Essays On Managerial Pay Structures

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Dissertation

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Introduction

My dissertation consists of micro-level analysis of three different aspects of managerial compensation: (i) its tournament structure, (ii) its gender differences, and (iii) the effect of corporate governance on top managers' pay for performance as opposed to "pay for luck". My first two essays rely on wage records of Czech managerial employees around the time of the Czech Republic's accession to the EU. The third essay employs the ExecuComp data set to compare executive compensation before and after the passage of the Sarbanes-Oxley Act of 2002.

The topics were inspired by the dramatically changing role of managers in modern firms in the recent years. In the command economy, where the state was the largest owner, managers were not motivated explicitly to pursue a firm's prosperity. However, with the transition to a market economy, the new owners have faced the challenge of viewing their managers as employees assigned in high-control positions who play a decisive role in the development of their companies. As a consequence, managerial contracts have started to be perceived as an important incentive device in transition economies. The motivation for the third essay comes from the series of corporate scandals in the beginning of 2000 in the United States. While the post-transition economies face the challenge of designing new incentive mechanisms, one of the most developed economies in the world had to completely re-design the well established role of the Chief Executive Officer by delegating back her monitoring authority to shareholders.

In the first chapter, I examine the structure of wages among Czech managers in a representative sample of medium and large firms in the context of tournament theory. This theory assumes that managers compete to be promoted to a higher job position within a firm. To provide incentives for participation in the tournament, managerial pay has to

rise across hierarchical levels at an increasing rate. While there is evidence supporting the predictions of the theory in the most developed economies, it is not known whether this type of wage setting, which creates large within-firm wage disparity, is common practice in transition post-communist economies. Guided by the predictions of tournament theory, first, I find that the managerial pay differential between organizational levels is non-decreasing as managers climb the corporate ladder. Second, the winner's prize in the tournament, i.e., the pay gap at the very top of a firms' hierarchy, increases with the number of competitors for the position of the top manager.

In the second chapter, co-authored with Štěpán Jurajda, we study gender pay differentials among top- and lower-level managerial employees in a large sample of Czech firms. Even though there is an extensive literature on the gender pay gap in post-communist economies, a study of a high-paid group such as that of managers is missing. Using the traditional Oaxaca-Blinder technique we find that approximately a third of the raw gender wage gap for both top- and lower-level managers can be explained by gender differences in age and education. This is in contrast to the situation with ordinary employees, where the demographic composition of the workforce is actually more favorable for women and does not explain the pay gap. The analysis suggests the presence of a sizeable "unexplained" component of the managerial gender wage gap. Using matching decomposition techniques, we find that this "unexplained" wage gap (for men and women that are comparable in terms of demographics and employer type) is about 20% for both the two types of managers and for basic employees. The policy implication of these findings is that equality-enhancing policies aimed at the highly visible group of executives are more likely to be effective in equalizing wages of male and female top mangers if they focus on promotion policies practiced in the most prestigious high-paying companies.

In the third chapter, I examine the effect of the Sarbanes-Oxley Act of 2002 (SOX) on the structure of CEO pay in the largest US corporations. Since this law changes an important component of governance—the company board structure—it provides a natural ground for examining the existing theories of executive pay. Specifically, I consider the increased board oversight implied by SOX, which is expected to weaken the pay-for-performance link under standard agency models. Alternatively, if entrenched CEOs

managed to capture the pay-setting process before SOX, stronger boards after SOX are expected to strengthen the pay-for-performance link and to reduce CEO "pay for luck", that is, the unearned reward that executives obtain for industry-wide movements in performance out of their control. Using the ExecuComp data, I find that the pay-for-performance link increases after 2002 in firms with weaker board oversight before 2002, that is in firms more affected by SOX stipulations. In contrast, the pay-for-performance relationship changes little in firms with independent boards. Further, "pay for luck" disappears after 2002, consistent with improved governance.

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Chapter 1

Czech Managerial Compensations and Their Tournament Structure[1]

1.1 Introduction

In recent years economists have devoted considerable attention to the properties of different compensation schemes and especially to the incentives they provide. Among the schemes discussed, pay-for-performance and rank-order tournaments have drawn much attention in the US and Western Europe. The former arrangement motivates managers to act in their owners's best interests by linking their compensation to company performance, while the latter one ranks manager's performance with that of his/her peers in order to promote the most productive manager to higher paid positions. In the US, where developed capital markets efficiently evaluate managerial decisions, pay-for-performance arrangements are the most common setting to explain CEO pay structures.[2]

To efficiently link pay to firm performance, it is crucial that managerial actions are the key factor affecting company development. In transition economies, where a great number of major institutional, political and economic reforms took place managerial decisions

[1]The author is thankful to Štěpán Jurajda for providing remote access to the data and for helpful suggestions and comments throughout the writing of the paper.

[2]See Murphy (1999) for a detailed discussion of CEO compensation contracts and their structure in the US.

may have less influence in company performance compared to the situation in developed countries.[3] Thus, linking pay to performance may not efficiently motivate managers to act in shareholder's best interests. Lazear and Rosen (1981) offer an alternative compensation mechanism. Rather than relying on *cardinal* measurements of managerial performance, which may be especially difficult to ascertain in highly volatile transition economies, employers could make *ordinal* rank-order comparisons of performances (tournaments), thus avoiding both the costs of output measurement and the systematic risk managers bear.

To assess whether tournament incentives are implemented in transition economies, I study managerial compensations in one post-communist country: the Czech Republic. Until the early 1990s, limited attention was paid to the role of incentives in command economies. It is well known that under central planning managers were not motivated to increase firm productivity, but rather they "faced a mix of monetary and career-based incentives, which were a function of plan fulfilment, enterprize performance and political loyalty" (Djankov and Murrell, 2002, p.7). Since the majority of Czech firms has been privatized in the last decade, the new owners have faced a challenge to find compensation schemes stimulating their managers to act in the companies' best interests.[4] There is important research on transition corporate governance (Claessens et al., 1999; Frydman et al., 1999; Eriksson, 2005); however, there is no evidence on relative compensation packages within transition firms. The lack of evidence on transition corporate governance mechanisms motivates my analysis on the use of tournament managerial compensation schemes in the Czech Republic.

This paper contributes to the understanding of hierarchical organizations by providing empirical evidence on the distribution of managerial salaries across the corporate ladders of a sample of Czech firms. The empirical literature on Czech firms has primarily studied their ownership structure and performance (Estrin, 2002), but not the managerial peer

[3]See EBRD (1994) for description of the transition process in Eastern Europe and the former Soviet Union.

[4]Aghion et al. (1994) and Shleifer et al. (1997) argue that the incentive systems of managers are crucially important for transition reforms to be successful.

relayed reward packages. Eriksson (2005) studies managerial pay in the Czech Republic, but he does not ask about the presence of tournaments. My analysis is therefore the first to examine whether Czech firms implement tournament-based wage policies to elicit higher effort response from their managers and to explore the relationship between the compensation of top- and mid-level managers.

Several testable predictions of tournaments are exploited. The first major hypothesis is that the function describing the relationship between executive compensation and organizational level is convex. In particular, I ask whether the difference in compensation levels of the chief executive officer and his/her competitors is "especially" large relative to the differences in compensation levels observed across lower levels of firm' hierarchy. The second major hypothesis is that the prize, that is the difference between top executive and his/her competitors' pay, increases in the number of tournament participants. The third hypothesis suggests that corporate performance is positively related to within-firm wage dispersion, which may motivate firms to maintain dispersed wage structures.

The paper is organized as follows. The next section provides a brief discussion of the existing theoretical and empirical literature on relative compensations. Section 1.3 describes the data set and the analysis-ready sample. Section 1.4 presents the empirical specification, Section 1.5 discusses the results and performs robustness checks. Section 1.6 concludes.

1.2 Tournament Compensation Schemes: Literature Review

Lazear and Rosen (1981) model internal compensation as sequential elimination tournaments, in which managers compete against one another in a related series of tournaments. Tournament models could be regarded as a reduced form of an agency model,[5] meaning

[5]An alternative model for understanding the structure of compensation is the agency model (Holmstrom, 1979; Grossman and Hart, 1983), in which the compensation contracts have to realign the interests of risk-averse self-interested manager to those of the shareholders. For that purpose the optimal contract the principal offers is an increasing function of performance.

that the managers work for a principal who has committed to a compensation contract, but it does not provide a complete statement of the principal's problem.

It is assumed that the principal wants to place high-performing agents in the upper-level managerial positions because they choose the strategy of the firm and can potentially affect their subordinates. Agents compete against one another at the n-th organizational level. Considering their relative performances, high-performance agents are promoted to the next organizational level and receive a prize that is the difference in compensation between the two adjacent levels. Since only relatively high-performing agents advance up the corporate ladder, sequential elimination tournaments enable firms to identify managerial talent and optimally match agents to organizational positions.

The theory implies that the salary of a corporations' top executives may exceed their marginal product and yet be efficient because it will create adequate incentives for the employees down the corporate ladder to exert effort in order to be promoted to a better-paid position. Lazear (1998) implies that the managers who move up the corporate ladder do so by "being better than their peers, not necessarily by being good". Hence, the message behind tournament theory is that it may be necessary to design large salary differences among the organizational hierarchies of a firm, where the participants compete for a fixed prize and are rewarded based on their relative performance.[6]

Tournament theory suggests several testable implications concerning the shape of internal compensation structure across organizational levels that are explored in this paper. First, greater prizes lead to more effort. This hypothesis suggests that the function describing managerial compensations is convex with respect to the levels of corporate hierarchies. Second, the difference in compensation for the CEO relative to the next lower position in the organizational hierarchy should be "extraordinarily" large relative to changes in compensations at other points in the hierarchy. Third, more competitors increase the prize for becoming CEO.

Prior studies have found support for the convexity of internal compensation structure.[7] Using US data for managers, O'Reilly et al. (1988), Leonard (1990), Main et al.

[6]See Ehenberg and Bognanno (1990a); Cappelli and Cascio (1991); Prendergast (1999); Bloom (1999).

[7]This prediction is verified in several studies of sports (Ehrenberg and Bognanno, 1990b; Becker and

(1993) and Lambert et al. (1993) have shown that differences between the hierarchical levels are non decreasing, therefore consistent with the theory.[8] For a sample of British firms, Conyon et al. (2001) found a convex executive compensation, similarly to Eriksson (1999), who studied a sample of Danish firms. Heyman (2002), however, does not find convex pay structure for Swedish managers.

The "extraordinarily" large increment of the prize at the top of the hierarchy is confirmed by Leonard (1990), Main et al. (1993), and Lambert et al. (1993) using US data, and Heyman (2002) using Swedish data. Eriksson (1999) does not find evidence for large increase of the prize at the top of the corporate ladder with his Danish sample.

Another prediction, derived in McLaughlin (1988), is that the tournament prize increases with the number of competitors. Since the marginal increment of effort decreases with lower probability of winning (larger number of contestants), in order to provide an incentive for higher effort, the prize spread should increase. Concerning this prediction, O'Reilly et al. (1988) remark: "It should mean that, after controlling for other possible economic determinants of CEO's salary, the more vice presidents, the larger should be the observed gap between the CEO's salary and that of the vice presidents". Empirical support in favor of this proposition is provided by Main et al. (1993) and Bognanno (2001) for a sample of US corporations. Conyon et al. (2001) and Eriksson (1999) also illustrate this relationship using European data.

Further, tournament models predict that corporate performance is positively correlated with executive pay dispersion. Tournaments might create such a competitive environment where "sabotaging" coworkers at the price of being promoted might occur. Lazear (1998) suggests that the upper ranks of the organization tend to be dominated by "hawks" (employees who sabotage coworkers) and it pays off to compress their pay to reduce the incentive for fierce competition. The implication is that pay compression can potentially reduce sabotage incentives by making managers act in a more cooperative way. Eriksson (1999) finds that the coefficient of pay variation has a positive effect on firm performance in a sample of Danish firms. Main et al. (1993) documents similar ev-

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Huselid, 1992).

[8]Baker, Gibbs and Holmstrom (1994) also confirm this result with data on a single firm.

idence for the US contrary to Conyon et al. (2001), who concludes that wage dispersion does not have robust positive effect on firm performance in the UK.

1.3 Data Description and Basic Statistics

This study uses data from a quarterly national employer survey, called the Information System on Average Earnings (ISAE) from the first quarter of 2001.[9] It contains hourly wages, gender, education, age, a detailed occupational classification, the number of employees, ownership and industry (using the NACE classification). The wage records are drawn directly from the firms' personnel database and the definition of hourly wage is detailed and fully consistent across firms; it includes total cash compensation and bonuses and other special payment divided by total working hours per quarter.[10] Having available such complete measure of compensation makes the data appropriate for a study like mine that asks whether firms provide tournament-based incentive schemes for their managers. The data originally consist of 32,900 chief executives, directors, production, and specialist managers in 1,816 firms, which are classified according to the single largest owner into private, foreign, state, cooperative and mixed (firms without a majority owner) type. I exclude from the analysis cooperative owned firms and those with less than 50 employees. The managerial classification in the ISAE data set corresponds closely to major group one of ISCO 88(COM). It consists of three groups of managers: chief executives and/or directors, production managers and specialist managers. The first group, chief executives and the directors represent the top level managers. Some firms report more than one top manager, which does not allow me to identify who exactly the chief executive officer is. However, this is not crucial for this study because the tournament compensation requires the definition of hierarchy structure, not separate positions. Obviously, the group of chief executives and directors, which I define as chief executives (CEs), occupies a higher position than production and specialist managers. Production managers are classified according to the operation field like agriculture, manufacturing, construction,

[9]The survey is conducted for the Czech Ministry of Labor and Social Affairs.

[10]Bonuses and additional payments are spread evenly over the whole year.

wholesale etc. Specialist managers are divided into finance and administrative managers, personnel, sales and marketing, distribution, computing managers. In this study, I combine both production and specialist managers unless otherwise specified and label them "Managers".[11]

Unfortunately in the data set some firms have missing managers' records. The number of firms reporting their chief executives records is 921, while 492 firms do not report the wages of their executives. I investigate if the lack of managers' records is random across firms and discover that the missing records are randomly distributed across a set of firm characteristics. Specifically, a logit model is estimated, where the left-hand side variable is equal to one if the firm has a missing manager and zero otherwise. The right-hand side variables include a full set of ownership, size measured with the number of employees and industry dummy variables. The results suggest that the private, foreign and mixed firms are equally likely not to report their mangers. However, the state-owned firms are more likely to report their managers than private firms. Both mid-size firms (from 251 up to 500 employees) and large-size firms (above 500 employees) do not differ from small firms (from 50 up to 250 employees) in this respect.

Some of the firms also report a wage grid. A thirteen level wage-grid classification was originally inherited from the centrally planned regime where every worker, depending on their education, experience, occupation and industry was assigned a wage grid level. This policy did not leave room for managerial discretion, kept the dispersion of the wages between grids low and purposefully maintained "equality" between skilled and unskilled workers (Munich et al., 2005). Since the collapse of the communist regime in 1989, however, salaries are determined by market forces (Basu, 2004), but some firms still use a wage-grid system potentially modified to suit firm-specific wage policies.

I apply this grid classification to define a hierarchy level for each manager and to study whether their compensation is related to the job rank in a way tournament theory predicts. Since the wage grid is not available for all of the companies—853 firms out of a total of 1,413 do not use (or report) such grids—I perform selectivity analysis similar to

[11]See International Labor Office (1990), ISCO-88: International Standard Classification of Occupations for details.

that carried out for the incidence of missing managers. The results show that private and foreign firms are equally likely not to report managers' wage grid while the state firms are more likely to assign a wage grid to their managers (see Section 1.5.3 for robustness checks).

An important question is whether the wage grid continues to depend on years of experience and education or whether it is now used to express preliminary defined ranks linked stronger to certain tasks than to individual characteristics. To distinguish between these two explanations, I perform regression analysis of wage grid of managers on their age (proxy for experience) and education, which suggests that these variables explain only 8% of the total variation in the within-firm grid. Adding firm characteristics does not improve significantly the explanatory power of the regression model. Therefore, I assume that the present wage grid differs by structure and purpose from the old one, inherited from the communist regime.

Firms do not use the same grid scale across managerial records. For example, the grid level for chief executives varies from nine to thirteen. Since I am not concerned with the grid level itself, but with its ranking, I order the chief executives' grid in each firm as the maximum grid (the data shows that, indeed, firms assign their CEs with the maximum grid within a company); the next lower grid is assigned to managers who are in the same grid as the CEs; the six levels below are reserved for the rest. Therefore, I construct a hierarchy structure with seven levels ranked beneath the maximum chief executive grid in a firm.[12] The number of hierarchy levels varies across firms and the average ladder length is 3.5 ranks long. Only 10% of the firms have more than 6 ranks in the ladder. Since some firms have one-level hierarchy structure, I do not include them in the analysis and restrict the sample to firms with at least two-level structures. Thus, the analysis-ready sample contains 333 firms that report both their managers and a wage grid.

Table 1.1 presents the final number of firms and managers at each job level, and individual descriptive statistics of their wage, age, education and gender. Expectedly,

[12]No alternative definition of hierarchy is available in the data; therefore, I cannot check the sensitivity of the results to the way I determine the hierarchy.

the average hourly wage increases at higher job levels; the proportion of people with college education is higher in the upper hierarchy levels than in the lower part of the ladder. The fraction of female managers is smaller at the top, than at the bottom of the hierarchy. These descriptive findings though are hard to interpret in the light of tournament theory predictions. The next section formulates the empirical specification and testable predictions.

1.4 Empirical Specification

I estimate compensation equations, expressed as a function of individual characteristics (age, gender, education level), firm characteristics (type of ownership, company size and industry), and achieved job level in the company hierarchy. The basic regression equation is as follows:

$$\begin{aligned} W_{ij} &= \alpha_0 + \beta_1 Age_{ij} + \beta_2 Age_{ij}^2 + \beta_3 Female_{ij} + \sum_{n=1}^{2} \delta_n Education_{ij} + \sum_{m=1}^{3} \gamma_m Ownership_{mj} \\ &\quad + \sum_{k=1}^{2} \theta_k Size_{kj} + \sum_{s=1}^{11} \phi_s Industry_{sj} + \sum_{l=1}^{7} \lambda_l JobLevel_{lij} + \epsilon_{ij} \end{aligned}$$

where W_{ij} is the logarithm of quarterly average hourly compensation for manager i in firm j; $Female$ is a binary variable equal to one if the manager is female and zero otherwise; $Education$ consists of dummies for apprenticeship, secondary, and university education; $Ownership$ is a set of firm ownership dummies (foreign, private, state, mixed); $Size$ is a set of dummy variables indicating whether a manager works at small (from 50 to 250 employees), middle-sized (from 251-500 employees) or large company (more than 500 employees). $Industry$ is a set of dummy variables based on the 3-digit NACE classification. Finally, $JobLevel$ is a set of job level dummy variables. The highest job level in the hierarchy belongs to the chief executives with maximum wage grid, followed by managers (production or specialist) in the same grid class, and by managers classified into six grids down the corporate ladder.

The first testable hypothesis of tournament theory suggests that the relationship between the individual compensation and job level is convex. Let us denote the estimates of seven job level dummies as follows: CEs level by λ_8; manager in the same wage grid by

λ_7; manager in one grid class below the chief executive by λ_6; manager two levels below the CEs by λ_5, followed by λ_4, λ_3, λ_2 and λ_1, respectively for the third, fourth, fifth and sixth level beneath the CEs. In the model the difference, $\lambda_8 - \lambda_7$, is the average change in log pay of chief executives and that of managers in level 7. For this function to be convex we should observe: $\lambda_2 \geq 0$; $(\lambda_3 - \lambda_2) \geq \lambda_2$; $(\lambda_4 - \lambda_3) \geq (\lambda_3 - \lambda_2)$; $(\lambda_5 - \lambda_4) \geq (\lambda_4 - \lambda_3)$; $(\lambda_6 - \lambda_5) \geq (\lambda_5 - \lambda_4)$; $(\lambda_7 - \lambda_6) \geq (\lambda_6 - \lambda_5)$; $(\lambda_8 - \lambda_7) \geq (\lambda_7 - \lambda_6)$. The term convex is used to refer to a function in which compensation differences across adjacent hierarchy levels are non-decreasing.[13]

Managerial compensation data from many firms form a clustered sample, where each firm is a cluster (group). The error term of the regression equation likely consists of both a common cluster term and an idiosyncratic term. For example, it might turn out that managers in certain firms receive higher compensation because of an unobservable firm specific factor and/or because of an individual unobservable characteristic. Moulton (1990) demonstrated how an explanatory variable that was completely unrelated to the outcome of interest might be mistakenly estimated to have a significant relation if the values of this variable were common across many individuals in the same group. I adjust the standard errors for dependency of pay within firms; to deal with firm specific unobservables that might be correlated with the set of explanatory variables, I employ the firm fixed effect estimation technique.

1.5 Results

The regression analysis of managerial pay covering the first quarter of 2001 first asks whether the sensitivity of pay to job levels is increasing at an increasing rate. Next, I proceed with robust checks that test the sensitivity of the results to the differences in firm characteristics. I also study the relation between the probability of winning, approximated with the number of contestants for the chief executive position and the pay prize. Finally, the correlation between firm performance and within-firm wage dispersion is exploited.

[13]Lambert et al. (1993) have outlined similar testing procedure.

1.5.1 Managerial Pay and Job Level

I regress managerial log wages on job levels dummies, individual characteristics (age, education and gender), and firm characteristics (size, ownership and industry). Table 1.2 presents the results from several estimation techniques. Column 1 is ordinary least squares estimation of pay, controlling only for job levels. The results suggest that managers at level 8 earn 140% more than managers at the lowest job level. Similarly managers at level 7 receive 83% more than the managers at the lowest level. In column 2 age and education estimates are included. An extra year of age brings 2.4% increase in pay; the negative sign of age squared documents the concave profile between age and wage. University education adds 37% more to pay compared to primary education. Column 3 shows a specification which accounts for different firm characteristics. Without affecting the convex pattern of pay-rank elasticities, I observe that foreign-owned firms pay 20% more than private-owned firms and that large firms (measured with the number of employees) pay around 30% more than small firms. The median regression, that mitigates the impact of outliers and the firm fixed effects estimation, that purges away unobserved firm heterogeneity, do not cause the job level coefficients to differ by much from those in column 3. Overall, the results suggest that after controlling for age, education and various firm characteristics, the job level estimates are still highly significant and larger rewards result from movements up the hierarchy. Figure 1.1 presents visually the close similarity between coefficients obtained from different estimation procedures.

To shed light on the sources that explain the pay variation, I decompose the pay variation into variations driven by human capital and job rank differences. Job level variation alone explains 32% of the pay variation, and human capital—26%. Further, to account for the human capital contribution not only within levels but also between levels, I include job level and human capital interactions.[14] I find that 35% of the total explanatory power attributed to job levels is due to human capital and firm heterogeneity.

[14]Basically, I decompose R^2 from the total regression into R^2 separately attributed to human capital, job levels and firms characteristics. I remove the explanatory power coming from the correlation between job levels and human capital, job levels and firms characteristics, and job levels, firms characteristics and human capital all together.

Thus, the rest of the variation might be due to incentive tournament-like pay across job levels.[15]

I check for the sensitivity of pay-rank relation to the length of the corporate ladder. Slightly more than 50% of all firms use a four-level ladder and only 10% report an eight-level ladder. The length of the ladder might be used as a firm-specific incentive mechanism for motivating managers to compete for promotions. Figure A1 in the Appendix presents the pay-rank estimates starting with two-level ladder firms and finishing with eight-level ladder firms. Looking at the graph, differences between rewards across ranks in the short-ladder firms and the long-ladder firms are not detected, which suggests that firms may not use the length as an incentive device for competing for higher position.

Further, I examine the forces underlying the length of the ladder. I estimate a reduced-form firm-level regression that captures the effect of a set of firm size dummies, ownership, and industry dummies. The results suggest that the larger firms tend to have longer ladders, which potentially might affect the precision of the job level estimates from the pay regressions in Table 1.2. I re-estimate the above specification, however including interactions between firm size and job levels (untabulated). Assuming that the base effect of job levels is now more precisely estimated after removing the size effect, the results indicate that the same convex-like pattern of the pay-rank estimates is preserved.

Although the results presented in Table 1.2 show growing pay tendency as one climbs the hierarchy, I perform separate tests for convexity as stated in Section 1.4. The results based on OLS, median and firm fixed effect estimations are presented in Table 1.3. Convex pay structure requires the inter-grid spread between two adjacent levels to be non-decreasing compared with the inter-grid spread between neighboring lower levels. Looking at the first column where OLS results are presented, the inter-level pay spread between the chief executives at level 8 and managers at level 7 is significantly greater than the pay spread of mangers at level 7 and level 6. These results are robust to me-

[15]Additionally, I examine whether highly educated managers earn more than managers with lower education conditional on being at the same job level. None of the interactions between job level and education are statistically significant, which indicates that once at a certain job level, education difference does not impact pay.

dian estimation and firm fixed effects. Positive pay change exists when executives move from level 6 to level 7 relative to a change from level 5 to level 6. However, changing job position from levels 2 to 3, from 3 to 4, and from 4 to 5 are not associated with growing pay spreads. At the very bottom of the corporate ladder, a manger promoted from level 1 to level 2 will receive on average 10 to 17 percent higher pay depending on the job specification. Overall, Table 1.3, presenting job level coefficients from different estimation procedures, shows that at the top and at the bottom of the ladder, the pay spread increases significantly.[16] At the middle of the ladder however, there is no such increase. The results are robust to the method of estimation, which suggests that the spread difference between adjacent levels is not influenced by the correlation between firm specific factors and individual characteristics, and it is not affected by outliers.

