Integrating High-Powered Performance Pay into a Seniority Wage System*

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Abstract

This paper studies the incentive effects of a change in a performance pay scheme, using personnel data from one of Japan's largest auto dealership chain, which unlike Western counterparts extensively uses internal labor markets. The company replaced a salary-plus-commission-pay system with a high-powered commission with minimum guaranteed wage. The new remuneration system should have produced different productivity effects on workers depending on their ability and the level of guaranteed wage, which varies across workers and is highly correlated with seniority. We find that the heterogeneous incentive effects predicted by our static model are observed for senior workers but not for young workers. We conjecture that young workers are more strongly influenced by career concerns and other long-term incentives and less responsive to short-term explicit incentives. We also analyze whether workers gamed the timing of delivery dates to maximize commissions after the change in the pay scheme altered the shape of the pay profile to convex. We find strong evidence of such gaming behavior.

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1. Introduction

The past decade has witnessed the rapid growth of empirical research on pay schemes and productivity. Although studies have produced ample evidence that pay for performance yields higher productivity than fixed or hourly wages, the literature has focused primarily on simple jobs which are characterized by high reliance on temporary workers or high turnover (Paarsch and Shearer 1999, 2000; Shearer 2004; Lazear 2000; Bandiera, Barankay, and Rasul 2007). The reasons behind the research design of these studies are clear. First, jobs analyzed in prior research have minimal uncontrollable risk and coordination requirements, and employees have little opportunity to distort or manipulate outcomes. Therefore, the technological relationship between effort and performance is simple and stable. Second, since the firms studied lack internal labor markets and long-term employment relationships, researchers could be assured that there were no incentives other than the explicit pay scheme, such as promotion, career concerns or implicit incentives. This simplicity allowed researchers to measure the impact of pay scheme changes in "clean room" environments. However, such jobs are not representative of most of the occupations in the contemporary labor market. We still do not fully understand how effective pay-for-performance is when embedded in more complex human resource management systems. Our study addresses this question.

Performance-based pay systems have drawn increasingly greater interest from managers as well as economists. In the United States, many human resource (HR) managers are vexed by the

inflexibility of traditional job grade systems given rapidly changing competitive environments. Consequently, US corporations have attempted to increase the flexibility of wage systems by introducing various types of performance pay plans (Milkovich, Newman, and Gerhart 2010). In Japan the substitution of pay-for-performance systems for traditional, seniority-based pay systems became the most common approach to restructuring business and HR management during the prolonged recession of the 1990s. In their restructuring efforts, Japanese managers typically emphasized control of labor costs and stronger productivity incentives to motivate their aging workforces. Despite the increased use of performance-based pay schemes, researchers have not produced any systematic evidence on the effectiveness of such schemes in raising the productivity of employees working in relatively complex environments.

In order to analyze how performance-based pay operates in more typical forms of employment, we examine the impact of the introduction of such a scheme at a large Japanese auto sales firm, to which we have given the pseudonym "Auto Japan." In 2000 Auto Japan replaced a salary-plus-commission pay system with a high-powered commission-plus-minimum guaranteed wage system. On average, commissions--which vary across car models--became four to five times higher while the guaranteed wage began at a level equal to the pre-reform, largely seniority-based salary. To a considerable extent, a high-powered commission system has been integrated into a traditional, seniority-based wage system.

Rather than simply asking whether the policy change had a positive impact on average productivity, we explore where the productivity change came from, how heterogeneous are

worker responses to this change in pay policy, and whether those responses are consistent with the utility maximization behavior expected of workers in a "clean room" environment. We also reveal that sorting through the internal labor market played a significant role in improving the firm's performance, in contrast with the Safelite case in Lazear (2000) where self-sorting through the external labor market was vital to improving productivity. We illustrate how Auto Japan dealt with adverse selection (the sorting problem) as well as moral hazard (the incentive problem) using multiple human resource policies including job re-assignment and implicit incentives.

Our underlying assumption is that differences between our theoretical predictions, based on a static model where agents care only about short-term monetary payoffs, and our empirical findings stem from workers' consideration of factors concomitant with internal labor markets. We do not discuss what the optimal pay scheme contract is or what the welfare effects of the pay scheme change are by estimating a structural econometric model, as Copeland and Monnet (2009) and Paarsch and Shearer (2009) did, because such optimality or efficiency depends on the role of internal labor markets including career concerns and implicit contracts that are absent in their case studies.[1] In addition, the effort-output linkage in our case is much weaker than in the above works due to greater uncertainty, lack of sufficient demand control, and the possibility of manipulation of performance measures. As we discuss later, these factors all deepen our concern that the estimation of structural parameters may be much less precise given the nature of our data.

The company studied provides an excellent test case for investigating the efficacy of incentive wage systems under the influence of an internal labor market. First, the study targets only salespeople whose jobs are highly standardized and whose performances are objectively measured by sales records. Although the sales staff has other responsibilities, including customer relations and the training of new employees, selling cars is their primary activity. Our large dataset of comparable objective performance measures for 984 new car salespeople allows us to analyze whether workers' responses vary depending on their individual characteristics.[2]

Second, because long-term employment practices remain the norm in large Japanese firms, employment at Auto Japan was relatively stable before and during our observation period. Internal labor markets developed to sort (i.e., identify and promote) talented employees and employees are usually hired only at the entry level. Workers' pay generally rises with seniority and the best performers are promoted to managerial positions. Thus, the change of pay scheme cannot be examined in a "clean room" environment, but the existence of "other factors" associated with its internal labor market is not a disadvantage but rather an advantage for our investigation. Since the effects of career concerns and implicit incentives vary across age groups, the dataset allows us to roughly evaluate the effect of other implicit incentives on worker behavior by comparing the estimation results across subsamples with different age categories. To sum up, Auto Japan's data provide an excellent opportunity to examine the impact of a new incentive pay system on different types of workers in a stable employment environment.

The pay policy change carried out at Auto Japan was likely to have different productivity

effects on workers depending on their tenure and ability. First, workers with guaranteed wages that are high relative to their ability are likely to become less productive because, knowing that exceeding the threshold for commission payouts is difficult, they would expect to receive no commissions. Second, workers who receive guaranteed wages that are low relative to their ability should become more productive in response to the steeper incentive profile. We confirm that the data are consistent with these predictions for senior workers but not for young workers. We discuss the possibility that young workers have stronger career concerns and are more susceptible to implicit incentives (e.g., promotion prospects, chances of staying in a sales job, non-monetary prizes) and the possibility that the management gives strong negative feedback to those who fail to meet the new sales goals.

This paper also analyzes workers' manipulation of performance measures to increase their commission income without increasing actual firm revenue. Auto Japan made its pay profile convex (i.e., full commission with guaranteed wage), giving employees an incentive to manipulate the timing of delivery dates in order to shift some car sales from slow months to busy months. We call this behavior "timing gaming" following the existing literature on the gaming arising from nonlinear pay schemes (Healy 1985; Holthausen, Larcker, and Sloan 1995; Oyer 1998; Larkin 2007; Owan, Tsuru, and Uehara 2010; Misra and Nair 2011). We present considerably stronger evidence than earlier studies that such behavior is truly motivated by financial incentives because the marginal benefit of shifting delivery dates changed twice during our observation period and so did the pattern of sales at the same time.

The rest of the article proceeds as follows. Section 2 discusses the existing literature. Section 3 derives theoretical implications from a formal model. Section 4 outlines the workings of Auto Japan's new pay system and describes the nature of the data. Section 5 provides a detailed econometric analysis of the impact of the new pay scheme. Finally, Section 6 summarizes the main findings and derives some implications.

2. Related Literature and Research Questions

Considerable evidence now indicates that linking wages to performance can substantially raise employee performance; two of these works serve as the baseline for our study. Lazear (2000) analyzed a windshield installation company called Safelite where an hourly wage was replaced by piece rate pay combined with a minimum guaranteed wage. Lazear finds that this policy change led to a forty-four percent increase in productivity. About half of the productivity gain was due to the incentive effect--greater effort put forth by employees--while the rest was caused by the sorting effect as employee turnover led to an improvement in worker quality. Similarly, Shearer (2004) estimates the productivity differences between piece rates and fixed wages for tree planters in randomized field experiments conducted in British Columbia, Canada. His experiment reveals that the incentive effect of piece rates results in a twenty percent productivity increase, which is roughly the same magnitude found by Lazear.

In both studies described above, the employers had a measure for performance that was

reasonably effective with little room for distortion or manipulation. At Safelite, it was hard for workers to manipulate the number of completed installations and quality was maintained by requiring installers to correct installation errors on their own time and to pay the company for all replacement glass before resuming paid work. Piece rate schemes for tree planters can easily cause quality problems, as noted by Paarsch and Shearer (2000). However, Shearer (2004) designed a field experiment in which he carefully eliminated this difficulty by having supervisors monitor workers.

Neither Lazear nor Shearer had to consider any influence of internal labor markets as an alternate determinant of employee behavior. Installers at Safelite readily switched firms and external market forces strongly affected their wages. The tree planters in Shearer's experiment were all temporary workers who had no career concerns regarding that particular job. Our study addresses the gap in the existing literature on how changes in a compensation system affect employee behavior when employment relationships are more stable or when performance measures are more prone to distortion and manipulation.

