total credit, person credited, person's share of credit, compensation plan name, quota applied, credit as share of quota*, rolling measure of quota attainment*, commission applied, bonus applied
Payments	Person paid*, type of payment*, payment size*

NOTE – * denotes that this variable can be calculated from other variables.

TABLE 2— Descriptive Statistics by Industry

	Information & Enterprise Software	Scientific, Professional, & Technical Services	Manu-facturing	Other
	(1)	(2)	(3)	(4)
a. Basic Descriptives				
Firms	56	38	62	88
Firm-Months	1,032	679	1,165	1,693
Persons	18,662	14,448	22,297	13,920
Person-Months	286k	237k	330k	160k
b. Standardized Jobs				
Sales Managers	1,960	1,658	2,139	1,883
Sales Reps	4,028	5,255	6,829	3,686
Account Managers	2,227	2,239	2,174	2,332
Other	12,159	8,207	12,238	6,689
c. Orders & Payments				
Transactions	23m	22m	74m	37m
Commissions	15m	14m	39m	30m
Bonus Payments	49k	47k	176k	86k
Other V. Payments	14k	6k	54k	116k
Var. Pay (USD)	2,277m	1,462m	3,729m	1,523m
d. Key Variables				
Mean Team Size	5.3	5.2	4.1	6.5
SD Team Size	4.1	5.2	4.1	5.1
Turnover Events	8,968	3,170	9,346	7,909
Comp Plans	1,877	1,052	1,842	1,126
Quotas	28,702	21,087	32,006	19,175
EE-Fiscal Years	35,703	30,472	44,461	23,982

NOTE – "Other" industries include retail trade (14 firms), wholesale trade (13), administrative support (12), and finance and insurance (10). The suffix "m" denotes millions. Mean team size counts only those contributing to manager's quota (and not generally jobs in marketing, technicians, or support). Data include 89 private and 133 public companies and subsidiaries thereof. Sales managers include persons with reporting subordinates. "Credited transactions" include only unique order-worker combinations, and do not count, for example, annuity tails or redundant individual/team credits. "Other variable payments" include draws.

TABLE 3— OLS Spline Regression Predicting Log-Credited Business of Subordinate Employees with Employee Fixed Effects, by Industry

	Information & Enterprise Software	Scientific, Professional, & Technical Services	Manu-facturing	Other
	(1)	(2)	(3)	(4)
Months 1 - 3 (M_3)	0.281*	0.132*	0.268*	0.217*
	(0.014)	(0.015)	(0.011)	(0.016)
Months 4 - 6 (M_6)	0.157*	0.125*	0.162*	0.166*
	(0.006)	(0.006)	(0.005)	(0.007)
Months 7 - 9 (M_9)	0.136*	0.020*	0.070*	0.102*
	(0.004)	(0.003)	(0.003)	(0.004)
Months 10-12 (M_{12})	0.109*	0.018*	0.063*	0.0747*
	(0.003)	(0.003)	(0.002)	(0.003)
Months 13+ (M_{13})	-0.099*	0.002	0.009*	0.048*
	(0.002)	(0.001)	(0.001)	(0.002)
Constant	9.077*	6.766*	8.771*	6.846*
	(0.030)	(0.029)	(0.023)	(0.034)
SD of α_i	4.794	6.359	3.999	5.503
SD of ε_{it}	3.066	2.415	2.522	2.429
Share of var($\ln y_{it}$) explained by α_i	0.710	0.874	0.715	0.837
Fixed Effects (EEs)	11,397	10,961	8,314	7,864
Obs (EE-Months)	141,493	91,373	168,101	69,383

NOTE – $*: p < 0.01$. Table 2 presents aggregate regression results at the level of four industries. For the analysis (specifically, to distinguish poor performers and to generate Q_i^H), I perform this regression at the level of 834 job-firm combinations. The inclusion criteria include salespeople who: (i) do not have subordinates, (ii) have at least six months tenure, and (iii) who had at least four peers in their firm-job category.

