Gender and Dynamic Agency: Theory and Evidence on the Compensation of Top Executives*

Stefania Albanesi†
Columbia University, NBER and CEPR

Claudia Olivetti‡
Boston University

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Abstract

We document three new facts about gender differences in executive compensation. First, female executives receive *lower share of incentive pay* in total compensation relative to males. This difference accounts for 72% of the gender gap in total pay. Second, the compensation of female executives displays a *lower pay-performance sensitivity.* A $1 million dollar increase in firm value generates a $70 increase in total compensation for male executives and a $28 increase for females. Third, female executives' total pay is *more sensitive to bad firm performance* and less sensitive to good firm performance and aggregate stock market performance relative to males. We also show that there is no link between firm performance and the gender of top executives. We discuss evidence on differences in preferences and the cost of managerial effort by gender and examine the resulting predictions for the structure of compensation. We consider two paradigms for the pay-setting process, the efficient contracting model under moral hazard and the "managerial power" or skimming view of executive compensation. The efficient contracting model can explain the first two facts. Only the skimming view is consistent with the third fact. This suggests that the gender differentials in executive compensation may be inefficient.

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†Corresponding author. E-mail: stefania.albanesi@columbia.edu.

‡E-mail: olivetti@bu.edu

1 Introduction

We document three new facts about gender differences in the structure of executive compensation. First, female executives receive a *lower share of incentive pay* in total compensation relative to males. This difference accounts for 72% of the gender differences in total compensation. Second, the compensation of female executives displays a *lower pay-performance sensitivity* relative to males. A $1 million dollar increase in firm value generates a $70 increase in total compensation for male executives and a $28 increase for females. Third, female executives' total pay is *more sensitive to bad firm performance* and less sensitive to good firm performance than for males. Female executives's compensation is also less sensitive to aggregate stock market performance. We also show that there is no link between firm performance and the gender of top executives. These results are based on ExecuComp, Standard&Poor's database on executive compensation. They control for the fact that women tend to manage smaller firms and are less likely to hold the title of CEO.

What drives these differences in the structure of compensation by gender? To examine this question, we discuss evidence on gender differences in preferences and the cost of managerial effort and examine the resulting predictions for the structure of compensation based on two models of the firm-executive relationship.

We present three types of evidence on gender differentials in attributes relevant for the executive labor market. First, surveys of professionals and managers point to the existence of a pervasive set of barriers to career advancement for female executives. These include exclusion from informal networks, gender based stereotyping, lack of mentors and role models and asymmetric allocation of household responsibilities (Catalyst, 2004a). The evidence of gender asymmetries in the personal cost of career investments in relation to marriage and parenthood is substantial. High earning professional and executive women are less likely than men in similar circumstances to be married or have children, but they bear a larger fraction of household responsibilities if married (Hewlett, 2002). To investigate the trade-off between career building and personal life, we analyze time use patterns for top income earners from the American Time Use Survey (ATUS). We concentrate on the top 5% of income earners and find that, while home production is significantly lower than in the overall population and distributed evenly across genders, the allocation of child care responsibilities is not. Married women with children under 5 spend 25.2 hours per week on child care, while married men only spend 10.2 hours in the top 5%. Finally, we examine evidence on gender differences in preferences from experimental studies. We concentrate on three attributes that appear particularly relevant for the executive labor market: ability to perform in competitive environments, propensity to compete and initiate negotiations, and risk aversion. To summarize:

- Women display lower performance in competitive environments (Gneezy, Niederle and Rustichini, 2003), even with no differences in performance in non-competitive settings, and lower propensity to select into competitive environments (Niederle and Vesterlund, 2007).

- Women display lower propensity to initiate negotiations (Babcock and Laschever, 2003).
- Women exhibit lower risk tolerance to abstract gambles (Barsky, Juster, Kimball, and Shapiro, 1997), but there are no gender differences in risk aversion in contextual financial settings (Schubert, Brown, Gysler and Brachinger, 1999).

To explore the impact of these gender differences on executive compensation, we consider two paradigms, the classic agency model of executive compensation and the "managerial power" or skimming view. According to the agency model (Holmstrom, 1979, and Jensen and Murphy, 1990), shareholders (the principals) set the executive's (the agent) compensation package to maximize the surplus from their relationship. Private information over the executive's effort generates moral hazard, which requires sensitivity of pay to firm performance to insure incentive compatibility. Equity based pay or explicit bonus programs can be used to obtain this effect. Under this paradigm, the structure, as well as the level, of executive compensation will reflect actual or perceived attributes of the executive, such as their impact on firm performance, their cost of effort and risk aversion. Embedding this agency model in a general equilibrium assignment framework, as in Lucas (1978), will give rise to the prediction that executives with more valuable attributes will be assigned to larger firms. Executive compensation and the size distribution of executive are constrained-efficient.

The managerial power or skimming view (Bertrand and Mullainathan, 2001, and Bebchuk and Fried, 2003) is based on the notion that the members of the board of directors, who are typically responsible for setting executive pay, cannot be taken to make decisions to maximize shareholder value. The incentive to be re-elected, CEO's power to benefit them, informal networks linking them to CEOs, cognitive dissonance, small penalties for favoring executives, and ratcheting all imply that executives can exert significant power over their own compensation. This has implications for the structure, as well as the level of pay. Executive compensation will be more sensitive to good firm performance than to adverse performance, and will react to factors that are completely outside the influence of top executives, such as aggregate stock market performance. These patterns should be more prevalent for executives that are more entrenched and when corporate governance is weak.

If we posit that gender differences in performance in competitive environments, propensity to compete and to initiate negotiation and weight of household responsibilities reduce the impact of female executive on firm performance and increase their cost of effort, the efficient contracting model can explain the fact that female executives have a lower share of incentive pay in total compensation and they display lower pay-performance sensitivity. These patterns are also consistent with the evidence on risk aversion by gender. Moreover, the model is consistent with the fact that female executives tend to manage smaller firms. However, the efficient contracting model cannot explain why female executives are more exposed to the risk of adverse firm performance and why their compensation is less sensitive to aggregate stock market conditions. The skimming view is consistent with this fact, since female executives, who are younger, have lower tenure and are limited in accessing informal networks, are likely to be less entrenched than their male counterparts.

Our results suggest that the gender differences in the structure and level of compensation and the size distribution of executives by gender are not efficient. The gender differentials in the level of compensation are mostly accounted for by those in the share of incentive pay. Moreover, female executives' greater exposure to risk can be linked to equity based compensation. The implications of these findings extend beyond the executive labor market. Lemieux, MacLeod and Parent (2007) document a rise in the fraction of U.S. jobs explicitly linking pay to performance since the late 1970s. They show that this trend can explain a sizeable fraction of the growth in male wage dispersion, especially at the top-end. Hall and Murphy (2005) discuss the rise in equity based programs for employees at all levels since the early 1990s. Albanesi and Olivetti (2007) find that gender earnings differentials are greatest in occupations and industries with higher incidence of incentive pay.

The failure of the efficient contracting paradigm to explain the three facts on gender differences in the structure of executive compensation points to the possibility of distortions in the link between pay and performance that may influence a broader set of workers as incentive pay schemes become increasingly important. To the extent that performance pay amplifies earnings differentials resulting from effective or perceived differences in attributes across workers, if designed incorrectly, it exacerbates inequality and discrimination and can severely distort the allocation of resources. Our analysis suggest that performance pay schemes should be held to closer scrutiny and raises a note of concern for the standing of professional women in the labor market as incentive pay becomes more prevalent.

The paper is organized as follows. We review the related literature in Section 1.1. We discuss the three facts on gender differentials in the structure of compensation in Section 2. Section 3 reviews the evidence on gender differences in preferences and barriers to career advancement. We describe the efficient contracting model of executive compensation in Section 4 and the skimming view in Section 5 and evaluate their predictions against the evidence on gender differences in preferences and the structure of executive compensation. Section 6 discusses some open questions.

1.1 Related Literature

TBA

2 Evidence on the Compensation of Top Executives

It is well known that there are significant gender differences in the *level* of compensation for top executives. We find that the female/male ratio in total compensation is 65% and 31% of the implied gender differential in pay remains unexplained by time and firm effects, and executive characteristics such as job title, age and tenure.

Our contribution is to document three new facts about gender differences in the *structure* of executive compensation.

Fact 1: Female executives receive a *lower share of incentive pay* in total compensation relative to males. The sum of bonus, stocks and stock option grants account for 70% of total compensation for female top executives and 73% for males. The differences in the share of incentive pay accounts for 72% of the gender differences in the level of total compensation. Male top executives receive a larger share of equity based pay in the form of stock options.

Fact 2: The compensation of female executives displays a *lower pay-performance sensitivity* relative to males. A $1 million dollar increase in firm value generates a $70 increase in total compensation for male executives and a $28 increase for females. Conditioning on age and tenure increases the gender differential.

Fact 3: The compensation of female executives is *more sensitive to declines in firm value* and less sensitive to increases in firm value than that of males. Total compensation of female executives is also less sensitive to changes in aggregate stock market value.

We also document the size distribution of top executives by gender and its evolution over time. We examine the systematic differences in the structure and level of compensation by size, and relate them to the gender differences. Finally, we show that there is no link between standard measures of firm performance and female representation in the team of top executives.

Our analysis is based on Standard & Poor's ExecuComp, the Compustat data set on executive compensation. The data set collects information on the compensation of top executives in firms belonging to the S&P 500, the S&P Midcap 400 and the S&P SmallCap 600 for the period 1992 to 2004. The sample includes 139,680 executive-year observations. Firms report compensation data for the top 1 to 15 executives, depending on size. Approximately 70% of firms report information for 4 to 9 top executives, around 45% of the firms in the sample report information for 5 to 6 executives. We provide a detailed description of the data and all the variable definitions in the Data Appendix, where we also report summary statistics.