Three strands of research demonstrate that implicit incentives are important. First, there is a sizable literature regarding career concerns. A typical career concern model looks at what information on worker performance is revealed to the market and workers' effort to improve this information to raise their market value (see, for example, Holmstrom 1999 and Martinez 2009). Such incentives provided through market competition may play a much less important role in the Japanese context where large corporations rarely dismiss full-time employees and wages are

somewhat insulated from the external labor market. The pool of potential job switchers is small in Japan because the wage penalty for job separation is substantial, partly as a result of the stigma associated with job-switchers (Greenwald 1986). Another type of career concern we discuss in this study is related to how an employer updates its assessments of workers' ability, which are used in the firm's implicit long-term incentives such as promotion or threat of termination (Prendergast 1993; Shapiro and Stiglitz 1984).

Second, some authors have looked at the interaction between explicit and implicit incentives and their relationship with the underlying measurement technology. Baker, Gibbons, and Murphy (1994) find that explicit incentives and implicit incentives are complements when the room for distortion is relatively large but not overly so. Gibbs, Merchant, Van der Stede, and Vargus (2009) use data from surveys of managers in auto dealerships to show that implicit incentives are more likely to be used when it is possible to manipulate performance measures.

Third, recent studies have demonstrated that employees are influenced by widely used non-monetary incentives. For example, positive feedback and status incentives such as "employee of the month" awards can be effective motivating tools (Ball, Eckel, Grossman, and Zame 2001; Lizzeri, Meyer, and Persico 2002; Moldovanu, Sela, and Shi 2007; Ederer 2010).

In light of these recent research findings on implicit incentives, it is important to discuss what implicit incentives may be in operation at Auto Japan. First, although Auto Japan offers employment security, it is not unusual for poorly performing salespeople to be transferred to administrative jobs with lower pay. This practice could be an effective implicit incentive

contract given that a major portion of wages are deferred as the compensation system is strongly oriented toward seniority-based wages and generous retirement benefits. Second, Auto Japan has a promote-from-within policy and performance in the early stages of an employee's career significantly affects her or his chances of being promoted to managerial positions.

Third, Auto Japan managers clearly indicated in interviews that they wanted the pay reform to send a strong message to its employees that earning a monthly commission that exceeds the minimum guaranteed wage is a "required performance standard." Communicating the purpose of the pay scheme change in this way could be effective if Auto Japan's commission-with-guaranteed wage system provides a reference point against which individuals measure gain and loss and accordingly receive utility (Koszegi and Rabin 2006). Or, it may be the case that reaching or surpassing the minimum performance level brings higher status, while failure leads to negative feedback and being perceived as a substandard player. This non-monetary sanction may provide employees with an incentive to work hard to avoid stigmatization, assuming that individuals seek status in the manner suggested by the psychology literature. Such non-monetary incentives may partly enforce or offset the impact of explicit pay scheme change which is expected to weaken incentives for low performers.

One important implication of the above discussion is that the effect of career concerns or implicit incentives varies substantially across age groups – for example, career concerns should be greater for junior employees than senior ones. Therefore, reform of an explicit pay scheme may have a relatively small impact on young employees if the implicit component of the total

incentive system is more important to them. Another implication is that actual worker responses to the revision of an explicit contract may be quite different from those suggested by the analysis of a short-term explicit contract.

Another set of prior research that is relevant for our work focuses on employee manipulation of performance measures or "gaming" behavior caused by specific forms of incentive or evaluation schemes. Healy (1985) and Holthausen, Larcker, and Sloan (1995) show that a standard formula bonus with a cap and floor for top executives causes managers to manipulate the accounting of profits. Oyer (1998) demonstrates that when salespeople are given periodic sales targets under a nonlinear relationship between compensation and firm revenue (or profit), they have an incentive to manipulate the timing of customer purchases toward the end of an evaluation period to meet their targets. Further, Oyer shows that the "pull-in" effect is more likely to dominate the "push-out" effect and confirms that the observed fiscal year effects on firm revenue are consistent with this prediction in many industries.

A number of prior works provide more direct evidence of timing gaming caused by distortive pay or evaluation systems. For example, by examining the performance of 175 salespersons employed by a leading enterprise software vendor from 1997 to 2002, Larkin (2007) finds that the use of a quarterly commission system using nonlinear compensation produces gaming effects such as push-out and pull-in. According to the study, incentives to maximize commission income caused a loss of revenue because salespeople would discount prices in order to entice customers to purchase software before the period cutoff whenever they

expected pull-in to increase their commissions. Compounding the damage, the company also lost 8% of sales revenues on average in the form of inflated commissions resulting from this pull-in/push-out behavior. Similarly, Owan, Tsuru, and Uehara (2010) show strong evidence of gaming among car salespeople by analyzing the personnel and transaction records of two Canadian auto dealerships. In these firms, salespeople face discontinuous jumps in commission income at certain thresholds in their monthly car sales. Their analysis reveals that salespeople tend to offer greater price discounts when the stakes are high (i.e., selling one more car leads to a large increase in commission income).

Working from these insights, we have specified three core research questions for our investigation of Auto Japan:

1. What is the overall impact of the pay scheme change on productivity and where does the productivity change come from?
2. How do the performances of heterogeneous employees change following the change in the personnel system? Are there differences across age groups?
3. Does gaming behavior result from assessing performance within a set time period? Who is more likely to be engaged in timing gaming?

3. Theoretical Predictions: Who Should Perform Better After the Pay Scheme Change?

The pay policy change at Auto Japan is illustrated in Figure 1. Note that the basic structure of commission with minimum guaranteed wage is similar to the one introduced by Safelite, the windshield installation company analyzed in Lazear (2000). As noted earlier, there are two differences between the setting we analyze and that considered in Lazear (2000). First, Auto Japan maintains long-term employment practices and a highly structured internal labor market. Although we found no dismissals in our dataset, a substantial change in worker composition in the sales department resulted from lateral transfers within the firm as well as voluntary quits and new hires (who are mostly newly minted college graduates).

Second, the car retail business involves more uncertainty at the individual level than the windshield installation business because in the latter orders are aggregated and assigned to installers by branch managers. Therefore, installers' productivity is almost solely determined by ability and effort whereas car salespeople face tremendous uncertainty about how many units they can sell in each month. Given this fundamental difference in the stochastic nature of performance, we formalize the problem for workers as follows:

Let z be the gross profit the worker generates by selling cars. Suppose z is stochastically determined by $z = f(e, X) + \eta$ where e is the worker's effort, X is a vector of factors determining individual performance such as worker characteristics, market characteristics and competition within the branch, and η is a random error with $E[\eta] = 0$. η is the market uncertainty that individual workers face and is assumed to have distribution and density

functions *G* and *g*, respectively, which are identical for all workers. The pre-reform base-wage-plus-commission (BPC) system pays the worker

$$w = \underline{w}(x) + b_0 z = \underline{w}(x) + b_0 (f (e, X) + \eta) \qquad (1)$$

where $\underline{w}(x)$ is the base wage and b_0 is the commission rate. *x* is a vector of factors determining base wage $\underline{w}(x)$ such as age, tenure, and subjective evaluation, which is interpreted as a signal of *e*. Here we neglect the worker's strategic consideration of how his choice of *e* affects his future wage, and treat $\underline{w}(x)$ as exogenous, but we will examine the dynamic consideration later.

The post-reform commission-with-a-guaranteed wage (CWG) system pays the worker

$$w = \max[\underline{w}(x), b_1 z] = \max[\underline{w}(x), b_1 (f (e, X) + \eta)] \qquad (2)$$

where $\underline{w}(x)$ is the minimum guaranteed wage and b_1 is the commission rate. As we stated earlier, $b_1 > b_0$ and minimum guaranteed wage $\underline{w}(x)$ in Equation (2) is set equal to the base wage $\underline{w}(x)$ in Equation (1). Let Z^* be the level of gross profit earned at which $\underline{w}(x) = b_1 z$.

Suppose that the worker maximizes the quasi-linear utility E*U*(*w*,*e*) = E[*w*] - c(*e*). Then, the effort under the BPC system is given by

$$b_0 \frac{\partial f}{\partial e}(e, X) = c'(e) \qquad (3)$$

which does not depend on $\underline{w}$. Let $\hat{e}$ be the effort level determined by Equation (3). On the other hand, the expected wage under the CWG system is given by

$$\mathrm{E}[\mathrm{w}] = G(\frac{\underline{w}}{b_1} - f(e,X))\underline{w} + [1 - G(\frac{\underline{w}}{b_1} - f(e,X))]b_1 f(e,a) + b_1 \int_{\frac{\underline{w}}{b_1} - f(e,X)} \eta g(\eta) d\eta. \quad (4)$$

Then the effort level in the CWG system e^* is determined by

$$[1 - G(\frac{\underline{w}}{b_1} - f(e,X))]b_1 \frac{\partial f}{\partial e} = c'(e) \quad (5)$$

Note that the optimal effort level for the worker depends on $\underline{w}$. Proposition 1 follows immediately from $\frac{\partial^2 \mathrm{E}[\mathrm{w}]}{\partial \underline{w} \partial e} = -g(\frac{\underline{w}}{b_1} - f(e,X))\frac{\partial f}{\partial e} < 0$.

