Vertical Wage Gap Structure in the Retail Industry and Its Effects on Firms' Performance

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Abstract

Wage and compensation vary across individuals, companies, and positions because of different compensation systems. In evaluating the efficiency the increased pay from a promotion that is part of these various compensation systems, Rank-Order Tournament Theory states that implementing a compensation scheme based on an individual's relative position within the firm can increase employees' effort and the firm's performance. According to this theory, this compensation structure should have widening pay gaps along the corporate hierarchy. Using data from the Specialty Store Wage and Benefit Survey provided by the National Retail Federation (NRF), this paper tests the existence and the effects of this compensation structure in the retail industry. The dataset contains aggregated information on the number of employees and their average annual salary in each hierarchical level of large national retail chains for the years 1996-1998. With a new approach centering around the second differences between the pay levels, using different statistical tests, including polynomial regression and t-test, we found empirical evidence supporting the existence of a convex compensation structure in the retail industry, where pay level increases at an increasing rate, consistent with the tournament theory. However, through the two-sample t-test and error-in-variables regression, we found that neither the presence of a convex compensation system nor the convexity of this compensation scheme has a statistically significant influence on the firm's performance. The results of this study will solidify the implications of the tournament theory under organizational settings.

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Contents

Chapter 1

Introduction

It is common to observe variation in wages and compensation across individuals and positions because of different compensation systems. What might be the reasonable explanations for these gaps? Of course, explanations might include that an employee has more responsibilities at a higher level so he is rewarded more, or that he has more experience and thus is more crucial and valuable to the firm. Thus, it makes sense that pay level increases as one moves up the corporate ladder, but how should the increases change? What are the reasons for the pay *differences* to change? Within the retail industry, according to data collected in 1996 by the National Retail Foundation (NRF), the average annual salary for an area manager almost doubles that of an assistant store manager ($34,000 and $19,500, respectively). Higher up the corporate hierarchy, with an average annual salary of $91,700, a regional manager earns approximately three times what an assistant store manager does. Looking at this matter of pay differentials, the studies addressing the efficiency and the impacts of pay variation started to appear in the early 90s. There are many theories that explain and argue for different characteristics of an organization's reward system, stating that crafting appropriate variations in pay up the ladder can improve the employee's motivation and the organization's performance.

Pay variation refers to the difference in pay for people in an organization. Gupta, Conroy, and Delery (2012) identified three different types of pay variation: *horizontal* pay variation, *vertical* pay variation, and *overall* pay variation. Horizontal pay variation is the pay difference among people holding the same job but have different individual characteristics such as tenure, ability, skills, desires, etc. On the other hand, vertical pay variation is the pay difference across jobs and organizational levels or positions. Overall pay variation combines both horizontal and vertical pay variation. This paper focuses on vertical pay variation.

The Expectancy Theory (Vroom, 1964; Porter & Lawler, 1968) and the Efficiency Wage theory (Shapiro & Stiglitz, 1984; Akerlof & Yellen, 1986) are some of the theories that are used to explain and study the relationship between horizontal pay variation and people's motivation as well as performance. The expectancy theory proposes that an individual's motivation is determined through one's expectation of the outcomes. This theory directly relates to how an individual's cognitive system processes the desirability of the outcomes, evaluates different motivational elements, and ultimately makes choices. Due to this characteristic, the theory emphasizes that organizations should relate rewards to the employees' need and desire in order to foster motivation and performance. On the other hand, the efficiency wage theory argues that managers should pay their employees above the equilibrium level, i.e., the market-clearing wage, in order to increase the employees' productivity and efficiency. As aforementioned, horizontal pay variation centers around people holding the same job but have different individual characteristics. We might expect that these characteristics are hard to control statistically and therefore, the link between these characteristics and people's motivation is not apparent. Additionally, it is very hard to change one's ability and/or need due to its innate nature and thus, motivating employees via horizontal variation does not seem to yield much result.

On the contrary, we can create an incentive for motivation and effort through vertical pay variation. Tournament Theory is one of the most prominent explanations that have emerged to address this vertical pay variation. According to Lazear and Rosen's (1981) Rank-Order Tournament Theory, the employees' effort and the firm's performance can be improved by having vertical pay variation and implementing a compensation scheme based on an individual's relative position within the firm rather than his or her absolute level of output. Under this theory, an employee is evaluated based on his relative performance to those at his current level, instead of his absolute performance, so he has an incentive to strive to be the best employee in the group in order to be promoted to a higher position with higher pay. The collective effort made by every employee helps to increase the firm's performance. Furthermore, the pay differences between these levels are predicted to increase as the employee moves up the corporate hierarchy, as he has to put in more effort to advance when he is at a higher level. In other words, the pay differences between ranks grow at an increasing rate, creating a positive second difference between pay levels.

There are many empirical studies that attempt to identify the relationship between vertical pay variation and individual, team, and organizational performance. However, most studies focus on sports settings (Becker & Huselid, 1992; Frick, Winkelmann, & Prinz, 2003; Katayama & Nuch, 2011) or compensation of top executives, such as the CEO, board members, and top vice presidents (O'Reilly, Main, & Crystal, 1988; Main, O'Reilly, & Wade, 1993; Eriksson, 1999; Firth, Leung, & Rui, 2010; Liu, Tsou, & Wang, 2010). Despite the extensive library of theoretical and empirical studies on tournament models, very little work has been done in an organizational setting or in a specific industry. In addition, most of the existing papers only focus on the effects of the pay difference and firm's performance and ignore the tournament theory prediction that the pay differences are bigger at a higher level.

This paper seeks to close the gap by looking at the second differences between the pay level, or the rate at which the pay difference grows, to measure the convexity of the pay and the organizational-level relationship. We test the tournament theory in the retail industry, the largest private sector employer in the United States (NRF, 2014). We use the data from the Specialty Store Wage and Benefit Survey provided by the National Retail Federation (NRF). This panel dataset contains aggregated information on the number of employees and their average annual salary in each hierarchical level of large national retail chains for the years 1996-1999. It may be possible in the future to extend this paper and apply this model to more recent data.

This paper contributes to the tournament theory literature in several different ways. Firstly, it extends the literature testing the tournament theory predictions. We test whether companies in the retail industry utilize the compensation structure, where pay gaps widen along the corporate hierarchy, as predicted by the tournament theory. Additionally, instead of looking into the effects of pay variations on firm's performance, we test whether having this pay structure has an effect on firm's performance. We also extend the scope of the prediction to test whether the degree of convexity of this pay structure has a positive effect on firm's performance. Secondly, we propose a new approach to test the convexity of the pay level and the organizational level relationship. In the existing literature, Lambert, Larcker, and Weigelt (1993) compare the coefficients representing the effects of the positions dummy variables on the total level of compensation and Eriksson (1999) calculates the percentage change in total pay and the difference in the estimated logarithm of pay differentials to illustrate that the pay differences increase as one moves up the corporate hierarchy. With the intuition that the second derivative of a convex (concave up) function is non-negative, we calculate the second difference between pay levels and show that these differences across all observations are non-negative, consistent with the theory. This will be explained further in the methodology section. This approach is somewhat similar to the method utilized by Leonard (1990). In his paper, he calculates the steepness of the pay profile, which is the ratio of mean pay in levels 1 and 2 to mean pay in levels 5 and 6 (Leonard, 1990). Lastly, we acknowledge some of the shortcomings in our analysis, including some limitations proposed by the data, and propose ideas for future research.

Before continuing, we identify the following terminologies to be used in this paper. Figure 1.1 illustrates a simple example. In this paper, pay level, or pay, simply refers to the actual annual salary given to a particular position or level, i.e., $50,000 for Associate, $75,000 for Manager, and $125,000 for Vice President in the following case. More specifically, pay in this paper refers to the sum of base salary plus bonus in a year. It does not include other perks and benefits like stocks, options, pension, etc. Taking the difference between the pay levels, first difference, or pay difference, pay variation, pay gap, pay differentials, pay dispersion, represent the difference between the pay level of any two adjacent positional levels, i.e., any particular pay level and the pay level directly followed it. This is demonstrated through $\Delta = \$25,000$ between Associate and Manager or $\Delta = \$50,000$ between Manager and Vice President. Taking the difference once more, second difference, or second pay difference, spread between pay gaps, denote the difference between the pay gaps, or, In other words, the difference of the difference in pay levels. In Figure 1.1, $\Delta_\Delta = \$25,000$ represents this second difference. According to the predictions laid out by the Tournament Theory, not only should the pay difference but the second difference should be positive as well.

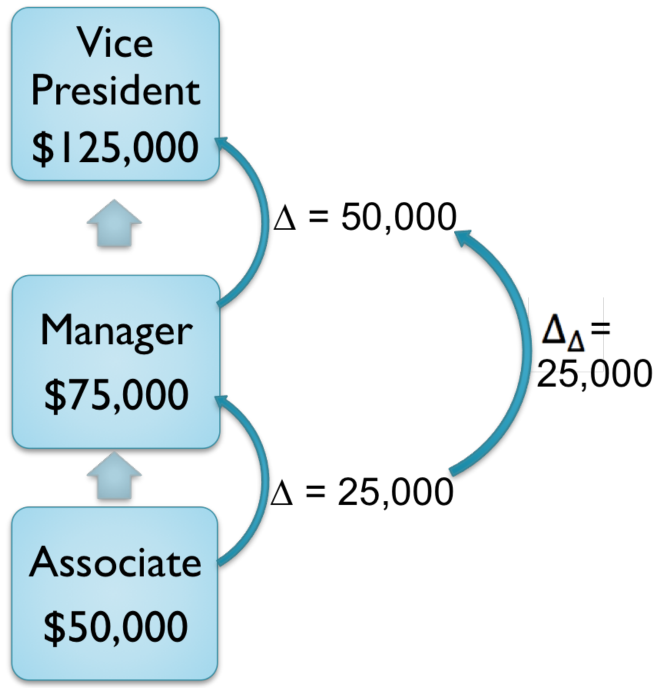

Figure 1.1: Illustration of Terminologies

This paper proceeds as follow. Chapter 2 provides a fundamental theoretical explanation of the tournament theory and and the rank-order tournament theory. Chapter 3 talks about some of the existing literature surrounding tournament theory as well as the motivation behind this paper and our contributions. Chapter 4 discusses the data to be used in this paper. Chapter 5 explains the methods to test the convexity of the pay and organizational-level relationship, as well as how this structure affects the firm's performance. Chapter 6 provides the empirical results and discussion. The last chapter offers some concluding remarks and future work.

Chapter 2

Theoretical Model

2.1 Tournament Theory – Two-player competition

To illustrate and lay the ground for the later sections, we summarize the tournament theory by Lazear and Rosen (1981) via a simple model. Assume that there are two identical players in a tournament, player j and player k. Assume also that the rewards are set in advance and the rule specifies that the winner receives the prize W_1 whereas the loser receives W_2. In our terminology, $W_1 - W_2$ is the first difference. Additionally, assume that the player's performance (or output) is determined by

$$q_i = \mu_i + \varepsilon_i, \qquad i = j, k \quad (1)$$

where μ is the player's predetermined choice of effort and ε is a random or luck component. Further assume that ε_i $(i = j, k)$ independently and identically distributed with $E(\varepsilon_i) = 0$ and $E(\varepsilon_i^2) = \sigma^2$. The winner is the player with the higher performance, i.e., bigger q, and the margin of winning does not affect earnings. Contestants choose and commit their level of effort before the game starts and do not communicate or collude during the game.

Let $C = C(\mu)$, with $C' > 0$ and $C'' > 0$, be the cost of investment, or the cost of putting in effort, and assume that both players face the same cost function. Then, each player's expected utility (wealth) depends on the probability of winning, P, as followed

$$\begin{aligned} U_i &= P(W_1 - C(\mu_i)) + (1-P)(W_2 - C(\mu_i)) \\ &= P(W_1 - W_2) + W_2 - C(\mu_i) \quad (2) \end{aligned}$$

Consider P, the probability player j wins depends positively on the effort he puts forth (μ_j) and negatively on the effort the other player puts forth (μ_k) and vice versa. Recall that player j wins when player j has higher performance and thus, the probability that player j wins is

$$\begin{aligned} P = \text{prob}(q_j > q_k) &= \text{prob}((\mu_j - \mu_k) > (\varepsilon_k - \varepsilon_j)) \\ &= \text{prob}((\mu_j - \mu_k) > \xi), \end{aligned}$$

where $\xi = \varepsilon_k - \varepsilon_j$ and $\xi \sim g(\xi)$. Since ε_j and ε_k are i.i.d,

$$E(\xi) = E(\varepsilon_j) - E(\varepsilon_k) = 0$$

$$\text{and} \qquad E(\xi^2) = \text{Var}(\xi) = \text{Var}(\varepsilon_j) + \text{Var}(\varepsilon_k) = E(\varepsilon_j^2) + E(\varepsilon_k^2) = 2\sigma^2$$

Let $G(\bullet)$ be the cumulative density function of ξ, then the probability P is

$$P = G(\mu_j - \mu_k) \quad (3)$$

Each player maximizes (2) by choosing his own level of effort μ. Then, the solution need to satisfy the first order condition and the second order condition:

$$\begin{aligned} &(W_1 - W_2)\frac{\partial P}{\partial \mu_i} + 0 - \frac{\partial C}{\partial \mu_i} = 0 \\ \text{and} \qquad & \qquad\qquad\qquad\qquad \text{for } i = j, k \quad (4) \\ &(W_1 - W_2)\frac{\partial^2 P}{\partial \mu_i^2} - \frac{\partial^2 C}{\partial \mu_i^2} < 0 \end{aligned}$$

From (3), if both players are choosing μ to maximize their utility taking the other player's choice of μ then it follows from (3) that

$$\frac{\partial P}{\partial \mu_j} = \frac{\partial G(\mu_j - \mu_k)}{\partial \mu_j} = g(\mu_j - \mu_k),$$

which by substituting into (4) gives player j's reaction function:

$$(W_1 - W_2)g(\mu_j - \mu_k) = C'(\mu_j) \quad (5)$$

Player k's reaction function looks similar due to our assumptions. The symmetry of (5) implies that there is a Nash solution when $\mu_j = \mu_k$ and $P = G(0) = \frac{1}{2}$. Substituting this back to (5) yields

$$C'(\mu_i) = (W_1 - W_2)g(0). \quad (6)$$

Equation (6) implies that the marginal cost of effort depends positively on the spread between winning and losing. As marginal cost equals to marginal returns, this means the individual decision to choose the level of effort depends positively on this spread. As the difference between winning and losing increases, the incentive to put forth more effort to increase one's probability of winning increases. This collectively will induce the higher productivity for the firm and increases firm's performance.

2.2 Rank-Order Tournament Theory

Note here that Lazear and Rosen (1981) assumed a simple winning vs. losing two-player model. However, the model can be extended to include multiple players, or multiple levels. In fact, Rosen (1986) extended the question to include multiple stages in the form of an elimination tournament. With quite a similar set-up as section 2.1, assume the tournament begins with 2^N players and proceeds sequentially through N stages. Each stage consists of matches between two players, where the winners proceed to the next round while the losers are eliminated from the tournament. The top prize W_1 is awarded to the winner of the tournament, the player coming in first place and having won all N matches, while W_2 is awarded to the player coming in second place and having won $N-1$ matches, W_3 is awarded to the both players coming in third place and having won $N-2$ matches, and so on. In general, W_s is awarded to the player(s) coming in s^{th} place, who have won $N-(s-1)$

matches. In other words, these players are eliminated in a match where there are $s-1$ stages remain in the tournament.

Define the interrank spread $\Delta W_s = W_s - W_{s+1}$. In our terminology, ΔW_s is the first difference. For the purpose of this paper, we will not dwell into details of the technical steps. Additionally, we will assume that all contestants are risk averse and equally talented. Rosen argues out that the value of winning at any stage includes not only the winner's prize at that stage but also the value of the prospect of further prizes in subsequent stages. For example, in a 10-stage competition, the value of winning at stage 1, i.e., being able to move to stage 2, includes the prizes W_{10} as well as the value of the opportunity to advance to the next 8 stages. Accordingly, the value of winning at stage 6, i.e., being able to move to stage 7, includes the prizes W_5 along with the value of the opportunity to advance to the next 3 stages. In his paper, Rosen (1986) shows that to maintain incentives throughout the tournament, not only do we need $\Delta W_s > 0$ for all s, i.e., there is a positive difference between the prizes of each rank, consistent with the results in section 2.1, but also the following:

- In all stages prior to the finals, $U(W_{s+1}) - U(W_{s+2})$ is constant. In this equation, $U(W_\bullet) - \sum_s C(x_s)$ determines the players' preferences, where $C(\bullet)$ is defined as section 2.1, being the cost of effort in any match, and $U(W_\bullet)$ is an increasing utility function. Then, if players are risk averse ($U''(W) < 0$), then we need ΔW_s strictly increases. In other words, we need strictly increasing interrank spreads, or strictly increasing first difference in our terminology.