Women are a relatively small but increasing fraction of the sample. The percentage of women rises from 1.6% in 1992 to 7% in 2004. Female executive are on average younger than male executives (49.5 and 52.2 years of age, respectively) and have lower average firm tenure (7.4 and 11 years, respectively). Women tend to be under-represented at higher ranks. They are less likely to hold the title of Chair/CEO and President but are more likely to hold the titles of COO and Vice-President. The gender differences in the incidence of job titles are statistically significant at the 1 percent level. The percentage of female CEOs, a mere 0.66% in 1992, rises to 2.3% in 2004. Excluding CEOs, female representation ranges from 2% in 1992 to 8.4% in 2004. See Table A1b in the Data Appendix.

We now present the evidence on Facts 1-3.

2.1 Gender Differences in the Level of Pay

Bertrand and Hallock (2005) are the first to systematically document gender differences in executive compensation, based on ExecuComp data. They argue that most of the difference can be accounted for by the size and industry distribution of female executives, in particular, the fact that women are represented in smaller firms and that they are less likely to hold the title of CEO. We update their analysis to the 1992-2004 sample and confirm their results. Though we find that a small fraction of the gender gap in executive earnings can be explained by observables.

Initial evidence on gender differences in compensation levels for all components of executive pay emerges clearly from Table 1a. The female/male ratio is 78% for Salary, 73% for Bonus, 48% for Stock Options, 80% for Stocks Granted and 65% for TDC1, a standard measure of total compensation.

To investigate these differences more closely, we regress the logarithm of TCC, the sum of Salary and Bonus, as well as the logarithm of total compensation on a female dummy with time and firm fixed effects[1]. We then progressively include a set of executive characteristics as conditioning factors. Specifically, we estimate the following regression:

$$y_{ijt} = \alpha_0 + \alpha_1 F_i + \alpha_2 X_{ijt} + T_t + f_j + \varepsilon_{ijt}, \tag{1}$$

where y_{ijt} represents in turn the logarithm of TCC or TDC1, F_i is the female dummy, X_{ijt} is the vector of executive characteristics, T_t are the year dummies and f_j corresponds to the firm fixed effects. The results are reported in Table 1b and Table 1c[2].

The estimates for the female/male ratio of TCC in column 1 are similar in magnitude to those reported in Table 1a, whereas the estimated ratio is 75% for TDC1. Since women are over-represented in lower ranked positions, we first condition on job titles. The estimate for the female/male ratio rises to 88% for both TCC and total compensation (column 2). Female executives tend to be younger and have lower average tenure than men. Thus, we also condition

[1] We also considered a specification that controls for firm characteristics, such as size and performance, as well as for industry fixed effects. This specification delivers similar results with lower explanatory power relative to our benchmark specification with firm fixed effects.

[2] For all regressions, we report robust standard errors, clustered at the firm-year level.

on age and tenure[3]. For both measures, the resulting estimate for the female/male ratio is 90% conditioning on tenure and 84% conditioning on age. Using TDC1 as a measure of total compensation, we find that the estimated female/male earnings ratio is 72%. The inclusion of conditioning variables generates a pattern similar to that for TCC. These estimates imply that 31% of the resulting gender differential in total compensation remain unexplained by executive characteristics and time and firm effects.

2.2 Gender Differences in Incentive Pay

We refer to "incentive pay" as to all components of compensation that are perceived to be linked to firm performance. In ExecuComp, these correspond to Bonus, Stocks Granted and Stock Options. Bonus typically includes discretionary bonus as well as cash payments resulting from performance based bonus programs. Stocks Granted and Stock Options are a measure of the equity component of incentive pay[4].

To document Fact 1, we run regression (1) using in turn the ratios Salary/TCC and Salary/TDC1 as dependent variables. Table 2a reports the results for TCC=Salary+Bonus. This is the most conservative measure of total compensation. The salary share of TCC for the average male top executive (the constant term in the regression) is 61% for this variable. Based on the estimates of the female dummy coefficient, the salary share of total compensation is 1.3% higher for females than for males (column 1). Columns 2-4 report results with additional conditioning variables. All columns control for job titles. Since women are over-represented at the lower ranks and lower level executives receive a lower levels of incentive pay, we expect the estimate for the female dummy coefficient to decline. While the estimated value of the constant is lower, the coefficient on the female dummy decreases if we control for job titles (0.5%) and job title and tenure (0.9%), while it increases to 2.1% conditioning on job title and age[5], and it remains significant in all specifications.

Table 2b reports results for Salary/TDC1. TDC1 includes TCC as well as the equity based components of compensation. The average value of this variable for men, corresponding to the constant term, is only 33%, while the estimated coefficient for the female dummy, at 2.6%, is larger than for TCC. Conditioning on job titles, tenure and age generates results similar to those for TCC.

There is also a significant gender difference in Stock Options. Table 1a already reveals that female top executives exhibit a higher share of Stocks Granted relative to Stock Options than male top executives. To examine this pattern, we first run regression (1) using the level of Stock

[3] This considerably reduces the size of our sample but it does not affect its gender composition. See Data Appendix.

[4] Bebchuk and Fried (2003) have argued that stock options programs are often structured in a way that does not make them sensitive to performance. We explore this issue in Section 2.3.

[5] The sample that includes age of the executive includes more observations for recent years, when the fraction of incentive pay is larger for all executives, as well as a larger fraction of CEOs.

Options as a dependent variable. Results are reported in Table 2c. Male top executives receive \$834.6 thousand in Stock Options, while female top executives only receive \$404.6 thousands. Thus, the female/male ratio of Stock Options is 48% and the gender difference is significant at the 1% level. Conditioning on job titles (column 2) reduces the gender differential, with a female/male ratio of Stock Options implied by estimates equal to 92%. The gender differential continues to be significant at the 1% level. Conditioning on tenure and age further reduces the gender differential.

We also investigate gender differences in Stock Options as a fraction of total compensation. Results are reported in Table 2d. In the baseline regression, the average for this statistic for male top executives is 27% while it is 25% for female, a difference significant at the 1% level.

The gender differences in incentive pay may appear small in percentage terms but they explain a sizeable fraction of the gender difference in total compensation. Table 2e reports the fraction of gender differences in yearly total compensation explained by differences in the level of incentive pay, that is:

$$\frac{\text{Incentive Pay}_m - \text{ Incentive Pay}_f}{TC_m - TC_f} = \frac{1 - s_m - (1 - s_f)\, TC_f/TC_m}{1 - TC_f/TC_m}, \tag{2}$$

letting TC_i and s_i for $i = f, m$ denote Total Compensation and the ratio of Salary to Total Compensation. Clearly, small differences in s_f and s_m can generate large values of (2).

For TCC, for which incentive pay is limited to Bonus, the gender difference in the share of Salary can account for 43% of the gender difference in total pay. For TDC1, which also includes equity based components of incentive pay, this ratio rises to 72%. The equity based components of compensation alone, that is Stock Options and and Stocks Granted, can account for 51% of the gender differences in TDC1.

2.3 Gender Differences in Pay-Performance Sensitivities

We now turn to Facts 2 and 3. To explore pay-performance sensitivities by gender, we regress the change in two measures of compensation on the change in firm value, a female dummy, as well as its interaction with the change in firm value, controlling for job titles, firm size, and industry. To investigate the sensitivity of compensation to overall stock market conditions, we also include in the set of regressors the change in aggregate market value (delta_MKT), defined as the average change in firm market value for all firms in the sample.

Table 3a.reports results for all job titles. We first consider TCC as a measure of compensation. The estimated value of the coefficient on the change in firm market value (column 1) implies that male executives receive \$8 for each \$1 million increase in market value. The corresponding statistic for female executives is \$5[6]. The gender difference in pay performance sensitivities is statistically significant at the 10% level. If we control for tenure and age, the

[6] This is given by the difference between the coefficient on the change in firms market value and the coefficient on its interaction with the female dummy.

gender differential becomes larger and more significant. Conditioning on tenure (column 2), male executives receive $10 for each $1 million increase in market value, while female executives receive $3. Conditioning on age (column 3), these statistics are $8 and $2, respectively. The intercept of this regression corresponds to the average change in compensation that is not driven by changes in firm or aggregate market value. This statistic tends to be larger for female executives relative to men, though this difference is not always significant[7]. There seems to be a negative relation between changes in aggregate market value and changes in TCC. Compensation falls by 6$ for each $1 million increase in aggregate market value, and it falls by $11 conditioning on tenure.

In columns 4-6, we report results for TDC, the sum of TCC and Stock Options and Stocks Granted[8]. Not surprisingly, pay-performance sensitivities are much greater for this measure of compensation, since it includes more incentive based components. In the baseline specification (column 4), men receive $70 for each $1 million increase in firm market value, while women receive $28. Conditioning on tenure, this statistic raises to $105 for men and declines to $10 for women. The gender difference is significant at the 5% level. Conditioning on age, men receive $60 for each $1 million increase in firm value while female executives only receive -$11. The gender difference is significant at the 5% level[9]. The results also suggest a strong sensitivity to changes in aggregate market value. TDC rises by $44 for each $1 million increase in aggregate market value, and this statistic rises to $112 conditioning on age. Both coefficients are significant, at the 5% and 1% level, respectively.

Based on the lower pay-performance sensitivities of female top executives, one would expect women's earnings to be less volatile than men's. This is true for TCC, the sum of Salary and Bonus, but it does not hold when Stock Options and Stocks Granted are also included. This point can be illustrated with a simple back of the envelope calculation. Lets take the product of the estimated pay performance sensitivity and the standard deviation of the change in firm value as an estimate of the variability in compensation driven by changes in firm performance. The standard deviation of the change in firm value is $1,629 million in our sample. Given our baseline estimates (columns 1 and 4), the standard deviation of TCC resulting from changes in firm value is then $13 thousand for men and $4.8 thousand for women. As a percentage of average compensation, the value of this statistic is 1.5% for men and 0.7% for women, given that the respective average TCC is $871 thousand and $657 thousand.