Proposition 1: Optimal effort e^* declines as the minimum guaranteed wage $\underline{w}(x)$ increases when *X* is constant.

Equation (5) implies that there are two sources of incentive differences among workers. The first are the worker and environmental characteristics *X* which affect the marginal return to effort $\frac{\partial f}{\partial e}(e,X)$. The second is the size of $\underline{w}$ relative to $b_1 f(e,X)$. Let $\hat{\underline{w}}(X)$ be the level of minimum guaranteed wage that keeps the level of effort unchanged for a fixed *X* after the pay scheme changes from the BPC system to the CWG system. From Equation (3) and Equation (5),

$$[1 - G(\frac{\hat{\underline{w}}}{b_1} - f(\hat{e},X))]b_1 = b_0. \quad (6)$$

By solving Equation (6) for $\hat{\underline{w}}$, $\hat{\underline{w}} = b_1 G^{-1}[1-\frac{b_0}{b_1}] + b_1 f(e, X)$. Proposition 2 is immediate from the definition and Proposition 1.

Proposition 2: $e^* > \hat{e}$ if and only if $b_1 f(\hat{e}, X) - \underline{w} > -b_1 G^{-1}[1-\frac{b_0}{b_1}]$.

Note that $b_1 G^{-1}[1-\frac{b_0}{b_1}]$, the right-hand side of the condition in Proposition 2, is constant as long as *G* is identical for all workers as is assumed. This means that $b_1 f(\hat{e}, X) - \underline{w}$ is a best predictor of whether the performance improves after the pay scheme change. Proposition 2 provides us with the justification for using the estimated value of $b_1 f(\hat{e}, X) - \underline{w}$ as the measure of incentive intensity.

The key implication of our theory is that we should evaluate the estimated value of $b_1 f(\hat{e}, X) - \underline{w}$ and use it as a predictor of worker responses to the pay scheme change, which is heterogeneous depending on worker characteristics.

4. Auto Japan Practices and Data

4.1 Organizational Structures

Auto Japan is one of the largest regional (prefecture-wide) chains of car dealers, employing more than 2,000 employees in 2004. Its main business is selling and leasing cars made by a

major Japanese auto manufacturer, selling parts and supplies, and repair and maintenance work. Unlike typical North American auto dealerships, it is a large firm. Auto Japan's sales for 2004 were 140 billion yen (approximately 1.3 billion dollars at the 2004 exchange rate). About one-third of Auto Japan's employees are salespeople and the data covers 984 new car salespeople over a six-year period, from 1998 to 2004. Because Auto Japan commits itself to providing job security like other large Japanese firms, the annual turnover rate among salespeople has been 4-7%, much lower than dealerships in North America, where the car sales business is characterized by high turnover. Changes in the composition of the sales force stem from new hires, voluntary quits, transfers in and out of sales departments, and mandatory retirements.

There were a total of 74 outlets with new car sales departments at the end of 2004. Each outlet typically includes new and used car sales departments and a service department, although small branches tend to have only a new car sales section. The size of sales forces ranges from 3 to 4 people at the smallest outlets to 22 at the largest. The head office determines both yearly and monthly sales targets and assigns specific objectives to outlets. Auto Japan's largest outlet is given a target of 80 to 90 new cars a month.

4.2 Pay Scheme Change

Auto Japan's growth has recently been significantly constrained by stagnant demand for automobiles. New car sales in Japan rose steadily from the 1950s until the beginning of the

1990s, when the market approached the saturation point and economic growth stalled; sales entered a downward trend and became more cyclical as shown in Figure 2.[3] Auto Japan sold 40,000 new cars and 16,000 used cars in 2004. Compared to 1995, however, the number of new cars sold fell by some 5,000, from around 45,000 to 40,000. The number of used cars sold remained about the same.

In 2000, to cope with the new conditions, the company comprehensively reformed its personnel system to make personnel costs more flexible and variable, and to shift the criteria for salary increases away from age and seniority in favor of sales performance, especially for high performers. Management also felt that the firm paid too much to low performers while continuing to offer a certain level of income stability to its employees.

As Figure 1 depicts, until 2000 the main component of employee remuneration was monthly base pay that rose steadily over an employee's career and was supplemented with limited performance pay. In contrast, the new system replaced base pay with substantially increased performance pay combined with a minimum guaranteed wage equal to the old monthly base wage.

Performance pay is a commission based on the gross profit on each vehicle sold, which is determined by subtracting the invoice price of the vehicle from its sale price.[4] Prior to the 2000 reform, the rate of commission varied by model and ranged from 2 to 5%. An employee could therefore realize a performance payment by selling even a single vehicle – however, the payment per vehicle was small so the incentive effect was minor. Under the new system, no

performance payment is made unless an employee's monthly total commission exceeds the minimum guaranteed wage, but once that threshold is crossed, an employee can enjoy much larger commissions ranging from a minimum of 7% to a maximum of 30% of the gross profit earned for each sale (i.e., two to six times greater than before). Commission rates are not changed except when models change and they are typically set lower for cars that are easy to sell.

Auto Japan has a pay grade system where all salespeople are ranked in one of the five pay grades based on the current base/guaranteed wage level. The old base wage and the new guaranteed wage were revised every year based on the current pay grade and performance evaluations, and the resultant new wage determines the pay grade in the next period. Since central tendency bias reduces the range of pay raises, guaranteed wages tend to be highly correlated with tenure.

In June 2003, Auto Japan managers further modified their pay policy. Claiming that monthly car sales by individual salespeople are excessively volatile, they changed the basis of the commission calculation from single-month performance to a two-month moving average, which greatly reduced the benefit of either pulling-in or pushing-out.

Overall, top management was pursuing two goals in instituting this pay scheme reform. The first was obvious: they wanted to strengthen incentives by creating an opportunity to earn much higher performance rewards. The second was much trickier: the managers believed that they could establish a very clear performance standard by making explicit the minimum

performance level necessary to earn a commission payout.

In reality, of course, the second goal is not so readily attained because the company's and employees' viewpoints differ. From the company's point of view, the commission threshold underscores the employees' *responsibility* to make sales. From the point of view of the employees, however, it may represent no more than a *soft target*, the missing of which would not result in any penalty, especially given the high job security the employees enjoy at Auto Japan. Furthermore, it is also possible that workers view the commission threshold differently depending on their career stage. Young workers may be more strongly influenced by the company's guidance if they have strong career concerns and care more about their yearly evaluations. We attempt to evaluate possible differences in worker response to the pay scheme reform across generations.

4.3 Data

This research uses personnel and wage data compiled by Auto Japan every month from January 1998 through December 2004. The HR data contains considerable detail including employees' birthdays, dates of hire, dates of separation, and branches worked in. Payroll records include detailed breakdowns of wages (base wage, guaranteed wage, commissions, various forms of benefits) and monthly performance in terms of the number of vehicles sold. We also obtained national and regional passenger car sales data from the Japan Automobile Dealers Association, which will be used to control for market demand in our regression analysis.

One major limitation of our dataset is that it does not include detailed information on individual sales transactions. The only performance outcome information is the number of vehicles sold. Critical related information, such as the brands, models, and prices of the cars and monthly gross profits earned, are not included.

The summary statistics are shown in Table 1. These indicate the employees' monthly car sales record, tenure, age, monthly total wage, minimum guaranteed wage as well as the national car sales. The data covers 984 new car salespersons and includes 47,705 observations of salesperson-month data over the six-year period.[5]

There were also a number of salespeople who did not receive commissions but were given special fixed allowances in addition to their base salaries after the pay scheme reform. These employees were lateral transfers from other departments or trainees who were supposed to be undergoing on-the-job training. We include those observations in our initial assessment of the pay scheme change (Section 5.1) but exclude them from our core analysis (Section 5.2 and after).

5. Empirical Analysis

5.1 Overall Impact of Pay Scheme Change

Our theoretical discussion indicates that the impact of the pay scheme change on sales performance would vary across individuals, but the theory offers no definite predictions about

what would be the average effect *ex ante*. Therefore, before analyzing individual responses to the pay scheme reform, let us evaluate the reform's overall effect. We begin by examining the distribution of vehicles sold each month by individual salespeople in three distinct periods: before the reform (January 1998-October 2000); after the reform (November 2000-May 2003); and after the introduction of the two-month-moving average (2MMA) of sales into commission calculations (June 2003 -December 2004). Figure 3 depicts the kernel density of annualized new car sales for each of the three periods. The initial impact of the reform seems to be clearly positive. The distribution shifted to the right by about one vehicle per month and did not change significantly after the performance-smoothing 2MMA measure was introduced.