TABLE 4— Monthly Turnover of Subordinates by Manager's Estimated Quota Attainment With and Without Subordinate's Credits

Parent's Q Attainment		$Q_i^H < 100\%$	$Q_i^H \geq 100\%$	$Q_i^H \geq 100\%$
Discounted Q Attainment		$Q_i^L < 100\%$	$Q_i^L < 100\%$	$Q_i^L \geq 100\%$
Outcome of Parent's Q Attainment wrt. Sub.:		"Misses Quota Anyway"	"Makes Quota Conditionally"	"Makes Quota Anyway"
		(1)	(2)	(3)
a. Poor Performing Subordinates				
Fourth Quarter	mean	18.6%	5.6%	22.2%
	s.e.	(0.69%)	(0.36%)	(0.35%)
	n	3,114	3,972	13,853
"Month 13"	mean	7.4%	14.4%	4.1%
	s.e.	(0.53%)	(0.61%)	(0.19%)
	n	2,427	3,306	10,137
b. All Other Subsordinates				
Fourth Quarter	mean	10.4%	11.1%	18.8%
	s.e.	(0.30%)	(0.32%)	(0.16%)
	n	9,857	9,133	56,887
"Month 13"	mean	3.7%	4.7%	1.5%
	s.e.	(0.22%)	(0.25%)	(0.05%)
	n	6,946	6,862	45,358

NOTE – "Month 13" results include only cases where the manager-worker pair matches across fiscal years (*i.e.* neither the manager nor subordinate were transferred, the manager did not turnover, and the subordinate did not turn over in the previous quarter).

TABLE 5— Transfer Rates by Managerial Quota Attainment
Transfer rates among poor performing subordinates

	Manager's Quota Attainment		
Quarter	'Misses anyway' Q_H, Q_L <100%	'In Bubble' $Q_L < 100\% < Q_H$	'Makes anyway' Q_H, Q_L >100%
Incoming Transfers			
Q1	.0184	.0243	.1423***
Q2	.0256*	.0075	.0146
Q3	.0123	.0174	.0175
Q4	.0053	.0018	.0016
Outgoing Transfers			
Q1	.0687	.0650	.0435*
Q2	.0225	.0074	.0150
Q3	.0101	.0034	.0082
Q4	.0724*	.1695	.1293**

Note. Numbers are rates of outgoing transfers among subordinates in the bottom quartile of sales within their job title and company. Asterisks denote significant difference in the rate of incoming/outgoing transfers from 'bubble' managers. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

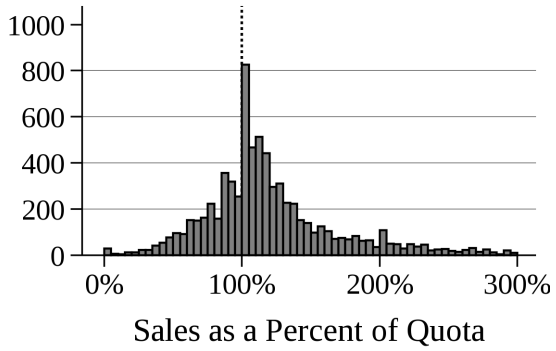
TABLE 6— Logit Predicting Subordinate's Downward Quota Adjustment by Manager's and Subordinate's Realized Quota Attainment (5% bins), for Fiscal Months 10 - 12

	Month 10 (1)		Month 11 (2)		Month 12 (3)	
	β^m	β^s	β^m	β^s	β^m	β^s
75-80%	-0.775**	-0.318	-0.530*	0.006	0.754**	0.215
	(0.210)	(0.178)	(0.209)	(0.151)	(0.263)	(0.196)
80-85%	-0.379**	-0.525**	-0.152	-0.317*	0.221	0.104
	(0.141)	(0.157)	(0.143)	(0.139)	(0.273)	(0.183)
85-90%	-0.615**	-0.180	-0.543**	-0.206	0.228	-0.271
	(0.147)	(0.133)	(0.160)	(0.130)	(0.231)	(0.194)
90-95%	-0.325**	-0.425**	-0.472**	-0.346**	0.153	0.0451
	(0.119)	(0.128)	(0.141)	(0.116)	(0.227)	(0.157)
95-100%	-0.233	0.212*	0.094	0.025	0.366	0.0216
	(0.119)	(0.108)	(0.116)	(0.106)	(0.249)	(0.161)
100-105%	ref	ref	ref	ref	ref	ref
105-110%	0.009	0.184*	0.055	-0.057	0.252	-0.103
	(0.0821)	(0.088)	(0.091)	(0.085)	(0.202)	(0.133)
110-115%	-0.360**	-0.190	-0.410**	-0.381**	0.769**	0.0243
	(0.090)	(0.097)	(0.104)	(0.094)	(0.198)	(0.134)
115-120%	-0.440**	-0.217*	-0.327**	-0.523**	0.361	-0.087
	(0.084)	(0.091)	(0.092)	(0.088)	(0.198)	(0.127)
120-125%	-0.523**	-0.274**	-0.522**	-0.506**	0.222	-0.183
	(0.098)	(0.104)	(0.106)	(0.098)	(0.208)	(0.141)
Exterior 5% F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-2.096*		-2.213*		-2.923*	
	(0.070)		(0.075)		(0.158)	
Obs.	41,665		41,090		38,228	