The corresponding statistics are significantly larger in magnitude for TDC, the sum of TCC, Stock Options and Stocks Granted. The standard deviation of TDC driven by changes

[7] The female dummies are jointly statistically different from zero at the 1 per cent level (Chow test).

[8] We exclude Long term incentive payouts + Other Annual + All Other Total from total compnesation, since they are not typically linked to performance. See Bebchuk and Fried (2003).

[9] Even though we are clustering at the firm-year level, one might be concerned by the absence of time fixed effect in our baseline pay performance sensitivity regressions. As a robustness check we have run the regressions reported in Table 3a to 3c including year dummies. The results are unaltered.

in market value is $103 thousand for men and $85 thousand for women. Since the average value of TDC is $2,111 thousand for men and $1,400 thousand for women, the standard deviation as a percentage of average TDC is 4.9% for men and 6.1% for women. Thus, the large gender difference in the average level of TDC implies that the percent standard deviation of TDC driven by sensitivity to firm performance is greater for female than male top executives.

Male executives' lower percentage standard deviation in TDC could in part be accounted for by the fact that they receive a larger share of compensation in the form of Stock Options. Options, especially if they are in-the-money, reward for any growth in firm value and have been found to be strongly connected to changes in aggregate market value (Bebchuk and Fried, 2003, and Hall and Murphy, 2005). To investigate exposure to performance risk by gender, we run the pay-performance sensitivity regressions separately for positive and negative changes in firm value, including a control for the change in aggregate stock market performance and its interaction with gender. This leads us to the discussion of Fact 3.

We find that for *positive* changes in firm value (Table 3b), for male top executive compensation rises by $53 for each $1 million increase in firm value (column 1). The corresponding statistic for female executives is -$14. This difference is significant at the 5% level. Conditioning on tenure (column 2), increases the sensitivity coefficient for males and the gender differential. Interestingly, conditioning on age (column 3), reduces the sensitivity coefficient for male top executives, whose compensation rises by $29 for each $1 million increase in firm value. The corresponding statistic for females is -$73. On the other hand, TDC increases by $150 for each $1 million increase in aggregate market value.

To investigate the sensitivity to changes in aggregate market value by gender, we also run the regression including an interaction between the change in aggregate market value and the female dummy in the set of regressors. Results are reported in columns 4-6. The inclusion of this term does not significantly alter the estimates for the sensitivity coefficient and the female dummy, but it reveals that the sensitivity to changes in aggregate market value is much greater for male executives. The gender differential is substantial, but not always significant. For the baseline regression (column 4), male compensation rises by $74 for each $1 million increase in aggregate market value. The corresponding statistic for females is $1. The gender differentials in sensitivities are much amplified when we control for tenure (column 5) and age (column 6). In both cases, the sensitivity of male compensation to changes in aggregate market value increases substantially. Controlling for tenure, males obtain $131 for each $1 million increase in aggregate market value and $83 for each $1 million increase in firm value. The corresponding statistics for females are $12 and $13. The gender difference in sensitivity to aggregate market value is significant. A similar pattern emerges when controlling for age[10].

For *negative* changes (Table 3c), for male top executives compensation falls by $44 for each $1 million decline in firm value (column 1). The corresponding statistic for female executives

[10] The gender differentials are substantial but not significant in this case, due to the low number of observations.

is \$32, though this difference is not significant. Pay rises by \$65 for each \$1 million increase in aggregate market value. Including the interaction term (column 4) does not significantly change the coefficients on changes in firm value and reveals that the sensitivity to changes in aggregate market value is higher for male top executives (pay rises by \$27 for each \$1 million increase in aggregate market value) than for female (for whom pay falls by 1\$), but this differences is not significant. The sensitivity to aggregate market value is small and not significant. The gender differences in sensitivities are much amplified when we control for tenure (column 2) and age (column 3). Controlling for tenure obtains a significant gender difference in the sensitivity to changes in firm value. While for men TDC falls by \$107 for each \$1 million decline in firm value, it rises by \$22 for females. This difference is significant at the 10% level. Conditioning on age (column 3) substantially increases the sensitivity to aggregate market value. Pay rises by \$153 for each \$1 million increase in aggregate market value. Including the interaction term between changes in aggregate market value and the female dummy (columns 4-6) does not affect the sensitivity to changes in firm value and on aggregate market value by gender.

We repeat the analysis for CEOs only and the results, reported in Table 3d, are very striking. For *positive* changes (column 1), we find that TDC rises by \$126 for each \$1 million increase in firm value for male CEOs, while it rises only by \$57, a difference significant at the 10% level. Conditioning on age (column 2) intensifies the gender differentials. Male CEO's TDC is less sensitive to rises in firm value than to changes in aggregate market value, whereas the opposite is true for female CEOs. Specifically, for males TDC rises by \$42 for each \$1 million increase in firm value and by \$ 212 for each \$1 million increase in aggregate market value. For female CEOs, TDC *falls* by \$243 for each \$1 million increase in firm value and rises by only by \$52 for each \$1 million increase in aggregate market value.

For *negative* changes, female CEO exhibit a greater sensitivity to change in firm value. Specifically, for each \$1 million decline in firm value, TDC declines by \$83 for male CEOs, while the corresponding statistic is \$305 (column 3) for females. This difference is significant at the 5% level. Male CEOs' pay rises by \$121 for each \$1 million increase in aggregate market value, while it falls by \$39 for female CEOs, though this difference is not significant. Conditioning on age (column 4) reveals that pay is not significantly responsive to changes in firm value, both for male and female CEOs. On the other hand, TDC for male CEOs rises by \$257 for each \$1 million increase in aggregate market value, while it rises by only \$159 for female CEOs[11].

Taken together, these results suggest that male CEOs' compensation is considerably more sensitive to changes in aggregate market value than to firm performance both for positive and negative changes in firm value. Female CEOs gain significantly less when firm performance is positive relative to male CEO, especially so conditioning on age. In addition, female CEOs

[11] AGE coefficients are negative but not significant in all CEO regressions. For positive changes, the age coefficient is quite large -16.78 with p-value of 0.22, while for negative changes the coefficient is close to zero.

are more exposed to declines in firm value and their compensation is less sensitive to changes in aggregate market value in instances when firm value declines.

2.4 Size Distribution and Firm Performance by Gender

To complete the analysis, we document the size distribution of executives and systematic differences in the structure of compensation by size. We also examine the relation between firm performance and female representation in the executive ranks.

The evidence in Table 4 suggests that female top executives are under-represented in larger firms. The female/male ratio of average size is 92% for firm value and 88% for sales. Figure 4a plots the percentage of female top executives by deciles of the firm size distribution, where size is measured as real market value. Over the entire sample period, the percentage of female executives declines with firm size, ranging from close to 15% in the first decile to below 3% in the tenth decile. Restricting attention to 1999-2004, the percentage of female executives ranges between 20% and 24% and rises with firm size above the third decile. Concentrating on CEOs, as shown in Figure 4b, the female representation is much lower but substantially increases over time. Between 1992-1997, the percentage of female CEOs ranges between 1.5% and 0.30% and decreases with size, while between 1999-2004 it ranges between 1.2% and 3.5% with no clear pattern in relation to size.

There are systematic differences in the structure of compensation by size. Figure 4c plots total compensation in thousands of dollars, TDC1, for each decile of the firm size distribution. In the first decile, average compensation is $567.5 thousands, while in the tenth decile, it rises to $6.119 million.

The other panels in Figure 4 explore the structure of compensation by size. Figure 4d plots the share of Salary and Bonus in total compensation. The share of Salary which clearly declines with size, from 57% for the first decile to 23% for the tenth decile. Bonus ranges from 13% of total compensation in the first decile to 21% in the tenth decile. Figure 5e plots the fraction of equity based pay, the sum of Stock Options (SO) and Stocks Granted (SG), as a fraction of total pay. This rises from 21% for the first decile to 42% for the tenth decile. Thus, the fraction of incentive pay increases with size. This panel also plots all other components of pay as a fraction of total. This is also rises with firm size, from 8% for the first decile to 14% for the tenth. This component of compensation is typically not sensitive to firm performance (Bebchuk and Fried, 2003 and 2005). Figure 4f explores the prevalence of Stock Options in equity based compensation. Stock Options decline as a fraction of equity based pay from 93% for the first decile to 82% for the tenth decile.

We also repeat the pay-performance sensitivity analysis by size, without conditioning on gender. We consider three size bins, based on market value: smaller than 25th percentile, between the 25th and 75th percentile, and larger than the 75th percentile. All regressions condition on job title. The results are reported in Table 4b. The sensitivity of compensation to firm performance clearly declines with firms size. For the smallest category of firms, TDC rises by $116 for each $1 million increase in market value, while TDC1 rises by $439. These statistics drop to $50 and $314, respectively, for the intermediate sized firms, and to $7 and $68 for the largest category of firms. This is consistent with Figure 5e that suggests the residual component of compensation that is not sensitive to firm performance rises with firm size.

These results suggest that compensation structure as well levels systematically vary with firm size. Since female top executives are over-represented in small firms, the gender differentials in compensation may in part be accounted for by the size distribution of executives by gender. However, our analysis suggests that the gender differentials we found in Section 2.2 cannot be completely accounted for by the size distribution of executives by gender. Since we condition on firm and time effects, any size effects that are correlated with these factors would be accounted for in the analysis. More importantly, not all the differences in structure of compensation by size are consistent with the gender differences in the structure of pay. The fact that Bonus and equity based compensation as a fraction of total compensation increase with firm size is consistent with the gender differential in these variables and the size distribution of executives by gender. On the other hand, the fact that Options account for a greater fraction of equity based pay in smaller firms is not. Finally, pay-performance sensitivities systematically decline with size, while, as we show in Section 2.3, female executives exhibit lower pay-performance sensitivity.