In order to evaluate the impact more rigorously, we next estimate the following linear regression model using the OLS:

$$y_{it}^{k} = X_{it}\beta + \alpha^{k} + \varepsilon_{it}$$

where y_{it}^{k} is monthly car sales by worker *i* in time *t* under the pay scheme *k*, and X_{it} is a vector of independent variables including worker characteristics such as tenure and education level, national or regional car sales to control for market demand, branch size to control for intra-branch competition, and month dummies to control for seasonality. α^{k} is constant during each of the three regimes and captures the impact of changes in pay policy and performance measurement, and ε_{it} is the error term. Later we replace ε_{it} with $u_i + \eta_{it}$ to control for salesperson fixed effects.

Simple OLS estimation (Model 1 in Column 1 of Table 2) that controls for market demand

and the workers' experience and education levels confirms the graphical impression we obtained from Figure 3. It indicates that the average monthly car sales increased by 0.822 vehicles after the pay scheme reform and did not change significantly after the 2MMA measure was introduced.

Model 2 in Column 2 additionally controls for worker age and examines the possibility that the pay scheme change had different impacts across age groups. The coefficients for the interactive terms between the after-reform dummy and the age categories indicate that the impacts for older employees in their 40s and 50s were lower than those for workers in their 20s and 30s. This result is consistent with the fact that workers under 40 pass the minimum threshold for commission payouts more frequently than older workers and thus should be more motivated by the pay scheme change as Propositions 1 and 2 imply (see Table 6 which will be discussed in detail later).

When including salesperson fixed effects to identify the pure incentive effect, however, the estimation indicates that the pay scheme reform has a much smaller impact than is suggested by simple OLS estimation which includes the sorting effect. Further, that impact is more than offset by the introduction of the 2MMA performance measure (Column 3 in Table 2). This result indicates that worker turnover helped improve the average productivity of workers. The finding is rather unexpected given the fact that Auto Japan has offered high job security and maintained a promote-from-within policy.

In order to examine what caused the turnovers that led to the average productivity increase,

we classified all worker movement in and out of new car sales departments before and after the pay scheme reform, in Table 3. Since many of the transfers that took place just before the introduction of the new pay scheme might have been induced by the announcement of the scheme change, we included turnover in September 2000, the last month of the pre-reform period, as part of turnover in the post-reform period.

There are four notable findings. First, a substantial improvement in average productivity seems to have been attained primarily through the separation of unproductive workers both as the result of voluntary quits and lateral transfers to other, mostly non-sales, occupations. But this pattern of worker movement had helped to sort out unproductive workers even before the pay scheme change. We therefore cannot confirm whether the pay policy change facilitated turnovers or not. During both the pre-reform and post-reform periods, 30% of the sales force at the beginning of each period left the new car sales department, two-thirds of whom quit voluntarily while one-third moved to other departments by command. Those who left in either way had roughly 50% lower average productivity than those who stayed in sales during the pre-reform period and about 40% lower average productivity in the post-reform period. People exiting the sales departments after the reform were slightly more productive than pre-reform leavers which may suggest that the management's implicit minimum performance standard was raised after the pay policy change.

Second, average productivity is similar between those who voluntarily quit and those who were involuntarily transferred to other departments, but the former group was 7-9 years younger

than the latter on average in both periods. This age gap indicates that the job separation penalty is too large for those who have longer tenure (e.g., are over 30 years old). Therefore, self-sorting is unlikely for them and it is up to the management to reallocate human resources through the internal labor market.

Third, one clear change in worker movement after the pay scheme reform was a sharp increase in the number of people promoted out of sales jobs. 64 new car salespeople were promoted after the pay scheme change while only one person was promoted before the reform. The sharp increase in promotions was primarily caused by both a change in the company's promotion policy that shortened the average term of office for managers and, presumably, by the company's early retirement plan.[6] This increased rate of promotion could have two opposite impacts. On the one hand, as Table 3 shows, those promoted are high-performers therefore promoting them out of the sales force may result in lower vehicle sales. On the other hand, however, promotions could further motivate sales staff if they believe that their hard work will be rewarded by promotion.

Fourth, in 2002 Auto Japan departed from its traditional practice of hiring only new graduates to also recruiting young job-changers. As Table 3 shows, new hires with prior work experience are more productive than new college graduates (58.6 vehicles per year vs. 49.2).

Given the above worker movement and the resultant change in sales force composition, it is important to focus our analysis on the fixed effect estimation. Column 3 in Table 2 seems to indicate that, after correcting for the possible impact of worker turnover, the pure incentive

effect seems to be limited. Furthermore, the introduction of performance smoothing completely eliminates the effect of the pay reform. Most of the productivity increase came from an improvement in worker quality, which can only be partially attributed to the pay scheme change.

One possible concern regarding the above estimation is that sales environments may have varied so that incumbents, leavers, and newcomers worked in systematically different environments. For example, it is possible that new hires and transfers from other departments were assigned to branches where demand was expanding while leavers may have been working where demand was shrinking. Correcting for such biases is difficult because we do not have an appropriate proxy for branch-level demand.

We present one more fixed effect OLS estimate where attempts are made to account for additional changes in individual sales environments. In Model 4, we correct for changes in workplace competition, namely the number of salespeople in the same branch. When the number of salespeople is reduced in a branch, those who remain benefit because they compete in the same local market. For example, the customer list maintained by a worker who left may be shared among those who stay. Model 4 controls for this size effect for both new car and used car sales staff. Specifically, we include as controls the following variables: $1/n_n$ and n_u/n_n^2 where n_n and n_u are the numbers of new car and used car sales staff, respectively. These particular forms derive from our view that per-worker demand can be expressed by $\frac{D}{n_n+\alpha n_u} = D\frac{n_n-\alpha n_u}{n_n^2-\alpha^2 n_u^2} \approx D\frac{n_n-\alpha n_u}{n_n^2} = D\frac{1}{n_n} - \alpha D\frac{n_u}{n_n^2}$ where D is the car demand for a

branch and α is the portion of time spent by used car sales staff for selling new cars. Although both variables have significant coefficients, the estimated impacts of the reform and the 2MMA measure are little different from Model 3.

In Model 5, we additionally control for worker age again. Now we find that a positive productivity improvement after the pay policy change can be observed only for workers in their 30s while the impact is negative for those in their 50s. The variation in the impact of the pay policy change across age groups is consistent with our prediction that workers who enjoy more frequent commission payouts put forth more effort after the pay policy change. The smoothing of the performance measure had a negative impact on the average again.

5.2 Formulating a Time-variant Measure of Incentive Intensity

The purpose of our study is not to examine whether the pay scheme change had a positive impact on sales performance or not. As Proposition 2 indicates, whether the reform had a positive effect or not depends on whether the minimum guaranteed wage was set sufficiently low for most workers. Since the minimum guaranteed wage was set equal to the old base wage, it was clearly not chosen to boost productivity for every salesperson. For this reason, we do not further investigate why the pay scheme reform does not seem to have improved productivity on average. Rather, our goal in this paper is to test the theoretical prediction that the performance improvement after the reform is a function of $b_1 f(\hat{e}, X) - \underline{w}$. We test Proposition 2 instead of Proposition 1 because minimum guaranteed wages differ across employees and are correlated

with actual productivity (i.e., $f(e,X)$).

In order to estimate $b_1 f(\hat{e}, X) - \underline{w}$ for each salesperson and use it as an incentive measure, we take the following steps:

Step 1: Estimate the fixed effect OLS model using only pre-reform data and use the result to predict new car sales after the reform.

This step gives us the predicted values of individual car sales if the base-wage-plus-commission (BPC) system were to continue. Independent variables include national monthly car sales, tenure, and month dummy. We drop workers who were hired in 2000 and after. It is not possible to make predictions for those who were hired after the reform or to make reliable predictions for those who were still receiving on-the-job training in 2000.

Step 2: Estimate the relationship between monthly car sales and commission totals after the pay scheme reform, then construct the predicted values of monthly commission totals for individuals.

This step is necessary because we do not have data on gross profits or sales by car model, which are necessary to calculate actual commissions. Using the estimated relationship between the number of vehicles sold and the monthly commission total in combination with the predicted series of individual car sales from Step 1, we actually can calculate the first term of the predictor of productivity change derived in the theory section. Namely, the steps so far give us the estimated value of $E[b_1 z \mid e = \hat{e}, X] = E[b_1 f(e, X) \mid X] = \alpha + X\beta$ where ê is the effort level given X and $\alpha + X\beta$ is the linear approximation of the expected commission total given

ê. Let $\hat{E}[b_1 f(\hat{e}, a)]$ denote this estimated value.

Step 3: Construct the category variable of incentive intensity by calculating $\hat{E}[b_1 f(\hat{e}, a)] - \underline{w}$, the predictor of productivity change.

Since we know the actual minimum guaranteed wage for every salesperson, which is included in the personnel data, obtaining $\hat{E}[b_1 f(\hat{e}, a)] - \underline{w}$ follows immediately from Step 2. We decided to construct a category variable because our theoretical model does not indicate that the relationship between $\hat{E}[b_1 f(\hat{e}, a)] - \underline{w}$ and performance is likely to be linear. Figure 4 shows the distribution of $\hat{E}[b_1 f(\hat{e}, a)] - \underline{w}$. We divide the entire range at the forty, sixty, and eighty percentiles and define a category variable *Incentive* as taking integer values 1-4 in each sub-range (see Figure 4).