- In the final stage, the incentive-maintaining prize structure requires a particularly large increment between the first and the second place, i.e., $\Delta W_1 > \Delta W_s$ for all $s \neq 1$.

These conditions highlight the fact that the advancement opportunity, or the deferred benefit, shrinks as a player wins more matches and moves into successive stages. Thus, with the decreasing prospect of future gains, the interrank spreads must increase to "fill-in" the gap and maintain the same level of incentives and enthusiasm. As for the last level, the increment must be larger as there is no deferred benefits anymore so the final-round spread has to make up for all the earlier option values of achieving possible higher ranks.

Chapter 3

Literature Review

We think of employees in a firm as competing in a sequential tournament where the winner gets promoted to the next level and start a new competition for the following level (Lazear & Rosen, 1981). The rewards to the winners are the pay raise associated with the promotion. Both the rewards and the probability of winning affect an employee's incentives to put in more effort to advance to the next level. Therefore, following directly from the model in section 2.1 (Lazear & Rosen, 1981), as pay difference increases, the value of a promotion increases and an employee is rewarded more for winning. This encourages greater effort, which collectively increases the firm's performance. Therefore, the first prediction of tournament theory is that pay variation exerts a positive influence on workforce performance.

However, the story becomes more complicated when we involve more than two levels. For multilevel structures, solely based on the tournament theory theoretical model, Lazear and Rosen (1981) show that if pay differentials are the same among all the pairs of levels, then the levels do not increase the amount of effort an employee puts in. Nonetheless, following the results from the rank-order tournament theory (Rosen, 1986), the compensation structure should not be as simple as a positive pay difference, but that should have an increasing pay difference. In other words, the pay level should not simply increases, but should increase at an increasing rate. This creates a convex relationship between pay and the organizational level. Rosen (1986) also notes, as in section 2.2, that at the final, there is no potential of advancing anymore and hence, those who reach this stage should be awarded an extra prize. This implies a very large pay difference between the CEO and the Vice Presidents right below the CEO, as there is no potential ladder rung after CEO. As the pay difference gets larger, an employee must put in at least the same, if not more, effort to move up the ladder. Thus, the second prediction of the tournament theory is that there should be widening pay gaps along the corporate hierarchy and that this structure has an influence on the overall performance of the firm.

Testing the first prediction, the results are somewhat mixed. In sports settings, the relationship between pay variation and team performance is observed to be positive, consistent with the theory, in auto racing (Becker & Huselid, 1992) as well as in basketball (Frick et al., 2003). However, also looking into basketball, Katayama and Nuch (2011) find no statistically significant relationship between the two variables. More interestingly, in football and baseball, Frick et al. (2003) discover a negative relationship between pay variation and team performance. There is one common feature in these papers and some other papers under sports settings, which is measurable performance. For example, an individual auto racer's performance is measured by his order of finish and the relative speed of the race he participates in (Becker & Huselid, 1992), whereas in basketball and baseball, team's performance is measured based on scores and winning position (Frick et al., 2003).

It is clear that performance is not easily measurable under non-sports settings, and that is one of the reasons that the literature on tournament theory under organizational settings in business is more limited. Additionally, since the corporate structure might be more complex, consisting of multiple ladders, categorizing the levels and distinguishing the pay variation becomes more challenging. Thus, under organizational settings, most existing papers concern the only pay variation within executives. O'Reilly et al. (1988) and Leonard (1990) do not find a strong positive relationship between the size of CEO's compensation and corporate success. However, other papers discover a positive relationship between vertical pay differentials and firm's performance around the world. In the United States, Main et al. (1993) find a positive relationship, concluding that ever-larger prizes at the top of the hierarchy can motivate participants and thus, substantial compensation dispersion is observed. Reaching a similar conclusion, Eriksson (1999), Firth et al. (2010), and Liu et al. (2010) also find that the pay dispersion has a positive effect on firm's performance in Denmark, China, and Taiwan, respectively.

What about non-executives? As aforementioned, it is difficult to separate a complex company structure with multiple lateral positions into rungs of the corporate ladder, not many papers have worked with non-executive positions. That is one of the motivations in this paper. We look closely at the company's report structure and system to identify the levels and calculate the appropriate pay differences.

Concerning the second prediction of tournament theory and how this pay structure affects the firm's performance, the literature is much more narrow. Using the same dataset that contains the pay for the years 1980 – 1984 of the top executives in over two hundred publicly held corporations, O'Reilly et al. (1988), Leonard (1990), and Main et al. (1993) all confirm that pay differentials increase with hierarchical levels, consistent with the tournament theory. However, all three papers reach a conclusion that corporate success is not significantly related to the steepness of pay differences across executive ranks. Also looking at CEO and executives compensation, Lambert et al. (1993) also conclude that pay difference is an increasing function of the organizational hierarchy, and the spread between adjacent levels increases as one moves up the corporate ladder. Nonetheless, Lambert et al. (1993) do not look into the effects of this characteristic on the firm's performance. Using data on Danish executives, Eriksson (1999) also reaches the same conclusion of widening pay gaps through the organizational hierarchy. Likewise, Conyon, Peck, and Sadler (2001) analyze individual executives from 100 U.K. stock market companies and find a convex relationship between their pay and corporate levels. Taking one step further, they find that this pay variation does not have a significant impact on the company's performance.

Through this literature review, it becomes clear that there is a need for an empirical test of the tournament theory predictions on non-executive positions within the firm. Moreover, even though many papers have tested and shown that the first prediction, concerning the direct impacts of pay variation on firm's performance, holds true, not as many have examined the second prediction, concerning the shape of the pay and organizational-level relationship. Furthermore, only a very few looked into the influences of this shape on the firm's performance and of those who do, the results do not support the tournament theory implications. These are the motivations behind this paper. Understanding the lack of an empirical study that addresses the previous concerns, this paper looks at the second prediction and its corollary within non-executive positions in the retail industry.

We present two hypotheses in this paper.

- **Hypothesis 1 (H1).** There is a *convex* relationship between pay level and position level in the retail industry. This means that pay level increases at an *increasing* rate as one moves up the corporate ladder.

- **Hypothesis 2 (H2).**

  - **H2a** Having this compensation structure, i.e., the strictly convex relationship between pay level and position level, has an influence on the firm's performance.

  - **H2b** The convexity of the relationship between pay level and position level has a positive influence on the firm's performance.

Chapter 4

Description of Data

In this empirical paper, we use the data from the Specialty Store Wage and Benefit Survey provided by the National Retail Federation (NRF). This panel dataset contains aggregated information on the number of employees and their average annual salary in each hierarchical level, totaling 46 positions, of 71 large national retail chains for the years 1996-1999. It is an unbalanced panel, with 62 companies in 1996, 59 companies in 1997, and 64 companies in 1998. The fact that data are collected for each and all positions in the firm is useful for our analysis. For each position, the survey reports the annual salary and number of employees, as well as the average number of people report to this position and the position to which this position reports. This feature of the survey helps us identify and recreate the corporate hierarchy from the available positions, thereby calculating the second difference between the pay levels. The companies in the sample are in a wide range of merchandise categories, ranging from clothing to footwear, accessories, gifts, general household, and others. Even though this dataset does not contain all possible retail companies of all possible merchandise, it represents a rather more representative sample.

The data are collected by a Human Resources Consulting Firm, which puts in great efforts to collect high-quality data. For example, it uses a number of methods and techniques to understand a firm's blank entry's meaning. It also provides a help line to clarify any item on the survey as well as specific instructions about what to do instead of filling in "N/A" or a leaving a question blank to ensure clarity of response. Firms that participate in the survey and report data receive a considerable discount on the purchase of the aggregated results, which help them understand the current trend in compensation structure in the market. This creates incentives for firms to participate and provide accurate information. Thus, non-response and selection biases are somewhat mitigated although avoided, given the fact that data is not collected from every existing firm in every year.

Each observation is the average annual total pay for a position in a particular firm. The survey also asks for annual base salary and bonus, in terms of dollars and/or percentage, for each position, but for the purpose of this paper, we focus on the total pay, which is the sum of base salary and bonus. Tables 4.1, 4.2, and 4.3 present the descriptive summary statistics (in dollars) of the 7 positions in the Store Operations ladder, which this paper focuses on, for the year 1996, 1997, and 1998, respectively. The complete tables for all 46 positions and the corresponding summary of statistics can be found in Appendix A. These tables show the number of observations, mean, standard deviation, minimum, and maximum average total annual pay for each position.

Position	Obs	Mean	Std. Dev.	Min	Max
Store Operations					
Head of Stores	52	192,309	74,560	91,000	399,000
Zone Manager	9	153,656	61,232	78,593	259,000
Regional Manager	56	91,767	27,128	40,554	161,700
District Manager	58	52,914	12,133	34,800	93,500
Area Manager	19	34,083	7,040	25,292	50,580
Store Manager	58	29,716	7,041	17,641	53,122
Assistant Store Manager	58	19,592	4,799	10,656	33,720

Table 4.1: Store Operations Summary Statistics (1996)

Position	Obs	Mean	Std. Dev.	Min	Max
Store Operations					
Head of Stores	43	210,690	86,978	70,000	465,000
Zone Manager	10	150,257	74,283	88,000	295,000
Regional Manager	47	101,174	40,213	47,700	285,000
District Manager	53	53,701	10,564	30,223	81,500
Area Manager	19	36,215	6,905	23,382	54,276
Store Manager	54	30,177	6,493	18,422	47,676
Assistant Store Manager (hourly)	55	9.67	2.42	5.44	16.58
Assistant Store Manager (annually)	55	20,118	5,031	11,315	34,486

Table 4.2: Store Operations Summary Statistics (1997)

Position	Obs	Mean	Std. Dev.	Min	Max
Store Operations					
Head of Stores	44	232,578	92,089	117,000	599,500
Zone Manager	9	175,228	77,286	81,420	296,865
Regional Manager	52	108,643	30,487	58,968	217,800
District Manager	58	58,565	11,768	39,266	86,631
Area Manager	16	40,169	10,342	26,700	57,931
Store Manager	59	32,717	6,930	19,150	48,336
Assistant Store Manager (hourly)	57	10.51	2.51	6.10	17.38
Assistant Store Manager (annually)	57	21,851	5,227	12,688	36,150

Table 4.3: Store Operations Summary Statistics (1998)

We would like to note that while the Assistant Store Manager figures in 1996 are annual pay, they are reported as hourly pay in 1997 and 1998. We annualized these figures by multiplying with 2,080, the average number of hours an Assistant Store Manager works, as reported in the survey. Comparing the figures across the three years, we see that the pay levels for each position are quite similar with a slight increase from year to year.

Apart from the average annual total pay for each position in a company, the data also include total annual sales volume, the number of stores for all divisions, and the number of employees for that company, all of which will be included in our analysis. Table 4.4 summarizes the number of observations, mean, standard deviation, minimum, and maximum total annual sales volume (in thousand dollars), the number of stores, and the number of employees for all companies in the dataset across 3 years. "NR" stands for Not Reported. This information gives us a general overview of the companies that are in the dataset. We see that the standard deviations in total sales volume, number of stores, and number of employees are all large, meaning that there is a wide range of companies in the dataset.

Variable	Year	Obs	Mean	Std. Dev.	Min	Max
Total sales volume	1996	50	737,642	871,559	61,108	5,085,599
(in thousand dollars)	1997	59	810,417	1,322,463	46,000	8,000,000
	1998	64	771,099	967,811	49,000	6,500,000
Number of stores	1996	66	711	768	62	4,300
	1997	59	694	825	39	4,236
	1998	64	763	860	42	4,473
Number of employees	1996	NR	NR	NR	NR	NR
	1997	59	7,658	10,746	618	60,000
	1998	64	8,089	10,703	523	81,000

Table 4.4: Dependent Variables Summary Statistics

Chapter 5

Methodology

Even though our dataset contains data across 3 years (1996-1998), we treat this as 3 separate pure cross-sectional datasets. In other words, each of the analyses mentioned hereafter is done for each of the year.

5.1 First steps

In order to fully understand and measure the impacts of second pay difference on the firm's performance, we have to acknowledge and understand each company's distinctive structure. By analyzing the dataset, we create a general company structure for most of the companies in our dataset (Figure 5.1). Not all of the companies present in our dataset have this exact structure – some have missing positions and some have missing ladders. However, this provides an overview of the company structure in the retail industry and helps us shape our approach.

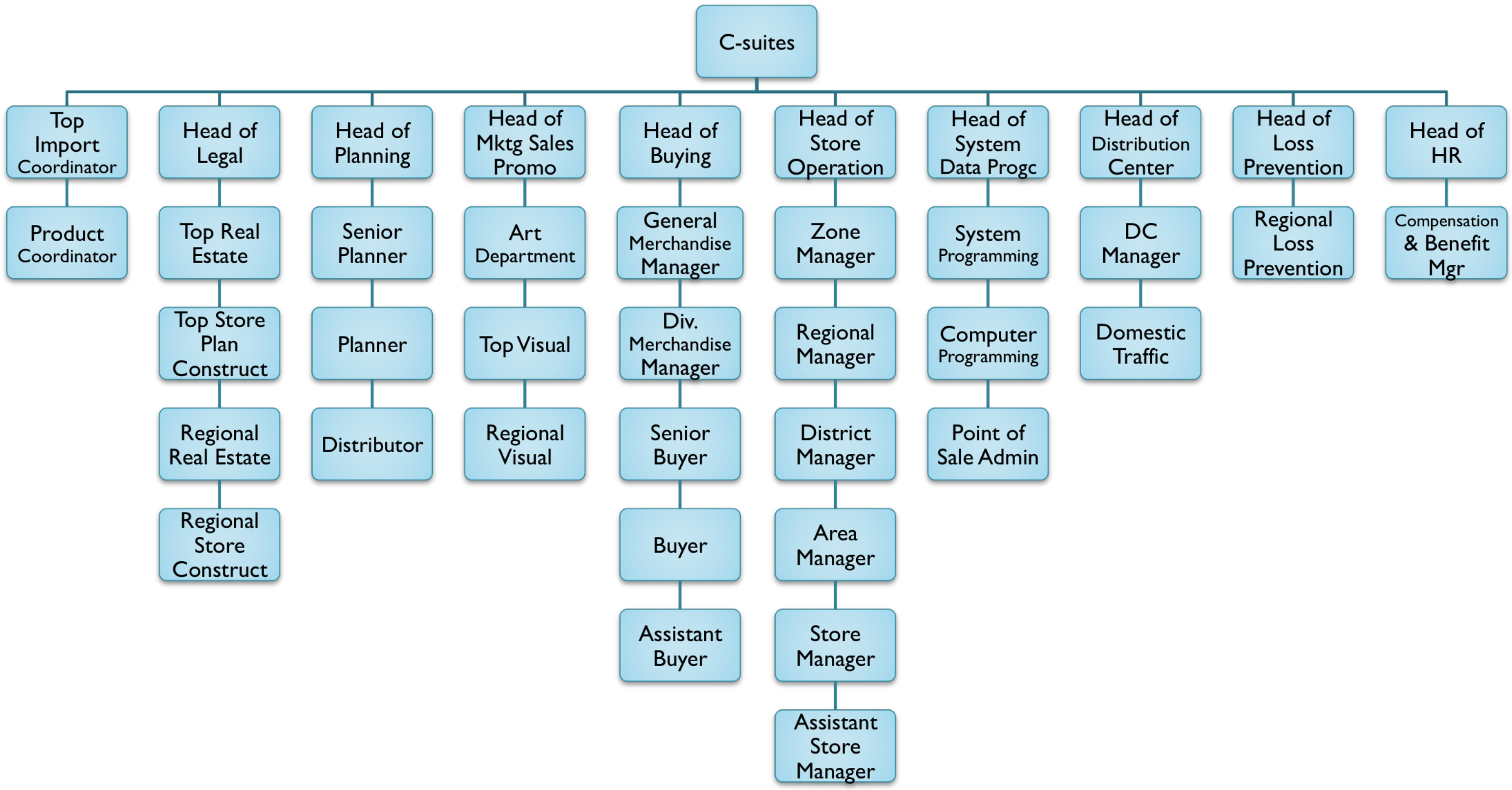

Figure 5.1: General Organization Structure

From Figure 5.1, it is evident that Store Operations is the longest ladder so we will focus on this ladder. Furthermore, in order to preserve the relatively accurate fit for the convexity of the relationship between corporate ladder and pay level, we will exclude C-suite positions (CEO, CFO, COO, etc.) from our analysis. As aforementioned, the pay difference between CEO and the position right below CEO is predicted by the theory to be particularly big. Therefore, the second difference relating to this gap will also be predominantly large and including this gap would skew the second differences average and introduce more error into our model. Also - and perhaps more importantly - there appears to be a different theory behind the C-suite pay levels.