The final piece of evidence we report is on firm performance by gender. The results are collected in Table 6. We use four measures firm performance: the ratio of market value to assets (Tq), firm operating profits as a fraction of assets (the ratio of Compustat variable EBIT to ExecuComp variable Asset), the percentage change in firm market value and the change in firm market value for all executives (columns 1-4) and for CEOs only (columns 5-8). We regress each measure on the fraction of female top executives for firm-year observation and a constant and include time and firm effects. All regressions control for time and year effects. The results suggest that there are no significant differences in firm performance by gender, though the coefficients on the female dummy are mostly positive. These findings are consistent with Catalyst (2004b). This study analyzes 350 Fortune 500 companies in a broad range of industries and finds that the group of companies with the highest representation of women in their top management team experienced better performance than the group of companies ranked at the bottom in terms of female representation. This holds for two measures of performance, Return on Equity and Return to Shareholders, in the aggregate and by industry.

3 Evidence of Gender Differences in Executive Labor Markets

We begin exploring the possible determinants of these gender differences in the structure of pay for top executives by reviewing the evidence on gender differentials in characteristics that could be relevant for the executive labor market. We examine three types of evidence: surveys of professionals and executives eliciting information on barriers to career advancement, time use evidence on household allocation of child care responsibilities for top income earners, and experimental and psychological studies of performance in competitive environments, propensity to compete and initiate negotiations and risk aversion. Taken together, the evidence can be summarized as follows:

- Exclusion from informal networks, gender stereotyping and lack of role models are perceived as substantial barriers to career advancements for female executives.
- Married women in the top 5% of the income distribution bear a disproportionately large share of child care responsibilities relative to married men in similar circumstances.
- Women display lower performance in competitive environments, even with no differences in performance in non-competitive setting, lower propensity to into competitive environments.
- Women display lower propensity to initiate negotiations.
- Women exhibit lower risk tolerance to abstract gambles, but there are no gender differences in risk aversion in contextual financial settings.

3.1 Surveys on Barriers to Career Advancement.

Surveys of top executives suggest that female executives may experience greater difficulties relative to men in corporate leadership roles. Catalyst (2004a) studies self-reported barriers to career advancement by gender for professionals in top management positions. The main findings are reported below:

Table 6: Barriers to Career Advancement

	Male	Female
Lack of mentoring*	16%	25%
Lack of role models**	13%	43%
Exclusion from informal networks**	18%	46%
Gender based stereotyping**	5%	46%
Inhospitable corporate culture**	13%	24%
Commitment to personal/family*	8%	15%
*p value=0.05, ** p value=0.01		

The lack of role models and the exclusion from informal networks, in addition to gender based stereotyping, are associated with the greatest gender difference. Gender asymmetries in the to commitment to personal and family responsibilities are significant but appear small from these results. This may be due to the fact that professional and executive women are more likely to be childless or not married than men. Hewlett (2002) reports that, in her sample of high earning (above $100 thousand) executives and professionals, 83% of male and only 57% of women are married. Moreover, 19% of male and 49% of female respondents are childless. The fact that the prime childbearing years overlap with the critical career building years may in part be responsible for this outcome and suggests that the gender asymmetries in the personal cost of career investments may be quite substantial.

Evidence in Hewlett (2002) also suggests that gender asymmetries in the allocation of family responsibilities may be quite substantial for married women in the sample. Among the married professionals and top executives, only 39% of men are married to women who are employed full time, and 40% of these spouses earn less than $35 thousand a year. On the other hand, 90% of women in the high achieving category have husbands who are employed full time or self-employed, and 25% are married to men who earn more than $100 thousand a year. Among her sample of high achieving women with husbands working full time, 51% take time off for child sickness, while only 9% of men do. Similarly, 61% of women are mainly responsible for organizing child activities, while only 3% of men bear this responsibility.

These results lead us to consider more systematic evidence on the allocation of child care and family responsibilities for high earning individuals using time use data.

3.2 Time Use for Top Income Earners

Table 7 reports information on weekly hours spent in child care activities, as well as total home[12] and market hours of work for workers in the top 5% of the income distribution in the American Time Use Survey (ATUS). The data is described in detail in the Data Appendix, where we also report summary statistics (Table A7). The sample has been selected to reflect the characteristics of individuals in the ExecuComp data set as closely as possible while maximizing the number of observations. The sample includes 171 women and 496 men. We also report information for the overall population (Table 7, column 1) to facilitate comparisons.

Two main facts emerge.

- Gender differences in overall weekly hours spent in home production are smaller for top earners than in the overall population. For the sample of married men and women the ratio of female to male home hours is 1.38 (column 5 in Table 8) and 1.73 in the overall population (column 1).

- Gender differences in time spent in the care of children do not vary much by income. The ratio of female to male hours of child_care_full for married individuals is 2.4 for top 5% income earners and 2.3 in the overall population. For the top 5% of earners, married

[12] Home production measures exclude any child care related hours in ATUS.

women with children under 5 spend 25.2 hours per week on child care, while married men only spend 10.2 hours (column 9).

The top 5% income group, women's years of schooling and average yearly income are higher than men's (see Table A7), and age is very similar across genders. The gender differential is particularly strong for the variable child_care_basic which includes time spent in the organization and planning for household children, attending children's events, picking up/dropping off children and activities related to children's health[13].

This analysis cannot be directly brought to bear on the sample of top executives in ExecuComp due to top coding of incomes in ATUS. Yet, the substantial gender asymmetry in child care responsibility may ultimately affect women's career advancement and exert a permanent effect on their behavior in market work.

3.3 Evidence on Gender Differences in Preferences

3.3.1 Performance in Competition and Propensity to Compete

Experimental evidence suggests that women may be less effective than men in competitive environments, even if they demonstrate the same ability to perform in noncompetitive environments, that the have lower propensity to select into competitive environments and to seek challenges.

The experimental setting involves participants solving a real task in a laboratory, first under a non-competitive piece rate and then a competitive tournament incentive scheme. Gneezy, Niederle and Rustichini (2003) show that as the competitiveness of the environment increases performance increases significantly for men, but not for women. This results in a significant gender gap in performance in tournaments, while there is no gap when participants are paid according to piece rate. The effect is stronger when women have to compete against men than in single-sex competitive environments. This rules out that women are unable to perform in competitive environments per se. Niederle and Vesterlund (2007) adopt a similar strategy to examine whether men and women of the same ability differ in their selection into a competitive environment. Although there are no gender differences in performance, men select the tournament twice as much as women when choosing their compensation scheme for the next trial. While 73% of the men select the tournament only 35% of the women make this choice. The gender gap in tournament entry is not explained by performance, and factors such as risk and feedback aversion only play a negligible role. Men's overconfidence and gender differences in preferences for performing in a competition explain most of the gender differential.

Niederle and Yenstruskas (2007) examine whether women and men of the same ability differ in their decision to seek challenges. The experiment first reveals participants to be either of high or low performance. Each participant's performance level is identified before the difficulty

[13] We also conduct the analysis for the top 10% of income earners and find very similar results.

level (easy or hard) for two subsequent tasks (only one of which will be chosen for payment) is chosen. They find no gender differences in performance, or beliefs about relative performance, yet men choose the hard task 50 percent more than women, independent of the performance level. Gender differences in preferences for characteristics of the tasks cannot account for this gender gap. They also allow for updating of choices in a multi-stage setting that reveals information on the participants' relative performance and reduces uncertainty about their ability. Under this treatment, high performing women choose the hard task significantly more often, at a rate now similar to the decision of men. Men's overconfidence in relative abilities and gender differences in representation in challenging or competitive tasks appear to be key.

3.3.2 Propensities to Initiate Negotiations

Babcock and Laschever (2003) present a variety of evidence, in the form of surveys, case studies and interviews, suggesting that women exhibit lower propensity to initiate negotiations. These finds are refined in a variety of experimental settings. Small, Gellman, Babcock and Gettman (2005) investigate agents' propensity to initiate negotiations when there are no overt prescriptions to negotiate. In their experimental setting, subjects play a word game and are then offered the lowest compensation possible by the experimenter. Consistently, women asked the experimenter for greater compensation much less often than men. They also explore the effect of "situational ambiguity," the presence of cues to the possibility of negotiating, on the initiation of negotiation by gender. They find that stronger cues about the negotiability of payment increase rates of asking, though these cues did not lessen the gender gap in initiation.

Results in Bowles, Babcock, and Lai (2005) suggest that social incentives may be critical in inducing gender differentials in the propensity to initiate negotiations. In two experiments, they show that sex differences in the propensity to initiate negotiations may be explained by differential treatment of men and women when they attempt to negotiate. In the first experiment, participants were asked to evaluate candidates who either accepted compensation offers without comment or attempted to negotiate higher compensation. They find that while men only penalize female candidates for attempting to negotiate, women penalize both male and female candidates. In the second experiment, participants were made to adopt a candidate's role in the same scenario and asked to assess whether to accept the compensation offer or attempt to negotiate for more. Women were less likely than men to choose to negotiate when the evaluator was male, but not when the evaluator was female.

Riley and Babcock (2002) explore how situational factors moderate gender differences in negotiation. Their evidence is based on a study conducted with MBA students and two laboratory experiments. In the first study, males (vs. females) report significantly higher performance targets and agreement payoffs within a structurally ambiguous negotiation. The first experimental study reveals a significant interaction between gender and structural ambiguity: gender differences (favoring males) are significant under high ambiguity but diminish under low ambiguity. The final study suggests the presence of a strong interaction between gender and the subject's representation role (the perception of herself by others) on prenegotiation expectations.