1.5.2 Pay Increase at the Top of the Ladder

According to tournament theory the last "prize" has to be much higher since it also includes an additional reward for the lack of more positions after reaching the position of the chief executive. Since this prediction is unique to tournament theory, finding support for it provides stronger evidence for identifying the presence of tournament-like incentive schemes in the sample of Czech firms. The results in Table 1.4 support the prediction of the tournament model that the difference in compensation levels between the chief executives' pay and level-seven-managers' pay is "extraordinary" large relative to changes in the compensation levels observed at other points of the hierarchy. Following the definition of Lambert et al. (1993), the spread between the CEs and the next lower level managers' pay has to be greater than the average of inter-rank pay spreads for the other levels, I find that $(\lambda_8 - 1.5\lambda_7) > 0$ at any conventional level.

Competition for a better paid position occurs not only within a firm but also across firms. For example, top managers in small firms might be willing to compete for better-

[16] I use an alternative procedure to examine the structure of pay across ranks. At the first stage, I estimate a linear regression to remove the effect of human capital and firms characteristics, and then I regress residual wages on job levels. The results show that the increase between adjacent levels is similar to the one reported in Table 1.2.

paid positions in large firms. It appears, however, that the top managers in large firms reaching the best paid positions, face limited choice of attractive job positions. In the context of tournament theory, assuming that managers at level 7 decide on moving from small to big firms, the pay spread for moving from level 7 to the executive position is expected to be larger in big firms than in small companies. This will motivate managers from big firms to compete despite the lack of lucrative jobs after reaching the top in their companies. Particularly, I compare the pay prize spread separately for big and small companies and find that managers in big firms receive 11% (significant at $p<0.14$) higher prize for reaching the top than their colleagues in small companies. The inter-firm difference is not "extraordinary" large according to the previous definition.

1.5.3 Robustness Checks

A great number of papers have documented that managerial compensation increases with firm size. Similarly to Rosen (1992) I document that big firms (above 500 employees) pay 30% more than smaller firms (between 50 and 99 employees). Usually this evidence is explained with human capital wage formation and managerial talent allocation. The most talented managers are efficiently assigned to the top control positions in the largest firms where talent and marginal productivity are complements. Thus observing increasing return relative to job levels might reflect increasing marginal productivity rather than a promotion competition in the context of tournaments. To shed more light on these two perspectives, I allow for the interaction of firm size, used for a proxy of managerial talent, and job level dummies. According to the tournament perspective, the convex relationship between job levels and pay is not related to firm size or managerial talent. The results in Figure 1.2 suggest that there is no difference between the pay-rank pattern for small and big firms, where big firms presumably employ more talented managers. I do not find pay-rank differences across different levels of managerial talent (i.e., different firm size), which further supports the view that within-firm reward systems might be associated with tournament structures rather than with managerial talent sorting.[17]

[17]Additionally, to completely explore the effect of firm size, I allow for full interaction specification, in which two groups of firms, split according to the median number of managers are examined. The results

An alternative proxy for managerial talent is education level. I consider the pay growth across job levels only for managers with university education. Comprising around 50% of the whole sample, the pay-rank coefficients for university educated managers suggest similar convexity to the pay-rank coefficients presented in Table 1.2.

Lazear (1989) focuses on the importance of compensation structures *across* industries. Assuming that some industries are riskier than others, the optimality conditions of the tournament model imply that larger wage spreads are observed in higher risk industries than in lower risk industries. Hence, the managerial choice of industry sectors, according to tournament theory, depends on whether the pay-rank slope is steeper in high-risk sectors than in low-risk sectors, which will compensate manager for working in more hazardous environment and motivate them to compete. To examine pay-rank sensitivities across industries, I use the OECD STAN data for the Czech Republic over the period 1990-2001 to define the degree of industry risk. In particular, I consider two measures of industry output whose variation over time is assumed to capture industry risk.[18] Having determined high- and low-risk industries by considering firms located above the 70th and below the 30th percentiles of the industry outcome volatility distribution, I examine pay-rank sensitivities of firms belonging to any of the two groups. Figure 1.3 shows comparisons for alternative measures of industry output. High-risk industries reward their managers more at all levels than low-risk industries except at the last level 8. The pay-rank curves, however, do not seem to exhibit different slopes as the tournament model suggests. This evidence can be explained by either the lack of tournaments across industries or the lack of incentives for competition in high-risk industries compared to low-risk industries. Due to data limitation it is not possible to elaborate more on these

do not allow for the conclusion that firm size affects rank-wage estimates.

[18]The STAN data is based on national accounts. I use industry gross output defined as ISIC 3-digit industry level, which represents the value of goods and/or services produced in a year, whether sold or stocked, to calculate industry variance for the period 1990-2001. I allow for different cut points of the industry output distribution to define high- and low-industry risk. Similarly, gross value added is employed across industries, which is calculated as the difference between production and intermediate inputs. Value added comprises labor costs, consumption of fixed capital, taxes less subsidies and net operating surplus and mixed income.

two explanations.

Rank-order tournaments might explain potential differences in managerial pay structure across firms with different ownership. Under centrally planned systems, wages were compressed so that they would not create disparities among employees. Tournament theory proposes exactly the opposite policy: a widely dispersed reward system would provide promotion incentives for employees and hence increase firm productivity. Previous literature on wage determination does not find a systematic effect of ownership on wages in the Czech Republic in the early 1990s; however, private ownership is associated with higher wages in Poland and Slovakia (Basu et al., 2004). Examining a later period from 1997 to 2000, Eriksson (2005) does not find differences between managerial pay in state-owned and privately owned Czech firms.

Guided by tournament theory rational, I expect pay-rank curves in the state firms to be flatter than those in other companies, potentially reflecting their traditional policies of compressed wages and lack of competition incentives. In particular, I ask whether pay-rank elasticities differ across several types of owners. A regression specification, similar to the one in Section 1.4 is estimated, however, interacting ownership and job level dummies. Figure 1.6 presents three different pay-rank comparisons. The top graph shows pay-rank paths of state and privately owned firms over eight job levels and confirms previous evidence of no difference between pay-rank sensitivities in the sample of Czech state and private firms, ceteris paribus. Further, the graph in the middle demonstrates that foreign-owned firms exhibit a somewhat steeper increase of pay at the upper levels of the ladder than the state-owned firms do. Potentially, the steeper increase might signify more intensive use of tournaments in foreign firms than in state firms. Similarly, the pay-rank function seems to have a greater slope for mixed firms in comparison to state firms. Overall, I find evidence for pay-rank disparities across firms with different owners; however, because of the small sample, I am hesitant to draw a decisive conclusion on the effect of ownership on pay in the light of tournaments. Rather, this exercise can be viewed as complementary evidence to all other explorations of tournament-like pay in this study.

1.5.4 Additional Aspects of Tournament Theory

Another prediction of tournament theory is that the increase of the number of potential competitors for the top managerial position enhances the tournament prize. The prize is measured as the difference between the chief executive's pay and the contestants' median pay similarly to Eriksson (1999), Main et al. (1993) and O'Reilly et al. (1988). I assume that the most plausible competitors for the chief executive positions are the managers in the same hierarchy level as the chief executives, namely the managers at job level 7. The results from the estimation are presented in Table 1.5. After conditioning on a set of firm-specific variables such as size, ownership type, and industry sector, the results indicate that the number of contestants and the prize spread are positively linked. The magnitude of this result is 3.4% and it is similar to that in Main et al. (1993), and Bognanno (2001), yet is stronger than in Eriksson (1999). It confirms the prediction of the theory that the contestants are provided with larger prizes as the probability to win decreases due to higher participation.[19] The second and the third columns of Table 1.5 show interactions between firm size and industry, and between firm size and ownership type, respectively. The interactions do not change the sensitivity of the prize to the number of competitors.[20] This estimation does not deal with potential endogeneity issues between the number of participants and the prize. On the one hand, the increase in the prize might attract more contestants, on the other hand as the tournament model predicts, higher number of contestants requires an increase of the motivational prize. Because of the lack of credible instrument variables, I cannot distinguish between both stories. Thus, the analysis can be viewed only as a correlation exploration between the

[19]To check the robustness of the result to the definition of prize, I use an alternative measure of pay prize. First, the effect of age and education is removed from the prize and only then the prize residuals are used to examine the link between pay spread and the number of competitors. Depending on the specification, the estimate of the number of competitors varies from 2.4% to 3.1%, which is consistent with the results from the commonly used approach presented in Table 1.5.

[20]Bognanno (2001) proves that the prize might increase not only with the number of competitors, but also with its square. I find that in all specifications the quadratic term is positive statistically significant which indicates the presence of a U-shaped relationship between the prize spread and the number of participants.

prize and the number of contestants.

In the present sample managers are classified as production and specialist managers. In the context of the Czech managerial labor market where in the past "the typical manager was a *production* engineer and not a businessman (Djankov and Murrell, 2002)," it is interesting to explore whether production managers are preferentially motivated with higher prizes than the specialist managers a decade after the launch of the Czech market reforms. The sensitivities of the number of production and specialist managers to the prize are statistically the same—5% and 4%, respectively for the production and the specialist managers.

Finally, to estimate the relationship between firm performance and wage variation, I follow Main et al. (1993) and Erikssson (1999). The wider pay dispersion is associated with higher level of effort in equilibrium and hence higher firm profit. Lazear (1989) suggests that some firms may adopt more compressed pay structure thus avoiding tournaments. If employees' cooperation is less important for a firm, wider pay gaps across job levels may increase performance; whereas this might not be the case if cooperation is crucial for optimal firm productivity. In the former case optimal wage policy would create large within-firm pay disparities, while in the latter case smoother wages will be more suitable. Although I do not find a proxy for employees' cooperation, the estimates in Table 1.6 suggest that wage dispersion, measured with the coefficient of variation is positively related to firm performance.[21] Eriksson (1999) finds that the coefficient of pay variation is positively related to return on assets for a sample of Danish firms. Conyon et al. (2001) detect a positive effect, though not significant at conventional levels. My results propose that it might be beneficial for Czech firms to introduce a dispersed within-firm wage structure as tournament theory suggests. However, additional analysis is required to address endogeneity between firm performance and pay variation.

[21]I obtain firm profit from ASPEKT data, which does not cover all firms from ISAE data. The number of firms in the ASPEKT data is 545, out of which 487 are matched successfully. Next, due to missing managers' records in the ISAE data, I use 360 firms for the estimation in Table 1.6. However, since only 230 firms of these report a wage grid, a sample selection issue might be present, which requires the sensitivity of pay dispersion to firm performance to be viewed with caution.

1.6 Concluding Remarks

The literature on corporate managers focuses primarily on their incentives to improve performance of firms. In transition economies, two theories have been extensively explored. First, researchers ask to what extent managerial ownership leads to optimal profit. Second, the effect of managerial turnover on firm profit is also extensively studied.

In contrast, this paper contributes to the small literature on managerial pay in the Czech Republic. Particularly, it examines the tournament structure of managerial pay. Theory suggests that firms can motivate managers by running competitions for promotions, therefore paying them according to the performance of their peers. In such a way, incentives depend on the corporate environment, contrary to the traditional individualistic pay schemes (e.g., pay-for-performance) that ignore the impact of peers.

I explore empirically two main testable predictions of tournament theory using a large Czech data set. First, I find a convex relationship between managerial pay and job level. Czech managers at the bottom of the corporate ladder earn around 40% less than managers in the middle of the ladder, and 100% less than the top managers. Further, consistent with the theory predictions, I find an "extraordinary" large compensation increase at the top of the firm hierarchy. Next, a positive relationship between the number of participants and the prize of the tournament is confirmed. Finally, I show that within-firm pay variation is associated with higher firm profit. Overall, I find evidence that after a decade into market reforms Czech firms do employ relative compensation to motivate their managers.

One important limitation of the data is that many firms from the initial sample do not report a wage grid class used to capture within-firm hierarchy, hence challenging the representativeness of the analyzed sample. Another limitation is that I can not check the sensitivity of the results to the hierarchical job-level definition. Starting and finishing dates of employment, useful for studying whether managers climb the ladder within firms or they are newly hired are not available as well.

An avenue for future research is to study the causal effect of the tournament-like incentives on company performance. Previous literature shows that they can influence the

profits positively or negatively depending on the corporate employee dependence. Hence, these incentives may turn out to be destructive for firms that depend on team cooperation and successful for firms that need competition among peers to improve performance. Therefore, further analysis on the corporate team dependence will shed light on the type of incentive devices that optimize firm profit.

Bibliography

Aghion, P., O. Blanchard, and S. Burgess (1994) "The Behavior of State Firms in Eastern Europe Privatization," *European Economic Review*, 38, 1327-1349.

Baker, G., M. Gibbs and B. Holmstrom (1994) "The Internal Economics of the Firm: Evidence from Personnel Data," *Quarterly Journal of Economics*, 109, 881-919.

Basu, S., S. Estrin and J. Svejnar (2004) "Wage Determination under Communism and in Transition: Evidence from Central Europe", IZA DP No. 1276.

Becker, B. and M. Huselid (1992) "The Incentive Effects of Tournament Compensation Systems," *Administrative Science Quarterly*, 37, 336-350.

Bloom, M. (1999) "The Performance Effect of Dispersion on Individuals and Organizations," *Academy of Management Journal*, 42, 24-40.

Bognanno, M. L. (2001) "Corporate Tournaments," *Journal of Labor Economics*, 19, 290-315.

Cappelli, P. and W. Cascio (1991) "Why Some Jobs Command Wage Premiums: a Test of Career Tournaments and Internal Labor Market Hypotheses," *Academy of Management Journal*, 34, 848-868.

Claessens, S. and S. Djankov (1999) "Ownership Concentration and Corporate Performance in the Czech Republic," *Journal of Comparative Economics*, 27, 498- 513.

Conyon, M., S. Peck and G. Sadler (2001) "Corporate Tournaments and Executive Compensation: Evidence from the U.K," *Strategic Management Journal*, 22, 805-815.

Djankov, S. and P. Murrell (2002) "Enterprize Restructuring in Transition: A Quantitative Survey," *Journal of Economic Perspectives*, 40, 739-792.

EBRD (1994), Transition Report 1994. London: EBRD.

Ehrenberg, R. and M. Bognanno (1990a) "The Incentive Effects of Tournaments Revised: Evidence from the European PGA Tour," *Industrial and Labor relations Review*, 43, 74-88.

Ehrenberg, R. and M. Bognanno (1990b) "Do Tournaments Have Incentives Effects?," *Journal of Political Economy*, 98, 1307-24.

Eriksson, T. (1999) "Executive Compensation and Tournament Theory: Empirical Tests on Danish Data," *Journal of Labor Economics*, 2, 262-280.

Eriksson, T. (2005) "Managerial Pay and Executive Turnover in the Czech and Slovak Republics," *Economics of Transition*, 13 (4), 659-677.

Estrin, S. (2002) "Compensation and Corporate Governance in Transition," *Journal of Economic Perspectives*, 16, 101-124.

Frydman, R., Ch. W. Gray, M. Hessel, and A. Rapaczynski (1999) "When Does Privatization Work? The Impact of Private Ownership on Corporate Performance in the Transition Economies," *Quarterly Journal of Economics*, 114, 1153-91.

Gibbs, M. (1995) "Incentive Compensation in a Corporate Hierarchy," *Journal of Accounting and Economics*, 19, 247-77.

Gneezy, U., M. Niederle and A. Rustichini (2003) "Performance in Competitive Environments: Gender Differences," *Quarterly Journal of Economics*, 118(3), 1049-1074.

Grossman, S. and O. Hart (1983) "An Analysis of the Principal-Agent Problem," *Econometrica*, 51, 7-45.

Heyman, F. (2002) "Pay Inequality and Firm Performance Evidence from Matched Employer-Employee Data," The Trade Union Institute for Economic Research, Working Paper 186.

Holmstrom, B. (1979) "Moral Hazard and Observability," *The Bell Journal of Economics*, 10, 74-91.

Jensen, M. and K. J. Murphy (1990) "Performance Pay and Top-Management Incentives," *Journal of Political Economy*, 2, 225-64.

Knoeber, C. R. and W. N. Thurman (1994) "Testing the Theory of Tournaments: An Empirical Analysis of Broiler Production," *Journal of Labor Economics*, 12, 155-79.

Lambert, R., D. Lacker and K. Weigelt (1993) "The Structure of Organizational Incentives," *Administrative Science Quarterly*, 38, 438-461.

Lazear, Ed. (1998) "Personnel Economics," MIT Press Cambridge, Third edition.

Lazear, Ed. (1989) "Pay Equality and Industrial Politics," *Journal of Political Economy*, 97, 561-580.

Lazear, Ed. and R. Sherwin (1981) "Rank-Order Tournaments as Optimum Labor Contracts," *Journal of Political Economy*, 89, 841-64.

Leonard, J. (1990) "Executive Pay and Firm Performance," *Industrial and Labor Relations Review*, 43, 13-49.

Main, Br., Ch. O'Reilly and J. Wade (1993) "Top Executive Pay: Tournament or Teamwork?," *Journal of Labor Economics*, 4, 606-628.

McLaughlin, K. (1988) "Aspects of Tournament Models: A Survey," In Research in Labor Economics, vol. 9, 225-256.

Moldovanu, B. and A. Sela (2001) "The Optimal Allocation of Prizes in Contests," *American Economic Review*, 91, 542-58.

Moulton, B. (1990) "An Illustration of a Pitfall in Estimating the Effect of Aggregate Variables on Micro Units," *Review of Economics and Statistics*, 72, 334-338.

Munich D., J. Svejnar and K. Terrell (2005) "Returns to Human Capital under the Communist Wage Grid to Transition: Restrospective Evidence from Czech Mirco Data," *Review of Economics and Statistics*, 87, 1: 100-124.

O'Reilly, C., B. Main and G. Crystal (1988) "CEO Compensation as Tournament and Social Comparison: A Tale of Two Theories," *Administrative Science Quarterly*, 33, 257-74.

Ortin-Angel, P. and V. Salas-Fumas (2002) "Compensation and Span of Control in Hierarchical Organizations," *Journal of Labor Economics*, 20, 848-898.

Prendergast, C. (1999) "The Provision of Incentives in Firms," *Journal of Economic Literature*, 37, 7-63.

Rosen, S. (1992) "Contracts and the Market for Executives," in Lars Werin and Hans Wijkander (eds.), Contract Economics, Oxford: Blackwell, 181-211.

Shleifer, A. and R. Vishny (1997) "A Survey of Corporate Governance," *Journal of Finance*, 52, 737-783.

Svejnar, J. (1999) "Labor Markets in the Transitional in Central and East European Economies," in Ashenfelter, O., and D. Card, eds. Handbook of Labor Economics, Elsevier Science B.V., 2810-2857.

Table 1.1: Descriptive Statistics

	Firms	Managers	Wage	Age	Sec. Educ.	University	Female
Chief	333	560	474	48.62	17%	81%	6%
Executives			[294]	[8.00]			
Level 7	333	4726	258	46.05	33%	66%	18%
			[150]	[8.72]			
Level 6	280	744	198	46.86	33%	67%	18%
			[84]	[8.67]			
Level 5	152	620	172	45.66	46%	51%	24%
			[62]	[8.95]			
Level 4	120	799	161	45.62	58%	40%	35%
			[62]	[9.12]			
Level 3	110	562	129	43.87	70%	23%	34%
			[37]	[9.79]			
Level 2	100	245	116	43.03	72%	9%	58%
			[32]	[9.82]			
Level 1	91	743	92	36.96	71%	4%	74%
			[22]	[11.75]			
All Sample	333	8,999	226.62	45.09	42%	54%	26%
			[173]	[9.53]			

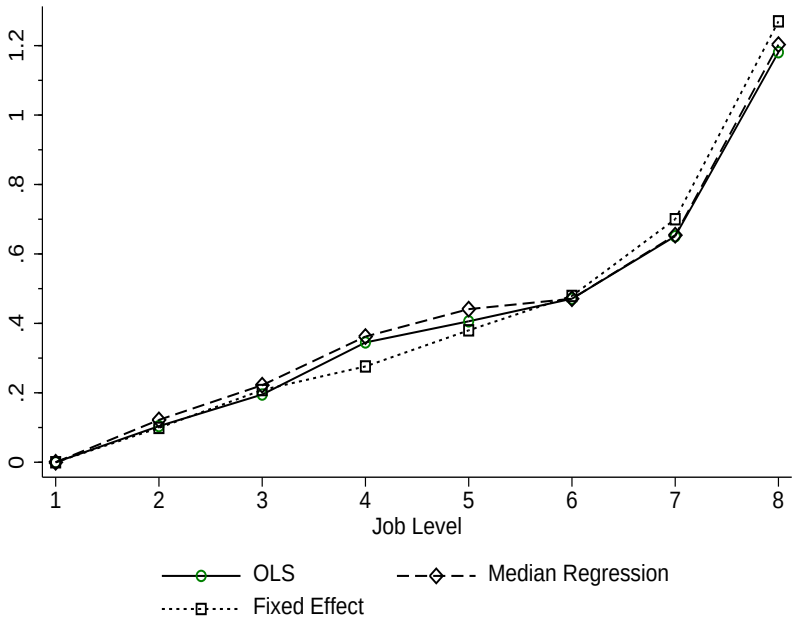
Note: Standard errors are in parenthesis. Mean pay is the quarterly hourly pay (thousands of Czech Crowns). Age is expressed in years. The omitted category of education is apprenticeship.

Table 1.2: Regression Results

	OLS	OLS	OLS	Median	Fixed Effect
	(1)	(2)	(3)	(4)	(5)
Chief Executives	1.388***	1.048***	1.181***	1.203***	1.270***
	[0.043]	[0.052]	[0.056]	[0.037]	[0.05]
Job Level 7	0.824***	0.543***	0.651***	0.654***	0.700***
	[0.029]	[0.042]	[0.044]	[0.031]	[0.042]
Job Level 6	0.660***	0.368***	0.471***	0.471***	0.479***
	[0.045]	[0.051]	[0.053]	[0.035]	[0.046]
Job Level 5	0.527***	0.287***	0.406***	0.441***	0.380***
	[0.046]	[0.052]	[0.048]	[0.035]	[0.046]
Job Level 4	0.471***	0.265***	0.345***	0.362***	0.276***
	[0.048]	[0.044]	[0.039]	[0.033]	[0.031]
Job Level 3	0.245***	0.101	0.195***	0.222***	0.208***
	[0.047]	[0.063]	[0.037]	[0.035]	[0.033]
Job Level 2	0.171***	0.087	0.104*	0.122***	0.099***
	[0.057]	[0.064]	[0.057]	[0.044]	[0.058]
Age		0.024***	0.028***	0.027***	0.027***
		[0.006]	[0.005]	[0.005]	[0.004]
Secondary		0.059	0.055	0.007	0.025
		[0.067]	[0.060]	[0.030]	[0.046]
University		0.369***	0.328***	0.224***	0.239***
		[0.079]	[0.066]	[0.031]	[0.051]
Female			-0.160***	-0.140***	-0.108***
			[0.016]	[0.014]	[0.011]
Private			-0.208***	-0.175***	
			[0.069]	[0.021]	
State			-0.091	-0.090***	
			[0.085]	[0.024]	
Mixed			-0.064	-0.034	
			[0.077]	[0.023]	
Employees (100-500)			0.209***	0.158***	
			[0.068]	[0.045]	
Employees (above 500)			0.306***	0.254***	
			[0.068]	[0.045]	
Industry dummies	No	No	Yes	Yes	No
Managers	6,819	6,819	6,819	6,819	6,819
Adjusted R^2	0.32	0.41	0.48	0.3	0.42

Note: *** Significant at the 1% level; ** Significant at 5%; * Significant at 10%. The dependent variable is the log of managerial pay. Clustered standard errors are in parentheses. Employees omitted category is firms with 50-99 employees. Ownership omitted category is foreign-owned firms. Education omitted category is lower than secondary education. Column 5 includes firm fixed effects. Age squared is not reported.

Figure 1.1: Estimated Pay-Rank Coefficients



Note: Level 8 corresponds to the highest managerial position (Chief Executives) and level 1—to the lowest one. Each curve comes from a separate regression corresponding to the results in columns 3, 4 and 5 presented in Table 1.2.