For each company, we construct the corporate hierarchy, focusing on the Store Operations ladder and obtain the pay level figure. Then, we categorize each firm in our dataset into different subgroups characterized by the structure of that firm's corporate ladder. This is to preserve the accuracy of the pay gaps. Table 5.1 summarizes some of the most well-represented subgroups. The comprehensive table of all subgroups can be found in Appendix B. When pay level for a position in a company is not reported, i.e, there is a missing data point for that position in the ladder, we treat it as if that position is not present in the company's corporate ladder. For example, in 1996, Brookstone reported figures for all positions except Zone Manager. Therefore, in our assumption, there is no Zone Manager in Brookstone's ladder - corresponding to *Type 1* in table 5.1.

Ladder Types	1996	1997	1998
All positions	3	2	1
Missing Zone Mgr *(Type 1)*	14	10	11
Missing Area Mgr	4	4	4
Missing Zone Mgr and Area Mgr *(Type 2)*	27	19	20
Missing Head of Stores, Zone Mgr, and Area Mgr	5	7	10
None of the positions	3	4	3

Table 5.1: Number of companies categorized by ladder types (well-represented)

From table 5.1, Missing Zone Manager (*Type 1*) and Missing Zone Manager and Area Manager (*Type 2*) are the two most well-represented types across all three years. We focus on these two types.

To aid in visualizing and understanding our data, figure 5.2 and 5.3 plot the pay level with respect to the organizational level for *Type 1* and *Type 2*, respectively.

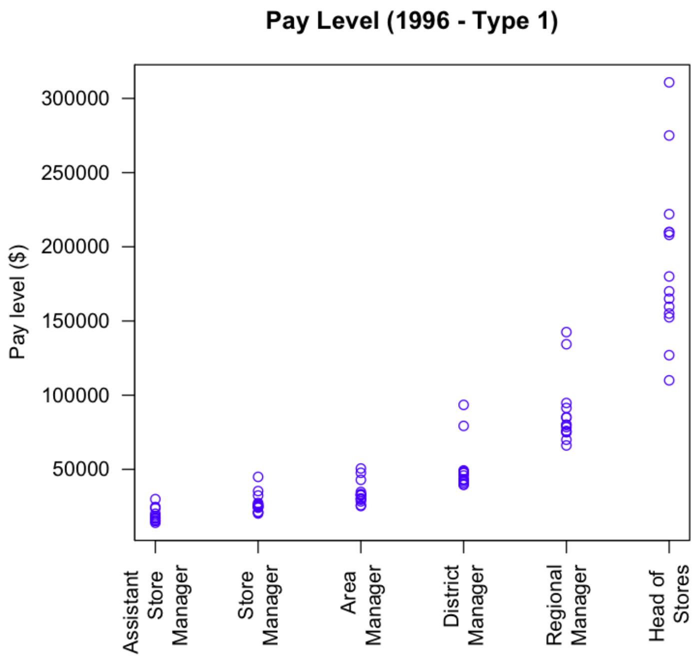

Figure 5.2: Pay Level (1996 - *Type 1*)

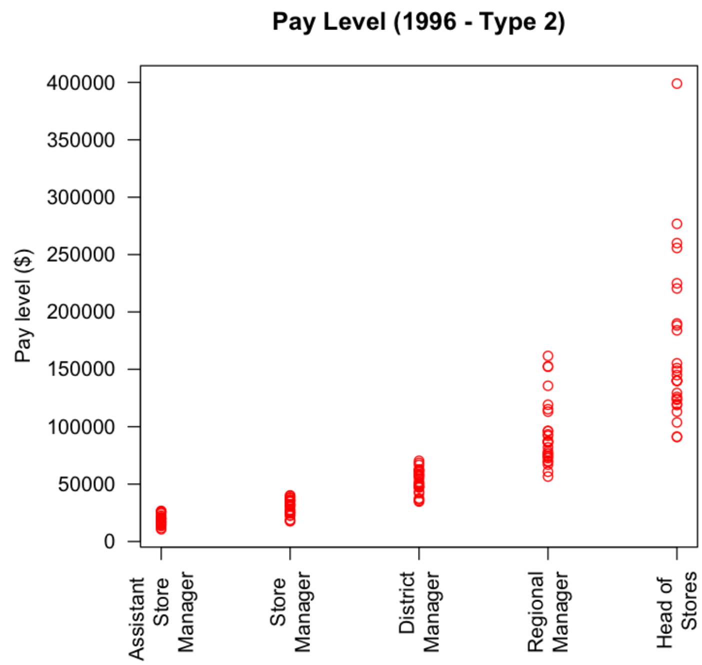

Figure 5.3: Pay Level (1996 - *Type 2*)

We see that, in both groups of *Type 1* and *Type 2*, there is a positive correlation between pay level and organizational level. Indeed, there seem to be a quadratic relationship instead of a linear relationship between these two, in accordance with the theory. However, we also note that the spread between data points increases towards the higher rung in the corporate ladder, showing increasing dispersion, something not anticipated by the theory.

Figure 5.4 combines and further summarizes the information in figures 5.2 and 5.3. The colors correspond to those of figure 5.2 and 5.3, with each position in each type represented by a boxplot, showing the minimum, maximum, average, and quartiles of the pay level.

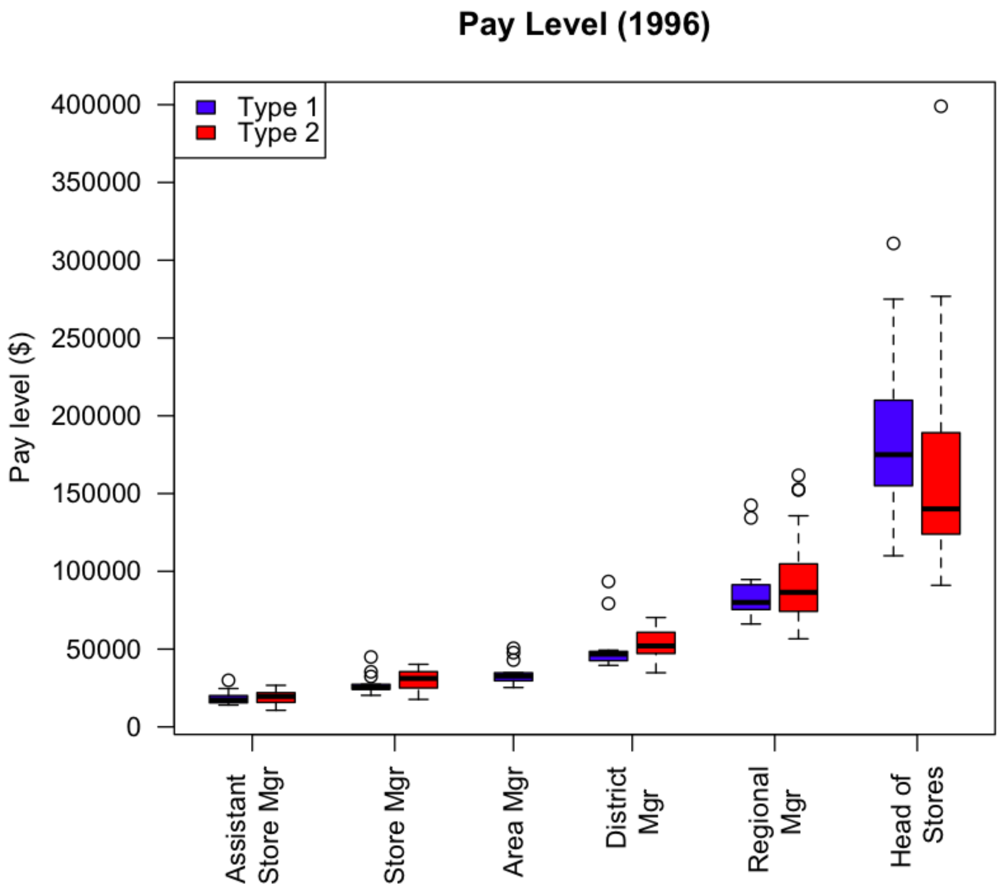

Figure 5.4: Summaries of Pay Level (1996)

Looking at the average level (the dark bar in each blue and red box) of each type, we see a general convex relationship between the position level and pay level, or that pay level increases at an increasing rate along the corporate hierarchy, giving the grounds for our first hypothesis. Figures for 1997 and 1998 illustrate a similar trend and can be found in Appendix C.

After obtaining the organizational structure and corporate ladder for each of the companies, we calculate the first pay differences between these levels. Since we interpret missing data as a structural feature of these firms, in *Type 1*'s ladder, we drop the Zone Manager rung, and in *Type 2*'s ladder, we drop both the Zone Manager rung and the Area Manager rung. Therefore, while *Type 1* has five first differences, *Type 2* only has four first differences. Table 5.2 summarizes *Type 1*'s first differences across all three years (1996-1998).

1996					
Position Gap	Obs	Mean	Std. Dev.	Min	Max
Assistant Store Manager to Store Manager	14	8,411	3,286	814	14,991
Store Manager to Area Manager	14	7,006	2,855	641	12,317
Area Manager to District Manager	14	16,598	10,320	4,657	45,750
District Manager to Regional Manager	14	37,446	20,431	-4,304	91,813
Regional Manager to Head of Stores	14	101,470	59,028	25,247	216,067

1997					
Position Gap	Obs	Mean	Std. Dev.	Min	Max
Assistant Store Manager to Store Manager	10	8,787	5,086	-3,104	16,612
Store Manager to Area Manager	10	7,453	5,564	-2,600	17,678
Area Manager to District Manager	10	15,431	5,608	8,427	27,053
District Manager to Regional Manager	10	50,947	27,356	24,359	113,600
Regional Manager to Head of Stores	10	117,048	89,387	4,850	330,000

1998					
Position Gap	Obs	Mean	Std. Dev.	Min	Max
Assistant Store Manager to Store Manager	11	9,240	5,837	-1,362	23,553
Store Manager to Area Manager	11	10,706	5,502	4,747	18,900
Area Manager to District Manager	11	15,648	11,139	1,318	43,200
District Manager to Regional Manager	11	37,405	13,424	23,650	68,364
Regional Manager to Head of Stores	11	107,015	50,318	37,879	174,267

Table 5.2: First Difference Summary (*Type 1*)

Similar to table 5.2, table 5.3 summarizes *Type 2*'s first differences. From this table and table 5.2, we see a general increasing trend in first differences. Standard deviations are quite large, especially that of the last position gap (Regional Manager to Head of Stores). This might be due to the fact that the spread between datapoints for the Head of Stores position is quite large (as illustrated in figure 5.2 and 5.3).

1996					
Position Gap	Obs	Mean	Std. Dev.	Min	Max
Assistant Store Manager to Store Manager	27	10,748	3,883	5,350	20,571
Store Manager to District Manager	27	22,829	5,158	12,058	35,700
District Manager to Regional Manager	27	41,176	23,739	15,330	95,050
Regional Manager to Head of Stores	27	72,857	49,759	19,800	263,300

1997					
Position Gap	Obs	Mean	Std. Dev.	Min	Max
Assistant Store Manager to Store Manager	19	11,138	4,039	4,165	20,656
Store Manager to District Manager	19	23,455	7,411	8,743	44,199
District Manager to Regional Manager	19	55,368	49,110	17,477	232,447
Regional Manager to Head of Stores	19	85,621	70,492	-60,000	284,100

1998					
Position Gap	Obs	Mean	Std. Dev.	Min	Max
Assistant Store Manager to Store Manager	20	11,159	3,950	3,841	21,401
Store Manager to District Manager	20	25,113	6,546	14,551	44,302
District Manager to Regional Manager	20	50,084	28,381	0	138,800
Regional Manager to Head of Stores	20	103,220	47,817	25,150	173,950

Table 5.3: First Difference Summary (*Type 2*)

Comparing both types, similar to figure 5.4, figure 5.5 represents the summaries of the first differences, or the pay gaps, for 1996 through boxplots. Figures for 1997 and 1998 can be found in Appendix C. As seen in table 5.2 and 5.3, for both types, the first difference, or the spread between adjacent levels, increases along the corporate hierarchy. The first difference average and range of each position gap for both types are somewhat similar, except for those of the last position gap (Regional Manager to Head of Stores), where the average of *Type 1* is much higher and its spread is also wider. Interestingly, first difference of *Type 1* tends to increase at a higher rate than that of *Type 2*.

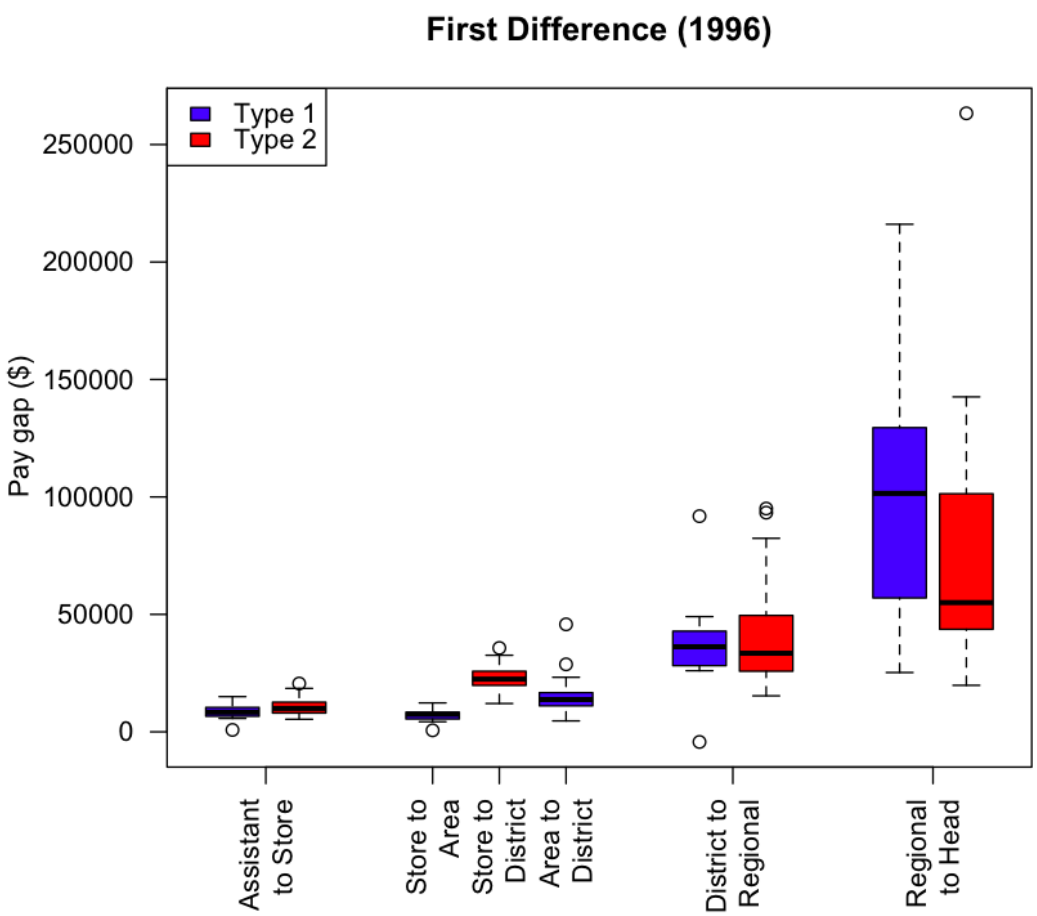

Figure 5.5: Summaries of First Pay Difference (1996)

Now in the final step, we calculate the difference between these first differences. These are the second differences between pay level that we are interested in. Table 5.4 summarizes the second differences for *Type 1* across all three years. In general, we see that the mean of second differences are greater than 0, except for the second position gap between Assistant Store Manager to Store Manager and Store Manager to Area Manager.