3.3.3 Risk Aversion

There is some evidence on potential gender differences in risk attitudes. Barsky, Juster, Kimball, and Shapiro (1997) find that females display smaller risk tolerance than males based on survey responses in the Health and Retirement Study. Survey evidence also suggests that wealth holdings of single women are less risky than those of single men of equal economic status (Jianakoplos and Bernasek, 2009, and Sunden and Surette, 1998). These findings are consistent with psychological evidence on gender differences in risk taking[14].

Unfortunately, this evidence is rather inconclusive. Controls for individual wealth and earnings are either weak or absent from the analysis. Yet, survey respondents considering lifetime income gambles or the risky behaviors in the psychological studies are prone to evaluate them based on their individual opportunity sets. A standard DARA utility model would predict that agents with high wealth, outstanding asset wealth or present discounted value of future labor earnings, would exhibit higher risk tolerance than one with low wealth. Since women's earnings are on average lower than men's, the gender differences in risk tolerance may be driven by this factor[15]. There is also evidence that behavior in abstract gambling experiments may not correspond to risk behavior in contextual decisions, such as those faced by managers and top executives (Hershey and Schoemaker, 1980).

Schubert, Brown, Gysler and Brachinger (1999) conduct experiments in which subjects are confronted with financially motivated risky decisions embedded in an investment or an insurance context. They show that the comparative risk propensity of males and females is strongly dependent on the decision setting. They do not find evidence of gender differences in risk propensities in contextual decisions.

3.3.4 Discussion of Evidence on Gender Differences in Preferences

Some of this evidence is hard to interpret. First of all, it is impossible to establish whether the behavior of the experimental subjects (mostly university students) is indeed representative of the behavior of the population at large or of top executives in particular. High level managers

[14] The strongest support for gender differences in risk attitudes in the psychological literature comes from patterns of risky sex and risky driving behavior. See Byrnes, Miller, and Schafer (1999).

[15] Mazzocco (2006) uses a structural model of household decision making to estimate intertemporal preferences. His estimates suggests that coefficient of relative risk aversion are higher for women than for men. He also finds that risk aversion is lower for married than single women, while the opposite is true for men. If spouses pool wealth and wives have lower earnings, this evidence is consistent with gender differences in wealth accounting in part for gender differences in risk tolerance.

undergo a severe process of (self-)selection, thus one would expect them to exhibit a comparative advantage in essential traits, such as ability to perform in competitive environments, propensity to negotiate and to embrace risk. Moreover, the simple repetitive tasks used to evaluate ability and performance in competition and the abstract negotiation settings seem far removed from those associated with the actions and decisions that face a top executive. The studies on risk aversion suggest that the decisional context may be important for the findings, and there is not reason to exclude this effect for competition and negotiation. These traits are also hard to distinguish in practice. For example, in the experiments on competition, the compensation schemes used both provide incentives. The piece-rate scheme only rewards individual performance, while the tournament rewards relative performance. Thus, a tournament is not only a more competitive scheme, it exposes the subject to more risk. While some attempt is made to distinguish aversion to competition from risk aversion, some doubts remain about the ability to separately identify each trait.

A number of systematic patterns that emerge from these studies increase confidence in the results. Women's lower propensity to initiate negotiation is consistent with the overconfidence displayed by male subjects in the competition treatments. Moreover, lack of confidence can result in pessimism, which can be modelled as fear of misspecification, which leads agents to behave as if they are more risk averse[16].

Despite these reservations, the evidence presented suggests that gender differences in preferences may be present. Differences in preferences or other characteristics, such as the costs of career investments or weight of family responsibilities, may also influence an executive's ability to influence firm performance or effect the value to the executive of a given compensation package. To explore the effects of these factors on executive compensation and the size distribution of executives by gender, we view the pay setting process as an agency problem. In Section 4, we explore an efficient contracting benchmark. We then discuss whether the evidence on gender differences in the structure of pay is consistent with the skimming or executive power view of the pay-setting process on executive labor markets.

4 Executive Compensation: An Efficient Benchmark

Our benchmark framework is a simple *arm's length* model of executive compensation. The shareholders (principals) hire an executive (agent) to manage the firm. They set executive compensation to maximize the surplus from the executive-firm relationship. Time, t, is discreet. The executive's effort, e_t, influences the growth in firm value, V_t, according to the law of motion:

$$V_{t+1} - V_t = b\left(V_t\right) e_t + \omega\left(V_t\right). \tag{3}$$

[16] Fear of mispecification can be represented as *ambiguity aversion*, as in Epstein (1999), or as *robust decision-making*, as in Hansen and Sargent (2008).

The term $b(V_t)\, e_t$ corresponds to the expected change in firm value, and the parameter $b(V)$ represents the impact of the executive's effort, or the marginal product of managerial effort. The term $\omega(V_t)$ is a random variable distributed normally with zero mean and standard deviation $\Sigma(V_t) > 0$. Following Baker and Hall (2004), the expected change in firm value and its volatility are allowed to depend on firm value, which is a proxy for size.

The executive's preferences are represented by the utility function:

$$U(w, e) = -\exp\left(-\sigma\left[w - \theta v(e)\right]\right), \tag{4}$$

where w corresponds to earnings. The coefficient of absolute risk aversion is $\sigma > 0$, and $v(\cdot)$ denotes the disutility of effort, where $e \in [0, 1]$. The function v is increasing, twice continuously differentiable and convex. The parameter $\theta > 0$ represents the cost of effort for the executive. The CARA utility specification eliminates income effects and allows for a closed form solution[17].

Effort, e is *private information*, while the change in firm value, $V_t - V_{t-1}$, is *observable*. This informational friction gives rise to and agency problem in the form of *moral hazard*.

The optimal compensation contract specifies an effort level and an earnings function, linking earnings, w, to the change in firm value $\Delta V_t = V_t - V_{t-1}$. The change in firm value is the only observable measure of the executive's performance and the dependence of earnings on this variable is essential for the contract to implement strictly positive effort, given the agency problem.

The optimal compensation contract solves the problem:

$$\max_{\{w(\Delta V), e\}, e \in [0,1]} ES(e)$$

subject to

$$e = \arg\max_{e \in [0,1]} E\left[U(w, e)\right] \tag{5}$$

$$E\left[U(w, e)\right] \geq U(u, 0), \tag{6}$$

where time subscripts are dropped for ease of exposition. The objective function is the expected surplus from the shareholder-executive relationship, (5) is the executive's incentive compatibility constraint. The executive has an outside option which provides him with certain income u, and (6) is the resulting participation constraint.

As shown in Holmstrom and Milgrom (1991), CARA utility implies that, without loss of generality, we can restrict attention to earnings functions of the form: $w(\Delta V) = \bar{w} + \tilde{w}\Delta V$, where $\bar{w}$ corresponds to cash salary and $\tilde{w}\Delta V$ is incentive pay. Interpreted literally, $\tilde{w}$ corresponds to the share of ownership of the executive in the managed firm, via stock grants or stock options programs. Since other components of executive compensation, such as bonuses, may also depend on changes in firm value, $\tilde{w}\Delta V$ can be taken to correspond to the component of executive compensation that is sensitive to firm performance.

[17] In a previous version of the paper, we present numerical solutions for CRRA preferences.

Given the linearity of the compensation function, the expected surplus from the firm-executive relationship is equal to its certainly equivalent:

$$ES(e) = b(V)e - \theta v(e) - \sigma(\Sigma(V))^2(\tilde{w})^2/2. \tag{7}$$

The first term is expected change in firm value, the second term is the utility cost of exerting effort for the executive. The last term corresponds to the reduction in the executives' utility due to the fact that her earnings depend on firm performance and are thus stochastic. If the executive is risk averse, that is $\sigma > 0$, the resulting earnings volatility reduces her utility.

The incentive compatibility constraint can be restated in the following simple form:

$$e = \arg\max_{e\in[0,1]} \tilde{w}b(V)e - \theta v(e). \tag{8}$$

Using the first order approach, we can replace (8) with the following:

$$\begin{aligned} \tilde{w}b(V) &= \theta v'(e), & (9)\\ -\theta v''(e) &\leq 0. & (10) \end{aligned}$$

Since we assume $v\prime' > 0$, (10) will automatically be satisfied.

To obtain analytical solutions, we will restrict attention to the following functional forms:

Proposition 1 *Let $n = \{b, \sigma, \theta, u\}$ denote the vector of executive attributes and assume:*

$$v(e) = \frac{e^2}{2}. \tag{11}$$

The optimal executive compensation contract satisfies:

$$\begin{aligned} e^*(n,V) &= \frac{b(V)}{\theta}\frac{b(V)^2}{b(V)^2 + \sigma\theta(\Sigma(V))^2}, & (12)\\ \tilde{w}^*(n,V) &= \frac{b(V)^2}{b(V)^2 + \sigma\theta(\Sigma(V))^2}, & (13)\\ \bar{w}^*(n,V) &= u + \frac{1}{2}\frac{b(V)^2}{\theta}\frac{b(V)^2}{b(V)^2 + \sigma\theta(\Sigma(V))^2}, & (14) \end{aligned}$$

for any firm with current value V.

Assumption (11) is driven by analytical convenience and is not critical for the results.

The optimal compensation contract is efficient and its properties depend on the executive's characteristics. Effort, e, the fraction of incentive pay, $\tilde{w}$, and expected total earnings, w, are *decreasing* in θ and σ and *increasing* in b. This property of the optimal compensation contract stems from the fact that the cost of providing incentives is increasing in θ and σ and declining in b.