Table 1.3: Testing Convexity Hypotheses

	OLS	Median	Fixed Effect
CE/Level 7 vs. Level 7/Level 6	0.35***	0.36***	0.35***
	[0.06]	[0.03]	[0.054]
Level 7/Level 6 vs. Level 6/Level 5	0.12*	0.15***	0.12***
	[0.07]	[0.04]	[0.02]
Level 6/Level 5 vs. Level 5/Level 4	0.01	-0.05	-0.01
	[0.06]	[0.05]	[0.04]
Level 5/Level 4 vs. Level 4/Level 3	-0.09	-0.06	0.04
	[0.07]	[0.05]	[0.036]
Level 4/Level 3 vs. Level 3/Level 2	0.06	0.04	-0.04
	[0.04]	[0.06]	[0.047]
Level 3/Level 2 vs. Level 2/Level 1	-0.01	-0.02	0.01
	[0.095]	[0.08]	[0.09]
Level 2/Level 1	0.10*	0.122***	0.09***
	[0.4]	[0.044]	[0.058]

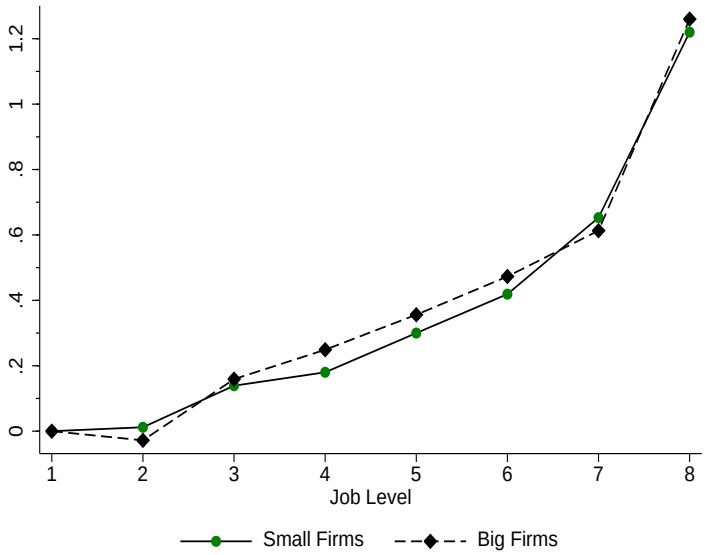
Note: *** Significant at the 1% level; ** Significant at 5%; * Significant at 10%. Clustered standard errors are in parentheses. Results come from Table 3, respectively columns 3, 4 and 5 for OLS, median and firm fixed effect estimation.

Table 1.4: Testing Extraordinary Large Pay Increase

	OLS	Median	Fixed Effect
Chief Executives vs. 1.6*Level 7	0.14**	0.16***	0.15***
	[0.5]	[0.03]	[0.048]
Chief Executives vs. 1.5*Level 7	0.2***	0.22***	0.22***
	[0.5]	[0.03]	[0.046]

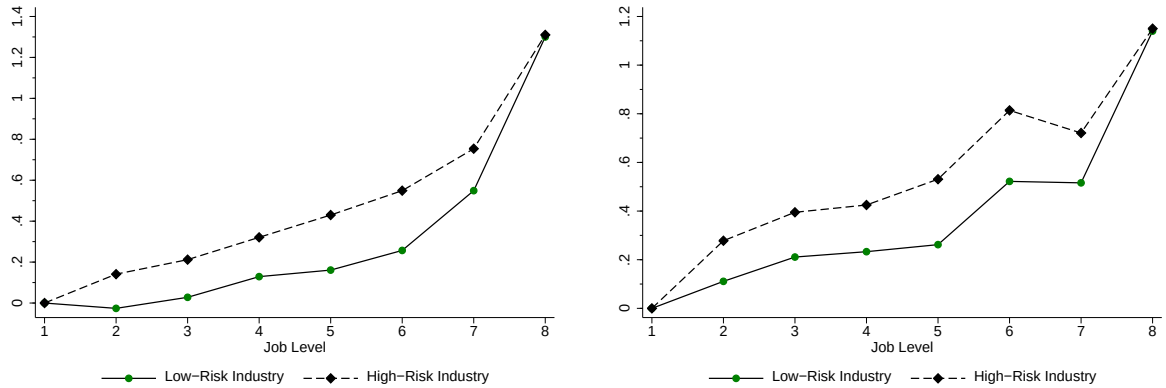
Note: *** Significant at the 1% level; ** Significant at 5%; * Significant at 10%. Clustered standard errors are in parentheses. Results come from Table 3, respectively columns 3, 4 and 5 for OLS, median and firm fixed effect estimation.

Figure 1.2: Pay-Rank Estimates: Size Effect



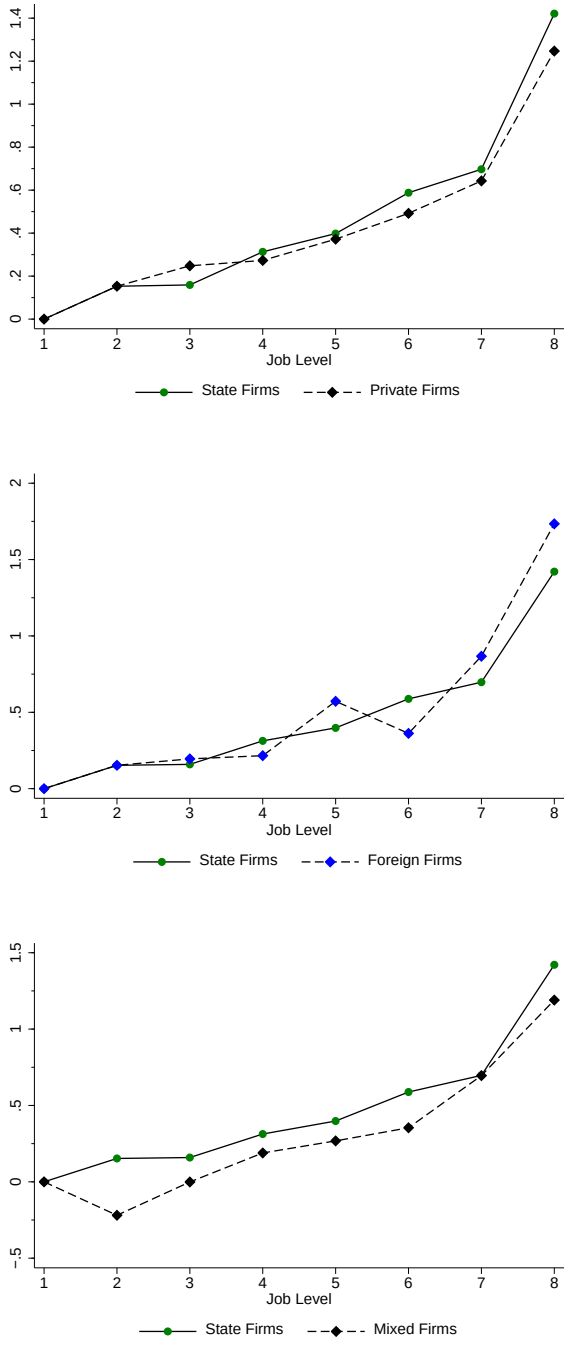
Note: The graph shows estimates of regressions analogous to the ones from Table 1.2, except for the interaction of job level and firm size indicators. Small (big) firms are firms with less (more) than 700 employees. Firm fixed effects are included.

Figure 1.3: Pay-Rank Estimates: Industry Effect



Note: The graph shows estimates of regressions analogous to the ones in Table 1.2, except for the interaction of job level and industry dummies. Left(right)-hand side graph uses variation of industry value added (production) over time to define industry risk. Low-risk industry is defined as an industry with variation below the 30th percentile, and a high-risk industry—above the 70th percentile. Firm fixed effects are included.

Figure 1.4: Pay-Rank Estimates: Ownership Effect



Note: The graphs show estimates of regressions analogous to the ones in Table 1.2, except for the interactions of job levels and ownership indicators. The top graph compares private and state firms. The middle graph compares foreign and state firms, and the bottom one—mixed and state firms. Firm fixed effects are included.

Table 1.5: Number of Contestants and Tournament Prize

Pay Differential	(1)	(2)	(3)	(4)
Number of Contestants	0.029***	0.034***	0.035***	0.034***
	[0.002]	[0.003]	[0.003]	[0.001]
Ownership Dummies		Yes	Yes	Yes
Industry Dummies		Yes	Yes	Yes
Size Dummies		Yes	Yes	Yes
Interactions				
Size & Industry			Yes	
Size & Ownership				Yes
R^2	0.32	0.37	0.40	0.38
Observations	280	280	280	280

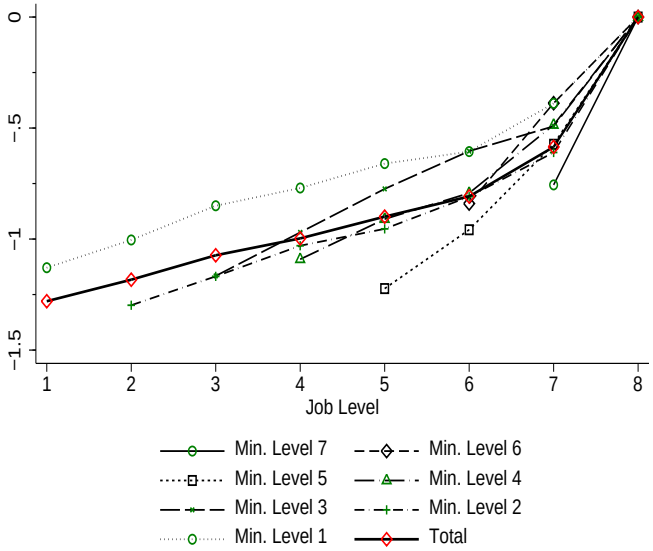
Note: *** Significant at the 1% level. Standard errors in parentheses. The dependent variable is the pay differential: (Log(Chief Executive Pay) – Log(Median Competitors Pay)). Number of Competitors is the number of managers at job level 7.

Table 1.6: Firm Performance and Wage Variation

ROA	(1)	(2)
CV of Pay	0.03*	0.027
	[0.018]	[0.02]
Industry Dummies	Yes	
Ownership Dummies	Yes	
Firm Size	Yes	
R^2	0.1	0.05
Observations	360	360

Note: * Significant at the 10% level. The dependent variable is ROA (net income before extraordinary items and discounted operations divided by total assets). Standard errors in parentheses. CV is the coefficient of variation.

Figure A1: Estimated Pay-Rank Coefficients:
Length of the Ladder Effects



Note: Each curve comes from separate firm fixed effect regressions, where only the firms with the same number of job levels are included. The specifications are analogous to those in Table 1.2. The reference group of job level is level 8.

Chapter 2

Female Managers and Their Wages in Central Europe[1]

Co-authored with Štěpán Jurajda

2.1 Introduction

There is growing evidence that women face a 'glass ceiling' —a barrier to career prospects, which precludes them from achieving high-paying positions and having equal wages with men especially in the upper part of the wage distribution (e.g., Albrecht et al., 2003). A particularly visible and influential type of high-paying position is that of the manager. The representation of women among top-level managers and their relative wage position are therefore of high general public interest. The increasing share of female executives and the narrowing managerial gender pay gap in the US may represent a cracking of the discriminatory 'glass ceiling' (Bertrand and Hallock, 2001; Bell, 2005).

A potential problem with this literature is that all of the existing analyses of the gender pay differences among executives rely on parametric Oaxaca-Blinder decomposition

[1]The authors are grateful for data assistance provided by Vladimír Smolka of Trexima, Ltd. This research is part of the EU Equal project "Fifty - fifty: Equal Opportunities for Women and Men" and is co-financed by the European Social Fund of the EU and the state budget of the Czech Republic.

techniques to understand the sources of the observed wage gap. The goal of any decomposition is to compare the wages of males and females with similar individual characteristics working in similar companies. Given the low and uneven representation of women among top managers, however, there will be a significant share of male managers for whom no comparable women will be observed. Such a lack of 'common support' is strengthened by gender-related sorting into specific types of firms or managerial occupations. Linear regression models used in the Oaxaca-Blinder techniques will therefore project the conditional wage distribution of women onto regions of the male wage distribution in which females are virtually nonexistent. Indeed, recent work by Nopo (2004) and Black et al. (2004) studying gender wage gaps (but not focusing on managers) suggests that such parametric assumptions lead to over-estimation of the 'unexplained' component of the gap, i.e. the part of the gap attributable to differences in rewards to individual characteristics and often interpreted as an upper bound on the extent of gender discrimination.

Following on this recent work, we therefore employ a nonparametric matching approach, which accounts for the gender differences in the 'support' of firm characteristics and does not impose a linear functional form of conditional wage expectations. This is not important only as a robustness check on standard estimation techniques, matching also aids in the interpretation of the data because it separates the part of the observed pay gap that 'occurs' among comparable male and female managers from the part that corresponds to women not being represented at all in the managerial workforce of certain firm types.

Our analysis is conducted on a sample of Czech managerial employees from 2000-2004. The study of managerial gender gaps is significant in the post-communist economies of Central Europe, such as the Czech Republic, where firm personnel strategies and corporate governance are converging towards Western standards (Denis and McConnel, 2003), but where little is known about the relative position of female executives. Although there are now several studies of the gender pay gap in these economies (see Section 2.2), none focus on managers. Our managerial gender wage gap decompositions appear to be the first available outside of the most developed economies. Furthermore, unlike most of the existing work on managers, our analysis covers not only top executives, but also

mid-level managers and employees, thereby allowing us to link the relative position of women across firm hierarchy levels.

We find Czech women to be well represented among low-level managers but severely under-represented at the top of firms' hierarchies, where the overall gender pay gap is also the largest. Our nonparametric estimates imply a smaller 'unexplained' part of the overall pay gap than regression-based techniques. Even after we compare male and female managers with similar education and age and working in similar firms, female wages are about 20 percent lower. We also find a strong within-firm link between the relative position of women at different hierarchy levels. The representation of women at the top of Czech firms as well as the structure of the gender wage gap there appears quite similar to those in the US.

The remainder of this paper is organized as follows: Section 2.2 explores the related literature, Section 2.3 describes the data, and Section 2.4 presents basic gender-related statistics. Section 2.5 then covers the OLS- and matching-based decomposition techniques while Section 2.6 discusses the estimated wage-gap decompositions. We also relate the relative position of women in a firm's management to that in the firm's employee workforce in Section 2.7 and contrast our findings with those from the US literature in Section 2.8. Concluding remarks are offered in Section 2.9.

2.2 Background

Our analysis builds on several strands of research. First, we extend the small literature on the gender wage gap among managers. Second, we complement the extensive set of gender wage gap analyses from post-communist economies. Third, we follow on the first gender-wage-gap applications of the recently developed matching evaluation techniques. In this section, we briefly discuss each of the related areas of research.

2.2.1 Female Managers and their Wages

There are now two detailed studies of the gender gap in top corporate jobs in the US, both relying primarily on Standard and Poor's ExecuComp data, which contain information on

the five highest-paid executives in large publicly traded US firms. Bertrand and Hallock (2001) study the data from 1992 to 1997 and find that women represent about 2.5% of the sample and earn about 45% less than men. Bell (2005) covers the 1992-2003 period and reports a much smaller average gap in gross compensation of 25%, suggesting dramatic reductions in the gap after 1997. Both studies show that women gradually increase their participation in top executive ranks (to over 6% after 2001) as well as their relative compensation. They both also suggest that about 50 to 75% of the raw wage gap can be 'explained' by women being less likely to manage large companies and to be CEO, Chair or company President. The ExecuComp data used in the US research report information on different components of executive pay including salary, annual bonus, incentive bonus, and the value of stock options. Bell (2005) finds that the 'unexplained' gender wage gap is not sensitive to different types of compensation measures. She also reports a positive relationship between the presence of a female CEO and the representation and relative wages of other female top-paid managers.

Outside of the US, there is so far apparently only one study of the gender pay differences among executives. Gregg and Machin (1993) study British senior managers and find that women are less likely to be promoted and are paid 30% less. Furthermore, two thirds of this raw pay gap is not explained by their observable characteristics. Little is therefore known about the relative position of female managers in most other countries. Standard international data provide no detailed information on the structure of the male-female pay gap among managers. The only widely available related statistic is the women's share as legislators, senior officials and managers, i.e. their share in the 1st major group of the ISCO-88 occupational classification. This statistic can be computed from household surveys, such as the widely available Labour Force Surveys, and is also featured in the International Labour Organization's Yearbooks (see, e.g., ILO, 2004). However, it is likely that this share is dominated by the fraction of women among the large group of senior officials and may therefore over-estimate female representation among top managers.[2]

[2]For example in the 2003 and 2004 Czech Labor Force Surveys, about 90% of the ISCO 1st major group was composed of senior officials, which includes municipality and public-administration officials.

To provide an aggregate cross-country comparison of the relative gender employment among managers of large firms, we use the Luxembourg Income Study (LIS), which harmonizes labor-market micro data from several countries.[3] This data allows us to focus on managers of large firms (occupation group 12 of the ISCO-88 classification) and to measure both the fraction of women in this group and the corresponding gender wage gap. Table 2.1 shows that the share of females in this occupational group varies widely from 17% in Belgium to 43% in the USA. The hourly pay gap, defined as the ratio of female to male average wages minus one is high in Russia, Spain, and the US, and the smallest for Ireland and Slovenia. In the Czech Republic females constitute only about 23% of the group of corporate managers. The corresponding gender pay gap, at 24%, is then close to the average gap taken across our small sample of countries. Based on this aggregate comparison, it therefore appears that the Czech Republic is a quite typical country in terms of the relative position of women in this most prestigious group of workers.

2.2.2 Wages in Post-Communist Countries

Much research now studies the size and structure of the gender wage gap in post-communist economies. A typical finding in this literature is that only a small part of the pay gap can be attributed to gender differences in productive characteristics. Several studies also point out the adverse effect of increasing wage inequality for the relative wage position of women and the important role of decreasing low-wage female labor force participation for explaining the observed reductions in the overall gap.[4] On the other hand, there is relatively little research on gender segregation (and the changes thereof) across occupations in these countries. Ogloblin's (1999) analysis implies a major role for occupational segregation in accounting for the observed gender wage gap in Russia in the early 1990s. Similarly, Jurajda (2005), who examines Czech data from 1998 and 2002,

[3] The LIS collects information at the individual and household level from labor force surveys. The data is available at `www.lisproject.org` .

[4] For recent gender wage gap decompositions from Central Europe see Jolliffe and Campos (2005) or Jurajda (2005).

suggests that a large part of the stable gender wage gap is due to segregation of women into low-paying occupations and firms. Still, he finds the unexplained component of the gap in the Czech Republic to be much larger, suggesting an extensive potential role for within-job wage discrimination.

The history of occupational gender segregation (Ogloblin, 1999) as well as the recent evidence on the presence of important segregation effects and on potential within-job wage discrimination all motivate the study of gender gaps in the highly visible role-model managerial occupation group. Yet, the literature on managerial pay in post-communist economies is miniscule as it apparently consists of two papers, both focusing on the relationship between managerial compensation and firm performance. While Jones and Kato (1998) examine the pay of Bulgarian managers immediately after the collapse of communism, Eriksson (2005) studies a recent sample of Czech and Slovak managers. He finds that private firms offer higher pay than state-owned companies and confirms a positive link between managerial compensation and company performance. There are 7% of females in his 2000 sample of 600 Czech CEOs responding to an earnings survey; he offers no further detail as to the gender structure of managerial employment.

2.2.3 Matching-Based Gender-Wage-Gap Decompositions

The vast majority of the existing gender wage gap studies and all of the managerial wage gap research employs the Oaxaca-Blinder decomposition to separate the part of the observed raw gap attributable to differences in average worker characteristics and the part due to differences in the rewards of these characteristics (i.e., the 'unexplained' part). This approach, however, relies on restrictive parametric assumptions about the functional form of the wage conditional expectation function, which could lead to misleading results, especially when there are important differences in the supports of the empirical distributions of male and female individual characteristics. For example, consider the likely case of women not being represented in certain types of firms or occupations. In this situation, the regression-based traditional framework will attempt to compare male and female wages conditional on a given set of characteristics by projecting the conditional wage distribution of women onto regions of the male wage distribution in which females

may be virtually nonexistent. Recent work reviewed below suggests that employing the regression-based techniques and thus ignoring this comparability issue, often referred to as the 'common support' problem, can lead to misleading results.[5]

The alternative non-parametric decomposition technique, advocated recently in the program evaluation literature (see, e.g., Heckman et al., 1998), relies on comparing only wages of 'matched' men and women—those with a very similar set of observed characteristics. The matching approach then remains silent about the extent of wage differences between men and women in those types of firms or occupations from which women are generally absent. There are now the first two applications available of the matching approach to gender wage gap decompositions. Nopo (2004) matches wages of Peruvian men and women with an exactly identical combination of observed characteristics. Black et al. (2004) also use this so-called exact matching approach to estimate the 'unexplained' gender wage gap among highly educated white, black, Hispanic, and Asian workers in the US. Both studies compare results based on matching with those of the traditional parametric approach and suggest that the explained portion of the overall raw gap is typically significantly higher when matching is used. We take away the lesson that analyses of gender wage gaps should compare results based on linear regressions with those based on the intuitively more appealing matching decompositions, especially in situations where either men or women are not represented across the whole range of explanatory characteristics.

2.3 Data

We use data from a national employer survey, the Information System on Average Earnings (ISAE), from the first quarters of 2000 to 2004. The enterprise survey is conducted on behalf of the Czech Ministry of Labor and Social Affairs and firm response is mandatory. It contains hourly wages, gender, education, age, and a detailed occupational

[5] The pitfalls of parametric decomposition techniques have been carefully analyzed by Barsky et al. (2002) in the context of estimating the portion of the black-white wealth gap that is due to differences in earnings. In a related line of work, Heckman et al. (2003) reject the functional form of the Mincerian wage regressions.

classification for each worker employed in the sampled firms, which also report their total employment, ownership and industry (using the NACE classification).[6] The wage records are drawn directly from firms' personnel databases and the definition of hourly wage is detailed and fully consistent across firms; it includes total quarterly cash compensation and bonuses divided by total hours worked for that quarter.[7] Having available a measure of hourly wage rates is ideal for the purpose of estimating differences in the pay of men and women because of the potential gender differences in hours worked. On the other hand, it is possible that Czech executive pay packages also contain other forms of compensation such as stock options, which are therefore ignored in our analysis. There is no systematic evidence on the extent of the use of stock options in post-communist countries.

A detailed occupational classification (ISCO-88) is used to identify managerial employees at three levels: (i) chief executives and directors (ISCO code 121), (ii) production managers and supervisors (ISCO 122), and (iii) specialist managers and supervisors in finance, administration, personnel, sales and marketing, distribution, or computing (ISCO 123). In this study, the first group is referred to as top-level managers. Many firms report more than one top manager. Next, we combine production and specialist managers under the heading of lower-level managers. In some cases, we will bring into the analysis a third, benchmark group of all regular employees.[8]

The original stratified random sample drawn from the country for-profit firm register consists of 2000 firms on average per year over the 2000-2004 period, and covers all industries, ownership groups and firm sizes (above 10 employees) with a natural over-

[6] We cannot construct an individual panel due to lack of personal identifiers.

[7] Annual bonuses are applied proportionately to each quarter in calculating the quarterly average wage rate.

[8] In a subset of our analysis in Section 2.8, we also use another alternative classification of managers, which distinguishes three managerial levels: (i) chief executives and directors (ii) directors in finance, administration, personnel, sales and marketing, distribution or computing, and (iii) all other managers and supervisors. This alternative classification employs the fact that the Czech version of ISCO-88 introduces specific 5th digit codes, which allow us to identify group (ii).

representation of large firms.[9] In our analysis we focus only on large firms—those with more than 250 workers—as the position and role of managers are defined more precisely in large organizational structures. The ownership grouping available in the data distinguishes foreign-majority, domestic-private-majority, state-majority, and no-majority (mixed) firms. We also omit large cooperatives (about 200 firms on average per year), because of their different legal and corporate governance framework (Bonin et al., 1993). The number of sampled large firms is evenly distributed across years, with the maximum of 733 in 2001.

As a result, we start with a sample of 3,297 firm-year observations. Unfortunately, wage records for top-level managerial employees are missing in almost a third of this pool of observations. Fortunately, many of the firms that do not report managerial wages in one year do so in another. In the whole five-year period, a total of 1,011 different firms are covered, out of which 218 do not report top-level managerial wage records in at least one year. The incidence of not reporting managerial wages is unrelated to observed firm characteristics.[10] Still, a potentially non-random response rate with respect to the relative position of female managers is a potential weakness of our analysis.[11]

Given the stable wage structure in the Czech Republic during our study period (Jurajda, 2005) and the goal of focusing on the small group of female top-level managers, our strategy is to combine the firm-year observations with available managerial wage records to maximize the size of a cross-section of firms, at the cost of combining data from different years. Specifically, we select one firm-year observation from the five year sample period based on several criteria.[12] The estimation-ready sample consists of 783

[9] The 2001 ISAE sample covers 38 (58) [64] percent of firms employing 250-500 (500-1000) [over 1000] employees.

[10] We estimated a logit model for the incidence of missing top-manager wages controlling for firm ownership type, industry and the number of employees. None of the estimated set of parameters was statistically significant. These results are available upon request.

[11] We evaluate this potential problem indirectly in Section 2.7.

[12] We look for the year with the maximum number of reported top- and lower-level managers, which, however, does not vary much within firms, conditional on reporting. In case a given firm reports a similar number of managers in more than one year, the year closer to 2002 or 2003 is preferred. In all

different firms reporting wages of almost 1,700 top-level managerial employees.

Overall, the data we use have several unique strengths as well as weaknesses. Among the strengths, it is a large data source covering the wage records of 1,692 top-level managers and over 36,000 lower-level managers. The data therefore allow us to study and relate gender gaps at two managerial levels.[13] The wage measure is free of reporting bias possibly present in survey data on managerial pay in less developed economies such as those used by Eriksson (2005). For the weaknesses, the data do not identify CEOs,[14] there is a substantial fraction of firms not reporting managerial wages, and only wage data (including bonuses) but no other forms of compensation are reported. The last weakness may be of relatively small concern. First, salaries will likely constitute the bulk of compensation for lower level managers. Second, Bell (2005) finds that the unexplained portion of the gender pay gaps among top-level US executives are similar when estimated off all-compensation or salary-only data.

2.4 Gender Gaps in Wages and Employment

A unique feature of our managerial wage data is that they allow us to compare the wage and employment patterns among two layers of managers as well as those prevailing among basic employees. Such comparisons are natural to the extent that lower-level managers are recruited from employees within industries or demographic groups and to the extent that top managers are promoted from lower-level ranks within firms. From an alternative perspective, these comparisons are interesting if the presence of a female top-level manager has a positive influence on the relative standing of lower-level female

estimated regressions presented below, we include a set of year dummies. In a previous version of this paper, we compare results based on alternative sample-inclusion criteria, which make relatively little difference. These results are available upon request.