1996					
Second Position Gap	Obs	Mean	Std. Dev.	Min	Max
Assistant Store Manager to Store Manager VS. Store Manager to Area Manager	14	-1,405	3,954	-9,342	4,123
Store Manager to Area Manager VS. Area Manager to District Manager	14	9,591	10,328	-5,904	33,433
Area Manager to District Manager VS. District Manager to Regional Manager	14	20,848	22,883	-33,028	75,133
District Manager to Regional Manager VS. Regional Manager to Head of Stores	14	64,024	70,212	-66,566	204,304

1997					
Second Position Gap	Obs	Mean	Std. Dev.	Min	Max
Assistant Store Manager to Store Manager VS. Store Manager to Area Manager	10	-1,333	8,421	-19,212	10,451
Store Manager to Area Manager VS. Area Manager to District Manager	10	7,978	8,347	-3,840	20,100
Area Manager to District Manager VS. District Manager to Regional Manager	10	35,516	25,288	8,634	86,547
District Manager to Regional Manager VS. Regional Manager to Head of Stores	10	66,101	91,178	-108,750	244,360

1998					
Second Position Gap	Obs	Mean	Std. Dev.	Min	Max
Assistant Store Manager to Store Manager VS. Store Manager to Area Manager	11	1,466	7,198	-11,889	11,402
Store Manager to Area Manager VS. Area Manager to District Manager	11	4,942	14,197	-16,506	38,453
Area Manager to District Manager VS. District Manager to Regional Manager	11	21,757	18,239	-10,900	55,457
District Manager to Regional Manager VS. Regional Manager to Head of Stores	11	69,610	57,229	-30,485	147,615

Table 5.4: Second Difference Summary (*Type 1*)

Likewise, table 5.5 summarizes the second differences for *Type 2*. As aforementioned, *Type 2* has one less position level than *Type 1*, resulting in 4 second differences for *Type 1* but only 3 second differences for *Type 2*. Unlike *Type 1*, all of the averages second differences of *Type 2* are positive.

1996					
Second Position Gap	Obs	Mean	Std. Dev.	Min	Max
Assistant Store Manager to Store Manager VS. Store Manager to District Manager	27	12,081	5,383	1,857	23,500
Store Manager to District Manager VS. District Manager to Regional Manager	27	18,348	21,195	-11,615	69,150
District Manager to Regional Manager VS. Regional Manager to Head of Stores	27	31,680	41,282	-46,805	184,200

1997					
Second Position Gap	Obs	Mean	Std. Dev.	Min	Max
Assistant Store Manager to Store Manager VS. Store Manager to District Manager	19	12,317	8,360	-3,996	34,250
Store Manager to District Manager VS. District Manager to Regional Manager	19	31,913	46,706	-5,491	205,836
District Manager to Regional Manager VS. Regional Manager to Head of Stores	19	30,253	94,253	-292,447	232,100
1998					
Second Position Gap	Obs	Mean	Std. Dev.	Min	Max
Assistant Store Manager to Store Manager VS. Store Manager to District Manager	20	13,954	8,992	-5,154	34,301
Store Manager to District Manager VS. District Manager to Regional Manager	20	24,971	26,835	-16,247	108,136
District Manager to Regional Manager VS. Regional Manager to Head of Stores	20	53,136	53,013	-48,100	151,032

Table 5.5: Second Difference Summary (*Type 2*)

Visualizing the two types' second differences, figure 5.6 shows the summaries for the second differences for 1996. In accordance with what we see in table 5.4 and table 5.5, most second differences of both groups are positive. The spread for the last second position gap (District Manager to Regional Manager VS. Regional Manager to Head of Stores) is quite large. In analogous to first difference, we notice that the averages and ranges of second differences for two types match up relatively closely, except for the last second position gap (District Manager to Regional Manager VS. Regional Manager to Head of Stores). We also see that while *Type 1*'s second differences seem to increase, those of *Type 2* follow a flatter pattern. As aforementioned, figures for 1997 and 1998 can be found in Appendix C.

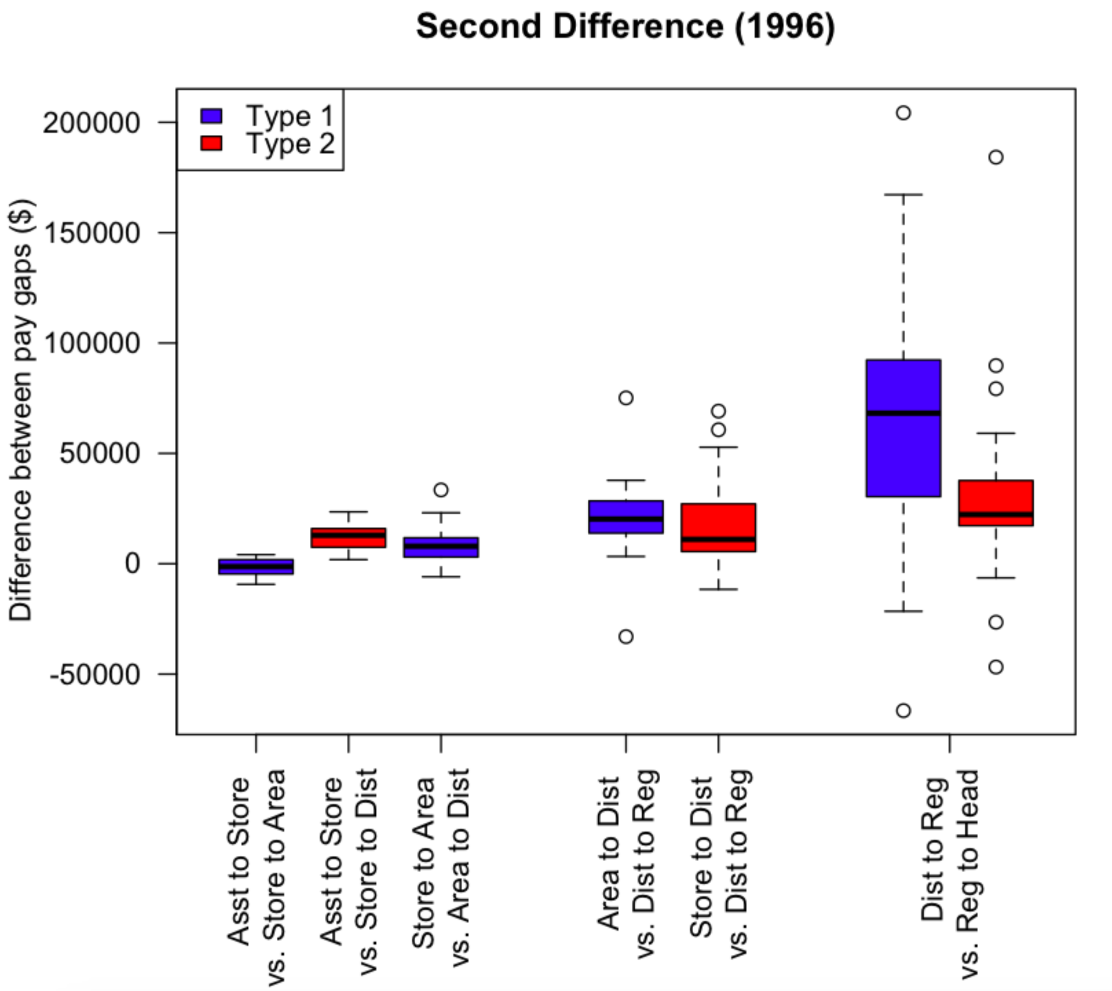

Figure 5.6: Summaries of Second Pay Difference (1996)

5.2 First hypothesis

In order to test **H1**, which proposes that there is a convex relationship between pay level and organizational level, we utilize two methods: (1) quadratic fit and (2) second difference t-test. The tournament theory predicts a convex relationship between the pay level and the positional level and therefore, we use a quadratic regression model, the simplest polynomial that can represent curvature through the quadratic term coefficient. Quadratic regression model is also appropriate, considering the shape of our data points as shown previously through figure 5.2 and 5.3. Another method that we use to test this hypothesis is the Student's t-test with second differences. We have the intuition that a convex function has a positive second derivative. However, in our analysis, the independent variable (position level) is discrete and not continuous. Therefore, the pay level as a function of position level is not differentiable. To account for this, we provide an analogy to the positive second derivative that a convex function with discrete independent variable has positive second pay differences.

5.2.1 Quadratic Fit

With the goal of testing the existence of a convex relationship between pay level and organizational level, we use the simple quadratic regression model, which takes the form:

$$PAY_i = \beta_0 + \beta_1 POSITION_i + \beta_2 POSITION_i{}^2 + \varepsilon_i, \quad (5.1)$$

where PAY is the pay level for each company and $POSITION$ is the corresponding rung in the hierarchical ladder, with Level 1 being the lowest organizational level, i.e., Assistant Store Manager, and Level 6 (or 5) being the highest organizational level for *Type 1* (or *Type 2*), i.e., Head of Stores.

As per our interest, we will evaluate the significance of our model as a whole, as well as β_1, and, in particular, β_2, as β_2 represents the convexity of the pay-organizational level relationship. We want to see whether β_2 is positive and statistically significant.

5.2.2 Second-Difference T-test

In addition to fitting a quadratic regression model, to test whether pay level increases at an increasing rate as one moves up the corporate ladder, we perform the t-test on each of the second differences of each type (four in *Type 1* and three in *Type 2*). For each of the second difference, our hypotheses for this t-test are as followed:

- Null hypothesis H_0: The second difference in the corporate ladder is less than or equal to 0, or $\Delta_\Delta \leq 0$
- Alternative hypothesis H_A: The second difference in the corporate ladder is greater than 0, or $\Delta_\Delta > 0$

5.3 Second hypothesis

5.3.1 H2a –Two-sample t-test

In the interest of testing whether having the strictly convex structure between the pay level and the position level has an influence on the firm's performance (**H2a**), we use two-sample t-test. We classify whether a company has this strictly convex structure, or not based the second differences of that company:

- If all of the company's second differences for a year are greater than 0, meaning that this company's compensation structure is *consistently convex*, then we regard it as *having* the strictly convex structure. In other words, this company belongs to the *Consistently Convex* group.
- On the contrary, if at least one of the company's second differences is less than 0 and at least one of its second differences is greater than 0, then we presume that this company belongs to the *Partially Convex* group.

- Finally, if all of the company's second differences are less than 0, then it belongs to the *Not Convex* group.

Consistent with theory, none of the companies in our dataset belongs to the *Not Convex* group in any of the observed years. Therefore, hereafter, we only consider *Consistently Convex* and *Partially Convex* groups.

To measure performance of a company, past papers have used return on equity, accounting profits, returns on assets, total shareholder returns, and Levinsohn-Petrin productivity measurement (O'Reilly et al., 1988; Eriksson, 1999; Conyon et al., 2001; Liu et al., 2010). Due to the availability and the restrictions of the provided data, we use the total annual sales volume as a measure of firm's performance or economic success.

As the two-sample t-test helps us evaluate and determine whether two distinct population means are equal, using this test help us clarify whether performance differs for those in *Consistently Convex* group versus those in *Partially Convex* group, thereby concluding whether having this convex compensation structure affects the firm's performance. We perform the two-sample t-test with the hypotheses:

- Null hypothesis H_0: Both groups have the same performance, i.e., there is no relationship between having a convex structure and performance. This means $\mu_A = \mu_B$, where μ_i is the average total annual sales volume of group i, with i being either *Consistently Convex* or *Partially Convex.*

- Alternative hypothesis H_A: The two groups have different performance, i.e., there is a relationship between having a convex structure and performance, or $\mu_A \neq \mu_B$.

We perform this two-sample t-test for companies within *Type 1*, within *Type 2*, and within the combined group of both *Type 1* and *Type 2*.

5.3.2 H2b – Errors-in-variable regression

Expanding on the convex structure of the the relationship between pay level and organizational level, **H2b** states that the convexity of this relationship has a positive influence on the firm's performance. To test this hypothesis, we need to characterizes companies by their convexity. With the same intuition as section 5.2.2, we assign each company's convexity as Γ_{2_i} where Γ_{2_i} is the coefficient for the second polynomial term in the following regression model for the appropriate i associated with the company

$$PAY_i = \Gamma_{0_i} + \Gamma_{1_i} POSITION_i + \boldsymbol{\Gamma_{2_i}} POSITION_i\,^2 + \varepsilon_i, \quad (5.2)$$

where PAY and $POSITION$ are defined similar to section 5.2.1.

After obtaining our regressors, we run the following simple regression model to test the effect of convexity on firm's performance. For a more robust regression, we also control for firm's size.

$$PERFORMANCE_i = \lambda_0 + \lambda_1 CONVEXITY_i + \lambda_2 [CONTROL\ VARIABLES]_i + \varepsilon_i, \quad (5.3)$$

where *PERFORMANCE* is the annual total sales volume, *CONVEXITY* is Γ_2 defined above, and *[CONTROL VARIABLES]* include number of stores and number of employees to control for firm's size, as done in some of the existing literature (O'Reilly et al., 1988; Finkelstein & Hambrick, 1988; Jensen & Murphy, 1990; Conyon et al., 2001).

Note that our regressor is obtained through another regression, there are noises that come with it but Ordinary Least Squares (OLS) regression assumes that the independent variable is measured without error; all error is assumed to be associated with the dependent variable. This assumption does not hold under this circumstance and therefore, an OLS estimate is not sufficient. The better approach is thus the errors-in-variable regression, which allows both the explanatory variable and the response variable to be measured with errors. The Maximum Likelihood Estimation (MLE) regression is used instead of an OLS regression to correct and control for this errors in our regressor. Given a dataset, an MLE regression model maximizes the likelihood, or the joint probability density, of seeing that data. The MLE regression model for in our particular case controls for the errors in the x-variable through the covariance matrix in the joint density function. Unfortunately, this model currently does not support controlling for other confounding variables, so the regression will only take the form:

$$PERFORMANCE_i = \Lambda_0 + \Lambda_1 CONVEXITY_i + \varepsilon_i. \quad (5.4)$$

Chapter 6

Results and Discussion

6.1 First hypothesis

6.1.1 Quadratic Fit

To test **H1**, which says that there is a convex relationship between pay level and position level, we fit a simple quadratic regression model (Equation 5.1).

Dependent variable = **Pay Level (*in dollars*)**						
	1996		1997		1998	
Variables of Interest	*Type 1*	*Type 2*	*Type 1*	*Type 2*	*Type 1*	*Type 2*
Position level (linear) (β_1)	**471,542**	**590,267**	**466,880**	**592,693**	**438,822**	**642,545**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Position level (quadratic)	**239,662**	**197,985**	**246,794**	**210,718**	**215,558**	**249,914**
(β_2)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted R-squared	0.816	0.716	0.721	0.685	0.848	0.813

Table 6.1: Quadratic Fit results

Table 6.1 presents the results across three years (1996-1998) for both *Type 1* and *Type 2*, with p-values in parentheses and the statistically significant values are in **bold**. From table 6.1, we see that the coefficients for the quadratic term (β_2's) for both types and across three years are all positive and statistically significant. Indeed, the p-values are all less than 0.001, implying that we are 99.9% confident that the coefficients are statistically different from 0. Additionally, the adjusted R-squared for all six regressions are at least 68.5%, representing a reasonably good fit. We know that if the coefficient for the quadratic term of a function is positive, then the function is convex. Therefore, since β_2 is positive and statistically significant, there is a convex relationship between pay level and organizational level. In other words, this supports our first hypothesis that pay level increases at an increasing rate (**H1**).