Firm characteristics, such as value V and the volatility of the change in firm value, Σ, also play a role. High values of Σ reduce the ability of the observed change in value to serve as a signal for the executive's effort, making the moral hazard problem more severe. Effort and the fraction of incentive pay decrease with the parameter Σ.

The surplus from the firm-executive relationship does not depend on, $\bar{w}$, which does not influence the executive's effort. The salary is pinned down by (6) and determines the division of the surplus between the firm and the executive. The salary is increasing in b, decreasing in θ, σ and Σ, and increasing in u[18]. The same comparative statics relationships hold for overall compensation, w.

4.1 Pay-Performance Sensitivity

Total compensation in the model is: $w_t = \bar{w}_t + \tilde{w}_t \Delta V_t$. Assuming that parameters related to executive and firm attributes (except value) are time invariant, the model delivers the following predictions for the growth in executive earnings:

$$\Delta w_t = \tilde{w} \left(\Delta V_t - \Delta V_{t-1} \right).$$

where $\Delta w_t = w_t - w_{t-1}$.

Running the conventional pay-performance sensitivity regression in the model, that is:

$$\Delta w_t = \alpha_0 + \alpha_1 \Delta V_t + \varepsilon_t,$$

implies that $\alpha_0 = \tilde{w} \Delta V_{t-1}$ and $\alpha_1 = \tilde{w}$ under the null that the model is true. Thus, the estimates of pay-performance sensitivity correspond to the fraction of the executive's pay that is linked to performance.

A critical parameter for the power of incentives in the model is the elasticity of $b(V)$ with respect to firm value V, since $E\Delta V_t = b(V_t)\, e_t$. If this elasticity is zero, then the marginal product of executive effort is invariant to firm size. In this case, $\tilde{w}$ is the only variable that matters to provide incentives. If the elasticity of b with respect to firm size is 1, that is the marginal product of effort varies one to one with firm size, the effect of a marginal increase in effort will be amplified for larger firms. This assumption is implicit in the empirical literature and underlies the size distribution model of Lucas (1978) and Rosen's (1982) span of control model.

We now explore the implications for the size distribution of executives by gender by embedding the agency model of executive compensation in an equilibrium assignment model.

[18] The surplus from the firm-executive relationship does not depend on the cash salary Since it does not influence the executive's incentives to exert effort. The salary merely determines the division of the surplus between shareholders and the executive.

4.2 Endogenous Size Distribution of Executives

We now endogenize the size distribution of executives by gender. We show that if gender differences in executive attributes $\{b, \sigma, \theta, u\}$ imply that female executives exert lower effort, an optimal assignment model can qualitatively match the observation that female top executives are more likely to be employed in smaller firms.

The previous discussion clarifies that the efficient contract prescribes that lower effort level for executives with lower b, and higher σ or θ. Moreover, lower effort levels are associated with lower fraction of incentive pay and lower pay-performance sensitivity. The maximized value of the certainly equivalent of the surplus, given the executive's characteristics and firm value, will be denoted with $S^*(n, V)$, with corresponding policy functions $\{\bar{w}, \tilde{w}, e^*\}(n, V)$. These objects fully describe the solution to the efficient contracting problem between an executive, n, and a firm with value V, described in Proposition 1.

Let the parameter γ correspond to the elasticity of the impact of effort on firm size. Following Baker and Hall (2004), we assume:

$$\begin{aligned} b(V) &= bV^{\gamma}, \\ \omega(V) &= \omega V^{\gamma}, \end{aligned}$$

where $b, \omega > 0$ and $\gamma \in [0, 1]$. Proposition 1 implies:

$$e^*(n, V) = \frac{bV^{\gamma}}{\theta} \frac{b}{b + \sigma\theta\Sigma^2}, \tag{15}$$

$$\tilde{w}^*(n, V) = \frac{b}{b + \sigma\theta\Sigma^2}, \tag{16}$$

$$\bar{w}^*(n, V) = u + \frac{1}{2} \frac{bV^{\gamma}}{\theta} \frac{b}{b + \sigma\theta\Sigma^2}. \tag{17}$$

The appeal of this specification lies in the fact that the sensitivity of executive compensation on changes in firm value, $\tilde{w}$, does not depend on value directly but only varies with executive characteristics. The correct measure of the sensitivity of executive compensation to changes in firm value is $\tilde{w}bV^{\gamma}$. This measure captures the amplifying effect of the impact of executive effort and firm value on incentive pay. On the other hand, effort does depend on firm value and so will total compensation.

Conditions (15)-(16) imply:

$$S^*(n, V) = \frac{1}{2} V^{2\gamma} A(n), \tag{18}$$

where

$$A(n) = \frac{b^4}{\theta(\sigma\theta\Sigma^2 + b^2)}, \tag{19}$$

is the sensitivity of the surplus to the executive's characteristics and can be taken as a summary indicator of the value of an executives with attributes n to a firm. Thus, the surplus from the executive-shareholder relationship is clearly increasing in b and declining in θ and σ, based on the dependence of $A(n)$ on these variables. As discussed earlier, the outside option u is not relevant for the surplus of the executive-firm relationship.

Let the distribution of $A(n)$ in the population of executives be $\varphi_i(\cdot)$ for $i = f, m$, where f stands for female and m for male. Let A_i be the support of the distribution. Then, we can derive the population wide probability distribution density of $A(n)$. Such an object will be denoted with $\varphi(\cdot)$ and defined over the support $A_f \cup A_m$. For example, if φ_i is a uniform and $A_i = [\underline{a}_i, \bar{a}_i]$ with $\underline{a}_m > \underline{a}_f$ and $\bar{a}_f < \bar{a}_m$, then:

$$\Pr(A(n) \leq \hat{a}) = \pi_f \int_{\min\{\hat{a}, \underline{a}_f\}}^{\max\{\hat{a}, \bar{a}_f\}} \frac{1}{\bar{a}_f - \underline{a}_f} dx + \pi_m \int_{\min\{\hat{a}, \underline{a}_m\}}^{\max\{\hat{a}, \bar{a}_m\}} \frac{1}{\bar{a}_m - \underline{a}_m} dx,$$

where π_i $i = f, m$ is the fraction of executives on gender i in the population.

We model assignment as follows. Take an executive type/firm pair: $\{A(n), V\}$ and let, Ω, denote total market capitalization. We select the firm size distribution to maximize economy wide surplus:

$$\max_{V(n)\geq 0} \int_{A_f \cup A_m} S^*(n, V(n))\, \varphi(n)\, dn,$$

subject to

$$\Omega = \int_{A_f \cup A_m} V(n)\, \varphi(V)\, dV. \tag{20}$$

The first order necessary conditions for this problem are:

$$S_V^*(n, V(n))\, \varphi(n) - \varphi(n)\, \zeta \begin{cases} \leq 0 \\ = 0 \text{ for } V(n) > 0 \end{cases}, \tag{21}$$

where ζ is the multiplier on constraint (20), jointly with (20).

Proposition 2 *The optimal size distribution of executives satisfies:*

$$V(n) = (A(n))^{-\frac{1}{(2\gamma-1)}} \left[\frac{1}{2} \frac{\int_{\underline{n}}^{\bar{n}} (A(n))^{\frac{-1}{(2\gamma-1)}} \varphi(n)\, dn}{\Omega} \right]^{-1}. \tag{22}$$

The distribution of executives does not depend on the density $\varphi(n)$ of $A(n)$ but only on its support, that is the relative ranking of executives with respect to this variable.

Condition (22) implies that:

$$\frac{\partial V(n)}{\partial A(n)} = -\frac{1}{(2\gamma - 1)} \frac{V(n)}{A(n)},$$

so that the firm value assigned to an executive with characteristics summarized by $A(n)$ is higher if $\gamma < 1/2$.

4.3 Hypothesis Regarding Gender Differences

Proposition 1 delivers the following comparative statics results on the link between optimal compensation and the executive's attributes for given firm size:

- Effort, e, is increasing in b and declining in θ, σ.
- Pay-performance sensitivity, $\tilde{w}$, is increasing in b and declining in θ, σ.
- Cash salary, $\bar{w}$, and total compensation, w, are increasing in b and decreasing in θ and σ, as well as increasing in u.

The empirical evidence discussed in Section 3 suggests that women may have lower propensity to compete and initiate negotiations, especially against men, and that they display lower risk tolerance when confronted with abstract gambles. Finally, professional and executive women experience higher costs of career investments and bear a larger share of child care responsibilities.

The executive labor market is highly competitive, entails constant negotiations, involves bearing risk and is mostly male. In addition, a high number of work hours is required, making it hard to reconcile these positions with responsibilities outside of work. Thus, the gender differences in preferences and home responsibilities, to the extent that they can be found among top executives, may exert a significant influence on women's performance on the executive labor market. We now discuss a possible mapping between these gender differences discussed in Section 3 and the executive attributes in the agency model $\{b, \sigma, \theta, u\}$.

Women's lower propensity to compete or engage in negotiations may be represented as entailing a higher utility cost of exerting managerial effort, that is a higher value of θ for female executives. These traits could also reduce the impact of effort on firm performance, that is the parameter b. Higher θ or lower b would both lead to less incentive pay as a share of total compensation and lower pay-performance sensitivity, for given firm size.

The evidence on women's lower risk tolerance in abstract gambles can be mapped into higher values of their coefficient of absolute risk aversion, σ, relative to male executives. Such a differential is consistent with no gender differences in intrinsic risk attitudes. These are better captured by the coefficient of relative risk aversion, σ^R. As discussed in Baker and Hall (2004), there is an inverse relation between absolute risk aversion and the executive's wealth, for given relative risk aversion:

$$\sigma = \sigma^R / W,$$

where W is the executive's wealth. Since female executives have lower earnings, they would display lower absolute risk aversion.