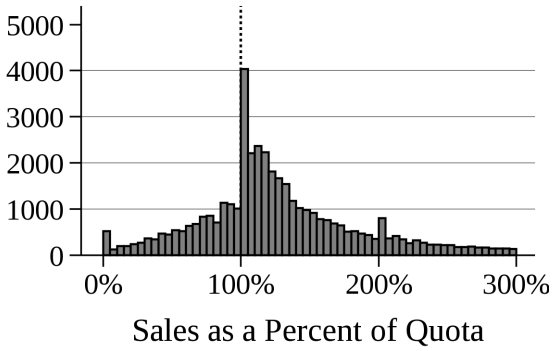
NOTE – $**: p < 0.01$, $*: p < 0.05$. Each regression spans two columns. The table presents coefficients inside the interval of 75-125% quota attainments. Regressions further control for 5% bins outside interval (see corresponding figure). Standard errors clustered by the manager-worker pair.

FIGURE 1: Histogram of Quota Attainment, Salespeople and their Immediate Managers

a. Managers

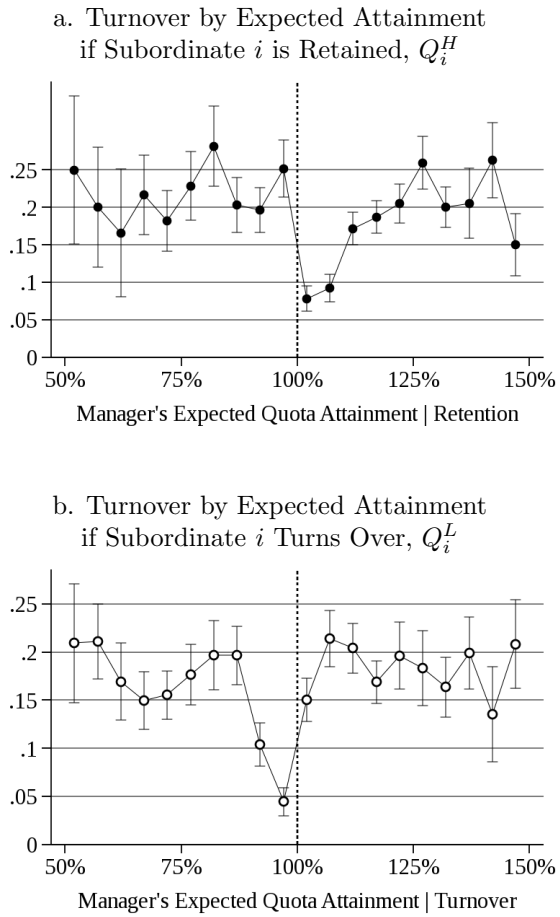


b. Subordinates



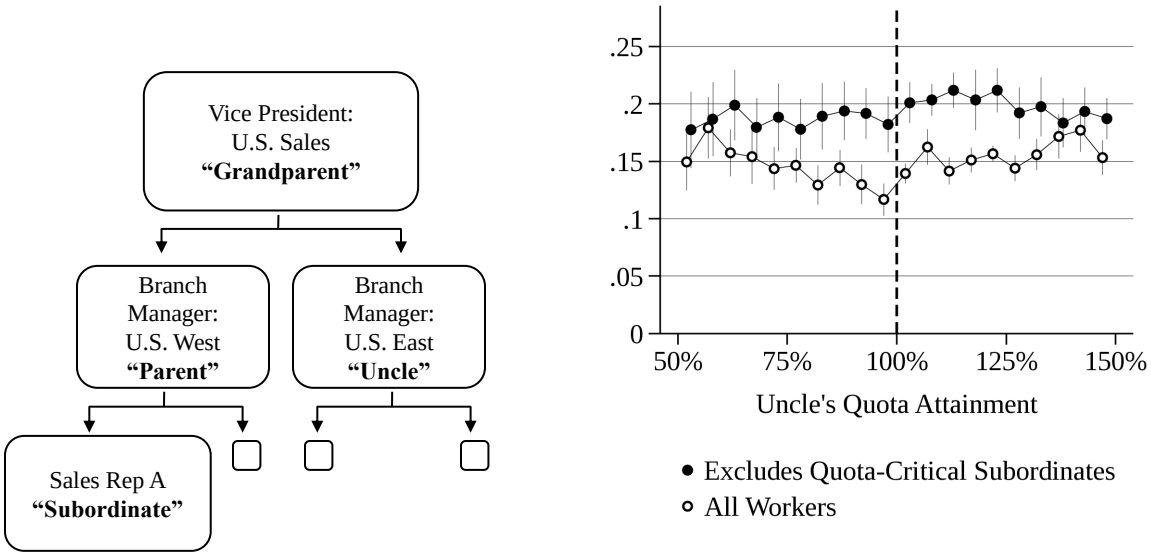
NOTE – Histograms represent counts by total annual quota attainments at 5% intervals for salespeople and managers employed for the entirety of the fiscal year. Includes immediate sales managers who: have fewer than four subordinates, whose subordinates do not have subordinates, and whose subordinates' quotas do not sum to their manager's quota. The quartiles of the sum of subordinates' quotas are 50%, 100%, and 200% of the manager's quota.