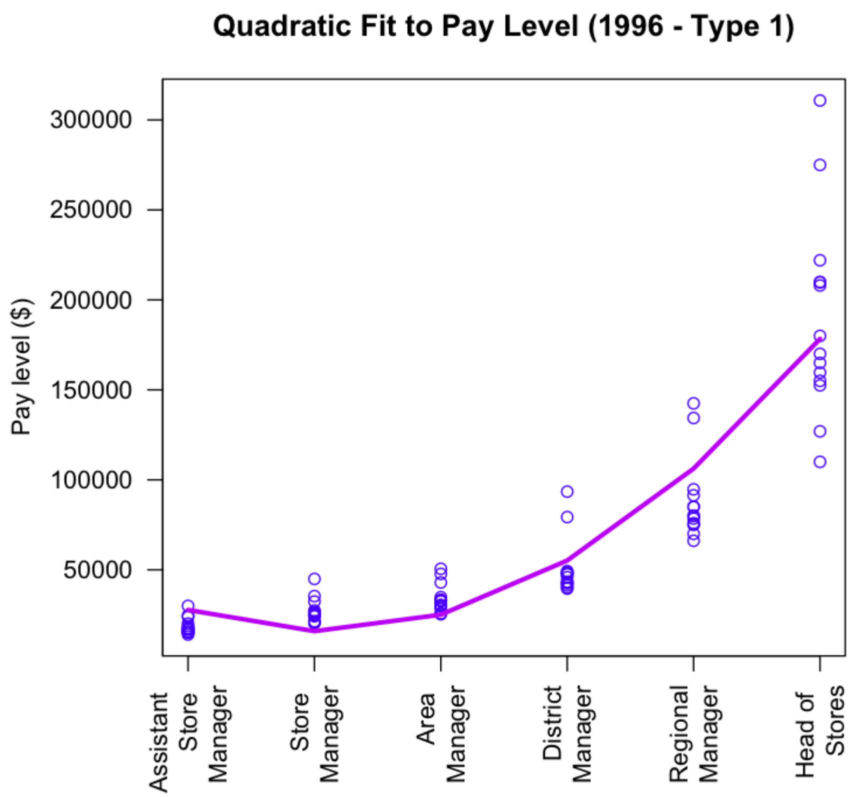

Figure 6.1: Quadratic Fit to Pay Level (1996 - *Type 1*)

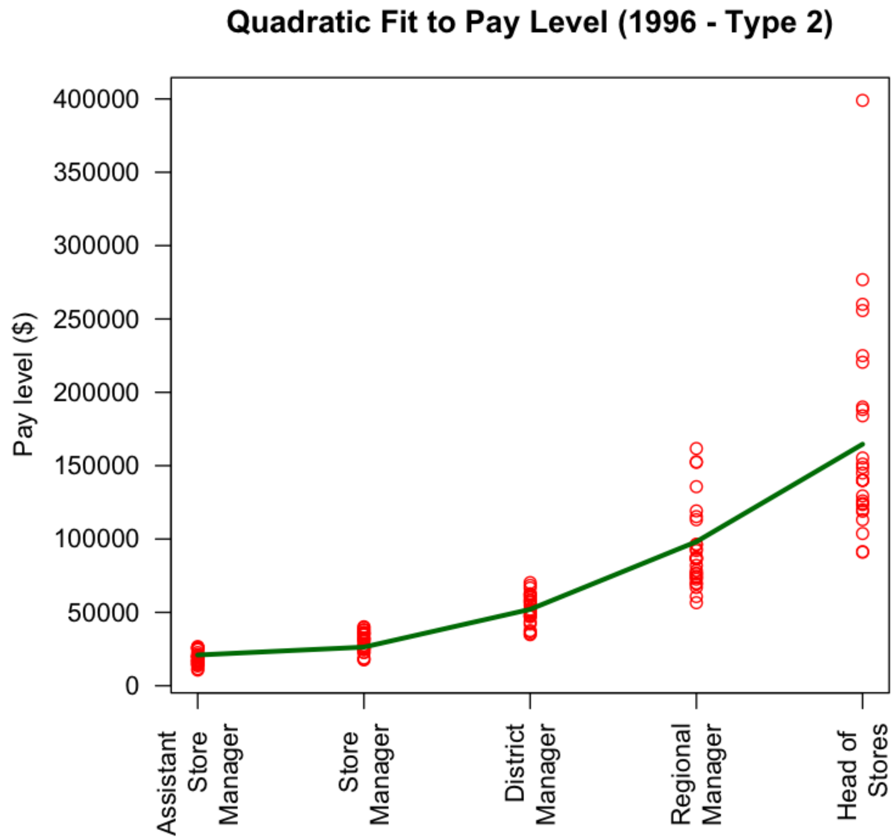

Figure 6.2: Quadratic Fit to Pay Level (1996 - *Type 2*)

To visualize the regression model, figure 6.1 and 6.2 plot the predicted and the actual pay levels for each position in the corporate hierarchy in 1996 for *Type 1* and *Type 2*. Looking at figure 6.1 and 6.2, we see that there is actually a convex relationship between pay level and position level. This means that as one moves along the corporate hierarchy, he faces a pay level which increases at an increasing rate. This is the similar results obtained by most of the past papers (O'Reilly et al., 1988; Leonard, 1990; Main et al., 1993; Lambert et al., 1993; Eriksson, 1999; Conyon et al., 2001). Figures for 1997 and 1998 demonstrate a similar trend, as supported by the regression results in table 6.1. These figures can be found in Appendix D.

6.1.2 Second-Difference T-test

In addition to fitting a quadratic regression model, we perform a t-test on each of the second differences in each group with the null hypothesis being that the second difference is less than or equal to 0. Table 6.2 presents the results of the t-tests for *Type 1*. The table shows the sample estimates, which are the averages of the second pay differences in each second position gap in each group, with p-values in parentheses and statistically significant figures in bold. Referring to figure 5.6, the sample estimates are the mean presented in the blue boxplots, corresponding to second position gaps in *Type 1*.

Second Position Gap	1996	1997	1998
Assistant Store Manager to Store Manager	-1,405	-1,333	1,466
VS. Store Manager to Area Manager	(0.897)	(0.686)	(0.257)
Store Manager to Area Manager VS.	**9,591**	**7,978**	4,942
Area Manager to District Manager	(0.002)	(0.007)	(0.138)
Area Manager to District Manager VS.	**20,848**	**35,516**	**21,757**
District Manager to Regional Manager	(0.002)	(0.001)	(0.001)
District Manager to Regional Manager VS.	**64,024**	**66,101**	**69,610**
Regional Manager to Head of Stores	(0.002)	(0.024)	(0.001)

Table 6.2: Second-Difference T-test results (*Type 1*)

Looking at *Type 1*, we see that most of the second differences means are positive, except the first second position gap (Assistant Store Manager to Store Manager VS. Store Manager to Area Manager) in 1996 and 1997. Besides that, this first second position gap appear to be the only second position gap whose the average second difference is not statistically significant across all three years, with p-values relatively high. This might be due to the fact that while all the salary figures for positions starting from Store Manager are reported under annual basis, Assistant Store Manager is reported under hourly basis and is annualized by multiplying with 2080 hours, the average annual hours worked. However, the situation may be that Assistant Store Manager in some companies work longer hours or shorter hours than others, resulting in an underestimate or an overestimate of the annual salary for this position.

Other than that, all the other second differences are positive and statistically significant at 1% with p-values less than 0.01, with an exception of the last second position gap (District Manager to Regional Manager VS. Regional Manager to Head of Stores) in 1997 being statistically significant at 5% and the second second position gap (Store Manager to Area Manager VS. Area Manager to District Manager) in 1998 being insignificant at 10%. This means that for most of the second position gaps, type I error is less than 1%. More specifically, we have less than 1% of making mistake when we reject the null hypothesis and conclude that the parameter, i.e., the second difference in this case, is statistically greater than 0. This provides evidence in support of our first hypothesis that pay level increases at an increasing rate as one climbs up the position ladder. Another interesting find in this table is that the mean second differences in *Type 1* also tend to increase as we proceed along the hierarchical ladder.

Second Position Gap	1996	1997	1998
Assistant Store Manager to Store Manager	**12,081**	**12,317**	**13,954**
VS. Store Manager to District Manager	(0.000)	(0.000)	(0.000)
Store Manager to District Manager VS.	**18,348**	**31,913**	**24,971**
District Manager to Regional Manager	(0.000)	(0.004)	(0.000)
District Manager to Regional Manager VS.	**31,680**	**30,253**	**53,136**
Regional Manager to Head of Stores	(0.000)	(0.089)	(0.000)

Table 6.3: Second-Difference T-test results (*Type 2*)

Related to table 6.2, table 6.3 present the results of the t-tests for *Type 2* across all three years. Table 6.3 shows the sample estimates, being the mean associated with the red boxplots in figure 5.6, corresponding to second position gaps in *Type 2*, with p-values in parentheses and statistically significant figures in bold.

From this table, we see that unlike *Type 1*, where some of the second differences are negative, all second differences in *Type 2* are positive. In addition, all second differences in *Type 2* are statistically significant at the 10% level. In fact, the only p-value that is greater than 0.005 is that of the last second position gap (District Manager to Regional Manager VS. Regional Manager to Head of Stores) in 1997. All the other p-values in table 6.3 are less than 0.005. This means that if our null hypothesis (the second difference is less than or equal to 0) is true, we only have less than 0.5% of collecting data as extreme or more extreme than what we have acquired here. Since this is very unlikely to happen, we reject the null hypothesis and conclude that there is a convex relationship between pay level and organizational level in both *Type 1* and *Type 2*. More specifically, pay level increases at an increasing rate as one moves along the corporate ladder. In other words, pay difference is an increasing function of the organizational hierarchy, meaning that the pay spread between adjacent levels widens when the position level increases. This conclusion is in alignment with the Rank-Order Tournament Theory. Moreover, though using different approaches, we reach the same conclusion as in past papers (O'Reilly et al., 1988; Leonard, 1990; Main et al., 1993; Lambert et al., 1993; Eriksson, 1999; Conyon et al., 2001).

6.2 Second hypothesis

6.2.1 H2a – Two-sample T-test

Considering the effects of this convex structure, where pay level increases at an increasing rate along the corporate hierarchy, we use the two-sample t-test to compare the performances (total annual sales volume) between two independent groups: *Partially Convex* and *Consis-*

tently Convex. The methods which we use to categorize whether a company has this convex compensation structure, i.e., falls into the *Consistently Convex* category, or not can be found in section 5.3.1.

As mentioned in section 5.3.1, we perform the two-sample t-test using either (1) only companies of *Type 1*, (2) only companies of *Type 2*, or (3) both companies of *Type 1* and companies of *Type 2*.

To better visualize and understand the two-sample t-test, figure 6.3 and 6.4 illustrate the boxplots of the sales volume in 1996 separated by structure for *Type 1* and *Type 2*, respectively. Figures for 1997 and 1998 can be found in Appendix D.

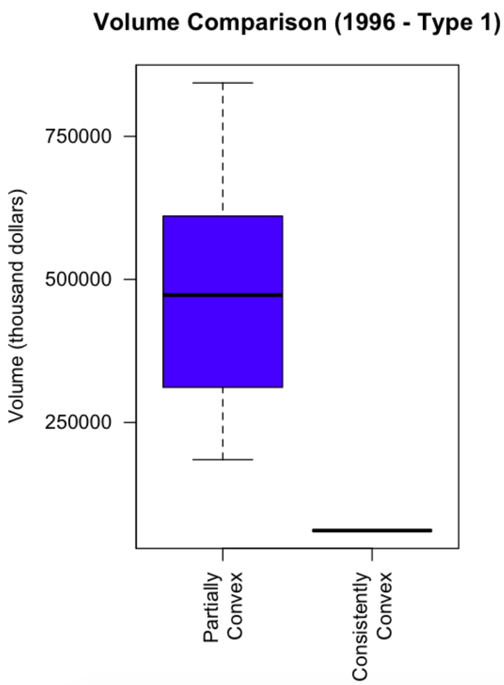

Figure 6.3: Sales Volume Comparison (1996 - *Type 1*)

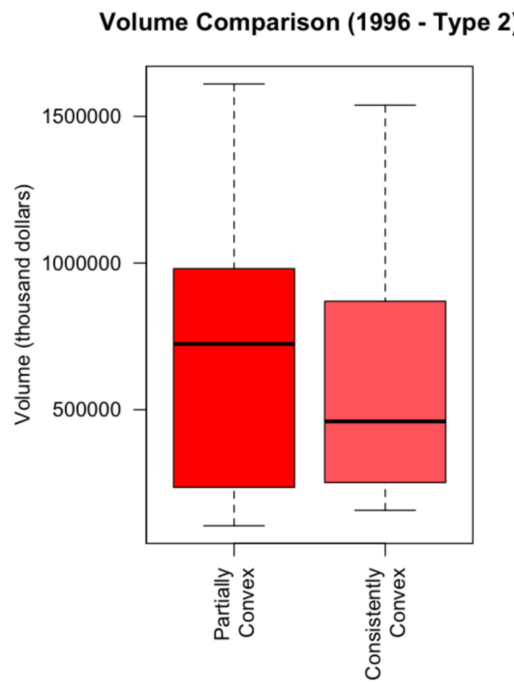

Figure 6.4: Sales Volume Comparison (1996 - *Type 2*)

From figure 6.3 and 6.4, we see the opposite of what we expected, the total annual sales volume for the group *Consistently Convex* is lower than the total annual sales volume for the group *Partially Convex*, implying that there is a negative correlation between performance, measured by total annual sales volume, and having this convex compensation structure, where pay difference depends positively on position level. However, the argument might be that the ranges and number of observations are not big enough. We notice that the *Consistently Convex* boxplot in *Type 1* has only one line, meaning that either there is only one observation, or that all companies in this category has the same total annual sales volume, which is very unlikely. In fact, as stated in table 6.4 later, there are only 2 companies that fall into this category, one of which has a missing value for total annual sales volume.

Combining companies of *Type 1* and *Type 2* together in one dataset, figure 6.5, 6.6, and 6.7 demonstrate the total annual sales volume comparison in 1996, 1997, and 1998, respectively.

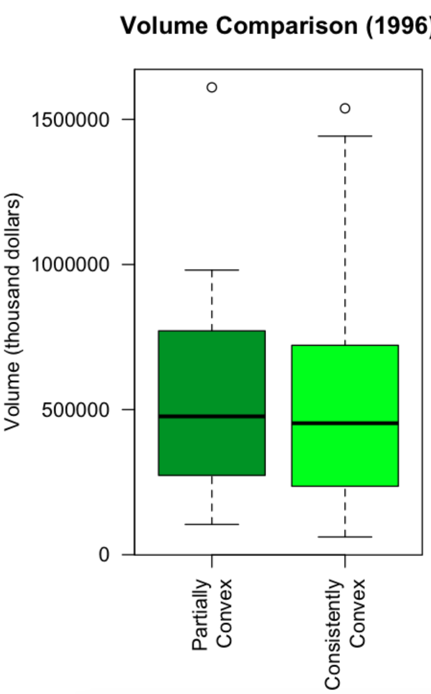

Figure 6.5: Sales Volume Comparison (1996)

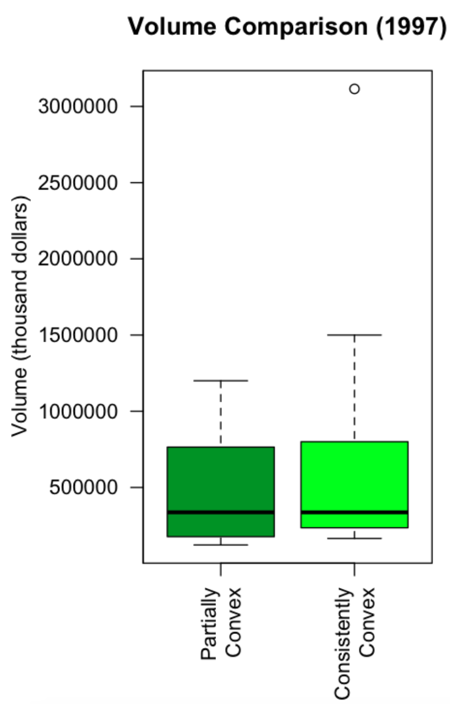

Figure 6.6: Sales Volume Comparison (1997)

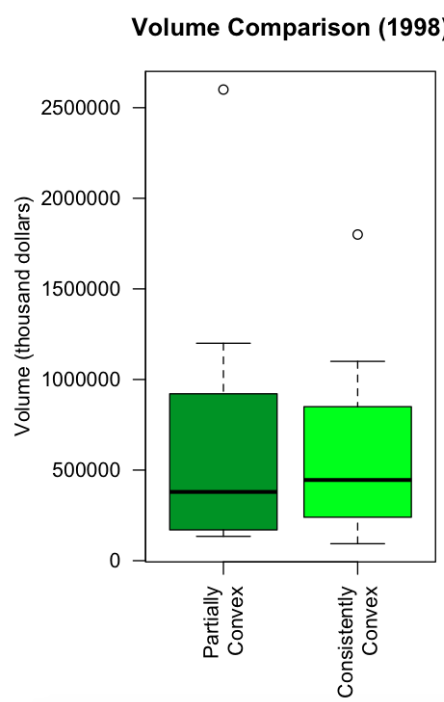

Figure 6.7: Sales Volume Comparison (1998)

From these three figures, it appears that while the total sales volumes in 1996 seem to be higher in the *Partially Convex* category when broken into two separated groups, the difference is negligible when looking at both groups at a whole. Indeed, across all three years, the average total sales volumes of both categories are somewhat similar and fluctuate around 500,000 thousand dollars, with some outliers. From these observations, we believe that a two-sample t-test is a reasonable next step to determine whether having this convex compensation structure affects firms' performance. Table 6.4 presents the results of these two-sample t-tests, with p-values in parentheses.