Finally, professional women's higher cost of career investment and greater burden of family responsibility could be taken to correspond to higher value of θ for female executives relative to males.

The executive's outside option u only influence the level of cash salary and total earnings. There is not direct connection between the evidence in gender differences may influence u. The fact that female professionals and executives tend to be married to high earning men would suggest that that u is higher for women. On the other hand, if the outside option corresponds to the next best executive position, women's reported greater difficulties in accessing professional networks, may entail lower values of u for women.

To summarize, the empirical findings on the gender differences in structure of compensation are consistent with female executives having low b, high θ or high σ relative to men. Baker and Hall (2004) estimate γ to vary between 0.35 and 0.5. Hence, based on these estimates, the model predicts that female executives will be assigned to smaller firms if they have lower b or higher θ and σ relative to men.

Should we then conclude that the gender differences in pay and assignment in the executive labor markets are efficient? Such a conclusion would be unwarranted, given that the efficient contracting model cannot account for many of the empirical findings we discuss in Section 2. First, after conditioning on all observables, we do not find any significant differences in firm performance in relation to the female presence in executive positions. The efficient model predicts that lower effort will be implemented for executives with lower b, or higher σ, θ, leading to lower average performance, as measure by the change in firm value. This contradicts the evidence. The efficient model predicts that women should receive lower fraction of incentive and exhibit lower pay-performance sensitivity, as we find in the data. However, the model cannot explain why female top executives' pay is less sensitive to positive changes and more sensitive to negative changes in firm performance relative to males. It also cannot account for the fact that female executives' pay is less sensitive to changes in aggregate stock market performance and are thus more exposed to firm level risk. The efficient model would predict that female top executives bear a lower risk exposure, if indeed they are more risk averse.

We now turn to an alternative model of executive compensation to examine these issues.

5 Alternative Views of the Pay-Setting Process

The efficient contracting approach to executive compensation assumes that compensation packages are generated by *arms length contracting* between executives and a principal, possibly representing the board of directors, who seek to maximize the value for shareholders. However, Bebchuk and Fried (2003 and 2005) criticize this approach and propose instead that executive compensation depends on managerial power. The heart of their hypothesis is that board members also face an agency problem, which implies that they cannot be taken to make decisions to maximize the shareholders' value. Then, executives can exert power on their compensation packages and distort them to increase average pay and undermine incentives. (See also Crystal, 1991.) Bertrand and Mullainathan (2001) refer to this paradigm as *skimming* and suggest that in this case CEOs can act like "agents without principals." Such behavior may give rise not only to higher average executive pay but also to distortions to incentives, such as rewarding for growth in size, low sensitivity to firm performance, excessive risk taking and so on.

Bebchuk and Fried (2003) summarize the factors that may make board members sensitive to executive power when setting compensation packages. These include the incentive to be re-elected, CEO's power to benefit directors, participation in informal networks leading to loyalty and incentives for reciprocity towards the executive by the board, cognitive dissonance stemming from executive positions currently or previously held by board members, the small cost of favoring executives, and ratcheting resulting from competition on executive labor markets. They argue that market forces are limited in stemming these effects.

According to this view, it is the social costs of excessive pay that limit the degree to which CEOs can exert influence over their own pay. This effect leads to the desire to camouflage executive compensation packages, by using executive pension plans, deferred compensation and post-retirement perks. The social costs of increasing top executive compensation may vary with aggregate stock market performance and decline in good times. Thus, executive compensation may rise more steeply in periods of good firm and stock market performance. The level and structure of executive pay will also be sensitive to corporate governance variables. In particular, executive pay should rise when the board is large[19], fall with the presence of large outside shareholders or institutional shareholders, and rise if anti-takeover provisions are present.

5.0.1 Pay-Perfomance Links

The managerial power or skimming view predicts that the links between executive pay and firm performance will be weak. In particular, it argues that components of compensation, such as bonus programs and equity based pay, that are officially presented as incentive pay, may easily be structured so that they do not expose the executive to bad firm performance. In particular, equity based compensation can be designed so that executives benefit from windfalls. That is the executive can gain from *any* increase in the nominal value of the stock price above the grant-date market value. This implies that executives can experience gains in pay even if their firm performs below the relevant peer group, as long as market-wide and industry-wide movements provide sufficient lift for the stock price. In addition, the ability to unwind incentive schemes by cashing stock options as soon as they vest, with discretion on the timing of sales, enables executives to reap gains from short term increases in stock prices, even when long term performance is poor.

Thus, the managerial power or skimming view of executive compensation has some implications for the structure, as well as the level of pay. In particular, compensation, and in

[19] Large boards are deemed to be weak and inneffectual because of difficulties to reach an agreement to oppose the CEO.

particular incentive pay, should be more sensitive to increases in firm value than declines, and should increase with aggregate market value and luck, that is factors that positively influence firm performance but are completely outside the scope of influence top executives. Results in Bertrand and Mullainathan (2001) suggest that CEOs are indeed rewarded for luck and that strong corporate government limits this effect.

5.0.2 Gender and Managerial Power

The fact that female top executives perceive limited access to informal networks, gender stereotyping, an inhospitable corporate culture, jointly with their younger age and lower tenure, suggests that they might be considerably less entrenched and exert lower control on their own compensation than their male counterparts on average. It follows that, if the skimming view is correct, female compensation packages should display fewer of the features that are predicted by the managerial power model.

The evidence on pay-perfomance sensitivity is consistent with this hypothesis. In particular, while we find that female top executives display lower pay performance sensitivity than male top executives, female compensation is less sensitive to good firm performance and to aggregate market performance and more sensitive to bad firm performance than for male compensation. These patterns intensify conditioning on age and tenure and restricting the analysis to CEOs.

We plan to include controls for corporate governance to complete the analysis of this hypothesis.

6 Concluding Remarks

The efficient contracting model can rationalize the gender differences in the structure of compensation for top executives and the fact that female executives are overrepresented in smaller firms, based on the experimental and survey evidence on gender differences in preferences and costs of managerial effort that would make them less valuable to the firm. The optimal compensation contract, reflecting these perceived differences in attributes, would induce lower effort for female managers, resulting in lower effective performance relative to males with the same characteristics. We find no differences in measured firm performance based on the percentage of women in top executive positions. The efficient contracting paradigm also fails to explain why female executives' earnings are more exposed to bad firm performance or respond less to changes in aggregate stock market value. The managerial power view of executive compensation can rationalize these differences based on the notion that female top executives are less entrenched than male top executives, due to their younger age and tenure and their relative difficulties in accessing informal networks.

These two views of the pay-setting process lead to a very different evaluation of the gender differences in assignment and compensation for top executives. Under the arm's length contracting paradigm, the allocation is efficient, provided the gender differences in attributes are true. The skimming view suggests that it may be optimal to have more women in top executive positions, even if they have less desirable attributes as managers, as long as they remain less entrenched than men. However, this advantage cannot be expected to persist in the long run, since presumably, the resulting increase in the number for female executive would enable them to become more entrenched over time.

Both views fail to generate predictions that would enable us to disentangle whether the gender differences in attributes that may lead to differences in pay and assignment are based on mistaken perceptions. Thus, it is possible that the gender differentials in executive compensation are driven by discrimination. The gender stereotyping perceived by female managers suggests that this is a concrete possibility. However, it is hard to evaluate this hypothesis empirically. Wolfers (2006a, 2006b) explores a promising approach, based on the idea that financial data provides continuous measures of the market's perception of firm value, and these would take into account the beliefs of market participants on the abilities of senior managers. He argues that financial data could potentially provide evidence of taste- or mistake-based discrimination. If female headed firms were systematically under-estimated, they should outperform expectations, leading to excess returns. Wolfers (2006a) analyzes S&P 1500 data for 1992-2004 and finds no systematic differences in returns for female headed firms. This analysis has weak statistical power due to the low number of female CEOs in the sample. Wolfers 2006b examines analysts forecasts of earnings announcements. He finds that female-headed firms systematically outperform market expectations, despite the fact that their characteristics are not significantly different from the overall sample. He also finds that it is male analysis that under-estimate female CEOs.

Bertrand and Schoar (2002) present evidence that "managerial style," which can be taken as an indicator of executive attributes influences not only performance but a broad range of corporate strategies such as capital structure, investment behavior, R&D and advertising expenditures, diversification policies and so on. Thus, a more detailed examination of the strategies of firms with a significant female presence at the helm, jointly with the structure of compensation packages, may yield useful evidence to evaluate alternative hypothesis on gender differences in executive pay. We plan to expand on this insight in future work.

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7 Data Appendix

7.1 The data set and variable definitions

The ExecuComp data set includes more than 150,000 executive-year observations. The number of top executives sampled in each firm ranges from 1 to 15 top-executives. This variability depends on firms size. The vast majority of firms (around 70%) report information for 4 to 9 top executives, around 45% of the firms in the sample report information for 5 to 6 executives.

Our sample is built according to the following criteria:

1. All observations with missing executive-firm IDs (Compustat variable CO_PER_R) are deleted.
2. All observations from fiscal years 2005 or above are deleted.
3. All "retired" executives are deleted. Executives are considered to be retired if any of the following words appear in the modified TITLEANN (see below): "former", "retired", "ret.", "emeritus".
4. Whenever an executive has observations with non-consecutive years, all observations for that executive are deleted.

This selection criteria delivers a sample of approximately 140,000 observations (depending on the variable) for which detailed data on the structure of the executive compensation as well as measures of the firm's market performance are available.