[13] We also observe non-managerial employees. There are 752,181 such wage records.

[14] We note, however, that the fraction of women among all top-level managers in our data (7%) is identical to the fraction of Czech female CEOs reported by Eriksson (2005).

employees.[15] While we are not able to distinguish between these two perspectives, we believe that the benchmark all-employee-based comparisons offered below aid in the interpretation of the descriptive statistics for managers.[16]

Top-level managers in our data make on average 2.69 times more per hour than lower-level managers who, in turn, enjoy wage rates 2.46 times higher compared to those of basic employees. How well are women represented among these high-paid groups of workers? If the gender of managers were assigned randomly in a fashion reflecting the overall employment patterns, the share of female managers would be around 46%, which is the fraction of females in the whole sample before dropping the non-response firms and the small firms. In contrast, our data show that only 7% of top managers are females, while women constitute 32% of all lower-level managers.[17] Female top-level (lower-level) managers make on average 41% (38%) less per hour than their male colleagues, while the employee-based gender wage gap is 22%.[18]

Demographic patterns of gender-specific employment and wages are presented in Table 2.2 separately for the three hierarchy levels of top managers, lower-level managers and all remaining employees. Specifically, the table shows the fraction of females and the gender wage gap in each group (i.e. one minus the ratio of female to male average wages) as well as the relative pay position of a given group within a hierarchy level.[19] Women

[15] See Bell (2005) for several hypotheses on why this might be the case and an extensive list of related references.

[16] We return to the relationship between relative female positions across hierarchy levels in Section 2.7.

[17] Our Czech data have a sister data set in Slovakia (collected by the same agency). However, the Slovak data are much smaller compared to the Czech sample as they cover only 227 non-cooperative firms employing over 250 workers as of 2002. Of these firms, all report lower-level managers, but only 54% report top managerial wages. We therefore hesitate to use this data for detailed analysis. Nevertheless, the representation of women is similar to that found in the larger Czech sample as 7% of reported Slovak top managers are female, while 40% of lower managers are women.

[18] The median gender wage differential for top-level and lower-level managers is 41% and 37%, respectively.

[19] In the Table, we report the statistical significance for tests asking whether the within-hierarchy group-specific statistic is significantly different from that calculated using all data in a given hierarchy

are relatively highly represented among younger and especially among less educated top managers—and these groups of managers are also the least highly paid. Among lower-level managers, the wage gap is small in the group of highly educated, where there are also relatively few women. The representation of women and the gender wage gap are more equalized across major demographic groups in the large sample of basic employees.

Firm-level patterns of employment and wages are presented in Table 2.3, which focuses on firms' ownership type, size, and industrial sector. The results for top managers suggest that state-owned firms have the lowest gender pay gap and also feature more women at the top of the firm hierarchy compared to other ownership categories. Dividing firms into four quartiles by size (total employment) implies that females are more likely to be at the top of the few very large firms. Finally, the 'femaleness' of the top brass is highest in the relatively low-paying retail and transport/communication industries, where 38% of all female top managers work.[20] The gender wage gap for top managers fluctuates across all industry branches, but is particularly high in the retail industry.[21]

Shifting attention to lower-level managers, Table 2.3 suggests that female representation in the managerial workforce is highest in state-owned and very large firms, similar to the case with top-level managers. The gender wage gap is now somewhat more equalized across firm types in comparison to the relevant top-level-managerial statistic. Looking at industry patterns of lower management's 'femaleness' we again find the retail and transport industries having high shares of women. More than half of all female lower managers are concentrated in transport/communication and manufacturing. However, the sector with the highest number of females—transport—pays some of the lowest wages and exhibits the second highest wage gap after banking and insurance.

Of course, these simple descriptive findings are hard to interpret as the cross-industry differences could be driven by a different demographic or firm-size composition of the

level. This should help signal the amount of information available within each detailed data cell.

[20] We also note that banking and insurance feature a high share of female employees and lower-level managers, but a low share of female top managers.

[21] The construction and service industries are notable in that they exhibit very high shares of women among basic employees, but very low shares of female top-level managers and high gender wage gaps.

sampled firms. Nevertheless, the evidence does suggest that female managers tend to be under-represented in the highest paid jobs and there appears to be a clear divide in the share of women between top- and lower-level managerial positions. The rest of this study asks to what extent the observed gender wage gaps among managers can be explained by the gender employment patterns and differences in demographic characteristics highlighted above.

2.5 Decomposition Techniques

2.5.1 Regression-Based Decompositions

The traditional Oaxaca-Blinder mean wage gap decomposition technique, which isolates the part of the overall gap related to observable differences between men and women, is based on estimating gender-specific linear log-wage regressions controlling for observed characteristics. We approximate the counterfactual non-discriminatory wage structure (Oaxaca and Ransom, 1994) with the 'male' regression coefficients based on running a regression on the sample of male managers. This choice makes our parametric decompositions comparable to the matching decompositions presented below. The approach we choose is to isolate the effect of belonging to the female demographic group by asking how much women would be paid if they were treated like men; this corresponds to estimating the effect of 'treatment on treated' in the terminology of the program evaluation literature.

We therefore decompose the gap between the male and female mean of the natural logarithm of hourly wages as follows:

$$Gap = \overline{\ln w_1} - \overline{\ln w_0} = (\overline{X_1} - \overline{X_0})' \beta_0 + UnexplainedGap, \tag{2.1}$$

where $\overline{X_1}$ and $\overline{X_0}$ denote the respective vectors of female and male mean values of explanatory variables and β_0 stands for the estimated set of male slope coefficients. In order to reflect the likely presence of inter-dependence of unobservables within firms, we cluster residuals at the firm level in all reported specifications.

The estimated wage equations condition on individual characteristics (age groups and

education degrees) and also control for firm characteristics (type of ownership, firm size and two-digit industry category).[22] Introducing firm controls affects the interpretation of the unexplained gap because they absorb the potential barriers to the entry of women into managerial positions in certain firm types.[23] Controlling for firm characteristics, however, helps us compare the wages of comparable female and male managers and therefore approximate more closely potential violations of the equal pay for equal work principle. This is also the goal of the matching approach presented below, which will allow us to decompose the overall gap into the part due to wage differences among comparable managers (explained and unexplained) and the part related to a lack of presence of female managers in certain firm types.

2.5.2 Matching-Based Decompositions

Non-parametric matching, which contrasts wages of ('matched') male and female workers with similar observable characteristics, is an intuitive alternative to regression-based methods. We again start with the total wage gap, defined as the difference between female and male conditional expected wages

$$Gap = E(\ln w_1 | D = 1) - E(\ln w_0 | D = 0),$$

where $\ln w$ is the natural logarithm of wages. We consider the 'treatment' effect of being a female ($D = 1$) as opposed to belonging to the 'control' demographic group of men ($D = 0$). The matching approach aims to estimate the missing counterfactual—what would a woman's wage be if she were a man. The answer is given by the wage of men with the same set of observable characteristics.

First, we sort both males and females into data cells, indexed by k, based on their age, education, industry, firm size and ownership. This allows us to write the overall average

[22] Wage-age dependence is specified using a flexible step function with five-year intervals; education controls consist of four dummies for primary, apprenticeship, secondary and university degrees; ownership dummies correspond to majority foreign, private, state and mixed ownership; firm size is controlled for using a step function corresponding to deciles of the size distribution; finally, twelve industry dummies are also included.

[23] See Blau and Ferber (1987) for a similar discussion related to the inclusion of occupational controls.

wage of females as $E(\ln w_1|D=1) = \sum_{k=1}^{n} p_k E(\ln w_1|D=1,k)$, where $E(\ln w_1|D=1,k)$ is the expected wage for females in the k^{th} cell and p_k is the proportion of females in that data cell. Similarly, for men, we use q_k to denote the proportion of males in the k^{th} cell. Thus the gap can be expressed as

$$Gap = \sum_{k=1}^{n} p_k E(\ln w_1|D=1,k) - \sum_{k=1}^{n} q_k E(\ln w_0|D=0,k)$$

and by adding and subtracting $\sum_{k=1}^{n} p_k E(\ln w_0|D=0,k)$ we obtain

$$Gap = \sum_{k=1}^{n} p_k [E(\ln w_1|D=1,k) - E(\ln w_0|D=0,k)] + \sum_{k=1}^{n} (p_k - q_k) E(\ln w_0|D=0,k). \tag{2.2}$$

This is of course reminiscent of the Oaxaca-Blinder decomposition. The first term in the equation describes how much less women would earn if they shared equal observable characteristics with men. The group-specific gender wage gap is averaged across groups with respect to the distribution of the "treated" (p_k), resulting in an estimate of the 'average treatment on the treated' (ATT) in the terminology of the program evaluation literature or the 'unexplained gap' in the jargon of the regression-based decompositions.

Equation 2.2 makes clear that a basic requirement for the implementation of the matching approach is a sufficiently large overlap between the distribution of the observable characteristics of the "treated" and "untreated" individuals. This is known as the *common support* condition. In our application, it asks that for every female manager a sufficient number of 'similar' males be available. By the same token it stipulates that we only use 'similar' males for comparison with every female manager in our data and drop from the calculation of the ATT those males who work in firm types where no women are employed. The common support condition is ignored in the parametric decomposition techniques, which use functional form assumptions to project the conditional wage distribution of women onto regions of the male wage distribution in which females are virtually nonexistent.

There are available several algorithms for matching 'comparable' workers. Matching 'exactly' on the whole vector of observed covariates leads to the 'curse of dimensionality' as the number of data cells containing a given combination of X increases with the number of covariates and the size of the available data within each cell dwindles. For-

tunately, Rosenbaum and Rubin (1985) demonstrate that matching can be done on the conditional probability of 'participation' (in our context the conditional probability of being female) known as the *propensity score*, thus reducing the dimensionality problem considerably. In this study we apply 'exact', kernel and Mahalanobis-metric matching with replacement.[24] Exact matching, or cell matching, compares individuals with exactly the same set of values of the observed variables. Kernel matching is based on the estimated propensity scores and takes local averages of the untreated observations near each treated observation.[25] Finally, Mahalanobis matching consists of matching on specific variables (a subset of X that is assumed to be particularly important) in addition to the propensity score; it may decrease selection bias and may also serve as an additional protection against any impact due to inconsistent estimation of the propensity score.[26]

2.6 Decomposition Results

2.6.1 Regression-Based Decompositions

In this section we present the estimated conditional ('pure', 'unexplained') wage gaps based on the Oaxaca-Blinder procedure outlined in Section 2.5.1. Table 2.4 first lists the 'raw' average gender log-wage differentials and then the corresponding conditional gaps based on different regression specifications. The results are presented separately for top managers, lower managers and employees. The unconditional log-wage gender gap is -

[24] Matching is implemented in Stata 8 using the psmatch2 software suggested by Leuven and Sianesi (2003) and available at: http://ideas.repec.org/c/boc/bocode/s432001.html. 'Replacement' refers to the repeated use of the "untreated" (male) individuals in forming the matched comparison groups. Given that in our application the size of the treatment group is typically smaller than the control group size, matching with replacement is the only reasonable option.

[25] For exact matching, we use so-called 'pair' matching (one woman to all matched men); for propensity score matching, we use trimming to determine the common support, see Smith and Todd (2005).

[26] See Rubin (1980) and Rosenbaum and Rubin (1983) for further details. An assessment of the matching quality consists of checking whether the matching procedure is able to balance the distribution of the relevant variables across the control and treatment group. To this effect we perform two-sample t-tests as suggested by Rosenbaum and Rubin (1985).

0.55 for top managers, -0.43 for lower managers and -0.22 for employees. Approximately a third of the raw gender wage gap for both top- and lower-level managers can be explained by the gender differences in age and education. This is in contrast to the situation with regular employees, where the demographic composition of the workforce is actually more favorable for women. Next, controlling only for firm characteristics but not for employee demographics suggests that the type of firm that is more likely to have female managers pays significantly lower wages. Firm ownership, size and industry explain up to 10 percentage points of the managerial gender wage gaps, but little of the regular-employee gap. While there are more women in the group of lower-level managers, they are sorted into less-paying types of firms in a fashion similar to that applying to top-level managers.

The overall conclusion of the presence of a sizeable 'unexplained' component of the managerial gender wage gap is confirmed in the bottom part of Table 2.4, where we present gaps controlling for both individual and firm characteristics. The top-managerial conditional log-wage gap is above -0.28 even in the richest specifications, where we introduce interaction terms between firm size and industry categories. The unexplained gaps are generally somewhat smaller for lower-level managers and decrease further when we focus on employees only. However, they remain above 20% even there.[27] Our next question is to what extent these regression-based 'unexplained' wage gaps can be thought of as capturing the wage gap between truly comparable male and female managers. We therefore turn to the results based on matching methods.

2.6.2 Matching-Based Decompositions

To estimate the average treatment on the treated (ATT), we implement the kernel, Mahalanobis-metric, and exact matching procedures.[28] But first, we estimate the propen-

[27] In unreported specifications, we have controlled for firm characteristics fully, using a firm fixed effect. This led to a dramatic reduction in the gap. For example, the gap for top-level managers, estimated based on a specification with firm fixed effects and individual characteristics, shrinks to 0.13. Unfortunately, the within-firm comparison for top managers comes from only 64 firms, which are mostly in manufacturing and almost all quite small.

[28] We experimented with different kernel functions and bandwidth parameters and found that these choices affected the ATT little. The reported results are based on the Epanechnikov kernel using an

sity score—the probability that an individual with certain characteristics is female. Specifically, we run logit models controlling for the same set of observables used in the OLS wage regressions, entered in flexible forms as step functions and allowing for interaction terms.[29]

Table 2.5 shows the 'unexplained' wage gap from the regression-based decompositions together with the estimated ATT parameter from all three types of matching. Bootstrapped standard errors are reported below the average treatment effects, which are rather similar across the three types of matching, suggesting little sensitivity to the details of the matching technique. We note that the ATT estimates for top managers are smaller than the OLS-based conditional gaps, but remain large and are above zero with high levels of statistical significance. The Oaxaca-Blinder decomposition suggests that for top managers out of the raw log-wage gender gap of -0.55, about -0.28 remain unexplained, while the ATT estimate ranges from -0.15 to -0.22 depending on the procedure.[30]

In contrast, the ATT for lower-level managers, at about -0.20, is more similar to the OLS-based conditional gap. This is perhaps not surprising, given that the common support condition is less of a problem in the group of lower-level managers where women are more highly represented. The number of 'comparable' male and female wage records used in each decomposition is presented in the Table and shows that matching excludes from comparison only a few male and at most 9% of female lower-level managers. In stark contrast, the share of non-comparable top managers is high. Exact matching is the most strict procedure as it drops all observations that do not find a gender counterpart with the same set of all covariates (age and education group, industry, firm-size and owner class, and year); as a result only 79 females are matched with 251 males out of

optimal bandwidth of 0.06. The sub-set of X used for matching on top of the propensity score consists of ownership, firm size, and industry indicators.

[29] Age enters as a step function with five-year intervals, education in four attainment-level dummies, and firm size as a step function in percentile steps. We also control for a set of year, industry and ownership dummies, and interact the firm size and industry terms.

[30] We also estimated specifications conditioning only on pre-market characteristics (age and education). For the top (lower-level) managers the exact-matching ATT estimate is -0.34 (-0.26).

the original sample of 118 females and 1,572 males. Accounting for common support in terms of the unidimensional propensity score is less restrictive, especially for men, but results in similar ATT estimates.

Matching indeed highlights the support problem in a way that regression does not. Let us consider for example the exact matching procedure. Starting with the raw wage gap for all top managers of -0.55, we analyze only the small sub-sample of matched managers, where the raw gap happens to be -0.12. This shows that a major part of the gap comes from the existence of non-comparable top male and female managers. Using matching averaging on the matched sub-sample (i.e., weighting the group-specific gender wage gaps with the distribution of the 'treated') then results in an unexplained gap of -0.17.[31]

Finally, we note that both the kernel and the Mahalanobis matching procedures succeed in reducing the variability of observable characteristics across the two genders, which suggests high matching quality.[32] We conclude that in the presence of low female representation among top managers, matching leads to lower 'unexplained' gaps compared to OLS decompositions, while there is less difference in the estimated conditional gaps across our diverse decomposition methods for the group of lower-level managers, where women are better represented.

2.7 Relationships Across Hierarchy Levels

Here, we explore some interesting correlations linking the three within-firm hierarchy levels that we have thus far analyzed separately. There are two potential interpretations

[31] Naturally, applying the Oaxaca-Blinder decomposition on the exactly matched sub-sample does not allow one to explain any part of the gap there, given how balanced observables are across genders in this sub-sample.

[32] Diagnostic results are available upon request. We have evaluated pseudo-R^2 statistics before and after matching separately for each procedure and each hierarchy level. In all cases there are no systematic differences in the distribution of covariates after matching and the pseudo-R^2 is close to zero (0.02, down from 0.2 before matching). Similar conclusions come from F-tests on the joint significance of all regressors.

of such within-firm linkages: Women in upper firm hierarchy levels could 'help' women enter lower-level positions and/or a high fraction of women among employees could lead to more females reaching the higher hierarchy levels. The first mechanism is featured in the economic theory of discrimination (Becker, 1985), where female managers are inclined to hire women into their firms because they may prefer to work with similar individuals. The alternative mechanism is natural to the extent that lower-level managers are recruited from employees and top-level managers were once lower-level managers. In the absence of information about the timing of the entry of female top managers, however, it is difficult to disentangle the likely two-way causality. In a similar spirit, one can also ask whether the gender wage gaps of employees and lower-level managers are correlated with the fraction of females among top-level managers. Such analysis has been recently performed by Bell (2005), who explores the correlation of the presence of a female CEO with the relative standing of female employees in US companies. She concludes that women are relatively better off in women-led firms in terms of pay and that having more women in a firm is positively associated with the chances of a woman reaching the top of the firm.

Our initial analysis of this issue links the share of women across adjacent hierarchy levels within firms. Specifically, we regress the firm-specific share of women among employees on the firm's share of women among low-level managers, controlling for a full set of firm-type observables used in the gender gap decompositions presented above. We then repeat this analysis for all combinations of adjacent hierarchy levels. In all specifications we find similar statistically significant coefficients of about 0.3 to 0.4. Next, we ask similar descriptive questions for the firm- and hierarchy-specific gender wage gap. For instance, we regress the gap among employees on the share of women among lower-level managers and then use all other combinations.[33] Again, we find a highly similar set of significant conditional correlations with a coefficient of about -0.1. In sum, there is a statistically strong positive link at the firm level between the fraction of women at various hierarchy

[33] We measure the firm-specific wage gap using the female dummy from a series of firm-specific pooled wage regressions. In terms of Equation 2.1 we capture the 'unexplained' gap by the female dummy coefficient.

levels and a negative link between the gender wage gap at a given hierarchy level and the presence of women at other levels. These results are in accord with those Bell (2005) reports for the US; they are consistent with Czech firms differing in a systematic way (within industry and size categories) in how friendly they are to women.[34]

Table 2.6 then presents specifications where we simultaneously condition on the fraction of women in the other two firm hierarchy levels. Particularly interesting is the middle panel of the Table, in which we ask whether there are more female lower-level managers in firms that have, ceteris paribus, a higher share of female employees or a higher fraction of female top-level managers. We find that a high fraction of women at a lower hierarchy level predicts the representation of women at a given level better than the share of women at a higher hierarchy level; the regression estimates thus support the notion that lower-level managers are promoted from among the employees. In most specifications, however, the data do not allow us to distinguish between the effects of female representation at several hierarchy levels.

2.8 Comparison to US Findings

Although we have estimated the gender wage gap among Czech managers using several techniques, it is not clear how large the Czech gap is in an international perspective. Bertrand and Hallock (2001) study the gender pay differential of the five highest-paid executives in a sample of large publicly traded firms in the US. In order to compare the Czech managerial gender gap to the US one, we therefore select and separately study the five highest-paid managerial employees from each firm in our ISAE sample. The US and Czech firm samples are, however, not comparable in terms of average firm size as the ExecuComp data covers much larger firms from the S&P 1500. Bertrand and Hallock (2001) also report the US managerial wage gap from the Current Population Survey

[34] These results also suggest that the firm-specific gender wage gap among top managers, which we cannot effectively measure, is likely to be related to that among lower-level managers. Using this premise, we can ask whether firms in our data not reporting the wages of top managers (see Section 1.3) have unusual gender wage gaps for lower level managers. We did not find any connection between these two firm-level variables; these results are available upon request.

(CPS), which includes not only top-level managers but all managerial occupations;[35] the managerial coverage of the CPS and ISAE data is thus more comparable.

The share of females among the five highest-paid managers in each of the Czech firms in our sample is 9%, which compares favorably to the 2.5-6% in the ExecuComp US data. The ratio of female to male pay among the five highest-paid Czech managers is 74%, which is comparable to the 73% ratio for executive salary measured in the US by Bertrand and Hallock (2001). Comparing the combined group of top- and lower-level Czech managers to the CPS managerial occupations covered by Bertrand and Hallock (2001), the Czech raw wage gap appears about a third smaller in comparison to the US gap.

How does the structure of the Czech wage gap for the highest-paid managers compare to that estimated in the US? To answer this question, we have estimated a series of pooled regressions with a female dummy on the sub-sample of the five highest-paid Czech managers and compared our results to those of Bertrand and Hallock (2001) based on total compensation.[36] The results are presented in Table 2.7. The mean Czech gender log-wage differential is 35%. About a fifth of it, or 8 percentage points, can be accounted for by the lower participation of women in large firms. Indeed, 74% of the five highest-paid female managers appear in the smallest firms. In the US, however, the effect of sorting in large firms is stronger as a third of the whole gap is explained by the lack of women in the higher paying large firms. The different representation of women across industries does not affect the Czech gap in column (3), similarly to the US case. Finally, in column (4) we additionally control for occupational structure among the highest paid executives. Specifically, we introduce a dummy variable differentiating between directors and chief executive officers on the one hand and financial, sales, personnel and R&D

[35] Specifically, they report on full-time workers in an occupation category between 3 and 22 in the 1980 Census of Population Occupational Classification.

[36] This strategy corresponds to the Oaxaca-Blinder decomposition we used in the main body of this paper (Equation 2.1) to the extent that the pooled regression coefficients are close to the male parameters and to the extent that the introduction of the female dummy to the pooled regression does not affect its slope parameters.

managers on the other hand.[37] The scarcity of female directors and chief executive officers explains a substantial part of the gender compensation differential. The combined effects of occupational, industrial and firm-size segregation reduced the Czech 'unexplained' gap measured by the female dummy estimate to -0.20. This is a larger conditional gap compared to the US analysis presented in column (5).

Overall, we find the representation of women at the top of US and Czech firms very similar. While the Czech managerial raw gaps are somewhat lower, the power of our Czech data to explain these gaps is lower compared to the US case; however, there are similarities in the structure of wage gap across the two countries.

2.9 Conclusion

This paper presents the first available evidence on the gender structure of managerial employment and wages outside of the most developed economies—in a post-communist country at the time of its accession to the EU. We study managerial wage gaps using an intuitively appealing matching approach, which recognizes the lack of comparable female managers for many male managers, particularly those of the largest companies. Unlike most of the existing work on managers, our analysis covers not only top executives, but also mid-level managers and employees, thereby allowing us to link the relative position of women across firm hierarchy levels.

We find that at 7% women are severely under-represented in top managerial positions, and that there is a clear gender divide between lower- and top-level managerial ranks. Given that the raw average pay gap between men and women increases with firm hierarchy level, as the fraction of women dwindles, descriptive statistics suggest an increasingly female-unfriendly environment as workers progress towards higher hierarchy levels. However, our wage-gap decomposition analysis suggests that the size of the wage gap that cannot be linked to observable differences between men and women is quite similar across hierarchies. To the extent that this conditional wage gap can be interpreted as an upper bound on potential on-the-job discriminatory wage setting, this suggests that

[37] See Section 2.3, note 8, for details on the data.

women are treated similarly at the top and bottom of firms, once they are there. A large part of the average wage difference across genders among top managers is then related to the different types of firms that women and men typically head. This conclusion is reached based on the matching analysis, while the traditional Oaxaca-Blinder decomposition technique would maintain the existence of larger 'unexplained' gender wage gaps among top managers—a group of workers for which the differences in 'common support' of men and women are the strongest.

Our main finding is therefore twofold: After comparing the wage rates of women and men who are comparable in terms of basic demographic characteristics, employer type and within-firm hierarchical position, there remains a gender wage gap of about 20 percent. The key reason for why the relative wage position of Czech female top managers is worse compared to lower-ranking female employees is that they tend not to be present at the top of the highest-paying companies. The policy implication of these findings is that equality-enhancing policies aimed at the highly visible group of executives are more likely to be effective in equalizing wages of male and female top managers if they focus on promotion policies in the most prestigious companies.

Our study thus finds intriguing similarities between a post-communist country and a developed market economy when focusing on the small group of managers. Similarly, Jurajda and Harmgart (2007) find the gender composition of 274 detailed occupations to be highly comparable between East and West Germany in 1995 despite the different history of labor market practices. Such similarities are consistent with gender-specific preferences for occupational characteristics explaining the bulk of gender employment patterns and/or with a similar extent of barriers preventing women from entering high-wage occupations in very different labor markets.