Step 4: Estimate the fixed-effect OLS model (similar to the one shown in Section 5.1) by adding the new variable *Incentive* as a key independent variable and using the entire sample. We let *Incentive* take the value 0 before the pay scheme change.

Formally, we estimate the following linear regression model using the fixed-effect OLS:

$$y_{it} = Incentive_{it}\alpha + X_{it}\beta + \gamma 2MMA_t + u_i + \eta_{it}$$

where y_{it} is the monthly car sale by a worker *i* in time *t*, $Incentive_{it}$ is a vector of dummies that correspond to each of the category values of the worker/time-dependent new variable *Incentive* defined above. X_{it} is a vector of control variables including worker tenure, national or regional car sales to control for market demand, branch size to control for intra-branch competition, and month dummies to control for seasonality. $2MMA_t$ is the dummy variable

that indicates the period in which the two-month moving average measure is in effect. Note that the coefficient of *Incentive* captures the impact of the pay scheme change for each of the worker groups, which differ in their likelihood of exceeding the threshold for commission payouts. u_i is the worker fixed effect and η_{it} is the error term.

Following the above steps, we evaluate the heterogeneous impacts of the pay scheme changes on the performance of workers with different characteristics.

5.3 Heterogeneous Effects of the Pay Scheme Change

Table 4 shows the estimation results for the model with the time-variant and worker-dependent incentive intensity variable *Incentive*, which is a category variable created from the estimated $\hat{E}[b_1 f(\hat{e}, a)] - \underline{w}$ following the steps described in the previous section. Models 1 and 2 control for trends in overall market demand by including national car sales, while Models 3 and 4 use regional car sales. The fact that Auto Japan's sales account for an especially large share of regional car sales (i.e., sales in this prefecture) does not cause much concern because we are interested in variation across the company's workers. Model 2 and Model 4 also take into account the possibility that the effect of the 2MMA measure varies across the incentive intensity categories.

The theory predicts that the coefficient for *Incentive* should be higher as it moves from 1 to 4 because a greater integer value indicates a larger value for $\hat{E}[b_1 f(\hat{e}, a)] - \underline{w}$. None of the results for the four models seem to confirm this theoretical prediction because there is little

difference in the magnitude of coefficient among different values of *Incentive*. Surprisingly, the pay scheme change had the greatest impact on the productivity of those for whom $\hat{E}[b_1 f(\hat{e}, a)] - \underline{w}$ is smallest (*Incentive_1*) except in Model 4 where the impact is greatest for the category with the largest $\hat{E}[b_1 f(\hat{e}, a)] - \underline{w}$ (*Incentive_4*). More sales by previously lackluster employees may imply that the non-monetary incentives we discussed in Section 2 were effective. Namely, underperforming salespeople worked harder to avoid receiving negative feedback and reputation loss because the threshold for commission payouts provided a reference point for the employees.

The aversion to negative feedback or reputation loss may be stronger for young people because they have career concerns and are more susceptive to pressure. Junior workers in their 20s are likely to perceive the threshold as a *standard* or *quota* that has to be reached. Senior workers in their 50s may view it as a *soft target*, which does not incur a penalty if not met. Moreover, performance directly affects one's prospects for promotion or transfer to undesirable administrative jobs, which significantly affect lifetime income, especially for junior workers.

In order to examine the possibility that non-monetary incentives or career concerns are inducing behavior that contradicts short-term utility maximization, we run the same regression for two subsamples: those who are forty years old or older and those under forty. According to the results shown in Table 5, there is a distinct difference between older and younger workers.

Among senior workers, the coefficients for *Incentive* are monotonically higher for a greater integer value. A senior salesperson with *Incentive* = 4 sold 0.7 more cars after the pay scheme

change whereas one with *Incentive* = 1 did not show any significant improvement when controlling for market demand using regional car sales. This pattern of performance improvement after the pay scheme change is consistent with the theoretical prediction. Namely, it implies that workers who expect to exceed the threshold with a greater margin (i.e., higher $E[b_1 f(\hat{e}, X)] - \underline{w}$) exert more effort. However, it is notable that senior workers whose expected commission total falls far short of the minimum guaranteed wage level do not seem to have been discouraged. It may suggest that non-monetary incentives are effective even for senior workers.

The same pattern is not observed for the subsample of younger workers which has estimation results similar to those of the entire sample. Young workers whose expected commission total falls far short of the minimum guaranteed wage level seem to have improved their performance significantly after the pay scheme change.

Finally, using the two-month moving average to smooth out performance fluctuations seems to have discouraged all workers. This negative impact can be explained by the reduced frequency of commission payouts. As shown in Table 6, the percentage of months in which workers earned commission payouts declined from 58% to 49%. The decline is notably larger for older workers. The lower chance of receiving commissions presumably reduced the return on effort, thus leading to worse sales performance. The true negative impact of the 2MMA measure, however, may be even greater because the estimated impact is likely to be biased upward. Remember that, as we explained earlier, used car salespeople were excluded from new

car transactions around the same time the 2MMA measure was introduced. This policy should have reduced competition among salespeople. It is also unlikely that coordination and information sharing between new car and used car sales staff were weakened by the change because afterward used car salespeople were paid referral commissions for sending their customers to the new car sales department. Therefore, we believe that the smoothing of performance measures weakened the incentive effect of the pay scheme.

5.4 The Role of Implicit Incentives through Subjective Evaluation

Earlier, we argued that the behavior of young workers is more likely to be influenced by non-monetary incentives and career concerns than older workers' behavior. Another possible explanation for the difference in behavior is the dynamic incentive created by the subjective personnel evaluations that Auto Japan conducts. Subjective evaluations are used to determine increases in the minimum guaranteed wage for the following year, and sales performance is the most important determinant of the evaluation. Note that this dynamic effect accumulates over time.

In order to evaluate how the long-term effect of subjective evaluations plays out through the minimum guaranteed wage, we run a regression to estimate how sales performance affects the guaranteed wage (which is equivalent to the base wage in the pre-reform period) in the following year. Specifically, we estimate the following model using OLS.

$$\underline{w}_{i,t} - \underline{w}_{i,t-1} = \alpha + \beta_1 age_{i,t} + \beta_2 \underline{w}_{i,t-1} + \beta_3 z_{i,t-1} + \beta_4 \underline{w}_{i,t-1} z_{i,t-1} \qquad (7)$$

where $\underline{w}_{i,t}$, $age_{i,t}$, $z_{i,t}$ are minimum guaranteed wage, age, and number of vehicles sold by worker *i* in year *t*. It turns out that the average impact of selling one additional car on the guaranteed (base) wage in the following year is ¥372, compared with the average commission per vehicle of ¥57,000-58,000. If the worker is 30 years old and expects to work until age 60, the company's mandatory retirement age, the accumulated effect might be ¥372 × 30 = ¥11,160, far lower than the average commission for a single vehicle. Therefore, we conclude that the dynamic effect through this channel is almost negligible.

5.5 The Gaming Effect

The distinctive feature of the commission-with-a-guaranteed wage (CWG) system is that, owing to the convex shape of the pay profile, salespeople gain by concentrating sales in some months and receiving the guaranteed wage in other months. Since each month's commission calculation is based on delivery dates that are scheduled by the salespeople themselves, manipulation of delivery dates is very likely. Prior research has demonstrated that such "timing gaming" could be economically significant (Oyer 1998, Larkin 2007; Owan, Tsuru, and Uehara 2010). We look for evidence of gaming behavior in this section.

Gaming behavior would be relatively easy to detect with daily car delivery records, but they are not available. Therefore, we first look at the variance of monthly car sales records for individual salespeople. If workers manipulated delivery timing to concentrate sales after the pay scheme reform and before the 2MMA measure was introduced, the variance of monthly sales

among workers should be greater during that period. As Table 7 shows, it is indeed greater than in the preceding and following periods. This change cannot be explained by market demand fluctuation because the variance of national new car sales does not exhibit a similar pattern.[7]

To obtain more direct evidence of gaming behavior, we also evaluate residuals in regressions of performance equations and investigate how their serial correlation coefficients changed when the pay system was reformed. Since the discretionary range of delivery dates is likely to be limited to a week at most, concentration of sales in one month is likely to be followed by a weak month. Therefore, negative serial correlation is likely to be observed during periods when gaming behavior is induced.

We estimate the following linear regression model:

Car sales (number of vehicles) = f (tenure, time fixed effect, worker fixed effect)

Table 8 exhibits the results for lag-1 to lag-3 serial correlations for three sub-periods: (1) the pre-pay scheme reform period (January 1998-October 2000); (2) the immediate post-reform period before the 2MMA measure was introduced (November 2000-May 2003); and (3) the later post-reform period when the 2MMA measure was in effect (June 2003-December 2004). Note that gaming behavior is unlikely to arise when the two-month moving average of performance measure is used because manipulation is eliminated by smoothing.

According to the analysis using the whole sample (Row 1), there is a significant positive correlation during the pre-reform period. This result is reasonable because there are likely to be time-variant worker characteristics that affect productivity. For example, there should be a large

difference in learning capability that causes the tenure effect to vary across workers. However, the lag-1 coefficient turns to a significantly negative value in the second period when the pay scheme is changed to CWG, which is believed to encourage gaming behavior. Then the coefficient reverts to positive in the third period when the performance smoothing practice was in use. These findings are consistent with our predictions.