		1996		1997		1998	
		Obs	Mean	Obs	Mean	Obs	Mean
Type 1 (1)	Without Structure	12	495,861	8	510,125	9	343,311
	With Structure	2	61,108	2	327,950	2	317,750
	p-value		(0.105)		(0.479)		(0.924)
Type 2 (2)	Without Structure	8	730,941	4	439,725	5	1,119,240
	With Structure	19	585,918	15	686,273	15	614,673
	p-value		(0.565)		(0.554)		(0.106)
Combined (3)	Without Structure	20	574,221	12	486,658	14	620,429
	With Structure	21	555,047	17	644,118	17	579,741
	p-value		(0.899)		(0.498)		(0.841)

Table 6.4: Two-sample T-test results

Similar to what we expected from the boxplots, the t-test results turn out to be insignificant, with p-values relatively large. From table 6.4, only the tests performed in *Type 1* for 1996 and *Type 2* for 1998 have p-values close to 0.1. All other p-values are all greater than or close to 0.5, so we do not have enough evidence to reject the null hypothesis and conclude that there is a relationship between having the convex compensation structure and company's performance. In other words, we do not find empirical support for the prediction that the compensation structure, where pay differential depends on the organizational level, has a positive effect on firm's performance. Our findings match with some of the past works (O'Reilly et al., 1988; Leonard, 1990; Main et al., 1993).

In spite of this, we acknowledge some shortcomings in our analysis, which may have caused this insignificance. Due to data restrictions, we do not have a sufficient number of observations in each category, resulting in a greater standard error, which in turns result in a smaller t-statistics and a higher p-value. Looking at the two blocks that have p-values closer to 0.1, we note that the number of observations in two categories are unbalanced, implying that we do not have a robust and balanced estimate. Furthermore, we use total annual sales volume to measure performance, which may not fully reflect a firm's performance. Indeed, firm's performance may be measured in various ways, including but not limited to returns on equity, returns on assets, or productivity measurement indexes. The question of a better measurement for performance will be addressed in future works.

6.2.2 H2b – Errors-in variable regression

Expanding **H2a**, which looks into the effect of having a convex compensation structure on firm's performance, we also examine the effect of the convexity of the relationship between pay level and position level (**H2b**). Table 6.5 summarizes the regression results for each group (*Type 1* or *Type 2*) in each year (1996-1998). In this table, (1) is the simple linear regression of *Performance*, measured by total annual sales volume, on *Convexity*, represented by Γ_2, the quadratic coefficient in the polynomial regression of pay level on position level (Equation 5.2), and (2) controls for firm's size, measured by number of stores in 1996, and number of stores and number of employees in 1997 and 1998 (Equation 5.3). This table reports the coefficients, with the significant values in bold, adjusted R-squared, and p-values in parentheses.

Dependent variable = **Performance** = Total annual sales volume (*in thousands of dollars*)												
	1996				1997				1998			
Variables of interest	*Type 1*		*Type 2*		*Type 1*		*Type 2*		*Type 1*		*Type 2*	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Convexity	**7.87**	**5.11**	2.57	1.45	2.74	0.01	5.23	**4.07**	-0.33	0.69	-5.62	5.15
	(0.022)	(0.012)	(0.448)	(0.466)	(0.188)	(0.994)	(0.270)	(0.093)	(0.940)	(0.164)	(0.291)	(0.185)
Number of stores		**413.11**		**736.51**		**256.20**		543.66		**213.30**		**564.82**
		(0.001)		(0.000)		(0.072)		(0.197)		(0.026)		(0.082)
Number of employees						**35.99**		42.33		**48.47**		**53.73**
						(0.067)		(0.303)		(0.007)		(0.076)
Adjusted R-squared	0.401	0.836	(0.020)	0.650	0.106	0.915	0.017	0.784	(0.110)	0.990	0.010	0.685
p-value	(0.022)	(0.000)	(0.448)	(0.000)	(0.188)	(0.000)	(0.270)	(0.000)	(0.940)	(0.000)	(0.291)	(0.000)

Table 6.5: Linear Relationship between Convexity and Sales Volume

Out of the 12 regressions, concerning our variable of interest, i.e., *Convexity*, only the coefficients from the regressions in *Type 1* in 1996, both before controlling for firm's size (1) and after controlling for firm's size (2) are statistically significant at the 5% level, and *Type 2* in 1997 after controlling for firm's size (2) is statistically significant at the 10% level.

Looking at *Type 1* in 1996, (1) shows that an one unit increase in the level of convexity results in a 7.87 thousands of dollars increase in total annual sales volume. However, we see that once we control for firm's size, the value of this coefficient drop down to 5.11, meaning that an one unit increase in the level of convexity will only lead to a 5.11 thousands of dollars increase in total annual sales volume. This makes sense, since the higher number of stores a company has, the higher its sales volume should be, so number of stores is positively related to total annual sales volume. Note that in this model, the adjusted R-squared increases from 40.1% to 83.6% after controlling for the number of stores, suggesting that the "goodness-of-fit" increases. This indicates that should we had not controlled for firm's size, we would have overestimated the effect of convexity on firm's performance.

With an analogous argument, considering *Type 2* in 1997, controlling for firm's size significantly increases the adjusted R-squared, from 1.7% to 78.4%. Moreover, by controlling for firm's size, we find that convexity has a statistically significant effect on firm's performance, creating a 4.07 thousands of dollars increase in total annual sales volume with every one unit increase in convexity.

On the other hand, nine other regressions have p-values greater than 0.1 so we do not have enough evidence to conclude that the parameter is statistically different from 0. Even though we see a similar trend that adjusted R-squared increases once we control for the number of stores and number of employees, implying a better-fitted model, the convexity coefficient itself is statistically insignificant. Thus, we cannot infer much about the effects of convexity on firm's performance under these circumstances. In addition, an interesting find in table 6.5 is that in 1998, before controlling for firm's size, the effects of convexity on firm's performance for both *Type 1* and *Type 2* companies, though being insignificant, are negative. Nevertheless, after controlling for number of stores and number of employees, the coefficients switch signs.

In short, although we do have some evidences for a statistically significant relationship between convexity and firms' performance, in the majority of the analyses, we do not have enough empirical evidence supporting this relationship. Hence, in the interest of the big picture, we cannot conclude that convexity has an effect on firm's performance. At the same time, for the reasons previously mentioned, in future work, if we could collect more comprehensive data with a larger sample size, we may be able to identify the effects of convexity on firm's performance by either increasing the number of observations in each group or measuring performance differently.

As explained in section 5.3.2, using regular OLS regression does not control for the fact that our regressor, i.e., *Convexity* or Γ_2, is measured with errors. Therefore, we also use an Error-in-variables regression model, for which the results are presented in table 6.6, with standard errors in parentheses and significant figures in bold.

Dependent variable = **Performance** = Total annual sales volume (*in thousands of dollars*)						
	1996		1997		1998	
Variables of interest	*Type 1*	*Type 2*	*Type 1*	*Type 2*	*Type 1*	*Type 2*
Convexity	**17.01**	83.39	13.06	73.29	-493.22	-90.81
	(6.635)	(362.387)	(64.008)	(118.556)	(3,746.073)	(267.032)
Lower bound of 95% CI	4.00	-626.87	-112.39	-159.08	-7,835.39	-614.18
Upper bound of 95% CI	30.01	793.66	138.51	305.65	6,848.95	432.56

Table 6.6: Errors-in-variables Regression results

From table 6.6, we see that only one out of six analyses is statistically significant. More specifically, only the regression in *Type 1* in 1996 has a 95% confidence interval that does not include 0. The confidence interval in this analysis is (4, 30), suggesting that we are

95% confident that we have captured the true parameter with a (4, 30) interval and thus, the true parameter is statistically greater than 0. Intuitively, this makes sense, since in table 6.5, only this regression has a statistically significant coefficient before controlling for confounding variables like number of stores and number of employees, and controlling for x-variable errors through error-in-variables model should not greatly alter the significance of the coefficients. In particular, an unit increase in convexity will result in a 17.01 thousands of dollars increase in total annual sales volume. This also makes sense, since controlling for x-variable meaning that we are able to identify and take out part of what was considered standard errors, which should result in a steeper estimate. This is reflected in all other coefficients as well, even in 1998 where the coefficients in table 6.5 are negative. However, just as in the models before and after controlling for firm's size in table 6.5, we suspect that 17.01 might be an overestimation, with the reasons aforementioned.

Notwithstanding that the regression in *Type 1* in 1996 is significant, we have to acknowledge that the five remaining regressions are not, with 95% confidence intervals spanning over 0, from negative to positive. This implies that we fail to reject the hypothesis that these coefficients are not different from 0. Again, looking at the big picture, we do not have enough empirical evidence to conclude that there is a significant relationship between the firm's convexity and the firm's performance. Our results are similar to that of existing literature (O'Reilly et al., 1988; Leonard, 1990; Conyon et al., 2001). As aforementioned, a potential explanation for why we fail to identify this convexity or convex compensation structure's influence on firm's performance might be that we could not properly measure performance through total annual sales volume. Performance may or may not be better represented by return on assets, return on equity, growth, profit margin, etc. Additionally, small sample size also affects our ability to obtain a significant result. Above all, one drawback exists in this paper and perhaps past papers as well. That is, we have not controlled for all confounding variables that might affect performance and it is not easy to make the connection between one's effort and one's performance. All of these may be better addressed in future research.

Chapter 7

Conclusion

To recapitulate, we have considered the vertical wage gaps structure in the retail industry and tests the predictions set forth by the Rank-Order Tournament Theory. In alignment with the theory, we found empirical evidence supporting the prediction that there exists a convex relationship between pay level and organizational level. In theory, in order to preserve or increase the level of efforts an employee puts in, companies should follow a compensation structure in which the employee is rewarded based on his relative position in the corporate hierarchy. In particular, his pay level should increase at an increasing rate as he moves up the corporate ladder. We indeed see this structure in the retail industry. However, we found that firm's performance or corporate success was not statistically affected by either the presence of the compensation structure in the company or the degree of convexity in this compensation structure, in contrast to the predictions. In fact, we only found weak evidence that the degree of convexity of the relationship between position level and pay level has a positive effect on firms' performance. Nevertheless, there are rooms for improvements in our models. While we have controlled for firm's size and have taken steps to resolve the errors-in-variable problems, we may have not fully control for other confounding factors that might affect firm's performance. Additionally, further research could be done with a richer dataset with more observations and a wider range of measurements for performance.

Appendix A

Summary of Statistics

Table A.1, A.2, and A.3 list the all 46 positions and the corresponding descriptive summary of statistics for the year 1996, 1997, and 1998, respectively (in dollars). These tables show the number of observations, mean, standard deviation, minimum, and maximum total annual pay for each position. Note that for 1996, Selling Supervisor, Full Time Sales, and Part Time Sales staff, the figures are hourly. However, for 1997 and 1998, Assistant Store Manager, Selling Supervisor, Full Time Sales, and Part Time Sales staff, the figures are hourly.

Table A.1: All Positions Summary Statistics (1996)

Position	Obs	Mean	Std. Dev.	Min	Max
Central Administration					
Chief Executive Officer	45	553,039	327,008	190,375	2,114,100
Head of the Legal Department	27	169,942	89,691	58,000	375,000
Top Real Estate Executive	38	186,382	78,219	55,000	374,500
Regional Real Estate Executive	23	103,269	45,112	40,533	210,361
Head of Store Planning & Construction	39	102,472	36,877	57,000	230,000
Regional Store Construction Supervisor	28	56,632	16,438	26,800	106,000

Position	Obs	Mean	Std. Dev.	Min	Max
Financial					
Chief Financial Officer	47	244,755	98,860	90,000	575,000
Controller	42	127,519	64,112	54,500	360,000
Treasurer	19	142,051	48,402	76,500	230,000
Top Internal Auditor	17	88,528	50,069	30,000	211,800
Buying					
Head of Buying	50	235,369	95,794	82,552	475,000
Divisional Merchandise Manager	46	123,824	44,341	60,200	275,800
Senior Buyer	25	83,887	23,657	49,500	145,000
Buyer	56	63,669	16,028	30,008	104,200
Assistant Buyer	46	35,802	10,628	16,625	79,500
Head of Merchandise Planning	52	124,234	58,183	66,000	380,000
Senior Merchandise Planner	31	71,814	27,390	37,500	138,000
Merchandise Planner	50	50,698	15,700	28,000	95,854
Merchandise Distributor	46	31,546	7,825	17,392	56,100
Head of Imports	18	122,763	60,138	46,000	250,000
Production Coordinator	16	64,250	34,678	23,000	152,124
Marketing					
Head of Marketing/ Advertising/ Sales Promo	26	135,070	77,060	41,500	375,000
Art Department Head	23	66,603	26,920	26,708	135,000
Head of Visual Merchandising	49	77,978	44,247	30,000	240,000
Regional Visual Merchandiser	15	35,508	10,293	23,190	60,500

Position	Obs	Mean	Std. Dev.	Min	Max
Systems & Data Processing					
Head of Systems & Data Processing	41	169,058	78,343	75,000	470,000
Head of Systems/Programming	29	100,863	34,350	55,000	208,700
Head of Computer Operations	37	86,640	47,994	29,000	314,400
POS Administrator	33	47,408	16,072	24,500	99,600
Human Resources					
Head of Human Resources	47	170,852	91,191	49,800	410,000
Compensation & Benefits Manager	23	79,258	25,979	47,500	152,549
Loss Prevention					
Head of Loss Prevention	41	86,943	25,236	45,500	168,055
Regional Loss Prevention Manager	26	48,142	9,956	25,950	75,756
Distribution Centers					
Head of Distribution Centers	42	136,181	64,228	57,700	315,100
Distribution Center Manager	23	76,327	28,953	36,439	164,722
Domestic Traffic Manager	31	57,505	24,022	29,000	118,903
Store Operations					
Head of Stores	52	192,309	74,560	91,000	399,000
Zone Manager	9	153,656	61,232	78,593	259,000
Regional Manager	56	91,767	27,128	40,554	161,700
District Manager	58	52,914	12,133	34,800	93,500
Area Manager	19	34,083	7,040	25,292	50,580
Store Manager	58	29,716	7,041	17,641	53,122

Position	Obs	Mean	Std. Dev.	Min	Max
Assistant Store Manager	58	19,592	4,799	10,656	33,720
Third Key (Selling Supervisor)	35	7.57	1.78	5.22	13.92
Full Time Sales	55	7.30	2.06	4.73	18.47
Part Time Sales	57	5.66	0.87	4.25	8.48

Table A.1: All Positions Summary Statistics (1996)

Table A.2: All Positions Summary Statistics (1997)

Position	Obs	Mean	Std. Dev.	Min	Max
Central Administration					
Chief Executive Officer	44	670,749	536,102	204,000	3,250,000
Head of the Legal Department	31	206,861	114,366	68,547	515,000
Top Real Estate Executive	36	180,163	89,044	70,000	530,000
Regional Real Estate Executive	25	109,216	45,867	41,830	225,300
Head of Store Planning & Construction	33	115,605	50,638	46,000	280,000
Regional Store Construction Supervisor	24	58,836	21,633	32,500	123,000
Financial					
Chief Financial Officer	42	282,121	130,987	93,600	614,880
Controller	47	132,646	58,339	49,400	325,000
Treasurer	21	135,325	52,133	41,000	240,000
Top Internal Auditor	13	109,042	67,711	45,000	293,000
Buying					
Head of Buying	41	254,981	114,424	83,300	543,700
Divisional Merchandise Manager	39	135,035	41,877	63,204	259,956
Senior Buyer	18	86,577	29,273	58,711	185,525