Bibliography

Albrecht, J., Bjorklund, A., and S. Vroman (2003) "Is There a Glass Ceiling in Sweden?" *Journal of Labor Economics*, 21 (1), 145-177.

Babcock, L. and S. Laschever (2003) "Women Don't Ask: Negotiations and the Gender Divide," Princeton University Press, Princeton, New Jersey.

Baker, G., M. Jensen and K. J. Murphy (1988) "Compensation and Incentives: Practice vs. Theory," *Journal of Finance*, 43(3), 593-616.

Barsky, R., J. Bound, K. Charles, and J. Lupton (2002) "Accounting for the Black-White Wealth Gap: A Nonparametric Approach," *Journal of the American Statistical Association* 97, 663-673.

Becker, G. (1985) "Human Capital, Effort, and the Sexual Division of Labor," *Journal of Labor Economics*, 3, 33-58.

Bell, Linda A. (2005) "Women-Led Firms and the Gender Gap in Top Executive Jobs", IZA Discussion Paper No. 1689.

Bertrand, M. and K. Hallock (2001) "The Gender Gap in Top Corporate Jobs," *Industrial and Labor Relations Review*, 55, 1-21.

Black, D., A. Haviland, S. Sanders and L. Taylor (2004) "Gender Wage Disparities Among the Highly Educated," mimeo, Center for Policy Research, Syracuse University.

Blau, F. and M. Ferber (1987) "Discrimination: Empirical Evidence from the United States," *American Economics Review*, 77(2), 316-320.

Bonin, J., D. Jones and L. Putterman (1993) "Theoretical and Empirical Studies of Producer Cooperatives: Will Ever the Twain Meet?," *Journal of Economic Literature*, 31, 1290-1320.

Costa, D. L. (2000) "From Mill Town to Board Room: The Rise of Women's Paid Labor," *Journal of Economic Perspectives*, 14 (4), 101-122.

Denis D. and J. McConnel (2003) "International Corporate Governance," *Journal of Financial and Quantitative Analysis,* 38, 1-36.

Eriksson, T. (2005) "Managerial Pay and Executive Turnover in the Czech and Slovak Republics," *Economics of Transition*, 13 (4), 659-677.

Gneezy, U., M. Niederle and A. Rustichini (2003) "Performance in Competitive Environments: Gender Differences," *Quarterly Journal of Economics*, 118 (3), 1049 - 1074.

Gregg, P. and S. Machin (1993) "Is the Glass Ceiling Cracking? Gender Compensation Differentials and Access to Promotion among UK Executives," University College London, Discussion Paper 94-05, July.

Heckman, J.J., H. Ichimura and P. Todd (1997) "Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Program," *Review of Economic Studies* (64), 605-654.

Heckman, J.J., H. Ichimura and P. Todd (1998) "Matching as an Econometric Evaluation Estimator," *Review of Economic Studies* (65), 261-294.

Heckman, J.J., R. LaLonde and J. Smith (1999) "The Economics and Econometrics of Active Labor Market Programs," in *Handbook of Labor Economics*, III, ed. by O. Ashenfelter and D. Card, 1865-2097, Elsevier.

Heckman, J.J., L.J. Lochner and P. Todd (2003) "Fifty Years of Mincer Earnings Regressions," Working Paper 9732, National Bureau of Economic Research.

Holmstrom, B. (1979) "Moral Hazard and Observability," *The Bell Journal of Economics*, 10, 74-91.

ILO (2003) "Yearbook of Labour Statistics", ILO Geneva.

ILO (2004) "Breaking Through the Glass Ceiling: Women in Management," ILO Geneva.

Jolliffe, D. and N.F. Campos (2005) "Does Market Liberalization Reduce Gender Discrimination? Econometric Evidence from Hungary, 1986-1998," *Labour Economics*, 12 (1), 1-22.

Jones, D. C. and T. Kato (1998) "Chief Executive Compensation During Early Transition: Further Evidence from Bulgaria," *William Davidson Institute*, Working Paper 146.

Jurajda S. (2005) "Gender Segregation and Wage Gap: An East-West Comparison," *Journal of the European Economic Association, Papers and Proceedings*, 3 (2-3), 598-607.

Jurajda, S. and H. Harmgart (2007) "When do female occupations pay more?" *Journal of Comparative Economics,* 35, 170-187.

Munich, D., J. Svejnar and K. Terrell (2005) "Is Women's Human Capital Valued More by Markets than by Planners?," *Journal of Comparative Economics*, 33(2), 278-299.

Murphy, K.J. (1999) "Executive Compensation," *Handbook of Labor Economics*, Vol. 3B, Elsevier Science, North-Holland, 2485-2563.

Nopo, H. (2004) "Matching as a Tool to Decompose Wage Gaps," IZA Discussion Paper No. 981.

Oaxaca, R. (1973) "Male-Female Differentials in Urban Labor Markets," *International Economic Review*, 14, 693-709.

Oaxaca, R.L. and M.R. Ransom (1994) "Discrimination and Wage Decomposition," *Journal of Econometrics*, 61, 5-22.

Ogloblin, C.G. (1999) "The Gender Earnings Differential in the Russian Transition Economy," *Industrial and Labor Relations Review*, 52(4), 602-627.

Rosenbaum, P. and D. Rubin (1983) "The Central Role of the Propensity Score in Observational Studies for Causal Effects," *Biometrica*, 70, 41-55.

Rosenbaum, P. and D. Rubin (1985) "Constructing a Control Group Using Multivariate Matched Sampling Methods that Incorporate the Propensity Score," *The American Statistician*, 39 (1), 33-38.

Rubin, D.B. (1980) "Bias Reduction Using Mahalanobis-Metric Matching," *Biometrics*, 36, 293-298.

Smith J. and P. Todd (2005) "Does Matching Overcome LaLonde's Critique of Nonexperimental Estimators?," *Journal of Econometrics*, 125(1-2), 305-353.

Wood, R.G., M.E. Corcoran and P.N. Courant (1993) "Pay Differences among the Highly Paid: The Male-Female Earnings Gap in Lawyers' Salaries," *Journal of Labor Economics*, 11, 3, 417-441.

Table 2.1: Managers

	Female %	Hourly Pay Gap
Austria	0.19	-0.29
Belgium	0.17	-0.34
Canada	0.36	-0.21
Czech Republic	0.23	-0.24
Germany	0.30	-0.24
Ireland	0.27	-0.07
Russia	0.36	-0.44
Slovenia	0.36	-0.11
Spain	0.18	-0.55
UK	0.35	-0.29
USA	0.43	-0.38

Source: Workers in the group 12 of the ISCO occupational classification from the Luxembourg Income Study for 2000, except for Czech Republic (1996) and Slovenia (1999). The hourly wage gap is defined as the ratio of female to male average gross hourly wages minus one, except in Slovenia where only net wages are availble.

Table 2.2: Demographic Gender Employment and Wage Patterns

	Managers						Employees		
	Top-Level			Lower-Level					
	Fem. %	Rel. Pay[a]	Pay Gap[b]	Fem. %	Rel. Pay	Pay Gap	Fem. %	Rel. Pay	Pay Gap
Overall	7	1	-0.41	32	1	-0.38	40	1	-0.22
Age									
≤39	8.7	0.93	-0.51	34.8*	0.98	-0.44	38.8*	0.99	-0.19
40-49	8.1	1.01	-0.33	34.1*	1.02	-0.36	45.4*	1.01	-0.21
≥50	5.2	1.02	-0.43	26.6*	0.99	-0.33	36.9*	1.01	-0.20
Education									
Lower	12.6*	0.63*	-0.43	45.8*	0.70	-0.32*	0.4	0.93*	-0.20
University	5.6	1.08	-0.33	17.5*	1.33	-0.18*	0.3*	1.71*	-0.15

Notes: [a]Ratio of the average pay by age/education category to average pay in each hierarchy level. [b]Ratio of average pay of women to average pay of men within age/education category minus one. * denotes groups where the fraction of women is different from the overall fraction in the hierarchy level with a p value below 0.01, similarly for the gender pay gap and the relative pay.

Table 2.3: Firm-Type Gender Employment and Wage Patterns

	Managers						Employees		
	Top-Level			Lower-Level					
	Fem. %	Rel. Pay[a]	Pay Gap[b]	Fem. %	Rel. Pay	Pay Gap	Fem. %	Rel. Pay	Pay Gap
Overall	7	1	-0.41	32	1	-0.38	40	1	-0.22
Ownership									
Foreign	8.9	1.25	-0.60*	31.1	1.10	-0.44	46.5	1.02	-0.29*
Private	5*	0.99	-0.33	19.9*	1.03	-0.61*	36.4	0.93*	-0.21
State Owned	11.8*	0.68*	-0.09*	51.9*	0.72*	-0.38*	41.2	1.02	-0.21
Mixed	7.3	1.10	-0.58	24.3*	1.24	-0.28*	41.4	1.13*	-0.10*
Firm size									
250-625	6.6	0.89*	-0.24	22.3*	1.01	-0.20*	37	0.91*	-0.17*
626-1310	4*	1.23*	-0.35	18.3*	1.18*	-0.25*	37.8	1.04	-0.15
1311-3500	6.9	1.22	-0.57	23.3*	1.08*	-0.34	39.1	0.98	-0.22
over 3500	11.1*	0.76	-0.51	42.8*	0.92	-0.44	41.7	1.06	-0.21
Industry									
Agriculture	2	0.52*	-0.22*	11.2*	0.66*	-0.20*	20.8*	0.99	-0.22
Manufacturing[c]	5.9	1	-0.47	17*	1.05	-0.24*	35.8*	0.97	-0.23*
Utilities	6.7	0.99	-0.25	14.9*	1.07	-0.26*	14.9*	1.01	-0.05*
Construction	0.0	1.27	-	14.5*	1.17	-0.29	59.3*	0.74*	-0.3
Retail	12.7*	0.85	-0.60*	49.4*	0.65*	-0.40	42.8	1.04	-0.19
Transport	12.5*	0.90	-0.24	50.8*	0.80	-0.43	40	0.82*	-0.18
Banking & Insurance	12	1.90*	-0.43	42.7*	1.73*	-0.47	55.7*	0.91	-0.27
Services	4.5	0.95	-0.46	32	1.01	-0.27	74.6*	1.4	-0.32*

Notes: [a]Ratio of the average pay by firm-type category to average pay in each hierarchy level. [b]Ratio of average pay of women to average pay of men by firm type minus one. [c]Manufacturing includes mining and metallurgy. * denotes groups where the fraction of women is different from the overall fraction in the hierarchy level with a p value below 0.01, similarly for the gender pay gap and the relative pay.

Table 2.4: OLS Conditional ('Unexplained') Log-Wage Gender Gaps

	Managers		Employees
	Top-Level	Lower-Level	
Raw Gaps	-0.55	-0.43	-0.22
Gaps Conditional on			
Individual Characteristics			
Age and Education	-0.37	-0.27	-0.25
Firm Characteristics			
Ownership, Size, Industry	-0.47	-0.37	-0.20
Ownership, Size and Industry Interacted	-0.45	-0.35	-0.19
Firm and Individual Characteristics			
Size and Industry Interacted	-0.29	-0.24	-0.21
No Interactions	-0.30	-0.25	-0.22

Notes: The table presents 'unexplained' gender wage gaps from a series of Oaxaca-Blinder decompositions conditioning on different sets of observables and based on the male slope parameters.

Table 2.5: Matching Results: Top and Lower-Level Managers

	Unexpl.	Exact	Propensity Score	
	Gap[a]	Matching	Kernel	Mahalanobis
Top-Level Managers				
ATT[b]	-0.29*	-0.17*	-0.22*	-0.15*
	(0.056)	(0.089)	(0.10)	(0.09)
N treated	118	79	108	80
N control	1,572	251	1,166	1,166
Lower-Level Managers				
ATT	-0.24*	-0.20*	-0.21*	-0.20*
	(0.01)	(0.02)	(0.06)	(0.05)
N treated	11,388	11,020	10,380	10,790
N control	24,666	24,666	24,237	24,237

Notes: Bootstrapped standard errors in parenthesis. * Statistically significant at the 0.01 level. [a]Oaxaca-Blinder decomposition from Table 5. [b]Average Treatment on the Treated over the common support.

Table 2.6: Gender Relationships Across Firm Hierarchy Levels

	Employees		Lower-Level		Top-Level
Explanatory variables	% Fem.	Wage Gap	% Fem.	Wage Gap	% Fem.
% Fem. Employees			0.71*	-0.58	0.52
			(0.37)	(0.41)	(0.36)
% Fem. Lower-Level Managers	0.31*	-0.25			0.16
	(0.12)	(0.16)			(0.28)
% Fem. Top-Level Managers	0.18	0.03	0.13	0.20	
	(0.15)	(0.09)	(0.22)	(0.19)	

Notes: Each column represents a separate specification controlling for year, industry, firm-size and ownership indicators with either the fraction of women or the gender wage gap on the left-hand side. Wage-gap regressions are weighted with the inverse of the standard errors of the estimated firm-specific gaps. * Denotes statistical significance at the 0.05 level.

Table 2.7: Gender Wage Gap Among the Five Highest-Paid Managers

Country	CZ	CZ	CZ	CZ	US
	(1)	(2)	(3)	(4)	(5)
Female	-0.35*	-0.27*	-0.26*	-0.20*	-0.11*
	(0.05)	(0.04)	(0.04)	(0.04)	(0.03)
Firm size	No	Yes	Yes	Yes	Yes
Industry	No	No	Yes	Yes	Yes
Occupation	No	No	No	Yes	Yes
N	3,853	3,846	3,846	3,726	42,677

Notes: All Czech regressions control for year dummies. The US results are taken from Bertrand and Hallock (2001). Residuals are clustered at firm level. * Statistically significant at the 0.01 level.

Chapter 3

Corporate Governance and Executive Pay: Evidence from a Recent Reform

3.1 Introduction

Executive compensation is at the center of a heated corporate governance debate in the U.S. due to its substantial increase in the last two decades. Hall and Liebman (1998) report a 209% increase of the mean salary in the largest U.S. firms for the period 1980 to 1994. Recently, Bebchuk and Grinstein (2005) use data from 1993 to 2003 and find that CEO pay has increased by 146% among S&P 500 firms. The fraud at Enron, WorldCom, Sunbeam, Adelphia, Xerox and Global Crossing in 2001 provided new reasons for discovering what lies behind the astonishing CEO pay bonanza.[1] Legislative authorities responded quickly to these cases of corporate governance failure with new

[1]Among many articles in the financial press, Gimein (2002) analyzes the behavior of top executives shortly after the market bubble in the late 1990s. He has found that even when shareholders were, at that time, losing more than 70% of their holdings, executives became extraordinary wealthy by selling stock and stock options. From 1999 onwards, the magazine concluded that 1,035 companies in the Fortune sample had made $66 billion from stock sales, $23 billion of which went to 466 insiders in 25 corporations. For a recent discussion on executive pay see a report in The Economist (20/01/2007).

rules aiming to discipline firms and restore confidence in the security markets.

The major provisions of the Sarbanes-Oxley Act of 2002 (hereafter, SOX) prohibit auditors from performing non-audit services for their audit clients, impose greater criminal penalties for corporate fraud, and require more detailed and timely disclosure of financial information. Further, CEOs and CFOs have to certify financial statements, assess the firm's internal control system, and restrict their own trading activities. In addition, the requirement for managers to return bonuses and stock-trading profits in the case of accounting restatement increases the punishment for CEO and CFO misconduct.

Pursuant to the Act, in 2002 both the New York Stock Exchange and NASDAQ introduced rules designed to strengthen the corporate governance of their listed firms. Both exchanges mandated that there be a majority of independent directors on company boards, and a larger role for independent directors in the compensation and nominating committees. The Act also puts emphasis on board monitoring by regulating the role of audit committees. The consequence of the set of regulations is a substantial change in company board structure, supporting effective monitoring. Overall, the Act is viewed as "the most important securities legislation since the original federal securities laws of the 1930s."[2]

Due to improved board monitoring, increased responsibilities for executives, and higher costs of misconduct, one would expect the reforms to affect CEO compensation. The purpose of this paper is to empirically examine how the structure of CEO compensation has changed due to the regulations. My analysis is guided by two theoretical perspectives of executive pay, namely by the standard principal-agent theory and the "skimming" hypothesis.

Traditional agency theory (Holmstrom, 1979) suggests that CEO pay is used to reduce a moral hazard problem between the CEO and shareholders by linking pay to firm performance; in practice, executives are offered stock, options, bonuses and long-term incentive plans (LTIPS) to motivate them to maximize shareholder wealth.[3] Concerned

[2]SEC Chairman William H. Donaldson, September 17, 2003.

[3]See Murphy (1999) and Core et al. (2003) for a survey on the components of CEO pay and the incentives they provide.

with determining the optimal balance between risk sharing and incentives, this model concludes that pay should not respond to performance beyond CEO control because it might fail to provide incentives (pay-for-performance) and only increase risk. In addition, Hart and Holmstrom (1987) argue that increased board oversight will reduce incentives because direct monitoring reveals CEO actions and the board can instruct the CEO to act in the owners' best interest, making the provision of financial incentives unnecessary.[4]

Alternatively, the second view, known as rent-extraction or "skimming", refers to the possibility that the CEO gains control over the pay-setting process and, as a result, rewards herself for positive performance shocks beyond her control (pay for luck). Recently the potential of "unjust" CEO rewards has drawn a lot of attention.[5] Bebchuk and Fried (2004) argue that the main reasons for the presence of pay for luck are weak boards, which find it difficult to oppose the CEO who then gains control over the pay-setting process.

Both the principal-agent and the "skimming" perspectives are relevant for an empirical analysis of the consequences of SOX because of its requirement of increased board oversight. The Act provides variation in board monitoring unavailable to previous studies. There is much research exploring the incentives-monitoring relationship empirically; however, such evaluations may be misleading because board monitoring level and CEO pay were often determined by the same person (Hermalin and Weisbach, 2003).[6] The

[4]Almazan and Suarez (2003), Gibbon and Murphy (1992), and Hartzell (2001) demonstrate theoretically that under agency models different incentive devices act as substitutes.

[5]For example, Lee Raymond, Exxon's CEO, attracted media attention because he retired with $405 million compensation, lump-sum pension and current value of stock grants in 2005. Further, Robert Nardelli has received $210 million in 2007, while the shares of his company Home Depot fell during his six years in charge. Similarly, Phil Purcell from Morgan Stanley collected $66 million severance pay in 2004 though the company stock fell 25% in the last five years. Apparently, CEO pay remains the "acid test in judging whether corporate America is serious about reforming itself" (Warren Buffett, The Economist 20/01/2007).

[6]It would hardly be reasonable to expect that executives sitting on the board would monitor themselves and construct efficient pay schemes. A plausible reason for the lack of strong board oversight is that the nomination process in public U.S. firms allows the CEO to affect the composition of the board; further, board members sit on several boards simultaneously and they have little time and few incentives

present research thus extends the existing analyses of monitoring and CEO pay by explicitly using increased board oversight imposed by the lawmakers.

I first document the before/after reform shift in the performance-based components of CEO compensation, which is more closely connected to the monitoring structure and may be better understood from the principal-agent theoretical perspective.

Next, I use the independence of board members as a direct measure of the reform's treatment. Because the reforms call for independence of company boards, firms with many dependent board members at the eve of the Act's passage will be affected the most. Focusing on the specific effect of changing board structure allows for a cleaner identification strategy for the monitoring effect of SOX on executive pay compared to simple before/after comparisons.

In addition, I compare the effect of the reform of CEO pay to the effect on the pay of other executives (except CFOs). The fact that SOX specifically addresses the role of the CEO implies that one can compare within-firm "treatment" and "control" groups, where "treatment" includes the CEOs and "control" consists of all other executives but CFOs. This identification strategy is based on the strong assumption of no direct link between the CEO and non-CEO pay but it also allows one to go beyond simple before-after comparisons.

Third, I study how the Act affects the rent-extraction behavior of the CEOs, expecting improved governance to reduce "skimming". Similarly to Bertrand and Mullainathan (2001), I focus on pay for luck—the reward that an executive obtains for company performance driven by industry-wide movements out of her control. I also study separately the effect of positive and negative industry shocks since CEOs are expected to be rewarded for luck during positive shocks and to remain "unpunished" for negative ones (Garvey and Milbourn, 2006).

Using ExecuComp data, I find that the CEO pay-for-performance link increases after 2002 in firms with weaker board oversight prior to 2002, that is, in firms more affected by SOX stipulations. In contrast, the pay-for-performance relationship changes little in firms with independent boards. The pay structure for all other executives remains the

to negotiate CEO compensation (Fich and Shivdasani, 2006).

same across different board independence levels during the whole analyzed period.

The findings of my pay for luck exploration are consistent with the "skimming" hypothesis. CEO pay shows on average a significant response to luck before the reform, but this response disappears after SOX. Consistent with the improved governance after 2002, CEO pay does not respond either to positive or to negative industry shocks. In contrast, before the reform, positive shocks were highly rewarded, while negative ones were not "punished."

Overall, examining jointly the pay-for-performance and pay for luck parameters of executive compensation, I find that CEO pay can be usefully explained by both, depending on firm governance. After SOX, CEOs in firms with strong board monitoring are rewarded for high company performance as before 2002, while firms with weak boards have strengthened significantly CEO pay-for-performance. While pay for luck is part of the CEO pay in firms with weak boards before the reform, it disappears after the passage of SOX in 2002.

Mine is not the first study of SOX effects on pay for performance. Using a similar difference-in-differences approach, Wang (2005) finds that Chief Financial Officer pay-for-performance decreases in firms with strong board oversight before the Act and high uncontrollable risk (i.e, risk that cannot be eliminated by maximum auditing), while it increases in firms with weaker board oversight and high controllable risk (i.e., risk that can be eliminated by maximum auditing). My paper contributes to the corporate governance literature by shedding light on the pay of a particularly visible group of executives—Chief Executive Officers—before and after SOX. In addition, my analysis is guided by both pay-for-performance and pay-for-luck perspectives. The latter, known also as pay without performance, gained widespread attention in the recent corporate governance debate (Bebchuk and Fried, 2004). After Bertrand and Mullainathan (2001), and Garvey and Milbourn (2006), who explore the pre-reform period, I focus on the impact of SOX on CEO pay for luck and document that stronger governance, such as that established by SOX, has the potential to reduce pay without performance.

The remainder of this paper is organized as follows: Section 3.2 explores corporate governance regulations and patterns, Section 3.3 reviews the related literature, Section

3.4 presents alternative theoretical views and their empirical implications, Section 3.5 discusses data and pay patterns, Section 3.6 offers the research methodology, Section 3.7 describes the results of pay for performance, and Section 3.8 proceeds with the results of pay for luck. Concluding remarks are offered in Section 3.9.

3.2 Background

3.2.1 Corporate Governance Regulations in 2002

The unreliability of corporate managers and board members in the U.S. raised arguments for introducing a regulation that would guarantee confidence in the security markets. The response was the passage of the Sarbanes-Oxley Act in 2002. The corporate governance reforms initiated by the federal government in 2002 are among the most extensive reforms affecting U.S. corporate governance since the establishment of the Securities and Exchange Commission in the 1930s.

The main focus of the Act is the company board structure. SOX mandates that the audit committee—the committee that oversees the firms's auditors—be composed of independent directors defined as: "Not receiving, other than for service on the board, any consulting, advisory, or other compensation fee from the issuer, and as not being an affiliated person of the issuer of any of its subsidiaries." The audit committee must have a minimum of three members and consist entirely of independent directors. In addition, each member of the audit committee must be financially literate; one member must be an "audit committee financial expert," or the company must disclose that it does not have such a committee and explain why.

Following the SEC, the NYSE and NASDAQ also adopted new listing requirements. The board of directors of each NYSE- and NASDAQ-listed firm must have a majority of independent directors. Further, the regulations require the independent directors to approve the nomination of directors and CEO compensation.

Timely accurate information for investors is guaranteed by increasing drastically the sanctions for management misconduct. For example, the Act imposes a fourfold increase in the maximum prison term for criminal fraud. In addition, if there is an accounting

restatement as a result of misconduct, the Act requires CEOs and CFOs to reimburse any incentive-based compensation or profit from the sale of stock received 12 months after the misreporting (Section 304). Executives are prohibited from selling stock during the pension blackout period and are required to report sales or purchases of company stock within two days, rather than the previous—ten days after the transaction (Section 306). According to the NYSE regulations, shareholders have to approve all equity-based compensation programs.

The public reaction to the passage of the Act was controversial. Its fast passage was viewed as a political product (Hilzenrath et al., 2002) that was negatively accepted by the business community because of the high implementation cost. Executives argue that the Act will divert their attention from doing business to complying. A survey by Financial Executive International finds that the average first-year cost estimate is almost $3 million for roughly 26,000 hours of internal work and 5,000 hours of external work, plus additional audit fees of $823,200 or 53% more in comparison with the pre-SOX period.

Holmstrom and Kaplan (2003) reason that the Act provisions increase the risk of CEOs and CFOs selling a large amount of stock options because of the possibility to be accused of "misconduct". This will make the executives more reluctant to cash in their equity holding and henceforth their portfolios will be less liquid. The authors suppose that this might have a positive effect on firm value, since managers will shift their attention from short- to long-term stock prices.

Further, it is believed that SOX might affect the labor market for directors. Because of the requirement of "independence," the demand for those directors might exceed their supply due to the lack of such a type of managers. Previous work suggests that the supply of managers is inelastic, therefore shocks to aggregate demand, like the increased need for "independent" directors, raises the marginal value of their labor service (Himmelberg and Hubbard, 2000).