In order to strengthen our evidence, we repeated the same analysis for the subsample of workers whose tenure was over ten years at the time of the pay scheme reform. Since manipulation of delivery dates is likely to require particular skills (such as communication skills to persuade customers and the ability to cover up irregular delivery dates), manipulation is most likely to be perpetrated by experienced salespeople. As we expected, the size of the negative autocorrelation in the second period is much greater for this subgroup. The change in the frequency of commission payouts shown in Table 6 is also consistent with this result. The drop in commission frequency after the introduction of the 2MMA measure is larger for workers age forty and older than for younger workers.

We also repeated the same regression analysis for the subsample of high-performers who exceeded the sales threshold and thus enjoyed commission payouts with more than 90% probability after the reform. Note that the marginal benefit of pulling-in or pushing-out is not substantial when there is a limited chance of failing to exceed the threshold. Therefore, timing gaming is unlikely to be observed for this group which accounted for 27% of the total sales force in the new car sales department. As expected, the reversion of the lag-1 coefficient to a

negative figure in the second period is not observed for this group. This result also reinforces the evidence indicating gaming behavior by salespeople.

6. Conclusion

This paper has examined the impact of a performance-based pay scheme introduced in 2000 by a large Japanese auto sales firm. The company replaced a salary-plus-commission system with a high-powered, performance pay-plus-minimum guaranteed wage system. The guaranteed wage is set equal to the pre-reform salary, which was closely tied to tenure. Thus, high-powered incentives have been integrated into a traditional seniority-based wage system.

The theory presented in Section 3 that considers only static monetary incentives predicts the following points. First, workers who receive a guaranteed wage that is high relative to their ability will become less productive because they expect to earn commission with low probability. Second, workers who have a guaranteed wage that is low relative to their ability will become more productive because they now face a steeper incentive profile. Econometric analysis produced results that are consistent with this prediction for senior employees but not for young workers. Among the latter, those whose expected commission income falls far short of the minimum guaranteed level seem to have improved their performance significantly after the pay scheme change. To interpret this inconsistency, we have argued that career concerns and non-monetary incentives in the setting of an internal labor market matter more for younger

workers. The productivity of high-performing young workers was not boosted much by the availability of higher commissions because these workers were already motivated by other factors such as promotion prospects, long-term job security with deferred pensions, and the feedback and status they receive in the firm. Low-performing young workers put forth more effort after the reform despite the fact that they had a lower chance of commission payout because they were under stronger pressure to avoid negative feedback, stigmatization, and transfer to lower wage positions for failing to exceed the performance standard set by the commission threshold.

We have also investigated another critical issue related to explicit incentives: manipulation of performance measures. This occurs when employees "game" compensation systems in ways harmful to the profitability of their firms. This research verifies that the use of a nonlinear pay scheme with a month-end deadline motivated employees to manipulate delivery dates to their own advantage. In 2003, presumably seeking to put a stop to the gaming problem, Auto Japan replaced the single-month performance assessment system with a two-month moving average (2MMA) system. The measure seems to have been effective in eliminating the gaming behavior, but at the cost of negating the positive effect of the performance pay system. This result is not necessarily surprising because the return to effort declines on average for those whose chance to exceed the threshold for commission payouts is not sufficiently high. But, the implications for firm profitability are unclear. 2MMA led to a decrease in employee productivity, but also reduced the total commission payout. In order to evaluate the impact on the firm's bottom line,

we need more detailed financial information on gross profits earned for each transaction.

We believe that this paper suggests a new direction for research by showing that there could be a tradeoff between providing incentives and preventing gaming. One of the puzzles is why businesses continue to offer high-powered incentives with targets, quotas, or convex pay profiles, given that they so often result in gaming behavior. The reason might be that any attempts to prevent gaming by smoothing performance measures or making the measurement period longer lead to lower productivity. An inevitable tradeoff may exist, but the linkage is not necessarily clear and not yet generalized. We need to develop more theories on the optimal design of performance measurements.

To sum up, we find that worker responses to the pay scheme change integrating a high-powered commission into a traditional seniority wage system were partially consistent with utility maximization under standalone, explicit incentives in the static model. Although the pattern of performance improvement among young workers is at odds with this theory, we believe that employee responses are likely to be consistent with utility maximization once career concerns and implicit incentives are considered in the model. Further investigation of the firm's policies of promotion and job assignment, and management's communication with the employees are necessary to conduct a more rigorous analysis of the dynamic effects of the pay scheme reform. However such an investigation is beyond the scope of this paper and thus left for future research.

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Figure 1: Changes in the Performance Pay System

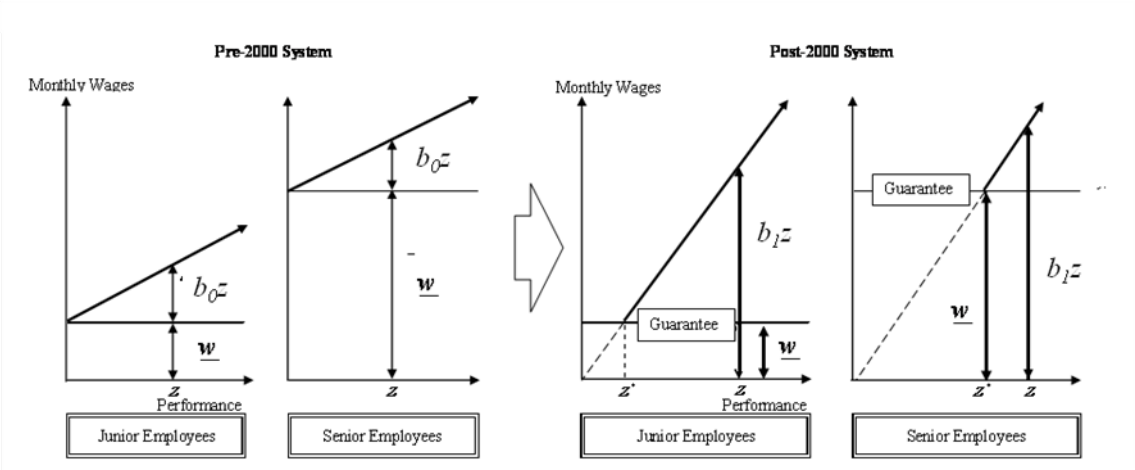

Figure 2: National Car Sales Trends in Japan

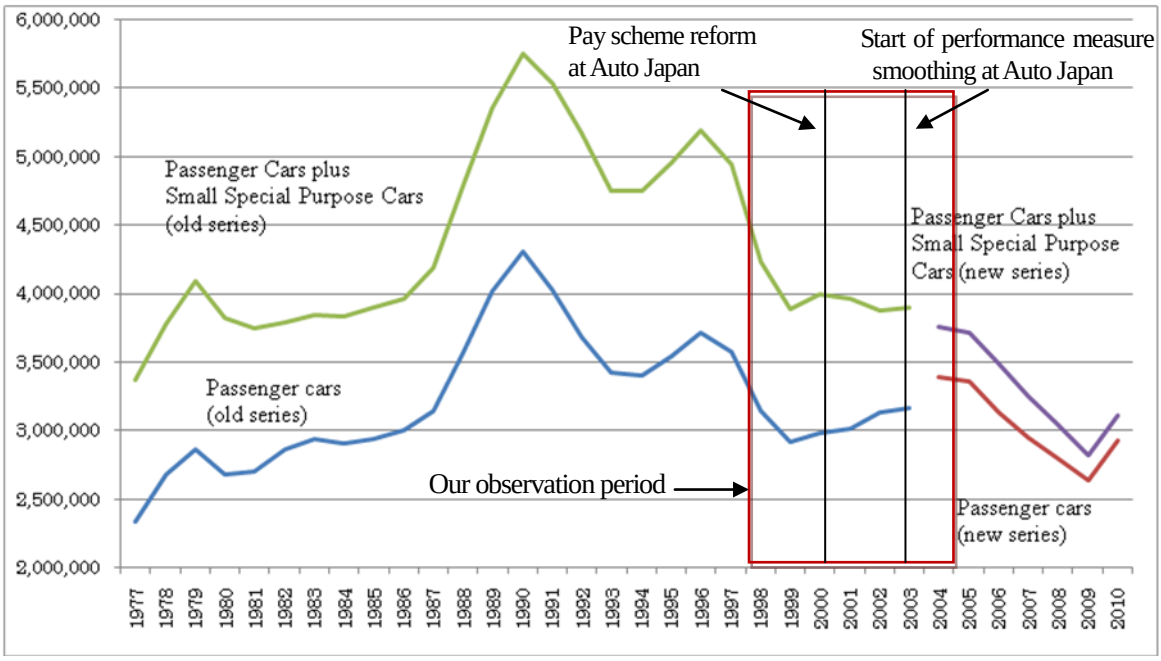

Table 1: Summary Statistics

	Total					Before the Reform				
Variable	# of obs.	Mean	S.D.	Min	Max	# of obs.	Mean	S.D.	Min	Max
National Car Sales	48,013	338,487	89,803	233,473	659,216	20,094	345,952	99,093	233,473	659,216
Monthly Car Sales per Salesperson	48,013	5.31	3.43	0	36	20,094	4.80	3.24	0	32
Tenure	48,013	11.03	9.32	0	42	20,094	10.10	8.75	0	41
Age	48,013	33.39	8.27	20	60	20,094	32.30	7.75	20	59
Total Pay (¥)	48,009	433,954	162,675	2,635	2,628,118	20,090	404,083	115,523	2,635	1,732,369