FIGURE 2: Turnover of Poor-Performing Subordinates at Managers' Quota Thresholds



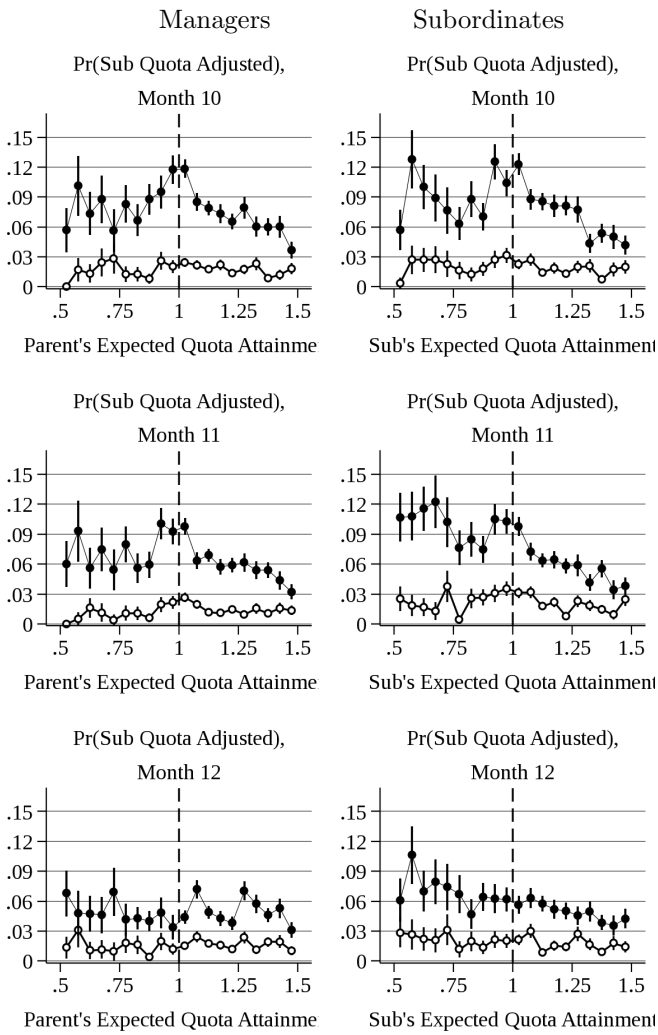
NOTE – Quota attainment is discretized into 5%-wide bins. Whiskers represent 95% confidence intervals.

FIGURE 3: Turnover of Poor-Performing Subordinates at Uncle-Position's Quota Thresholds



NOTE – Among rank-and-file subordinates, I use "uncle" to denote a randomly-selected manager who reports to the subordinate's parent's parent ("grandparent"). Fewer than 1% of all subordinates have no "uncle" position.Solid markers omit workers whose sales were predicted to be critical to meeting the parent position's quota. Whiskers represent 95% confidence intervals.

FIGURE 4: Predicted Probabilities a Subordinate's Quota is Adjusted, by Manager's and Subordinate's Own Ultimate Quota Attainment



NOTE – I estimate turnover probabilities by the manager's quota at the mean values for subordinate quota attainment bins. I estimate turnover probabilities by the subordinate's quota threshold at the mean values for manager quota attainment bins. Whiskers represent standard errors.