3.2.2 Corporate Governance Patterns

One mechanism of corporate governance operates through company board structure and particularly, its share of independent directors, assuming that the higher the number of

independent directors, the better the corporate governance is. Table 3.1, using IRRC data (see Section 3.5) examines recent corporate governance patterns separately for 1998, 2001, 2002 and 2004. Specifically, the share of employee and linked directors has decreased over time, while the share of independent directors has risen.[7] The increasing number of independent board members can be viewed as a positive change towards better corporate governance. It is not surprising to observe this trend because the Sarbanes-Oxley Act of 2002 requires a 100% independent audit committee, and the NYSE regulation demands an independent nominating and compensation committee.[8]

Further, the table reports that boards met more often in 2004 than in 1998, presumably indicating greater effort. In addition, the board size decreased on average, which is associated with better governance, from 9.62 in 1998 to 9.37 in 2004. At the same time the annual fees for attending board meetings has risen by 72% on average. A recent study finds that "busy" boards, having directors who hold more than three directorships, are associated with weak corporate governance, lower market-to-book ratios and profitability (Fich and Shivdasani, 2006). Fortunately, we observe that fewer directors choose to serve on more than three boards after SOX—20% in 1998 and 15% in 2004—presumably resulting in higher board efficiency.

The main corporate governance tendencies for the period 1998-2004 measured with board structure show that boards became more independent, smaller, met more often and were less "busy," all of which indicates an improved corporate governance environment after 2002.[9] These simple descriptive findings allow one to conclude that the Act indeed

[7]According to the Investor Responsibility Research Center (IRRC), a director who is linked to the company through certain relationships and whose views may be affected because of such links is classified as affiliated (linked). For more details see www.irrc.com/resources/glossary.htm.

[8]The share of independent directors is increasing over the whole period from 1998 to 2004. In order to distinguish the trend effect from the potential effect of SOX, I estimate a regression where board independence is a left-hand side variable and a linear trend and a dummy for the passage of the Act are right-hand side variables. The results show that the percent of independent directors increases significantly after 2002, even after accounting for the trend.

[9]Yermack (1996) finds an inverse correlation between board size and firm value. Companies with small boards also exhibit more favorable values of financial ratios than firms with large boards.

changed corporate governance, which might cause changes in executive pay structure.

3.3 Empirical Literature

My analysis builds on several strands of research. First, in a broad sense, I extend the literature on corporate governance, which examines how the board of directors, institutional shareholders, large creditors and the market for corporate control affect executive behavior and organizational performance. Second, I complement the small amount of literature on the effect of regulations on executive compensations; particularly, I extend the literature on the Sarbanes-Oxley Act of 2002. In this section, I briefly discuss each of the related areas of research.

3.3.1 Managerial Pay and Corporate Governance

The vast majority of existing studies links CEO pay to CEO power. Different measures of CEO power, such as whether the CEO is involved in the nomination process of new directors, whether the CEO has interlocking relations,[10] the percentage of affiliated directors on the board, whether the CEO is also the chair of the board and whether the number of directors on the company board are employed. Hallock (1997) finds that boards with interlocking directors give a higher wage to the CEO. Similarly, Core et al. (1999) show that the wage of the CEO is positively correlated with the presence of interlocking relations, the CEO in the role of chair, and the percentage of affiliated directors. Grinstein and Hribar (2004) discover that a powerful CEO, who is also a chairman manages to extract higher bonuses. In contrast, Daily et al. (1998) fails to detect a connection between compensation committee independence and CEO compensation. Institutional ownership concentration is positively related to the pay-for-performance sensitivity of executive compensation and negatively related to the level of compensation, which suggests that institutions might serve as monitors that mitigate the agency problem (Hartzell and Starks, 2002).

[10] A situation where an executive in one company sits on a board of another company and the executive of the second company sits on the board of the first company.

Usually the relation between corporate governance mechanisms and CEO pay is endogenous (Hermalin and Weisbach, 2003, Becht et al., 2002) because CEO pay can be simultaneously a result and part of the governance mechanisms. One approach to address this issue is to use *ex-post* performance metrics to infer causality. Core et al. (1999) investigate the consequences of excessive CEO compensation in firms with weaker governance and find a negative relation to future performance. The other approach is to generate an exogenous variation in the governance mechanisms, usually through changes in new legislation, and analyze before/after changes in the CEO compensation. In this paper, I rely on the second approach and use the Sarbanes-Oxley Act of 2002 as a source of exogenous board monitoring to identify shifts in executive pay.

3.3.2 Managerial Pay and the Sarbanes-Oxley Act of 2002

Before the passage of the Sarbanes-Oxley Act, few studies focus on the impact of various law regulations on executive pay. Hubbard and Palia (1995) find that CEOs in the banking industry earn more after banking deregulation in the U.S. in the 1980s and exhibit a stronger pay-for-performance link. Bertrand and Mullainthan (1999) consider state anti-takeover legislation. They suppose that a reduction in takeover threats should raise pay because the entrenched CEOs can "skim" more easily whatever pay they can. In other words, the lack of takeover threat allows entrenched CEOs to increase their rents at the expense of the shareholders. The authors find that large shareholders, who are associated with strong governance, help in limiting the rise in mean CEO pay after the passage of the law and also increase their pay-for-performance sensitivity.

So far there are only a few studies that directly explore the impact of the Sarbanes-Oxley Act using ExecuComp data. My paper closely resembles the approach of Wang (2005), who contrasts the effect of the Act on CFO pay in firms with strong and weak board oversight before the Act and with controllable and uncontrollable risk of material misstatement of an unaudited financial report in the absence of internal control procedures. According to Wang (2005) two factors are expected to affect CFO pay, the first is increased risk, and the second is increased monitoring. Wang argues that firms with strong boards will be affected mainly by the rise in risk. Thus, these firms will respond

to the increased risk with reduced incentive pay according to standard agency theory. The firms with weak boards, however, will be affected by both a rise in risk and improved monitoring. The direction of the change in pay is unclear since it depends on the proportion of uncontrollable risk, managerial risk aversion and the cost of effort.

The findings of Wang (2005) are that CFO's incentive pay is reduced after SOX in firms with strong boards prior to the Act and with a high proportion of uncontrollable risk; further, firms with weak boards before the Act and low uncontrollable risk seem to increase CFO incentive compensation after the reform.

Cohen et al. (2004) study the change in the structure of executive compensation after the passage of the Sarbanes-Oxley Act in 2002. The hypothesis is that firms will respond to the increased liabilities by lowering the incentive component of managerial pay and by increasing the fixed one that insures against risk beyond the CEO's control. The results based on the ExecuComp data confirm an increase of fixed salary and a decrease in incentive-based compensation of CEOs after the Act. The shift from more risk to less risky pay is interpreted as a form of insurance against the imposed liability after SOX. Another finding of the paper is that CEOs participate less in risky activities after SOX, which might affect negatively shareholder's return because of forgone profitable projects.

Unlike Cohen et al. (2004), I introduce a cleaner identification strategy for the effect of the Act by going beyond a before/after comparison. Unlike Wang (2005), I focus on CEOs. She claims that CFOs are a more targeted group by the Act because they are in charge of firms' financial reporting. However, I consider it equally important to focus on CEO pay, because their responsibilities are changed by the Act. When examining pay in the context of agency theory, which relies on a direct link between agents' pay and their actions, it would be reasonable to assume that CEOs' actions influence firm performance to a greater extent than CFOs' actions.

3.4 Theoretical Perspectives and Empirical Implications

3.4.1 Incentives

Two major theoretical approaches explain the role and composition of executive pay. First, principal-agency theory assumes that managers are likely to place personal goals ahead of corporate goals, resulting in a conflict of interest between shareholders and management. Jensen and Meckling (1976) demonstrate that investors in publicly traded corporations incur (agency) costs of monitoring managerial performance. In general, agency costs arise whenever there is an information asymmetry between a corporation and outsiders because insiders (managers) know more about the company and its future prospects than outsiders (investors) do. One way to limit agency cost is to offer such a pay package to managers so they would have incentives to act in the best interest of the shareholders. Usually managerial compensation is tied to the financial performance of the company by issuing stock options related to the firm's stock price, which is supposed to encourage the manager to maximize the value of shares. Thus, a regular managerial contract provides incentives (stock option, long-term incentive plans, stock, restricted stock) that give a manager reasons to take a risky project in favor of shareholders' and insurance that guards the managers against events out of their control.

There are two approaches for estimating the relation between CEO wealth and shareholder wealth. According to the first one, CEO wealth is directly tied to shareholder wealth through holdings of stock, restricted stock and stock options; the second approach, which I employ in my analysis, assumes that CEO wealth is indirectly related to shareholder wealth through accounting-based bonuses and through year-to-year changes in salary levels, bonuses, options and restricted stock. These year-to-year performance-related changes in total compensation are typically modeled as:

$$Log(Pay_{it}) \quad = \quad \beta Return_{it} + \delta X_{it} + \zeta t + \eta_i + \varepsilon_{it},$$

where i indexes firms, t indexes time and β is a CEO pay-for-performance link. *Return* is a vector of contemporaneous and lagged performance measures, X is a set of individual

and firm specific characteristics,[11] ζ is time trend estimate and η_i is a CEO or firm-specific effect.

According to agency theory, pay for performance is but one among many devices for realigning the interests of managers to those of shareholders. Bertrand and Mullainathan (1998) see the threat of a takeover to be another incentive device that motivates CEOs to perform better. In my study, I use the monitoring role of independent directors as an incentive device that potentially can motivate managers to act in the interests of their owners. Different incentive devices work as substitutes.[12] The passage of SOX demands stronger monitoring through majority independent directors, which according to the principal-agent theory might lead to a lower level of pay for performance because the corporate board can now instruct the manager to take actions leading to the maximum shareholder value. In such a way, pay for performance turns into a useless incentive device.

In my analysis I distinguish between two types of firms. The first includes firms with independent board structure prior to the reform, while the second includes firms with dependent board structures, i.e., those that had to change their boards because of SOX. Guided by agency theory that monitoring and incentives are substitutable, my

[11]Usually in the literature, CEO age, tenure, firm size and book-to-market ratio are controlled for. Particularly in my pay regression, I account for the effect of firm performance before 2002, the passage of the Act in 2002, firm performance after 2002, time trend squared and firm size; moreover, the results of pay-for-performance prove to be insensitive to the inclusion of age, tenure, book-to-market ratio and lagged performance.

[12]Monitoring not only has benefits in terms of reducing the agency costs, but also carries opportunity costs in terms of aggravating the agency problem. For example, entrenched managers might appoint their friends to the company board and thus capture the pay setting process. It can be shown analytically that monitoring reduces the variance of the managers' pay. Monitoring redistributes risk from the managers to the owners. The purpose of monitoring is to reduce the degree of information asymmetry between the managers and owners and thereby to enable owners to tailor the managers' rewards more closely to their actions rather than to profits. Hence, the result of increased monitoring should be to reduce pay for performance relative to the situation without monitoring. However, monitoring will happen only if the cost of doing so is offset by the additional pay off of economizing incentives. Monitoring will not be undertaken if marginal costs are too high or if firm risk is too low.

hypothesis is that the first group of firms will not exhibit a pay-for-performance shift because it will not change its monitoring mechanism; however, the second group will be obliged to appoint independent directors, which presumably leads to better monitoring. In this case pay-for-performance will be substituted by stronger board supervision.

3.4.2 "Skimming" Hypothesis

CEO pay-for-performance can be viewed as a mechanism to solve the agency problem. Nevertheless, it might happen that CEOs have managed to capture the pay process so that they set their own pay by extracting rents, which can be constrained by the availability of cash (free cash flow hypothesis), by the efficiency of monitoring, both by the board and/or institutional shareholders, by the fear of drawing shareholders' attention or by stricter legal regulations such as the Sarbanes-Oxley Act.

Bebchuk and Fried (2004) argue that because options contracts lack explicit relative performance valuation, executives receive windfall gains as market value increases. Inspired by this view, I explore the impact of luck on CEO pay, where luck is an event that has little to do with CEO activities. In general, an optimal CEO contract should not depend on luck, because it does not provide incentives for enhancing shareholder value. I define luck as the company performance driven by industry-wide returns. To estimate the sensitivity of pay to luck, I employ a two-stage procedure. In the first stage, the changes in firm performance due to luck, measured with industry-wide return, are isolated; in the second stage, the sensitivity of pay to these predicted changes in firm performance are estimated. Similarly to Bertrand and Mullainathan (2001), I estimate the following equations:

$$\begin{aligned} Return_{it} &= \beta_1 IndustryReturn_{jit} + \delta_{1X} X_{it} + \zeta_1 t + \eta_{1i} + \varepsilon_{1it} \\ Log(Pay_{it}) &= \beta_2 \widehat{Return}_{jit} + \delta_{2X} X_{it} + \gamma \varepsilon_{1it} + \zeta_2 t + \eta_{2i} + \varepsilon_{2it}. \end{aligned}$$

Industry Return is the weighted industry return on assets in year t in the 2-digit SIC industry j, where firm i itself is excluded from the mean calculation. Here β_2 is the estimated component of firm performance common to the industry group and not attributable to CEO actions or CEO quality, and ε_{1it} is the residual from the first equation. The coefficient of *firm-specific* performance, γ, could reflect both CEO skill and/or

unobservables unrelated to industry performance. Supposing that the CEO is not compensated for luck, we would expect a lack of sensitivity of industry-induced return to CEO pay. A recent study by Garvey and Milbourn (2006) raises an important point that positive sensitivity of pay to industry return might be compensation for bearing systematic risk but not necessarily pay for luck. This argument assumes that managerial pay is linked both to good and bad industry fortune. However, if executives have overcome the pay setting process, it is expected their pay to be sensitive to the industry performance when the industry (benchmark) is up but not when it is down. I explore this hypothesis in Section 3.8.

The Sarbanes-Oxley Act is a mechanism that aims at strengthening corporate governance, which potentially might restrict lucky pay. A previous study shows that in the presence of large shareholders, which is associated with strong governance, CEO pay responds less to luck (Bertrand and Mullainathan, 2001). In this paper, I study how SOX affects CEO pay for luck in firms with dependent boards, assumed to be poorly governed and in firms with independent boards, considered to be well-governed. Supposing that the skimming view can explain executive pay, we might expect that after the reform, dependent boards will strengthen company monitoring and limit the possibility for executives to control the pay-setting process, resulting in less pay for luck. In contrast, well-governed firms, are not expected to change their pay structure after SOX because pay for luck has not been part of their compensation package before the reform was implemented.

3.5 Sample and Descriptive Statistics

3.5.1 Sample

The Standard and Poor's ExecuComp database provides information about the five highest-paid executives available in proxy statements. Disclosure rules for U.S. executives require details on salary, annual bonuses, option holdings, equity and option grants, age, and tenure. The database covers firms from the S&P 500, the S&P Mid-Cap 400,

the S&P Small-Cap 600 and other supplemental S&P indices.[13] The IRRC data is of annual frequency and covers the directors of the S&P 500, S&P 400 mid-cap and S&P 600 small-cap firms for the period 1996 to 2004. The data provides details on the structure and practices of the boards of directors, historical information for each director, such as the committees they belong to, board affiliation, shares held and total voting power.

The ExecuComp sample contains 2,350 firms or 14,592 firm-years for the period 1998-2005 (See Table 3.2). Officers named as Chief Executive Officers (CEOs) are defined by the CEOANN field for each year.[14] In 1998, around 10% of the firms in the ExecuComp data did not report their CEOs, while in 2005—only 1%. Before excluding these firms from the analysis, I make a sample selectivity analysis on the relation between the incidence of not reporting CEOs and firm observable characteristics. The results from a logit regression show that none of the estimated set of parameters is statistically significant, which insures against biases from systematic non- reporting.

The IRRC data covers 2,906 firms or 11,514 firm-years for the period 1998 to 2004. The initial sample, obtained after matching both data sets over the period 1998-2005, consists of 1,722 executives named as CEOs and 10,812 firm-years.[15] Firm-level data are taken from COMPUSTAT industrial annual database. The industry affiliation is based on the SIC-code classification.[16] The three largest industry groups in the sample are coming from Commercial Banks (SIC 6020, 4.5% of the sample), Prepackaged Software (SIC 7372, 4.19% of the sample) and Crude Petroleum and Gas (SIC 1311, 2% of the sample). Further, after eliminating firms with missing data on either total pay or return, the analysis-ready sample consists of around 1,650 firms and 10,000 CEO-firm-years.

The data have strengths and weaknesses. Among the strengths is detailed unified

[13]Since the sample contains both large- and small-cap firms, *ex-post* survivorship bias is less likely.

[14]Chief Operating Officer (COO) and Chief Financial Officer (CFO) are retrieved from the field TITLEANN. The group of COOs is considerably smaller in comparison to CEOs and CFOs. It is possible that COOs are not ranked among the top highest-paid executives, nor are they reported in the data.

[15]Because I define company board independence before 2002 only, in the regression analysis I rely on a successful match between IRRC and ExecuComp only for the period 1998-2002. If a firm is present at least two years in this period and stays in the sample after 2002, it belongs to my analysis-sample.

[16]See http://listsareus.com/business-sic-codes-q.htm for details.

information on the top five highest-paid executives over a 14-year period; the data set is large and contains information for 1,500 firms that cover about 80% of the U.S. market capitalization. As for the weaknesses, there are 365 firms present in ExecuComp but not in IRRC.[17] A sample selectivity analysis explores whether the non-matched firms, which are the firms available in the ExecuComp sample but missing in the IRRC data for the period 1998-2002, are randomly distributed across firms with different characteristics. The results show that small-cap firms are more likely to be missing in comparison to the large-cap and mid-cap firms.

3.5.2 Executive Pay Patterns

Table 3.3 provides summary statistics for the average percentage change of various CEO pay components from 1998-2001 to 2002-2005.[18] Several notable tendencies can be observed. First, based on the sample average, the level of salary and bonus increases by 26 percent after 2002. The rise is most pronounced in firms operating in the service sector and is smoothly spread among firms with different market capitalization. CEOs in firms with dependent boards before SOX make on average 28% higher salary and bonus after the reform, while CEOs in firms with independent boards make 25% more, though the difference between the types of firms is not significant. Second, total pay, including salary, bonus, benefits, total value of restricted stock granted, total value of stock options granted, long-term incentive payouts and all other pay, increases on average by 16% after SOX. The results show that firms from mining and manufacturing have the highest increase compared to other sectors, while CEOs in the finance and insurance sectors do not earn more compared to the pre-SOX period. Looking separately at independent and dependent board firms, the increase in the former group is smaller than in the latter. Third, shifting attention to the option values, no change is observed; however, there is large variation across industry sectors. Option value in mining and manufacturing firms has increased after 2002, while that in finance and insurance sectors has dropped by 30%.

[17] I use the October 2006 version of IRRC, which does not cover 2005.

[18] The statistics come from the estimation of pool-sample regressions where a SOX dummy coefficient captures the percentage differences presented in Table 3.3.

Since the value of the stock option depends on various characteristics,[19] to shed more light on the reasons behind the fall of the options value in this sector before and after 2002, I explore the change of the number of options granted as a portion of total shares outstanding. It appears that finance and insurance firms grant significantly less options after 2002, which explains the decrease in their total value.

Figure 3.1 demonstrates the average pay level across years. As expected, the highest pay is in 2000 and 2001 when a series of corporate scandals broke out. As for CEO salary and bonus, which constitute around 30% of the whole pay package, the increase is gradual over time. Increases in option value contribute to the total pay rise up to 2003; however, afterwards, even though the value of options granted drops, the total pay increases. Apparently, other pay components such as restricted stock have become preferred to stock options.

Looking at firm-level patterns, Table A1 (in the Appendix) shows that both return on assets and the stock return mark their lowest value in 2001 and 2002—the year of the reform passage. Average sales increased from $3.7 billion in 1998 to $6.5 billion in 2005. A comparison of firm characteristics between dependent and independent board firms indicates that there is no statistically significant difference between both groups.

Overall, the CEO pay pattern reveals an increase in salary and bonus after SOX, and a remarkable increase of restricted stock. These descriptive findings are hard to interpret, though. There could be factors other than SOX after 2002 that influenced the change. The rest of this study asks to what extent the observed mean pay patterns can be explained by differences in firm characteristics before and after SOX.

[19]The most widely used method for valuing options is the Black-Scholes formula adjusted for continually paid dividends. The value of European call option paying dividends is: $OptionValue = Pe^{-ln(1+d)T}N(z) - Xe^{-ln(1+r)}N(z-\sigma\sqrt{T})$, where P is the grant-date stock price, X is the exercise price, T is the time remaining until expiration, d is the annualized dividend yield, σ is the stock-price volatility, r is the risk-free discount rate, N(.) is the cumulative distribution function, and $z = (ln(P/X) + [ln(1+r) - ln(1+d) + \sigma^2/2]T)/(\sigma\sqrt{T})$.

3.6 Research Methodology

I use the fall of Enron in 2001 as a motivating event for the corporate governance reforms in 2002.[20] The pre-reform period of analysis is from 1998 to 2001 and the post-reform from 2003 to 2005. Year 2002 is dropped as it is when the reforms were enacted.

I employ the main requirement of the Act for the majority of independent directors on compensation, nomination and audit committees to define how a certain aspect of SOX, namely improved board oversight, affects CEO pay. For this purpose, I analyze separately firms with stronger board oversight and firms with weaker board oversight as of before the reform. I consider firms with weak board oversight to be the "treated" group as opposed to the "control group," that is firms with strong board oversight.

Using legislation that mandates board independence helps to better identify the monitoring effect on pay for performance. Previous studies using cross-sectional data to examine board monitoring and compensation pay rely on a potentially endogenous source of variation. The observed variation in board oversight was limited before the reform, even where studies could benefit from the advantages of panel data, because the CEO herself would influence the pay process either personally or through the network of friends sitting on the board. Using the Act as a "surprising" event that causes a forceful change in the board structure suggests a better identification of the relationship, though the extent of board change depends on the composition of the board before the reform.

Little change in the CEO pay-for-performance sensitivity for the "control" group is expected because these firms have already met the requirements of SOX for board independence. The "treatment" group, however, is expected to experience a change in pay for performance because of a stronger shift in board independence.

I use two measures for board independence. First, I construct ten portfolios according to firms' sales and define the median percent of independent directors in each portfolio.[21]

[20]The implementation of the Act started soon after its passage. The final rule was agreed upon on July 24 (VandeHei et al., 2002), passed in Congress on July 25, and signed into law on July 30. August 14, 2002 was the first deadline for CEOs and CFOs of the 947 largest firms to certify the truthfulness of their financial reports.

[21]I employ the IRRC definition of an independent director. This is a director not affiliated with the

Then, for each portfolio I classify a firm as belonging to the independent-board subsample if its percent of independent directors is higher than the median percent of independent directors in the relevant portfolio. Similarly, the sample of dependent board firms prior to the reform are those with a lower percent of independent directors than the portfolio median. This measure accounts for the positive impact of firm size on independence documented first by Bebchuk et al. (2003) and confirmed in the present sample. Second, I consider an alternative proxy that does not depend on firm size, but only on the firm's majority of independent directors (more than 50% of all board members).

Table 3.4 reports how board structure is altered after SOX and confirms the actual reform's treatment. Regardless of the way an independent board is defined, we observe that the reforms seem to affect firms with dependent boards more than firms with independent boards. For example, the share of independent audit committee members increases by 22% for the median-portfolio-based approach and 24% for the majority-rule-based one. Overall, the percentage increase of the share of different types of independent directors is significantly higher (at the 1% level) in firms with dependent boards than in firms with independent boards before SOX, which provides grounds to use board structure as a proxy for the changed monitoring due to SOX.

The Act introduces significant changes in the responsibilities of certain executives, the CEOs (and CFOs), which are employed to study within-firm pay differences between CEOs and non-CEOs. Thus in addition to the before/after change of pay, and the pay change between CEOs in independent and dependent boards, I add to the analysis the change between CEOs and non-CEOs pay. Including non-CEOs, who are not affected by the Act, allows controlling for various macroeconomic and systematic shocks on the managerial labor market, thus ensuring even a cleaner identification of the effect of SOX.

3.7 Pay for Performance

In this section, I first examine the change in pay-for-performance sensitivities before and after SOX for all firms. Next, I study the change in pay-for-performance sensitivities sep-

company. For details see www.irrc.com.

arately for firms with dependent and independent board structures. Finally, in addition to comparing the before/after differences across independent/dependent firms, I analyze the difference between CEO and non-CEO pay.

Following the previous literature, I assume that CEO pay, measured by either salary and bonus or total pay (summation of salary, bonus, options granted to managers, LTISs, the value of restricted stock grants and other pay), is a function of accounting return measures on assets (ROA) and firm sales.[22] Changes in the value of the CEO's existing shares and options are ignored. Whether the consequence of this exclusion is an underestimation of the managerial incentives depends upon the managers' activities regarding their personal portfolios.[23] Given the difficulty of controlling for managers' activities, using current compensation has the advantage of measuring only compensation components, over which the board of directors has direct control. Moreover, the focus of my analysis is on the potential influence of SOX on executive pay, rather than on the optimal managerial pay dynamics. Since the major channel of SOX regulation comes through the board's decisions, presumably affected by strengthened independence, the current compensation measures are more appropriate for my tests. In addition, I study the impact of SOX on pay for luck (See Section 3.8), which does not vary with fluctuations in already granted pay. I assume that the Act has limited control through board oversight over the amount of pay that CEOs choose to retain in their portfolios. The use of current compensation is further justified by Core and Guay (1999) who conclude that firms use flow of equity incentives to reward past performance and re-optimize incentives for future performance.