	After the Reform (before the 2MMA Introduction)					After the 2MMA Introduction				
Variable	# of obs.	Mean	S.D.	Min	Max	# of obs.	Mean	S.D.	Min	Max
National Car Sales	16,510	338,304	87,294	248,377	582,373	10,893	326,996	73,522	237,437	574,977
Monthly Car Sales per Salesperson	16,510	5.79	3.54	0	36	10,893	5.75	3.40	0	36
Tenure	16,510	12.13	9.64	0	42	10,893	11.56	9.56	0	42
Age	16,510	34.47	8.47	22	60	10,893	34.19	8.53	21	60
Total Pay (¥)	16,510	485,603	203,259	112,009	2,628,118	10,893	422,493	142,678	111,873	1,624,638
Guaranteed Wage (¥)	16,510	326,767	79,158	190,800	535,050	10,893	326,577	78,664	190,800	532,450

Note: We drop the observations with no guaranteed wage from the two subsamples after the reform, but they are included in the total. These are cases in which the company paid lateral transfers and trainees a fixed special allowance plus base wages without commission.

Figure 3: Kernel Density of Annualized New Car Sales

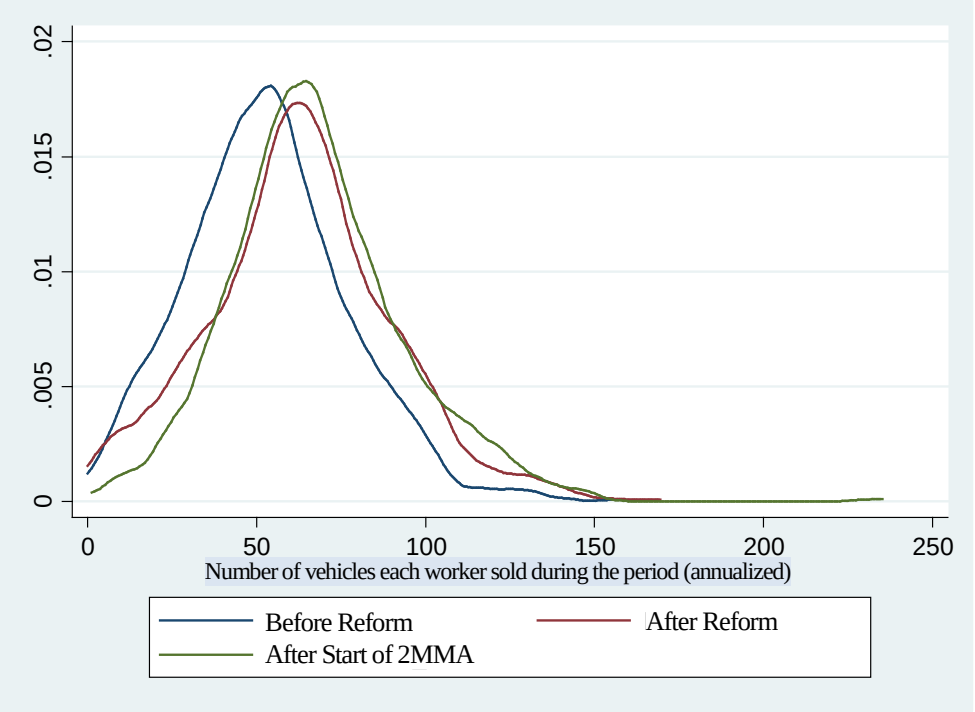

Table 2: Initial Assessment of the Pay Scheme Change

	Model 1	Model 2	Model 3	Model 4	Model 5
	OLS	OLS	OLS (fixed effect)	OLS (fixed effect)	OLS (fixed effect)
National new car sales	0.004 ***	0.004 ***	0.010 ***	0.010 ***	0.010 ***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
After-reform dummy	**0.822 *****	**0.817 *****	**0.114 ****	**0.121 *****	**0.043**
	(0.031)	**(0.041)**	**(0.057)**	**(0.057)**	**(0.080)**
2MMA dummy	**0.045**	**0.041**	**-0.267 *****	**-0.227 *****	**-0.225 *****
	(0.038)	**(0.038)**	**(0.056)**	**(0.056)**	**(0.056)**
30 ≤ Age < 40		0.306 ***			
		(0.060)			
40 ≤ Age < 50		0.754 ***			
		(0.094)			
50 ≤ Age ≤ 60		0.533 ***			
		(0.188)			
After-reform *Age < 40		**0.093**			**0.269 *****
		(0.061)			**(0.083)**
After-reform *Age < 50		**-0.177 ****			**0.103**
		(0.073)			**(0.112)**
After-reform *Age ≤ 60		**-0.361 ****			**-0.275 ***
		(0.157)			**(0.166)**
Tenure	0.636 ***	0.635 ***	0.843 ***	0.807 ***	0.837 ***
	(0.015)	(0.016)	(0.050)	(0.051)	(0.054)
Tenure^2	-0.040 ***	-0.044 ***	-0.041 ***	-0.040 ***	-0.046 ***
	(0.002)	(0.002)	(0.006)	(0.006)	(0.006)
Tenure^3	0.001 ***	0.001 ***	0.001 ***	0.001 ***	0.001 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tenure^4	0.000 ***	0.000 ***	0.000 ***	0.000 ***	0.000 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Branch size adjustment				9.444 ***	9.380 ***
(# of new car sales staff)				(1.461)	(1.474)
Branch size adjustment				-3.296 ***	-3.223 ***
(# of used car sales staff)				(1.577)	(1.574)
Month dummies	Yes	Yes	Yes	Yes	Yes
Education dummies	Yes	Yes	No	No	No
Salesperson Fixed Effects	No	No	Yes	Yes	Yes

Note: The base category for the three age group dummies is Age < 30. Eleven month dummies are included to control for seasonality.

Table 3: Productivity of Incoming and Outgoing Workers by Time Period

Jan. 1998 - Aug. 2000

	Observations	% of beginning workforce	Avg. age at the last obs. in the period	Avg. annual sales during the preceding 12 months
Total new car sales staff at start of period.	601			
Stayers	451	75%	34.9	75.3
Inflow of new workers				
New hires (new graduates)	105	17%	24.1	56.6
New hires (job changers)	1	0%	31.0	N.A.
Lateral transfers (in)	34	6%	48.9	69.2
Outflow of existing workers				
Retirements	2	0%	55.0	50.0
Voluntary quits	124	21%	27.1	34.7
Lateral transfers (out)	57	9%	34.5	38.5
Promotions	1	0%	41.0	72.0
Separation for unknown reasons	5	1%	34.8	55.7

Sept. 2000 - Dec. 2004

	Observations	% of beginning workforce	Avg. Age at the last obs. in the period	Avg. annual sales during the preceding 12 months
Total number of new car sales staff at the beginning.	559			
Stayers	374	67%	37.4	79.5
Inflow of new workers				
New hires (new graduates)	140	25%	24.1	49.2
New hires (job changers)	73	13%	28.5	58.6
Lateral transfers (in)	29	5%	32.8	67.6
Outflow of existing workers				
Retirements	14	3%	57.1	54.6
Voluntary quits	104	19%	27.8	46.1
Lateral transfers (out)	59	11%	36.6	45.3
Promotions	64	11%	42.8	87.0
Separation for unknown reasons	4	1%	31.5	41.0

Note: Workers who were in the new car sales department for less than 12 months in each period are excluded from the calculation of average vehicle sales.