Position	Obs	Mean	Std. Dev.	Min	Max
Buyer	50	65,959	17,461	31,700	105,759
Assistant Buyer	42	35,069	9,039	20,591	64,000
Head of Merchandise Planning	45	127,553	39,597	35,000	225,000
Senior Merchandise Planner	31	81,855	27,946	42,000	153,516
Merchandise Planner	38	47,959	12,164	30,600	80,095
Merchandise Distributor	39	31,535	7,372	18,300	57,602
Head of Imports	18	125,751	83,133	40,000	366,419
Production Coordinator	10	70,050	47,522	29,250	184,687
Marketing					
Head of Marketing/ Advertising/ Sales Promo	20	153,457	78,205	50,044	346,180
Art Department Head	24	62,786	30,184	28,400	187,500
Head of Visual Merchandising	39	84,081	41,811	26,000	251,526
Regional Visual Merchandiser	13	52,506	42,231	28,000	190,363
Systems & Data Processing					
Head of Systems & Data Processing	44	173,966	103,381	68,649	670,000
Head of Systems/Programming	37	106,190	45,240	61,000	283,000
Head of Computer Operations	38	88,734	61,157	38,400	413,000
POS Administrator	30	56,495	22,632	23,241	124,000
Human Resources					
Head of Human Resources	46	180,748	107,092	43,800	495,000
Compensation & Benefits Manager	20	80,124	28,063	41,000	153,700

Position	Obs	Mean	Std. Dev.	Min	Max
Loss Prevention					
Head of Loss Prevention	45	91,691	28,039	44,000	155,100
Regional Loss Prevention Manager	24	51,212	9,833	37,500	75,882
Distribution Centers					
Head of Distribution Centers	43	153,137	82,446	58,227	480,000
Distribution Center Manager	23	75,196	20,922	43,680	124,085
Domestic Traffic Manager	32	62,212	25,179	33,350	138,029
Store Operations					
Head of Stores	43	210,690	86,978	70,000	465,000
Zone Manager	10	150,257	74,283	88,000	295,000
Regional Manager	47	101,174	40,213	47,700	285,000
District Manager	53	53,701	10,564	30,223	81,500
Area Manager	19	36,215	6,905	23,382	54,276
Store Manager	54	30,177	6,493	18,422	47,676
Assistant Store Manager	55	9.67	2.42	5.44	16.58
Third Key (Selling Supervisor)	37	7.62	1.40	5.43	10.41
Full Time Sales	49	7.12	1.31	4.83	10.20
Part Time Sales	53	5.90	0.85	4.75	8.50

Table A.2: All Positions Summary Statistics (1997)

Table A.3: All Positions Summary Statistics (1998)					
Position	Obs	Mean	Std. Dev.	Min	Max
Central Administration					
Chief Executive Officer	44	673,036	571,757	168,750	3,584,850
Head of the Legal Department	26	226,963	122,161	93,725	485,000
Top Real Estate Executive	32	205,601	84,560	75,000	475,500
Regional Real Estate Executive	21	122,600	39,147	67,103	243,300
Head of Store Planning & Construction	27	145,202	54,565	53,000	295,000
Regional Store Construction Supervisor	23	66,199	16,324	44,500	109,500
Financial					
Chief Financial Officer	43	288,378	130,309	125,429	605,000
Controller	44	139,550	48,018	78,000	285,500
Treasurer	18	131,391	57,625	45,320	266,437
Top Internal Auditor	14	84,069	20,067	56,650	128,000
Buying					
Head of Buying (GMM)	38	296,466	141,496	106,600	814,436
Divisional Merchandise Manager (DMM)	46	149,138	52,594	67,845	323,100
Senior Buyer	28	89,641	26,988	43,233	189,052
Buyer	56	70,124	17,763	38,110	119,369
Assistant Buyer	49	39,559	9,368	23,510	63,800
Head of Merchandise Planning/Control	47	146,228	55,220	63,250	321,900
Senior Merchandise Planner/Controller	27	78,001	27,285	37,500	138,500
Merchandise Planner/Controller	46	50,972	10,671	33,495	79,300
Merchandise Distributor	48	32,641	8,348	18,866	59,973
Head of Imports	15	198,625	161,436	55,203	564,000
Production Coordinator	9	83,616	49,238	34,500	207,171

Position	Obs	Mean	Std. Dev.	Min	Max
Marketing					
Head of Marketing/ Advertising/ Sales Promo	26	173,851	90,514	53,845	392,490
Art Department Head	24	73,665	33,746	36,000	157,000
Head of Visual Merchandising	46	85,275	36,651	41,500	190,000
Regional Visual Merchandiser	17	45,198	10,600	31,666	68,000
Systems & Data Processing					
Head of Systems & Data Processing	40	179,275	81,961	84,876	499,200
Head of Systems/Programming	38	100,745	34,462	61,521	193,050
Head of Computer Operations	36	88,914	30,441	40,000	162,519
POS Administrator	26	57,083	22,813	22,239	125,580
Human Resources					
Head of Human Resources	46	174,818	83,389	62,000	520,000
Compensation & Benefits Manager	18	78,352	21,457	48,000	139,000
Loss Prevention					
Head of Loss Prevention	43	103,016	37,650	50,200	240,000
Regional Loss Prevention Manager	34	52,440	9,514	40,000	80,485
Distribution Centers					
Head of Distribution Centers	40	166,990	84,060	57,400	462,000
Distribution Center Manager	29	75,523	25,428	40,000	155,908
Domestic Traffic Manager	28	66,268	23,650	36,330	130,666

Position	Obs	Mean	Std. Dev.	Min	Max
Store Operations					
Head of Stores	44	232,578	92,089	117,000	599,500
Zone Manager	9	175,228	77,286	81,420	296,865
Regional Manager	52	108,643	30,487	58,968	217,800
District Manager	58	58,565	11,768	39,266	86,631
Area Manager	16	40,169	10,342	26,700	57,931
Store Manager	59	32,717	6,930	19,150	48,336
Assistant Store Manager	57	10.51	2.51	6.10	17.38
Third Key (Selling Supervisor)	36	8.00	1.36	5.79	10.72
Full Time Sales	49	8.12	2.56	5.75	23.72
Part Time Sales	56	6.29	0.83	5.25	9.53

Table A.3: All Positions Summary Statistics (1998)

Appendix B

Ladder Types

Table B.1 summarizes the number of companies in each ladder type.

Table C.1: Number of companies categorized by ladder types

Ladder Types	1996	1997	1998
All positions	3	2	1
Missing Zone Mgr	14	10	11
Missing Area Mgr	4	4	4
Missing Regional Mgr	0	1	1
Missing Zone Mgr and Area Mgr	27	19	20
Missing Zone Mgr and Regional Mgr	0	1	0
Missing Area Mgr and Regional Mgr	0	1	0
Missing Head of Stores and Zone Mgr	0	3	2
Missing Head of Stores and Area Mgr	1	1	2
Missing Head of Stores and District Mgr	1	1	0
Missing Head of Stores, Zone Mgr, and Area Mgr	5	7	10
Missing Head of Stores, Zone Mgr, and Regional Mgr	0	0	1
Missing Zone Mgr, Regional Mgr, and Area Mgr	3	2	1
Missing Zone Mgr, Area Mgr, and Store Mgr	0	1	0

Ladder Types	1996	1997	1998
Missing Zone Mgr, District Mgr, and Area Mgr	0	0	1
Missing Zone Mgr, Store Mgr, and Assistant Store	1	0	0
Missing Zone Mgr, Area Mgr, and Assistant Store	0	0	1
Missing Head of Stores, Zone Mgr, Regional Mgr, and Area Mgr	0	1	1
Missing Zone Mgr, Regional Mgr, District Mgr, and Area Mgr	0	1	0
Missing Regional Mgr, Area Mgr, Store Mgr, and Assistant Store	0	0	1
Missing Head of Stores, Zone Mgr, Regional Mgr, District Mgr, and Area Mgr	0	0	2
Missing Head of Stores, Zone Mgr, Regional Mgr, Area Mgr, and Assistant Store	0	0	1
Missing Zone Mgr, Regional Mgr, Area Mgr, Store Mgr, and Assistant Store	0	0	1
None of the positions	3	4	3
Total observations	62	59	64

Table B.1: Number of companies categorized by ladder types

Appendix C

Visual Summaries of Statistics

Figure C.1 and C.2 illustrate the pay level for each position level in the corporate hierarchy for 1997 and 1998, respectively. Similarly, figure C.3 and C.4 show the first pay difference between each pair of adjacent levels in the corporate hierarchy for 1997 and 1998, respectively. Finally, figure C.5 and C.6 demonstrate the second pay difference, i.e., the difference between the first pay difference, for each second position gap in the organizational ladder for 1997 and 1998, respectively. These boxplots show the average, the minimum, the maximum, the quartiles, and the outliers.

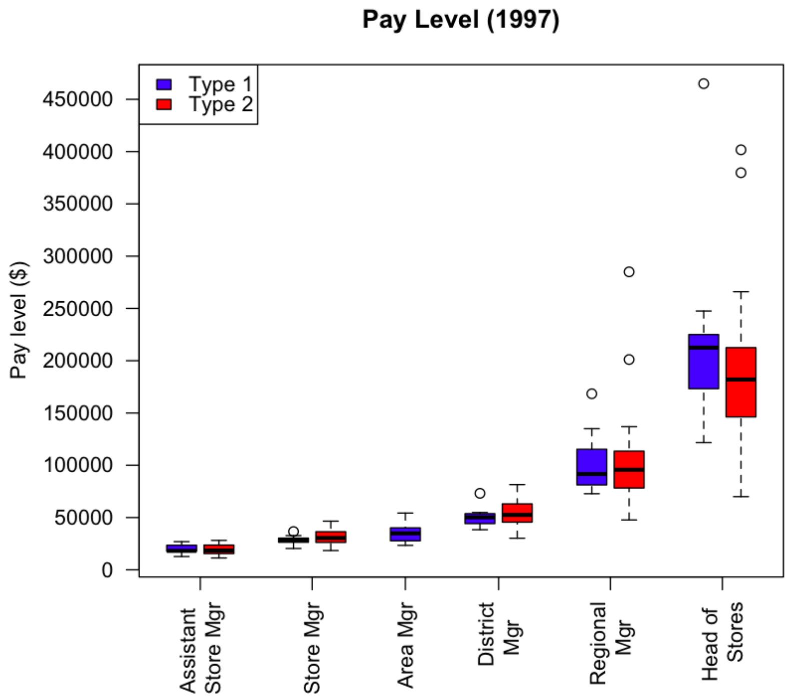

Figure C.1: Summaries of Pay Level (1997)

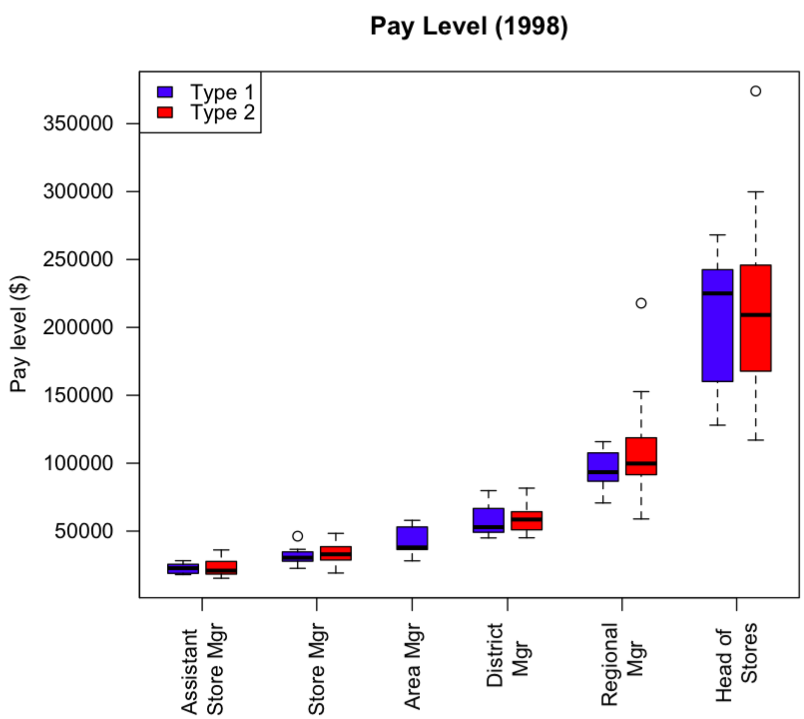

Figure C.2: Summaries of Pay Level (1998)

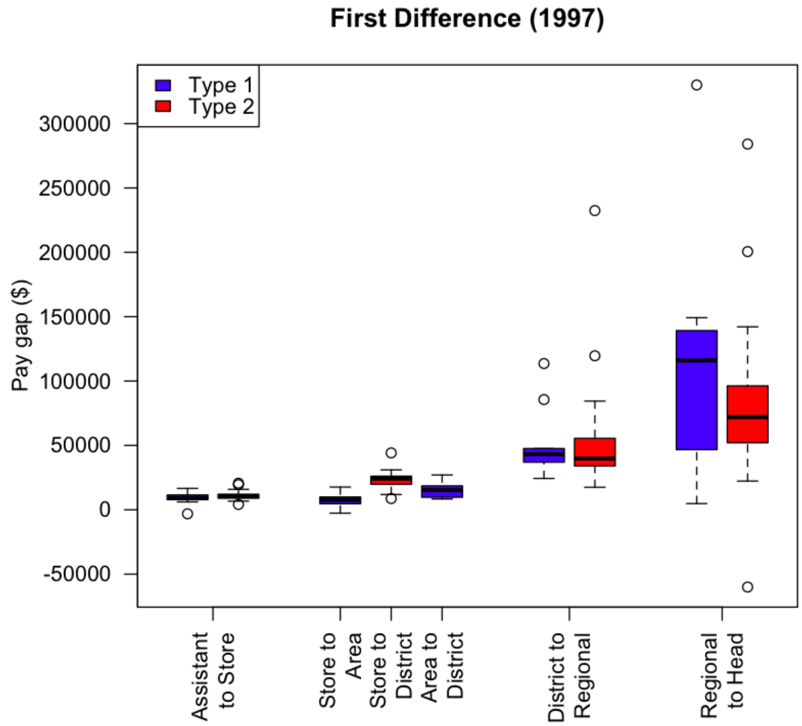

Figure C.3: Summaries of First Pay Difference (1997)

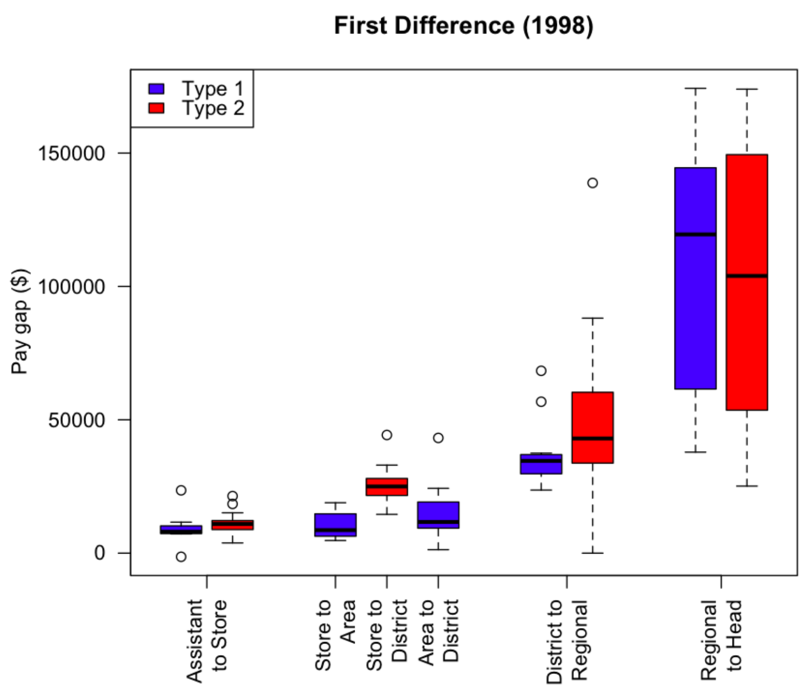

Figure C.4: Summaries of First Pay Difference (1998)