A well-documented feature of the ExecuComp data is the right skewness of pay, implying that only a small fraction of executives earn extremely high pay. To reduce the effect of outliers, I drop observation falling outside of the 1-to-99 percentile range

[22]Studies using accounting return measures include Leonard (1990) and Sloan (1993). In untabulated results I verify that all the inferences reported in this section hold when I consider stock return as a measure of firm performance.

[23]Ofek and Yermack (2000) report evidence that managers alter their portfolios in response to the composition of their pay packages. Similarly, managers counteract the effects of existing holdings through hedging transactions.

of pay. Return on assets is the net income before extraordinary items and discounted operations divided by total assets. Sales are measured by net annual sales as reported by the company. To control for the upward trend of CEO pay during the analyzed period from 1995 to 2005, I include a quadratic time trend in years. Most of the studies on managerial pay use the fixed effect model to control for unobserved heterogeneity among firms and/or executives.[24] The difference-in-differences approach is employed to estimate the impact of the Act.[25] The advantage of this methodology is that it measures the effect of the Act by comparing pay-for-performance sensitivities. However, it is well known that the difference-in-differences estimator is based on strong identification assumptions. In particular, it is required that in the absence of treatment, the average outcomes for the treated and control group would follow parallel paths over time. I perform tests for the equality of mean pay between CEOs in independent (control) and dependent (treated) board firms. The results suggest that the mean pay in firms with independent boards is not statistically different than the mean pay in firms with dependent boards, except for in 2003 and 2005, when the difference is statistically significant at the 10% level. Similarly I examine the ROA path over time and find that only in 1998 the mean ROA differs between the group of independent and dependent board firms. Overall, the assumption of a similar pattern of compensation for the treated and control group seems to be supported by the data.

Table 3.5 presents the estimated CEO pay specifications separately for the full sample, for firms with dependent and independent boards. The pay-for-performance elasticities for the full sample (column 1) before the reform, measured with the estimates of ROA, suggest that a one percentage point increase in return on assets leads to a 1.3% percent rise in pay. Although the result is comparable with previous research (See Murphy, 1999; Wang, 2005), the discussion in this paper focus on changes in sensitivity while ignoring the

[24]Murphy (1985) shows that controlling for firm fixed effects is important in the managerial pay literature.

[25]See Heckman and Hotz (1989) for an exposition of difference-in-differences, and Bertrand and Mullainathan (1998) for an application of this methodology to analyze the effect of legal regulations on CEO pay.

debate on the magnitude of estimates. The post-reform pay-for-performance coefficient increases significantly by almost 25 percentage points, resulting in an increase of total pay of almost 1.6 percent.[26]

Next, I explore whether firms exposed to a stronger reform treatment, namely, firms with dependent boards, react differently from those firms that were less affected by the Act, i.e., the independent board firms. If there was a common shock correlated with the passage of the Act that affects all firms, the above approach will not identify correctly the impact of SOX. To address this issue, I estimate separately pay-performance sensitivities for independent and dependent board firms. The latter group of firms do not change their pay-performance policy after SOX (column 2, Table 3.5); however, dependent board firms increase the link between firm performance and CEO pay by almost 50%. The effect of the reform is actually the difference between pay-for-performance post-reform changes between the "treated" and "control" group, that is 0.63 ($p < 0.12$). The statistically significant difference-in-differences estimate provides some evidence that the rise in incentives is valid only for the "treated" group of firms. These findings are similar to those of Wang (2005) who examines CFOs who are affected by SOX similarly as CEOs.

Further, the results in Table 3.5 are preserved when analyzing CEO salary and bonus—the reform leads to a rise in pay-for-performances only in dependent board firms. Modeling the time trend with less restrictive time dummies does not change the results. In addition, the results are not sensitive to including additional control variables usually considered in the executive pay literature. Particularly, I control for the variance of stock return calculated over 60 months as a measure of the noise of firm performance,[27] lagged return,[28] book-to-market ratio, CEO age and CEO tenure.

[26]The statistical inference accounts for the group-level variation in ROA by clustering residuals at the firm level.

[27]Aggarwal and Samwick (1999a) argue that ignoring the volatilities and their interactions with firm performance understates the pay-performance link. The variance captures both size and risk effects.

[28]See Core (2002) for a discussion of the roles of different performance measures on CEO pay. Because past performance may have an influence on current compensation (Jensen and Murphy (1990), lagged return has to be included as a regressor. The total sensitivity is the sum of the current and lagged return

Table 3.6 presents the results for the sample of non-CEOs, which includes all reported executives except CFOs.[29] Since the Act does not address all executives, but CEOs and CFOs, the analysis can be further refined by forming an additional within-firm "treated" group—CEOs—and a "control group"—non-CEO executives. Comparing pay-for-performance sensitivities between CEOs and non-CEOs will difference out the impact of common shocks on the managerial labor market. The same regression specifications for CEOs are estimated.[30] Basically, the results show that the non CEOs pay for performance estimates do not change for independent and dependent boards after the passage of the Act. This evidence further provides support that the change in pay for performance in the treated group can be attributed to the reform, because the pay for performance of the control group remains the same as before the reform.[31]

Figure 3.2 combines the estimated pay-for-performance coefficients with their corresponding 95% confidence intervals for CEOs and non-CEOs separately, before and after SOX, for independent and dependent boards. It is clear from the figure that non-CEO pay for performance is stable before/after SOX and between dependent/independent board firms unlike CEO pay for performance.

I assess the sensitivity of the results to the measure of board independence. Alternatively according to the definition in Tables 3.5 and 3.6, based on decile sales portfolios, I re-estimate CEO-total pay regressions, dividing the firms into four groups based on board independence quartiles and into two groups based on the majority of independent directors.[32] The results are presented in Table A2 in the Appendix. While the estimated

coefficients. The before/after effect of SOX on CEO pay is similar to the specification without lagged performance.

[29]Chief Financial Officers are omitted from the analysis since they are also affected by the Act. For more details on the effect of SOX on CFO pay, see Wang (2005).

[30]Since there are more than one executive in a firm, I also examine executive fixed effect to account for managerial talent differences. Similar estimates are obtained.

[31]I estimate a specification where CEO and non-CEO pay are assumed to share the same time trend and pay for firm size elasticities. The results are similar to the results in Table 3.5 and 3.6.

[32]Both measures are calculated prior to the passage of SOX in 2002, in accordance with the definition in Tables 3.5 and 3.6.

effect of SOX on pay-for-performance elasticities is significant in the lower two quartiles, where the group of firms with dependent boards is, the sensitivities remain the same after the passage of SOX for the group of firms in the upper quartiles. The results are similar when the sample is split into two groups depending on the majority of independent directors. A significant positive change is detected only for the firms with less than 50% of independent directors. In sum, regardless of board independence, the definition of CEO pay for performance increases after SOX in firms with dependent boards defined prior to the reform; however, no such change is detected for independent board firms.

A question arises as to whether these findings are consistent with the standard agency models. Bertrand and Mullainathan (1998) study the impact of takeover legislation on executive pay and find that pay for performance increases after the passage of anti-takeover legislation in the 1980s. They explain this evidence with the substitution effect of alternative incentive mechanisms inferred from the agency theory—if a reduction in the takeover threat is present, then pay for performance will rise to compensate for the weakened threat of takeover. Guided by the same theory, all else equal, I expect CEO pay for performance to decrease in firms with dependent boards after SOX because they will respond to the increased board oversight with lower incentives, i.e., lower pay for performance.

The present results, however, seem to be puzzling in regards to this view. Pay-for-performance and increased monitoring through independent directors after SOX, behave as complimentary mechanisms rather than as substitutes that reduce the degree of asymmetry between principal and agent. Potential explanation for the limited evidence in support of the standard agency theory can be found in the optimal contracting perspective. Improved board oversight will happen only if the cost of doing so is offset by the additional payoff of not increasing pay for performance. Stated differently, after SOX the marginal benefit of implementing contracts characterized by increased pay for performance and increased board monitoring has to be greater or equal to their marginal costs. Demsetz and Lehn (1985), for example, find evidence of increasing monitoring costs in more risky and uncertain environments, thus, instead of enduring greater monitoring costs to oversee CEO actions, shareholders use equity incentives to motivate managers.

It might be too costly for boards in the process of restructuring to meet the requirements of SOX and to exercise active monitoring. The evidence rather suggests that they choose to strengthen an alternative incentive device, namely pay for performance.

Moreover, the executive contract is not just a one-dimensional arrangement including pay for performance and monitoring (Kole, 1997). Other factors might affect these contracts. Garvey and Milbourn (2006) are concerned that the increase of firm performance sensitivity to CEO pay might be in part a windfall. Pay might be sensitive to exogenous forces (luck) linked to firm performance but irrelevant to CEO actions. Bertrand and Mullainathan (2001) refer to the phenomenon of pay for luck as managerial "skimming," according to which managers manage to skim off only the gains from good luck. Motivated by the corporate scandals in 2000 and the public opinion that CEOs are overpaid, I further examine the possibility that CEOs have captured the pay setting process and are paid for "luck" before SOX, however not after it when their corporate governance was presumably improved.

3.8 Pay for Luck

The analysis in Section 3.7 does not distinguish between earnings from company performance related to CEO activities and from "luck" that is attributed to events beyond the manager's control. In this section, I estimate whether CEOs pay depends on events beyond their control and how SOX affects such pay for luck. In a widely cited paper, Bertrand and Mullainathan (2001) explore empirically whether CEO pay depends on events beyond their control. The authors use year-to-year differences in mean industry performance to proxy for industry fortune.[33] Naming the response of pay to changes in industry performance pay for luck, the authors document that the average executive receives compensation for industry performance. Garvey and Milbourn (2006) reason that this argument is incomplete because it can be also interpreted as compensation for

[33]This study measures luck also by movement in oil prices in the oil industry and changes in industry-specific exchange rate for firms in the traded good sector. CEO pay responds to luck for all different measures.

bearing industry risk. They develop the pay-for-luck view by stressing the importance of bad luck versus good luck. If CEOs have managed to capture the pay setting process and to tie their pay to industry performance, then the link will be stronger when the benchmark is up than when it is down. I address the impact of SOX on both pay for good luck (when the industry is up) and pay for bad luck (when the industry is down).

My analysis of the effect of SOX on CEO pay for luck relies on the methodology proposed by Bertrand and Mullainathan (2001), and Garvey and Milbourn (2006). I estimate CEO pay for luck using a two-stage regression approach. In the first stage, I decompose the variation of firm performance into a component caused by the variation of average industry performance and a firm's specific performance. The residual from this decomposition represents skill, that is a firm-specific component combining CEO ability and other unobservable shocks. The average industry return employed as a regressor in the first stage is the weighted average rate of return on assets in a given year in the two-digit SIC industry that a firm belongs to, excluding the firm itself from the calculation. The weight of a given firm is the share of its assets in the total assets of the industry that the firm belongs to. In the second stage of the procedure, CEO pay is predicted using the industry-induced firm performance and firm-idiosyncratic performance estimated in the first stage.

Consistent with the skimming view, I expect improved monitoring after SOX to restrain CEOs' power to determine their own pay. Motivated by Bertrand and Mullainathan (2001) who show that paying for luck is weaker in firms with stronger corporate governance, I proxy the efficacy of corporate governance with board independence. CEOs are expected to better insulate themselves from bad luck outcomes when they are employed in a weak-governance firm, i.e., dependent board firm.

Table 3.7 presents selected coefficients from total-pay regressions on industry-induced ROA, firm-specific ROA and SOX interactions. The parameters of interest are the coefficient on industry-induced ROA, that is the predicted company return from the first-stage regression of company return on the average industry return on assets, and the corresponding SOX interaction (SOX*Industry-induced ROA).[34] Looking at the full-sample

[34]This first-stage regression is reported in the Appendix, Table A3. An important choice in the

column in Table 3.7, the point estimate for the predicted industry-induced ROA is 5 and for the firm-specific ROA it is 1.1 before SOX. These results confirm Bertrand and Mullainathan (2001) by documenting that before SOX executive pay is positively and significantly related to both luck and firm-specific performance, that is a proxy for managerial talent. Further on, the sensitivities to luck and skill are statistically different, which suggests that benchmarking is an important feature of the average CEO compensation.[35]

CEOs pay for luck falls after SOX. The point estimates of the coefficients imply that for the average CEO, a percentage point increase in industry-induced ROA will decrease total compensation by 2.4%, while a percentage point increase in firm-specific ROA will increase total pay by 0.62%, which in no case is statistically different from the sensitivity to luck. Thus, across all firms pay for luck is present before SOX, however, such practice disappears after the reform. Looking at the firms with an independent board structure before SOX, it is noticeable that these firms do not pay for luck during the whole period; however, in the dependent board firms, where CEOs can influence to a greater extent the pay process, pay for luck exists before SOX and disappears after it. The evidence suggests that firms that are considered to be better governed do not pay for luck, and after the

empirical design is whether to allow the sensitivity of firm performance to peer performance to differ across firms. Bertrand and Mullainathan (2001), for example, include firm fixed effects in their first-stage performance regressions. Estimating firm-specific betas, however, might introduce estimation error into the peer performance term in the second stage regression with two possible consequences. If the estimation error is simply noise, than the coefficient on peer performance in CEO pay regression is biased towards zero. If, on the other hand, the estimation error introduces elements of firm-specific performance into the estimated peer performance term, then I may erroneously document pay for luck. To insure against estimation error consequences, I estimate both firm-specific betas and common peer performance beta for all firms. The results in the Appendix consider firm fixed effects and cluster the residuals at the firm level or industry level (untabulated).

[35]If a firm does not distinguish pay for firm-specific return from pay for luck then we would expect both to be equally important components of the average CEO pay. Garvey and Milbourn (2006) show that equal sensitivity to both parameters might be due to optimal contracting arrangement than to skimming. Managers will not only choose to insure fully against luck but also to be rewarded for firm-specific performance.

reform, managers are also not compensated for luck in firms with weaker governance before the reform.

Figure 3.3 demonstrates the pay-for-luck coefficients, with their 95% confidence intervals before/after SOX for independent/dependent boards received from Table 3.7. Clearly, before the reform CEOs in dependent board firms were rewarded for luck, while CEOs in independent board firms did not receive such payment. After SOX, the sensitivity of industry-induced performance to pay is insignificant.

3.8.1 Asymmetric Response of Pay to Industry ROA

In the next step, I explore pay for luck when the benchmark is positive or negative. Finding evidence for asymmetric benchmarking supports the view that CEOs are paid for luck than for bearing systematic risk by linking their pay to industry performance. Under the pay for luck case, CEO pay is sensitive to industry fortune but not to industry recession. I allow the sensitivity of pay to industry-induced ROA and firm-specific ROA (i.e., skill) to differ depending on whether luck or firm-specific ROA is up or down before and after SOX. Table 3.8 presents results before and after the reform for a positive and a negative industry return benchmark. Particularly, I add interactions with indicator variables taking values of one if industry-induced or firm-specific ROA is smaller than zero, and zero otherwise.

Table 3.9 present the total elasticities and their standard errors based on the results from Table 3.8. For the full sample, displayed in the upper panel of the table, the sensitivity of total pay to industry-induced ROA before SOX is significantly higher in booms, 5.9, than in recessions, 1.04 (Industry-induced ROA + Industry-induced ROA*Down), which means that managers are rewarded for good luck; however, they are insulated from bad luck before SOX. Further, I reject the hypothesis that the sensitivity of pay for bad luck and bad firm-induced ROA are equal; similarly for good luck and good firm-induced ROA. After SOX, the sensitivity of pay to industry-induced and firm-specific ROA disappears. Consistent with improved governance, after SOX pay for good skill (the positive residual from the first stage) increases as well as punishment for bad skill.

Looking at the second and third panel of the same table, independent board firms

do not pay either for good or for bad luck over the entire 1998-2005 period. Dependent board firms, however seem to equally reward CEOs for good luck and punish them for bad luck, which is not preserved after the reform. Even though in the full-sample there is evidence of paying CEOs for luck, it appears that company board structure affects ambiguously the response of pay to industry-wide movements in performance.

The link between pay and industry-induced performance might be consistent with other economic perspectives. Demand-supply dynamics in the managerial labor market might play a role by increasing the demand for skilled CEOs during industry fortune, which results in higher compensation. Himmelberg and Hubbard (2000) argue that the supply of highly skilled CEOs is relatively inelastic, therefore shocks to aggregate demand increase both the value of the firm as well as the marginal value of the CEO pay. In other words, the dependence of pay to positive industry-wide return might be used to motivate the manager to stay with the company when facing the opportunity to receive a better outside option. If we believe that the link between CEO pay and industry return fluctuations is driven by demand-supply changes on the managerial labor market due to shocks, and particularly that during positive industry change, good CEOs are rewarded more for staying with the company, then we would expect positive shocks to affect this link consistently over time or demand-supply imbalances caused by booms to have a permanent effect. On the contrary, we see that the average CEO is rewarded more for positive shocks only before 2002 (Table 3.9).

Finally, one might believe that a CEO's actions and skills might affect industry performance through strategic interactions and oligopolistic industries (Aggarwal and Samwick, 1999). Thereby, fair CEO pay would be sensitive to industry performance. I evaluate whether the effect of industry performance on pay decreases as the industry definition broadens (as broader industries are less likely to be oligopolistic) and whether the effect is weaker for small firms (as small firms have weaker market power to affect the industry product market). There is no statistical difference between pay for luck coefficients when the industry is defined as a one-digit SIC or two-digit SIC. Further, the results (untabulated) clearly indicate that pay for luck in big firms is not statistically different from pay for luck in small firms. In sum, this evidence does not provide support for the argument

that sensitivity of pay to industry return is due to strategic interactions.

Overall, the results provide evidence to conclude that some CEOs were rewarded for luck before SOX, while this practice is not observed after enforcing corporate governance rules in 2002. When accounting for asymmetric benchmarks, the results confirm pay for luck for all firms before SOX but not after it, which advocates the skimming view. However, this evidence is not fully consistent with the board structure, which is expected to reduce more effectively such type of pay in firms where more independent directors sit on the company board. Finally, Table 3.10 summarizes the effect of the reform. Even though SOX does not regulate directly CEO compensation contracts, board structure is the channel through which pay for performance and pay for luck are affected. After SOX, pay for performance is strengthened, while pay for luck has decreased in firms expected to be affected by the Act – these are, dependent board firms. To understand the overall impact of the reform, however, it is necessary to evaluate both benefits and costs. Particularly, monitoring and audit costs seem to be inflated the most by SOX.

3.9 Conclusion

This paper examines the determinants of executive pay before and after the corporate governance regulations of 2002. Introduced soon after a series of corporate scandals, the reforms mandated independent audit, nomination and compensation committees together with higher sanctions for management misconduct. Unlike Wang (2005) who focuses on a highly specific executive group—CFOs and COOs—my study covers CEOs and all other executives, thereby placing the analysis into the contemporary literature on CEO pay.

Employing a difference-in-differences methodology, I study jointly pay for performance and pay for luck. I compare before/after differences in two types of firms: those with stronger board monitoring before the reform and those with weaker board monitoring. Further, assuming that non-CEOs would not be affected by SOX, the analysis compares CEO pay for performance to that of non-CEOs across different boards.

I find that the pay-for-performance link increases after 2002 in firms with weaker board oversight, that is, in firms more affected by SOX stipulations. In contrast, the

pay-for-performance relationship changes little in firms with independent boards. Non-CEO pay for performance remains stable over the whole period. These results cannot be explained by the standard economic theory of executive compensation—the principal-agent model—which motivates exploration on an alternative view, namely the "skimming view."

Following Bertrand and Mullainathan (2001), I examine CEO pay for luck before and after SOX. Consistent with this study, I document that after the reform, when corporate governance is improved, pay for luck measured by industry-wide movements in firm performance disappears on average. Further, to uncover the effect of governance on pay for luck, I explore separately its before/after reform change for different boards, and positive and negative industry shocks. Consistent with the "skimming" hypothesis, CEOs are rewarded only for positive industry shocks before SOX, but they are not punished for negative ones. These results confirm the earlier finding of Bertrand and Mullainathan (2001) that stronger corporate governance decreases pay for luck, which undermines shareholders's value. The contribution of my analysis is that I employ a different identification approach to answer how the recent governance reform affects pay for luck. Combining the pay for performance and pay for luck explorations, I find that in the dependent board firms the first component increases and the second one decreases after SOX, which supposedly is an indicator of improved corporate governance. The policy implication is that stricter corporate governance rules insured by the Sarbanes-Oxley Act of 2002, might be beneficial for shareholders because they manage to curb CEOs' rent-seeking behavior. To evaluate the total effect of the corporate governance reforms of 2002, however, is necessary to account for the costs of SOX—increased audit fees—which is left for future research.

Bibliography

Aggarwal, R. and A. Samwick (1999a) "The Other Side of the Trade-off: the Impact of Risk on Executive Compensation," *Journal of Political Economy* 107, 65-105.

Aggarwal, R. and A. Samwick (1999b) "Executive Compensation, Strategic Competition, and Relative Performance Evaluation: Theory and Evidence," *Journal of Finance* 54, 1999-2043.

Almazan, A. and J. Suarez (2003) "Entrenchment and Severance Pay in Optimal Governance Structures," *Journal of Finance*, 47, 519-548.

Bebchuk L. and J. Fried (2004) "Pay Without Performance: The Unfulfilled Promise of Executive Compensation," Cambridge, Harvard University Press.

Bebchuk L. and Y. Grinstein (2005) "The Growth of Executive Pay, *Oxford Review of Economic Policy*," 21, 2.

Bebchuk, L.A., J. Fried and D. Walker (2003) "Executive Managerial Power and Rent Extraction in the Design of Executive Compensation, *University of Chicago Law Review*, 69," 751-846.

Becht, M., P. Bolton and A. Roell (2002) "Corporate Governance and Control," ECGN Working Paper.

Bertrand, M. and S. Mullainathan (2001) "Are CEOs Rewarded for Luck? The Ones Without Principals Are," *The Quarterly Journal of Economics*, 116(3), 901-32.

Bertrand, M. and S. Mullainathan (1998) "Executive Compensation and Incentives: The Impact of Takeover Legislation," NBER Working Paper 6830.

Cohen D., A. Dey and Th. Lys (2004) "The Sarbanes Oxley Act of 2002: Implications for Compensation Structure and Risk-Taking Incentives of CEOs," Working Paper, Northwestern University.

Conyon M. (2006) "Executive Compensation and Incentives," *Academy of Management Perspectives*, 20, 25-44.

Core, J. (2002) "Discussion of The Roles of Performance Measures and Monitoring in Annual Governance Decisions in Entrepreneurial Firms," *Journal of Accounting Research*, 40, 2, 519-527.

Core, J. and W. Guay (1999) "The Use of Equity Grants to Manager Optimal Equity Incentive Levels," *Journal of Accounting and Economics*, 28, 151-184.

Core, J., R.W. Holthausen and D. Larcker (1999) "Corporate Governance, CEO compensation, and firm performance," *Journal of Financial Economics*, 51, 371-406.

Core, J., W. Guay and D. Larcker (2003) "Executive Equity Compensation and Incentives: A Survey," *Economic Policy Reveiw*, April, 27-50.

Daily, C., J. L. Johnson, A. E. Ellstrand and D. R. Dalton (1998) "Compensation Committee Composition as a Determinant of CEO Compensation," *The Academy of Management Journal*, Vol. 41, No. 2, 209-220.

Demsetz H. and K. Lehn (1985) "The Structure of Corporate Ownership: Causes and Consequences," *Journal of Political Economy*, 1155-1177.

Fich, E. and A. Shivdasani (2006) "Are Busy Boards Effective Monitors?," *Journal of Finance*, 61, 689-724.

Garvey G. and T. Milbourn (2006) "Asymmetric Benchmarking in Compensation: Executives are Rewarded for Good Luck but not Penalized for Bad," *Journal of Financial Economics*, 82, 197-225.

Gibbon, R. and K. J. Murphy (1992) "Optimal Incentives Contracts on the Presence of Career Concerns: Theory and Evidence," *Journal of Political Economy*, 100, 468-505.

Gimein, M. (2002) "You Bought. They Sold," Fortune, Sep. 2, 2002.

Grinstein, Y. and P. Hribar (2004), "CEO Compensation and Incentives: Evidence From M&A bonuses," *Journal of Financial Economics,* 73, 119-143.

Heckman J. and V. J. Hotz (1989) "Choosing Among Alternative Non-experimental Methods For Estimating The Impact of Social Programs: The Case of Manpower Training," *Journal of the American Statistical Association*, 84(408), 862-874.

Hall, B. and J. Liebman (1998) "Are CEOs Really Paid Like Bureaucrats?," *Quarterly Journal of Economics*, 103, 653-91.

Hallock, K. (1997) "Reciprocally Interlocking Boards of Directors and Executive Compensation," *Journal of Financial and Quantitative Analysis*, 32, 331-344.

Hart, O. and B. Holmstrom (1987) "The Theory of Contracts," In Advances in Economic Theory, Fifth World Congress (ed. T. Bewley), Cambridge University Press.

Hartzell, J. C. (2001) "The Impact of the Likelihood of Turnover on Executive Compensation," Working Paper, University of Texas at Austin.

Hartzell, J. C. and L. Starks (2002) "Institutional investors and executive compensation," *Journal of Finance*, Vol. 58, 2351-2374.

Hermalin, B.E. and Weisbach, M. (2003) "Boards of Directors as an Endogenously Determined Institution: A Survey of the Economic Literature," *Economic Policy Review*, 9, 7-26.