Figure 4: Incentive Intensity Categories based on the Predicted Value of $b_1 f(\hat{e}, a) - \underline{w}$

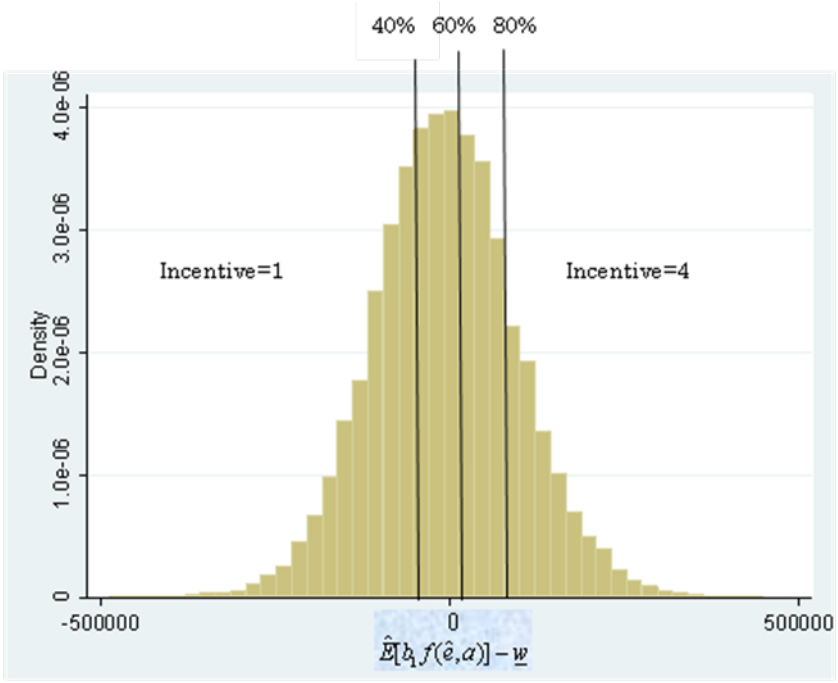

Table 4: Effects of the Pay Scheme Change by Incentive Intensity Category

	Model 1		**Model 2**		**Model 3**		**Model 4**	
National new car sales	0.0072	***	0.0072	***				
(thousand units)	(0.0009)		(0.0009)					
Regional new car sales					0.1305	***	0.1307	***
(thousand units)					(0.0096)		(0.0095)	
Incentive_1	**0.4175**	*******	**0.3871**	*******	**0.1236**		**0.0992**	
	(0.0748)		**(0.0721)**		**(0.0793)**		**(0.0764)**	
Incentive_2	**0.3504**	*******	**0.3311**	*******	**0.0802**		**0.0545**	
	(0.0699)		**(0.0752)**		**(0.0737)**		**(0.0784)**	
Incentive_3	**0.2384**	*******	**0.2634**	*******	**-0.0056**		**0.0094**	
	(0.0732)		**(0.0793)**		**(0.0762)**		**(0.0817)**	
Incentive_4	**0.3363**	*******	**0.3661**	*******	**0.1425**		**0.1779**	*****
	(0.1032)		**(0.1029)**		**(0.1038)**		**(0.1042)**	
2MMA	-0.2507	***			-0.2579	***		
	(0.0646)				(0.0642)			
(Incentive_1)*2MMA			-0.1470	*			-0.1729	**
			(0.0864)				(0.0859)	
(Incentive_2)*2MMA			-0.2172	**			-0.2050	**
			(0.0948)				(0.0941)	
(Incentive_3)*2MMA			-0.3420	***			-0.3190	***
			(0.1059)				(0.1064)	
(Incentive_4)*2MMA			-0.4093	***			-0.4335	***
			(0.1460)				(0.1449)	
Branch size adjustment	6.3085	***	6.3116	***	6.0638	***	6.0639	***
(# of new car sales staff)	(1.3689)		(1.3632)		(1.3644)		(1.3600)	
Branch size adjustment	-0.9104	***	-0.9150	***	-0.8921	***	-0.8957	***
(# of used car sales staff)	(0.1632)		(0.1617)		(0.1583)		(0.1572)	
Control for tenure	Yes		Yes		Yes		Yes	
Month dummies	Yes		Yes		Yes		Yes	
Individual Fixed Effects	Yes		Yes		Yes		Yes	

Table 5: Effects of the Pay Scheme Change by Age Group

	40 years old and over		**Under 40 years old**	
	Model 1	Model 2	Model 1	Model 2
National new car sales	0.0128***		0.0059***	
(thousand units)	(0.0019)		(0.0011)	
Prefectural new car sales		0.1862***		0.1148***
(thousand units)		(0.0196)		(0.0109)
Incentive_1	**0.3765*** **	**0.0371**	**0.4484*** **	**0.1707***
	(0.1275)	**(0.1276)**	**(0.0011)**	**(0.1010)**
Incentive_2	**0.5135*** **	**0.2123**	**0.3066*** **	**0.0485**
	(0.1573)	**(0.1621)**	**(0.0011)**	**(0.0861)**
Incentive_3	**0.6496*** **	**0.3799** **	**0.1735** **	**-0.0582**
	(0.1673)	**(0.1683)**	**(0.0011)**	**(0.0898)**
Incentive_4	**0.9318*** **	**0.7076** **	**0.2994*** **	**0.1194**
	(0.2833)	**(0.2864)**	**(0.0011)**	**(0.1094)**
2MMA	-0.3741***	-0.3357***	-0.2361***	-0.2488***
	(0.1016)	(0.1022)	(0.0011)	(0.0797)
Tenure	0.0720	0.0682	0.5879***	0.6124***
	(0.1462)	(0.1449)	(0.0011)	(0.0454)
Tenure^2	-0.0003	0.0001	-0.0142***	-0.0140***
	(0.0027)	(0.0026)	(0.0011)	(0.0021)
Branch size adjustment	5.9382***	5.5662***	7.1832***	6.9513***
(# of new car sales staff)	(2.0176)	(1.9901)	(0.0011)	(1.7447)
Branch size adjustment	-1.0788**	-1.0309**	-0.9335***	-0.9177***
(# of used car sales staff)	(0.4442)	(0.4431)	(0.0011)	(0.1724)
Month dummies	Yes	Yes	Yes	Yes
Salesperson Fixed Effects	Yes	Yes	Yes	Yes
Observations	10663	10663	30879	30879

Table 6: Frequency of Commission Payouts after the Pay Scheme Change

Worker age group	20s		30s		40s	
Before/after 2MMA start	Before	After	Before	After	Before	After
Months with payout	3,510	2,065	4,066	2,582	1,822	684
Frequency	59%	53%	64%	57%	52%	35%
Months without payout	2,413	1,830	2,264	1,913	1,709	1,250
Frequency	41%	47%	36%	43%	48%	65%
Total	5,923	3,895	6,330	4,495	3,531	1,934

Workers age group	50s		Total	
Before/after 2MMA start	Before	After	Before	After
Months with payout	334	120	9,732	5,451
Frequency	31%	16%	58%	49%
Months without payout	741	635	7,127	5,628
Frequency	69%	84%	42%	51%
Total	1,075	755	16,859	11,079

Table 7: Variance of Monthly Sales Among Workers by Time Period

	Period 1 Jan. 1998 - Sep. 2000 (before reform)	Period 2 Oct. 2000 - Apr. 2003 (before 2MMA)	Period 3 May. 2003 - Dec. 2004
Observations	750	699	617
Average within-worker S.D. of monthly new car sales	2.47	2.73	2.52
T test results for the difference with Period 2	Significant at the 1% significance level	N.A.	Significant at the 1% significance level
S.D. of monthly national new car sales	102,116	87,679	75,665

Table 8: Serial Correlation of Residuals from Performance Estimations

		Jan. 1998 ~ Sep. 2000 (before reform)	Oct. 2000 - Apr. 2003 (before 2MMA)	May. 2003 - Dec. 2004
Whole Sample	Lag 1	0.042***	-0.016**	0.019*
	Lag 2	0.071***	0.025***	0.072***
	Lag 3	0.086***	0.062***	0.070***
Only Workers with Tenure > 10yrs	Lag 1	0.011	-0.036***	-0.010
	Lag 2	0.043***	0.017	0.031**
	Lag 3	0.066***	0.048***	0.041***
Only Workers with Payout Frequency > 90%	Lag 1	0.061***	0.018	0.022
	Lag 2	0.046***	0.021	0.174***
	Lag 3	0.086***	0.088***	0.123***

[1] Many prior works that use data from auto dealerships discuss the optimality of pay scheme contracts and test the theoretical implications from agency theory. See Basu, Srinivasan, and Staelin (1985), Coughlan and Narasimhan (1992), Mishra, Coughlan, and Narasimhan (2003), and Gibbs, Merchant, Van Der Stede, and Vargus (2009).

[2] There is little difference in sales activities across pay ranks and branches, although different levels of emphasis are placed on certain activities in new and used car sales..

[3] There is a discontinuity in 2004 for national car sales data. In the old series, the distinction between passenger cars and special purpose cars was based on the specifications of a model's chassis while the new series uses registration number categories. As a result, vans and some SUVs were reclassified from the special purpose car category to the passenger car category.

[4] Auto Japan's performance pay system includes commissions for insurance sales and leasing, but these components combined are much smaller than the car sale commission (only 13.7% of the total), and are not predictable. Therefore, we treat these other components as exogenously given in our empirical analysis.

[5] During the same period, Auto Japan employed 253 used car salespersons. We exclude used car sales staff from the analysis below for two reasons. First, used car salespeople were allowed to sell new cars before 2003, but thereafter were excluded from new car transactions. After this policy change, used car staff received a fixed referral commission (30,000 yen per car new sale to a referred customer). Second, this policy change coincided with the pay scheme being shifted to the two-month moving average method in 2003. This coincidence makes it difficult to distinguish the impact of the used car policy change from that of the pay scheme revision. Against this background, we focus on the new car sales staff.

[6] Note that the number of retirements in Table 3 includes only new car salespeople. Given that many salespeople are transferred to non-sales departments before they retire, we cannot evaluate the effect of the early retirement plan using the figures in Table 3.

[7] Interestingly, the variance of national new car sales exhibits a downward trend meaning that auto sales are becoming less volatile, which is consistent with the US market as described by Ramey and Vine (2006).