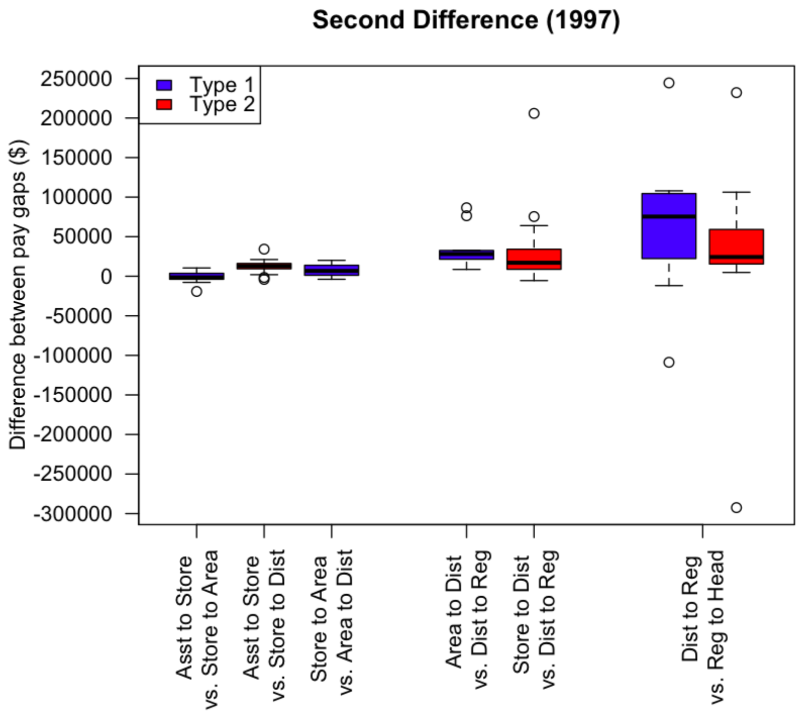

Figure C.5: Summaries of Second Pay Difference (1997)

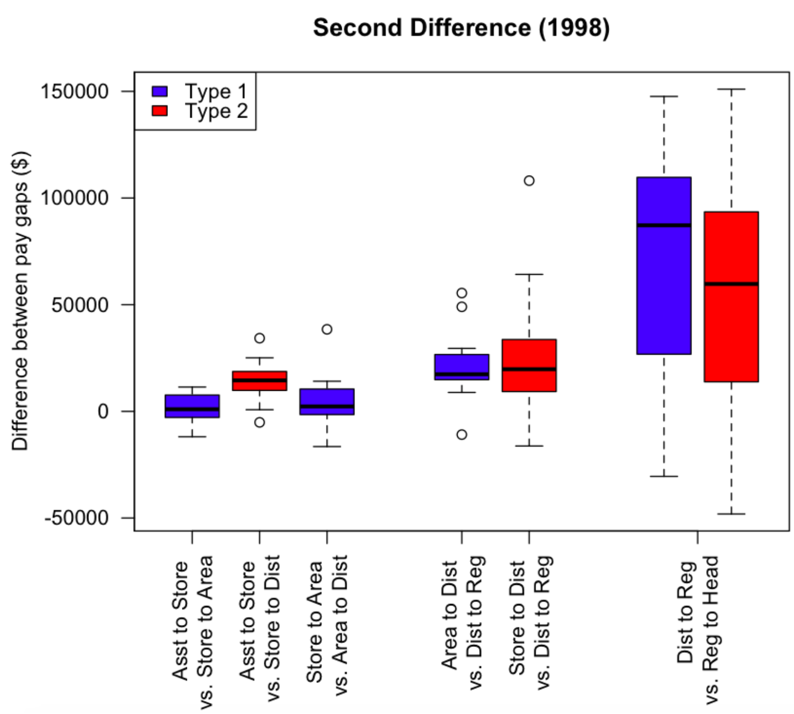

Figure C.6: Summaries of Second Pay Difference (1998)

Appendix D

Visual Results

Figure D.1 and D.2 plot the predicted pay levels as a quadratic function of the position levels against the actually pay levels in 1997 for companies in *Type 1* and *Type 2*, respectively. Likewise, figure D.3 and D.4 represent this fitted quadratic function and the actual pay levels in 1998 for companies in *Type 1* and *Type 2*, respectively.

Moving away from the quadratic fit of pay levels, figure D.5 and D.6 compare the total annual sales volume between the two groups, one with *Partially Convex* structure and the other one with *Consistently Convex* structure, for 1997, within companies of *Type 1* and companies of *Type 2*, respectively. Serving the same purpose, figure D.7 and D.8 illustrates the total annual sales volume comparison for 1998, within companies of *Type 1* and ompanies of *Type 2*, respectively.

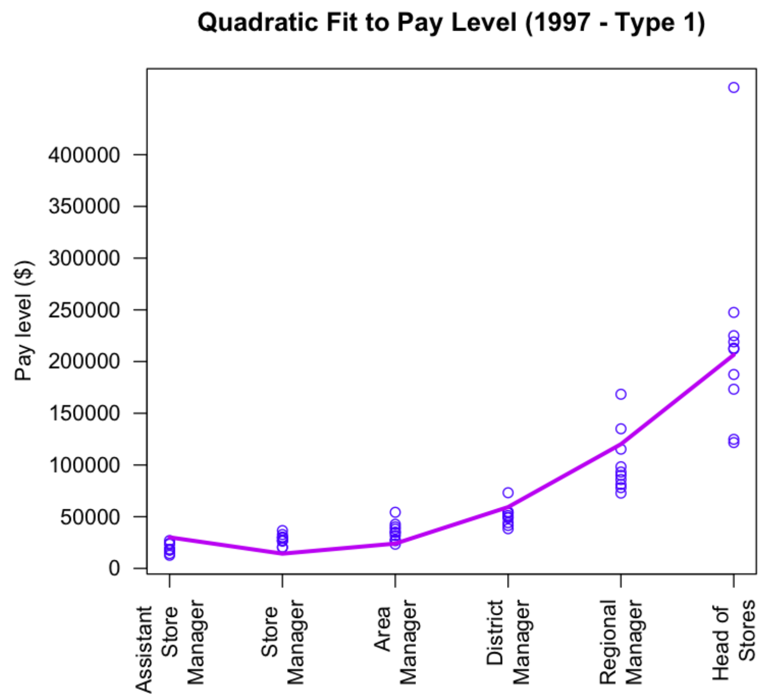

Figure D.1: Quadratic Fit to Pay Level (1997 - *Type 1*)

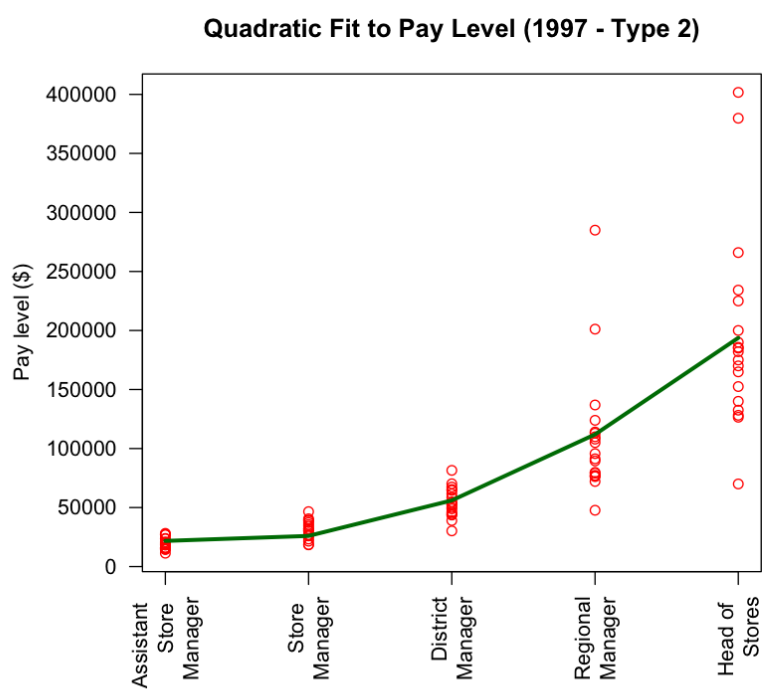

Figure D.2: Quadratic Fit to Pay Level (1996 - *Type 2*)

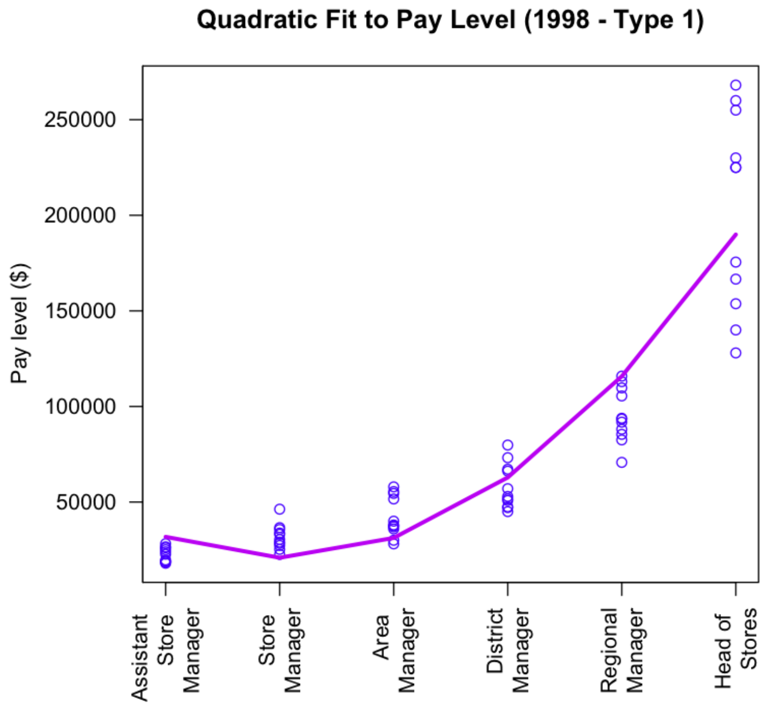

Figure D.3: Quadratic Fit to Pay Level (1998 - *Type 1*)

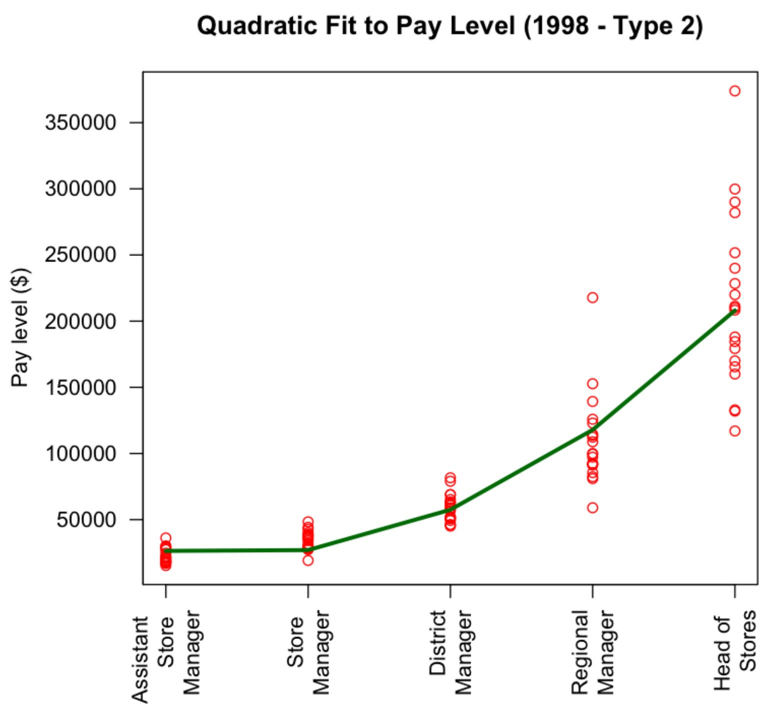

Figure D.4: Quadratic Fit to Pay Level (1998 - *Type 2*)

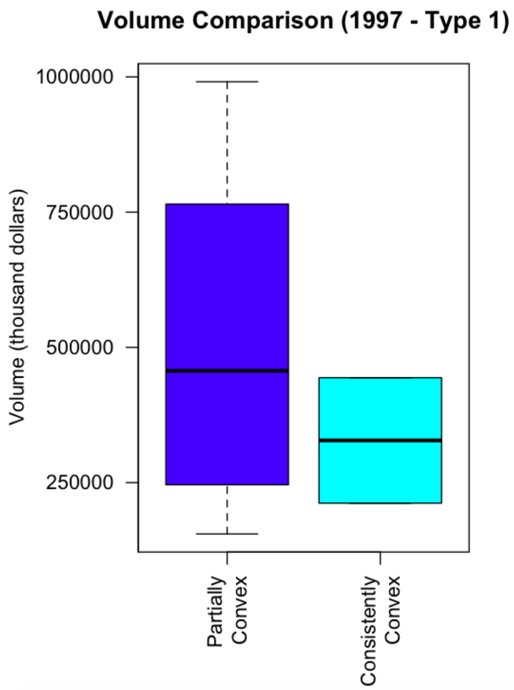

Figure D.5: Sales Volume Comparison (1997 - *Type 1*)

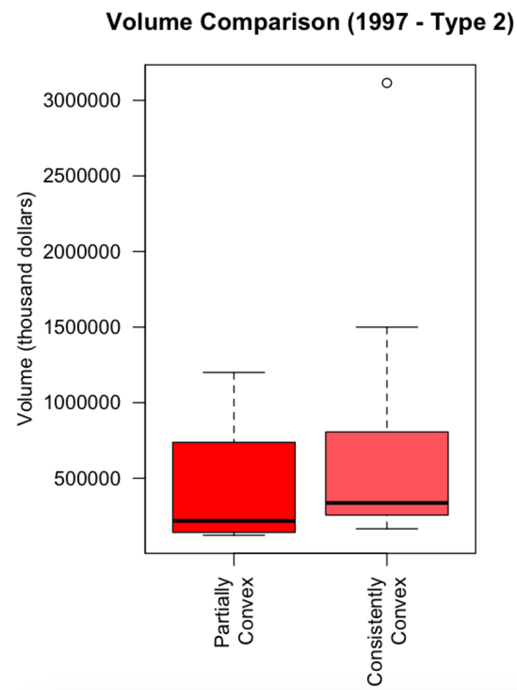

Figure D.6: Sales Volume Comparison (1997 - *Type 2*)

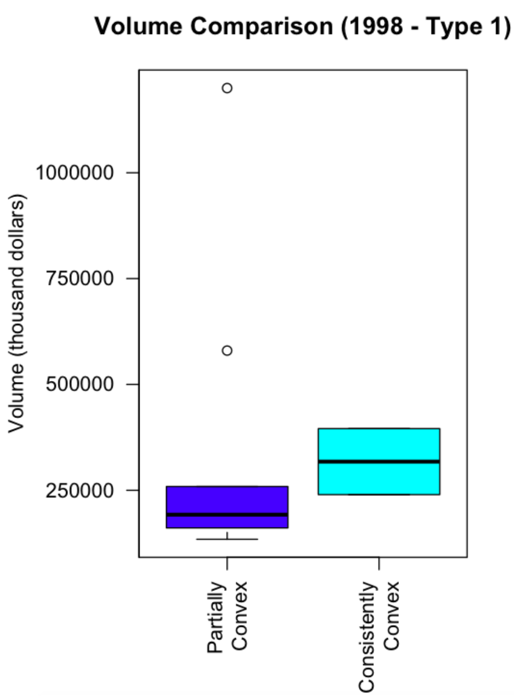

Figure D.7: Sales Volume Comparison (1998 - *Type 1*)

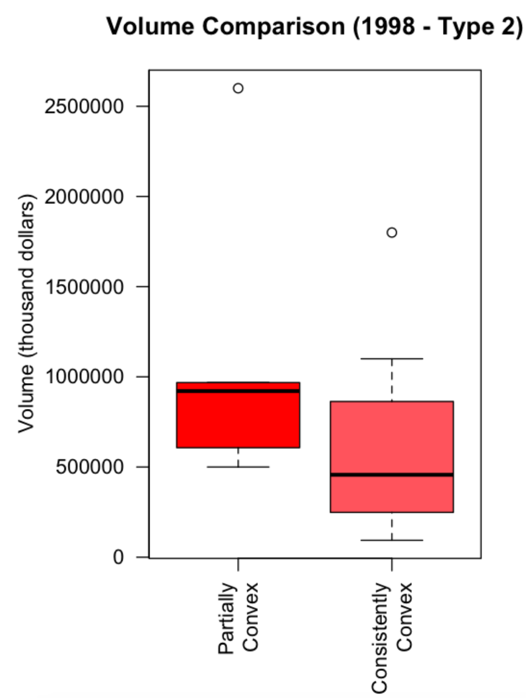

Figure D.8: Sales Volume Comparison (1998 - *Type 2*)

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