Hilzenrath, D.S., J. Weisman, and J. Vandehei (2002) "How Congress Rode a 'Storm' to Corporate Reform," The Washington Post, July 28, 2002.

Himmelberg, C. P., Hubbard and R. Glenn (2000) "Incentive Pay and the Market for CEOs: An Analysis of Pay-For-Performance Sensitivity," Working Paper, Columbia University.

Holmstrom, B. (1979) "Moral Hazard and Observability," *Bell Journal of Economics*, 13, 234-340.

Hubbard, R. and D. Palia (1995) "Executive Pay and Performance: Evidence from the US Banking Industry," *Journal of Financial Economics*, 39, 105-130.

Holmstrom, B. and S. Kaplan (2003) "The State of U.S. Corporate Governance: What's Right and What's Wrong?," University of Chicago.

Kole, S.R. (1997) "The Complexity of Compensation Contracts," *Journal of Financial Economics*, 43, 79-104.

Jensen, M. C. and W. Meckling (1976) "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," *Journal of Financial Economics*, 3, 305-60.

Jensen, M.C. and K. J. Murphy (1990) "Performance Pay and Top-management Incentives," *Journal of Political Economy*, 98, 225-264.

Linck J., J. Netter and T. Yang (2005) "Effects and Unintended Consequences of the Sarbanes-Oxley Act on Corporate Boards, Working Paper," University of Georgia.

Leonard, J. (1990) "Executive Pay and Firm Performance," *Industrial and Labor Relations Review*, 43, 13S-29S.

Murphy K. (1999) "Executive Compensation," In O.Ashenfelter and D. Card (eds), Handbook of Labor Economics, Volume 3, North Holland, 2485-2525.

Ofek E. and D. Yermack (2000) "Taking Stock: Equity-Based Compensation and the Evolution of Managerial Ownership," *Journal of Finance*, 55, 1367-1384.

Sloan, R. (1993) "An Examination of the Role of Accounting Earnings in Top Executive Compensation Contracts," *Journal of Accounting and Economics*, 16, 55-100.

VandeHei, J. and D.S. Hilzenrath (2002) "Hill Leaders Agree on Corporate Curbs; Attack on Fraud Includes Auditing Control and Jail Terms," The Washington Post, July 25, 2002.

Yermack, D. (1996) "Higher Market Valuation of Companies with a Small Board of Directors," *Journal of Financial Economics*, 40, 185-211.

Wang, X. (2005) "The Impact of the Corporate Governance Reform Initiatives on Chief Financial Officer Compensation," Working Paper, University of Chicago.

Table 3.1: Governance Patterns: Board Characteristics

	1998	2001	2002	2004	Test
Employee directors[1]	0.22	0.21	0.19	0.17	*
Linked directors[2]	0.18	0.16	0.12	0.12	*
Independent directors[3]	0.6	0.63	0.67	0.7	*
Independent nominating committee[4]	0.72	0.75	0.79	0.91	*
Independent compensation committee[5]	0.85	0.87	0.9	0.94	*
Independent audit committee[6]	0.82	0.88	0.9	0.95	*
Majority independent members[7]	0.67	0.71	0.77	0.88	*
Busy directors[8]	0.20	0.16	0.15	0.15	*
Board size	9.62	9.25	9.38	9.37	*
Annual director's fees ($thousands)[9]	17.34	19.95	21.98	29.78	*
Number of board meetings per year	7.25	7.02	7.22	7.84	*

Notes: The last column shows the significance of the non-parametric binomial test of differences in probabilities for 2004 and 1998. * denotes statistical significance at 1%. Board summary characteristics come from IRRC (full sample). The database identifies three types of board affiliation: employee, linked (director who provides professional services to the company or is a major customer including former employees and recipients of charitable funds; interlocks, and family member of a director or executive), and independent (no significant connection with the firm).

[1], [2] and [3] measure the percentage of employee, linked, and independent directors, respectively.

[4], [5] and [6] show the share of independent directors from the total number of committee members who sit on nominating, compensation and audit committees, respectively.

[7] reports the share of firms with more than 50% independent directors.

[8] shows the share of directors serving on more than 3 boards in a given year.

[9] is available in the ExecuComp data.

Table 3.2: Sample Overview

	1998	1999	2000	2001	2002	2003	2004	2005	Total
ExecuComp									
Number of Firms	1,941	1,952	1,844	1,795	1,825	1,801	1,784	1,650	14,592
Chief Executive Officers (CEO)	1,731	1,810	1,792	1,671	1,671	1,688	1,690	1,649	13,702
Chief Operating Officer(COO)	784	805	878	822	849	827	804	778	6,547
Chief Financial Officer (CFO)	1,161	1,271	1,358	1,327	1,376	1,398	1,416	1,451	10,758
All the rest	9,005	8,349	7,738	7,373	7,390	7,100	6,356	4,827	58,138
IRRC									
Number of Firms	1,770	1,804	1,755	1,797	1,439	1,472	1,477	n/a	11,514
Directors	17,046	17,419	16,675	16,669	13,498	13,792	13,733	n/a	108,832
Matched Sample									
Number of Firms	1,174	1,268	1,307	1,377	1,349	1,379	1,323		9,177
Chief Executive Officers (CEO)	1,170	1,244	1,297	1,349	1,340	1,373	1,342		9,115

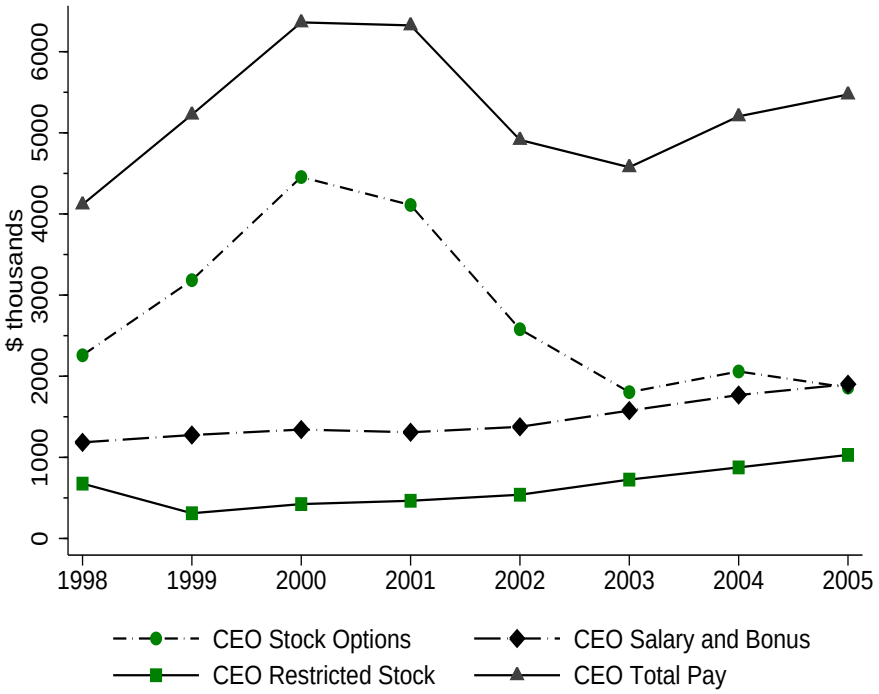
Note: ExecuComp and IRRC samples include all present firms. IRRC data is not available for 2005 (October 2006 version).

Table 3.3: CEO Pay Pattern: Percentage Changes Before and After SOX

	Firms	Salary and Bonus	Value of Options	Restricted Stock	Total Pay
All firms	13,216	0.26***	-0.03	0.4***	0.16***
Industry					
Mining and Manufacturing	2,851	0.29***	0.11**	0.49***	0.28***
Finance and Insurance	1,812	0.15***	-0.30***	0.19	-0.02
Utilities	800	0.22***	0.12	0.50***	0.22**
Services	1,958	0.32***	-0.14**	0.16	0.12*
Other	5,795	0.22***	-0.04	0.46	0.14***
Market Index					
S&P 500	3,618	0.26***	-0.09**	0.38***	0.16***
S&P MidCap 400	2,598	0.29***	0.4	0.6***	0.28***
S&P SmallCap 600	3,271	0.24***	0.10**	0.34***	0.20***
Other	3,729	0.12***	-0.17***	0.29***	-0.05
Board Structure					
Independent	5,763	0.25***	-0.01	0.43***	0.17***
Dependent	4,954	0.28***	0.01	0.4***	0.21***

Note: The sample includes all ExecuComp firms. Summary statistics of compensation show percentage change from 2002-2005 to 1998-2001. *** Significant at the 1% level; ** Significant at 5%; * Significant at 10%. *Option value* is the aggregate value of stock options granted to executives during the year as valued using S&P's Black-Scholes Methodology. *Restricted stock* is the value of restricted stock granted during the year. *Total Pay* is comprised of salary and bonus, other annual income, total value of restricted stock granted, total value of stock options, long-term incentives payouts and all other pay. The division of board independence is based on the percentage of independent directors on the board: 10 portfolios are formed based on firms sales. For each portfolio, independent boards are those with above the portfolio median independence percentage.

Figure 3.1: Mean CEO Pay, 1998-2005



Note: Figure 3.1 shows mean CEO pay for all firms in ExecuComp data. Total pay includes salary and bonus, other annual pay, total value of restricted stock granted, total value of stock options, long-term incentives and all other pay. Option value is the aggregate value of stock options granted to executives during the year as valued using S&P's Black-Scholes Methodology. Restricted stock is the value of restricted stock granted during the year.

Table 3.4: Board Structures Percentage Change Before/After SOX

	Median-Portfolio-Based[1]			Majority-Based[2]		
	Independ.	Depend.	Δ	Independ.	Depend.	Δ
Independent audit committee[3]	0.03	0.22	0.19	0.05	0.24	0.19
Independent nomination committee[4]	0.14	0.45	0.31	0.17	0.57	0.4
Independent compensation committee[5]	0.01+	0.19	0.18	0.02	0.27	0.25
Number of board meetings	0.07	0.14	0.07	0.07	0.19	0.12

Notes: Summary statistics show percentage change of the share of committee members from 2002-2004 to 1998-2001 for alterative proxies for board affiliation. + denotes statistically *insignificant* at any conventional level. All other statistics are significant at 1%.

[1] Board independence is based on the percentage of independent directors on the board: 10 portfolios are formed based on firms sales. For each portfolio, independent boards are those with above the median independence percentage.

[2] Boards with more than 50% independent directors.

[3], [4] and [5] report independent directors as a fraction of the total number of committees members who sit on audit, nomination and compensation committee, respectively.

Table 3.5: The Effect of SOX on CEO Pay

	Log(Total Pay)			Log(Salary and Bonus)		
	Full-Sample	Independent	Dependent	Full-Sample	Independent	Dependent
SOX*ROA	0.296*	0.018	0.629***	0.197	-0.052	0.525***
	[0.158]	[0.211]	[0.32]	[0.125]	[0.165]	[0.192]
ROA	1.256***	1.282***	1.253***	1.554***	1.640***	1.444***
	[0.115]	[0.19]	[0.26]	[0.091]	[0.121]	[0.140]
SOX	0.044*	0.028	0.059	0.062***	0.067**	0.05
	[0.026]	[0.035]	[0.039]	[0.021]	[0.028]	[0.032]
Log Sales	0.234***	0.209***	0.269***	0.180***	0.169***	0.193***
	[0.018]	[0.023]	[0.04]	[0.038]	[0.018]	[0.023]
Number of managers	7,997	4,418	3,579	8,058	4,477	3,581
Number of firms	1647	893	754	1656	896	760
R^2	0.25	0.24	0.27	0.24	0.24	0.24

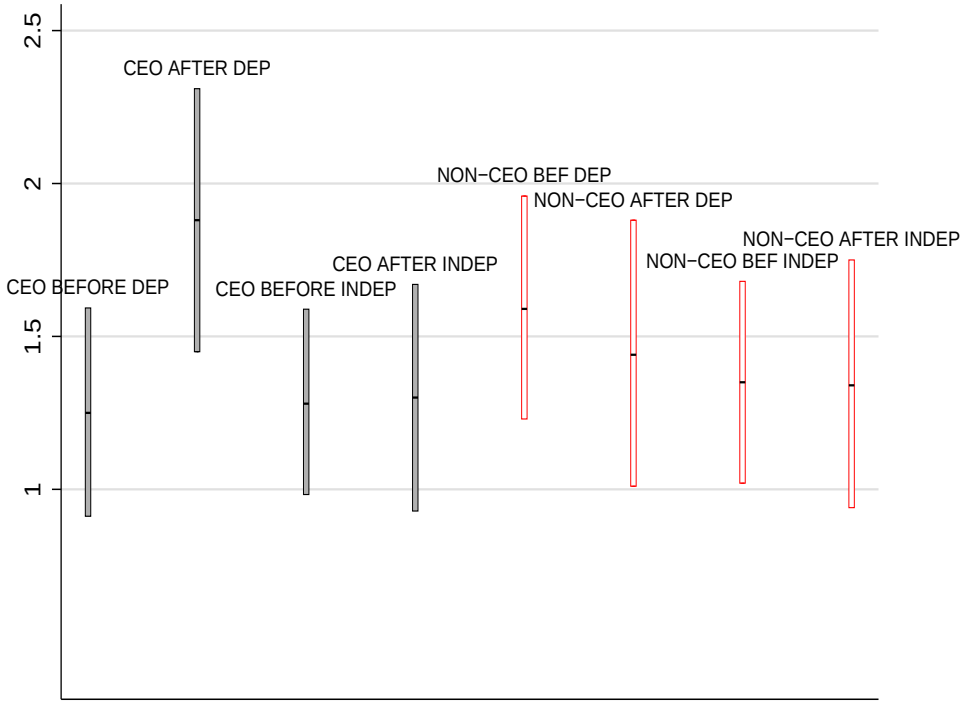
Note: *** Significant at the 1% level; ** Significant at 5%; * Significant at 10%. Robust standard errors are in parentheses. The dependent variable is the log of total pay (salary and bonus, other annual pay, total value of restricted stock granted, total value of stock options, long-term incentives and all other pay) and the log of CEO salary and bonus. SOX=1 for fiscal years 2003-2005; 0 for the period 1998-2001. ROA is the net income before extraordinary items and discounted operation divided by total assets. Firm fixed effects and quadratic trends are included in each regression.

Table 3.6: The Effect of SOX on non-CEO Pay

	Log(Total Pay)			Log(Salary and Bonus)		
	Full-Sample	Independent	Dependent	Full-Sample	Independent	Dependent
SOX*ROA	-0.102	-0.006	-0.14	0.072	0.069	0.088
	[0.144]	[0.201]	[0.211]	[0.078]	[0.106]	[0.114]
ROA	1.480***	1.354***	1.60***	0.894***	0.852***	0.932***
	[0.124]	[0.167]	[0.186]	[0.055]	[0.072]	[0.083]
SOX	0.036**	0.031	0.041	-0.042***	-0.030*	-0.056***
	[0.018]	[0.024]	[0.026]	[0.013]	[0.017]	[0.019]
Log Sales	0.173***	0.161***	0.20***	0.114***	0.109***	0.127***
	[0.013]	[0.016]	[0.016]	[0.019]	[0.011]	[0.013]
Number of managers	18,600	10,023	9,811	28,095	15,558	12,537
Number of firms	1,647	893	754	1,670	890	780
R-squared	0.12	0.13	0.1	0.13	0.14	0.12

Note: *** Significant at the 1% level; ** Significant at 5%; * Significant at 10%. Robust standard errors are in parentheses. Independence is based on sales portfolios. The dependent variable is the log of non-CEO salary and bonus and log of total pay (salary and bonus, other annual pay, total value of restricted stock granted, total value of stock options, long-term incentives and all other pay). SOX=1 for fiscal years 2003-2005; 0 for the period 1998-2001. ROA is the net income before extraordinary items and discounted operation divided by total assets. Firm fixed effects and quadratic trends are included in each regression.

Figure 3.2: Pay-For-Performance Coefficients



Note: Figure 3.2 shows the estimated pay-for-performance coefficients with their corresponding 95% confidence intervals. Each coefficient comes from a separate regression: estimates for the CEOs are from Table 3.5 and for non-CEOs from Table 3.6. The dependent variable is the log of CEO total pay, which is comprised of salary and bonus, other annual pay, total value of restricted stock granted, total value of stock options, long-term incentives and all other pay. Performance is measured with ROA that is the net income before extraordinary items and discounted operation divided by total assets.

Table 3.7: CEO Pay for Luck: Total Effect

	Log(Total Pay)		
	Full-Sample	Independent	Dependent
Industry-induced ROA	5.097	1.423	14.669***
	[3.33]	[3.88]	[4.46]
Firm-specific ROA	1.097***	1.247***	0.927***
	[0.174]	[0.266]	[0.276]
SOX*Industry-induced ROA	-2.403	-0.497	-8.826*
	[3.170]	[3.959]	[5.228]
SOX*Firm-specific ROA	0.626**	0.008	1.441***
	[0.31]	[0.327]	[0.393]
SOX	-0.648	-0.293	-1.918*
	[0.617]	[0.791]	[1.41]
Log Sales	0.22***	0.25**	0.16*
	[0.10]	[0.11]	[0.09]
Number of managers	7,986	4,415	3,571
Number of firms	1,644	892	752
R^2	0.25	0.24	0.27

Note: *** Significant at the 1% level; ** Significant at 5%; * Significant at 10%. Robust standard errors are in parentheses. Independence is based on sales portfolios. The dependent variable is the log of CEO total pay, which is comprised of salary and bonus, other annual pay, total value of restricted stock granted, total value of stock options, long-term incentives and all other pay. *Before SOX* covers 1998-2001, *After SOX* covers 2003-2005. Return is net income before extraordinary items and discounted operation divided by total assets (ROA). Industry-induced ROA is the predicted company return from a first stage regression with average industry return (asset-weighted industry ROA in the firm's 2-digit SIC industry, where the firm itself is excluded from the mean calculation). Firm-specific ROA is the residual from the same regression as the industry-induced ROA. Each regression includes trend, quadratic trend, sales, constant and firm fixed effects.

Figure 3.3: Pay-For-Luck Coefficients

Note: Figure 3.3 shows the estimated pay-for-luck coefficients with their corresponding 95% confidence intervals. The dependent variable is the log of CEO total pay, which is comprised of salary and bonus, other annual pay, total value of restricted stock granted, total value of stock options, long-term incentives and all other pay. Return is the net income before extraordinary items and discounted operation divided by total assets (ROA). Industry-induced return is predicted company return from a first stage regression with average industry return (asset-weighted industry ROA in the firm's 2-digit SIC industry, where the firm itself is excluded from the mean calculation).

Table 3.8: CEO Pay for Luck: Asymmetric Benchmarking

	Log(Total Pay)		
	Full-Sample	Independent	Dependent
Industry-induced ROA	5.849	2.051	15.833***
	[3.91]	[4.11]	[4.72]
Firm-specific ROA	1.840***	1.640***	2.146***
	[0.31]	[0.51]	[0.45]
Industry-induced ROA*Down	-4.805**	-5.460**	-2.904
	[1.91]	[2.606]	[2.535]
Firm-specific ROA*Down	-1.281**	-0.638	-2.117**
	[0.646]	[0.773]	[0.802]
SOX*Industry-induced ROA	-3.097	-0.963	-10.137*
	[3.426]	[3.889]	[4.01]
SOX*Firm-specific ROA	0.419	-0.008	0.859
	[0.644]	[0.613]	[1.037]
SOX*Industry-induced ROA*Down	3.214**	3.065	3.383
	[1.493]	[2.22]	[2.143]
SOX*Firm-specific ROA*Down	0.347	-0.022	0.969
	[0.915]	[0.887]	[1.39]
SOX	-0.667	-0.293	-2.022**
	[0.624]	[0.779]	[0.787]
Log Sales	0.23***	0.27*	0.16*
	0.08	[0.13]	[0.10]
Number of managers	7,986	4,415	3, 571
Number of firms	1,644	892	752
R^2	0.26	0.24	0.28

Note: *** Significant at the 1% level; ** Significant at 5%; * Significant at 10%. Robust standard errors are in parentheses. Independence is based on sales portfolios. The dependent variable is the log of CEO total pay, which is comprised of salary and bonus, other annual pay, total value of restricted stock granted, total value of stock options, long-term incentives and all other pay. *Before SOX* covers 1998-2001, *After SOX* covers 2003-2005. Industry-induced ROA is the predicted company return from a first stage regression with average industry return (asset-weighted industry ROA in the firm's 2-digit SIC industry, where the firm itself is excluded from the mean calculation). Firm-specific ROA is the residual from the same regression as the industry-induced ROA. *Down* is an indicator variable taking the value of 1 if industry-induced ROA is negative and 0 otherwise; similarly for firm-specific ROA. Each regression includes trend, quadratic trend, sales, constant and firm fixed effects.

Table 3.9: Total Sensitivity Effects

	Good Luck	Bad Luck	Good Skill	Bad Skill
		Full-Sample		
Before	5.849*	1.04	1.840***	0.55*
	[3.912]	[4.52]	[0.31]	[0.397]
After	2.75	1.16	2.25***	1.32***
	[2.83]	[3.17]	[0.60]	[0.416]
		Independent		
Before	2.051	-3.4	1.640***	1.00**
	[4.11]	[4.69]	[0.51]	[0.38]
After	1.08	-1.3	1.63**	0.97**
	[3.25]	[4.14]	[0.52]	[0.457]
		Dependent		
Before	15.83***	12.92***	2.15***	0.02
	[4.72]	[4.89]	[0.545]	[0.478]
After	5.69	6.17	3.00***	1.85***
	[3.98]	[5.15]	[0.859]	[0.49]

Note: *** Significant at the 1% level; ** Significant at 5%; * Significant at 10%. Robust standard errors are in parentheses. Independence is based on sales portfolios. Each panel represents a separate specification from Table 3.8.

Table 3.10: The Effect of SOX

	Pay-for-Luck	Pay-for-Performance
Dependent	-8.826*	1.441***
	[5.226]	[0.393]
Independent	-0.497	0.008
	[3.959]	[0.327]
Δ	-8.32*	1.43**
	[5.02]	[0.54]

Note: *** Significant at the 1% level; ** Significant at 5%; * Significant at 10%. Robust standard errors are in parentheses. Δ is the row difference between the treated group (dependent) and the control group (independent). Each coefficient is the before/after elasticity change in Table 3.7.

Appendix

Table A1: Firm Patterns Across Years

		1998	1999	2000	2001	2002	2003	2004	2005
		1998	1999	2000	2001	2002	2003	2004	2005
ROA	Mean	3.54	3.79	3.41	1.28	1.32	2.46	3.87	4.56
	Median	4.1	4.17	3.98	2.71	3.03	3.36	4.23	4.66
Stock Return	Mean	19	18	29	23	-3	50	25	0.16
	Median	10	3	22	14	-5	39	21	0.08
Sales	Mean	3,751	3,961	4,492	4,837	4,637	4,946	5,486	6,500
	Median	1,090	1,014	1,097	1,177	1,134	1,191	1,320	1,754

Notes: Return on assets (ROA) is the net income before extraordinary items divided by total assets. Return is the annualized monthly stock returns. Sales (in millions of USD) is the net annual sales as reported by the company. ROA and Return are reported in percent.

Table A2: Robustness to Board Independence

	Percentile ranges				Majority Independence	
	$\leq$ 25th	25/50th	50/75th	$\geq$ 75th	Yes	No
SOX*ROA	0.466*	0.938***	0.141	-0.241	0.457*	0.179
	[0.26]	[0.333]	[0.311]	[0.308]	[0.24]	[0.182]
ROA	1.062***	1.456***	1.141***	1.365***	1.153***	1.312***
	[0.241]	[0.216]	[0.237]	[0.235]	[0.237]	[0.132]
SOX	0.047	0.009	0.03	0.067	0.065	0.038
	[0.056]	[0.052]	[0.051]	[0.051]	[0.054]	[0.030]
Log Sales	0.320***	0.153***	0.198***	0.268***	0.326***	0.209***
	[0.038]	[0.035]	[0.034]	[0.035]	[0.038]	[0.020]
Number of managers	1,867	1,965	2,084	2,082	1,932	5,987
Number of firms	417	389	417	424	432	1,213
R^2	0.28	0.26	0.25	0.23	0.29	0.24

Notes: The dependent variable is the log of CEO total pay, which is comprised of salary and bonus, other annual pay, total value of restricted stock granted, total value of stock options, long-term incentives and all other pay. SOX=1 for fiscal years 2003-2005; 0 for the period 1998-2001. ROA is the net income before extraordinary items and discounted operation divided by total assets. Firm fixed effects and quadratic trend are included in each regression. Majority Independence board firms are with more than 50% independent directors. *** Significant at the 1% level; ** Significant at 5%; * Significant at 10%.

Table A3: First-Stage Regression

	Firm ROA
Industry-induced ROA	1.255***
	[0.317]
SOX	0.007**
	[0.003]
Log Sale	0.031***
	[0.002]
Trend	-5.325***
	[0.564]
Trend2	0.001***
	[0.000]
Number of managers	9,200
Number of firms	1,711
R^2	0.06

Note: *** Significant at the 1% level; ** Significant at 5%; * Significant at 10%. This is the first stage regression used in all other specifications. Robust standard errors are in parentheses. The dependent variable is ROA, measured with the net income before extraordinary items and discounted operation divided by total assets. *Before SOX* covers 1998-2001, *After SOX* covers 2003-2005. *Industry-induced ROA* is the average asset-weighted industry return on assets in the firm's 2-digit industry, where the firm itself is excluded from the mean calculation. Firm fixed effect are included.