We consider the following components of compensation:

- Salary=Dollar value of base salary (cash and non-cash)
- Bonus=Dollar value of bonus (cash and non-cash)
- SO=Total value of stock options granted (using Black-Scholes)
- SG=Total value of restricted stock granted

These components are used to define the standard Compustat measures of total compensation:

- TCC=Salary + Bonus
- TDC1=TCC + SO + SG+ Long term incentive payouts + Other Annual + All Other Total

In addition, we construct the following measure of total compensation:

- TDC=TCC+SO+ SG

This measure only includes the components of TDC1 that are sensitive to variations in firm performance.

We use the variable BLK_VALUE as a measure of the total value of stock options granted. This variable represents the aggregate value of all the stock options granted to the executive during the year as valued using the S&P's Black Scholes methodology. The time-to-expiration date for most stock options granted varies between nine and ten years.

We use the following Compustat variables to measure firm size:

- MKTVAL= Firm's market value as the close price for the fiscal year multiplied by the company's common shares outstanding
- SALES= Net annual sales as reported by the company
- EMPL= Number of total employees reported by the company.

Our measure of firm performance is the Compustat variable:

- EBIT=Operating income before depreciation and taxes.

All the components of executive compensation are expressed in thousands of dollars. Sales and firm market value are expressed in millions of dollars. The number of employees is measured in thousands. All the nominal variables are deflated using the CPI with base 2000 from the BLS.

The age and tenure of top executives are based on the age in the most recent fiscal year (P_AGE_2) and on the year in which the executive joined the firm (JOINED_C), respectively. Age is missing for almost 90% of observations and tenure is missing for 70%. Missing observations on age and tenure are equally distributed across genders. Moreover, the composition of the sub-samples of executives that report information an age, tenure, or both, is strictly comparable to that of the overall sample in terms of gender, job titles and average total compensation (for all definitions).

Job "Titles" We construct a variable 11 occupational categories based on the "title" variables in ExecuComp (TITLE, which shows the most recent title, and TITLEANN, which shows the title in a given fiscal year).

We construct the "title" variable as follows:

a. The dataset has two title variables – TITLE, which shows the most recent title, and TITLEANN, which shows the title in a given fiscal year. The former has less than 300 missing values, while the latter has almost 40,000. The two variables have discrepancies even in the most recent year. TITLEANN is used as the basis of all title variables. However, whenever it is missing in the most recent year, TITLE is used. The resulting combined variable has approximately 4,000 missing values.

b. Titles are classified according to specific key words that appear in the (modified) TITLEANN from a.. However, whenever a semicolon appears in TITLEANN, only the portion of the title that precedes the semicolon is used.

c. Titles are grouped into the following eleven categories:

Chairman and/or CEO
Vice Chairman
President
Chief Financial Officer
Chief Operating Officer
Other Chief Officer
Executive Vice President
Senior Vice President
Group Vice President
Vice President
Other

These categories correspond to categories used by Bertrand and Hallock (2001). The titles are listed in the order of perceived importance. Note that executives can hold multiple titles, but categorized titles show the highest title identified. Because the title categorization is based on an *ad hoc* process of searching for specific key words, it is necessarily imprecise. For a detailed list of key words used to identify each title, see Table A4. See Table A2 for a break down of the incidence of job titles by gender.

d. Some executives hold offices in subsidiary companies, as opposed or in addition to the parent company actually listed in the dataset. The presence of such subsidiary positions presents a serious problem for accurate title classification. We also construct an alternative variable that groups "titles" in 16 categories in order to take into account executive positions in subsidiaries. Executives who hold Chair/CEO, Vice Chair, President, or COO positions in a subsidiary company only were identified using the following method:

i. Dashes that appear to be part of title key word (e.g., V-P) were replaced with other characters.

ii. Remaining dashes were interpreted as indicators that the title includes the name of the subsidiary company. Abovementioned titles were then reclassified as subsidiary titles, e.g., President sub.

The results of the analysis do not change when we use this alternative definition for job "titles".

e. It should be noted that there are also instances of shared positions, e.g., Co-CEOs. In all classifications the "co-" prefix is ignored and such executives are treated like full CEOs, etc. There are also instances of multiple executives within a firm and year with the same title. Again, no special treatment is given to such observations.

The results of our regression analysis do not change when we use this alternative definition of job "titles". Hence, we do not report them in the paper.

Department Based on a priori assumptions and a frequency analysis of titles of female executives, three specific departments were identified (again based on key words in the title) – Human Resources, Marketing, and Administrative. The key words used for HR are "human," "HR," and "people." The key words for Marketing are "marketing" and "advertising." Titles with the word "admin" are classified as Administrative. Table A5 summarizes the distribution of executives across departments by gender. The T-Tests in column 3 show that the incidence of departments is statistically different by gender. We also run our regressions for a specification that includes dummy variables for both job-titles and department. The results are unchanged relative to the ones reported in the paper.

8 Model Appendix

Proof. [Proof of Proposition 1] The first order necessary conditions for the optimal compensation problem at an interior solution are:

$$b - \theta e + \mu(-\theta) = 0, \tag{23}$$

$$-\sigma\Sigma^2\tilde{w} + \mu b = 0. \tag{24}$$

To solve for effort, substitute $\mu = \frac{\sigma\Sigma^2\tilde{w}}{b}$ and $\tilde{w} = \frac{\theta e}{b}$, into (23) to obtain an equation in $e:$

$$b - \theta e - \frac{\sigma\Sigma^2\theta^2}{b^2}e = 0, \tag{25}$$

which implies (12) and (13). Constraint (6) implies:

$$u = \bar{w} - \theta v(e) - \frac{\sigma^2\Sigma^2\tilde{\omega}^2}{2}. \tag{26}$$

It follows that:

$$\begin{aligned}
\bar{w} &= u + \frac{\theta}{2}e^2\left[1 + \frac{\sigma^2\Sigma^2\theta^2}{b^2}\right] \\
&= u + \frac{\theta}{2}\frac{b^2}{\theta^2}\left[1 + \frac{\sigma^2\Sigma^2\theta^2}{b^2}\right]^{-1},
\end{aligned}$$

which implies (14). ■

Proof. [Proof of Proposition 2] From (18), the envelope condition for the optimal contracting problem is:

$$S_V^* = \gamma\frac{S^*}{V}. \tag{27}$$

The first order condition for the assignment problem at an interior equilibrium is:

$$\gamma \frac{S^*\left(n, V\left(n\right)\right)}{V\left(n\right)} = \zeta, \tag{28}$$

which implies:

$$V\left(n\right) = \left\{\frac{\zeta}{\gamma}\left(A\left(n\right)\right)^{-1}\right\}^{1/(2\gamma-1)}. \tag{29}$$

Rearranging (28) and integrating over $A_f \cup A_m$, with successive substitutions obtain the solution for ζ:

$$\gamma \int_{A_f \cup A_m} S^*\left(n, V\left(n\right)\right) \varphi\left(n\right) dn = \zeta \int_{A_f \cup A_m} V\left(n\right) \varphi\left(n\right) dn,$$

$$\gamma \frac{\int S^*\left(n, V\left(n\right)\right) \varphi\left(n\right) dn}{\Omega} = \zeta,$$

$$\frac{1}{2} \frac{\int_{\underline{n}}^{\bar{n}} \left(A\left(n\right)\right)^{\frac{-1}{(2\gamma-1)}} \varphi\left(n\right) dn}{\Omega} = \left(\frac{\zeta}{\gamma}\right)^{\frac{-1}{(2\gamma-1)}}. \tag{30}$$

Combining (29) and (30) obtains (22).

■

Table 1a: Gender Differences in Levels of Compensation

	Salary	Bonus	Stock Option	Stock Granted	TCC	TDC1
Females	307.016	350.428	404.583	305.25	657.444	1,507.85
Males	392.272	478.373	834.596	383.857	870.645	2,334.94
T-Stat	-38.39	-17.89	-10.13	-4.63	-25.63	-15.06
p-value	0.000	0.000	0.000	0.00	0.000	0.000
F/M Ratio	78%	73%	48%	80%	76%	65%

Note: Based on ExecuComp, Compustat Data. All regressions include time and firm effects. Dollar entries are in thousands.

Table 1b: Gender Gap in TCC = Salary + Bonus

	Dependent Variable: log(TCC)			
Female	-0.282***	-0.128***	-0.107***	-0.177***
	[0.008]	[0.008]	[0.017]	[0.033]
Constant	6.378***	6.881***	6.729***	6.205***
	[0.009]	[0.010]	[0.021]	[0.076]
Adj R-squared	0.44	0.55	0.58	0.6
Number of observations	153,157	148,924	45,222	20,847
Job titles		yes	yes	Yes
Tenure			yes	
Age				Yes

Table 1c: Gender Gap in Total Compensation

	Dependent Variable: log(TDC1)			
Female	-0.330***	-0.126***	-0.116***	-0.173***
	[0.011]	[0.010]	[0.021]	[0.046]
Constant	7.162***	7.742***	7.812***	7.510***
	[0.012]	[0.013]	[0.025]	[0.100]
Adj R-squared	0.48	0.59	0.61	0.64
Number of observations	128,548	126,688	40,805	18,644
Job titles		yes	yes	Yes
Tenure			yes	
Age				Yes

Notes to Table 1b and 1c: Based on ExecuComp data from Compustat All regressions include time and firm effects. Robust standard errors, clustered at firm-year level, in brackets. TCC and TDC1 are ExecuComp variables: TCC=Salary + Bonus, TDC1= TCC+SO+ SG+ Long term incentive payouts + Other Annual + All Other Total, SO= Total value of stock options granted (using Black-Scholes) and SG=Total value of restricted stock granted. *Significance at the 10% level, ** significance at the 5% level, *** significance at the 1% level.

Table 2a: Salary Share of TCC

	Dependent Variable: Salary/TCC			
Female	0.013***	0.005**	0.009**	0.021***
	[0.002]	[0.002]	[0.004]	[0.007]
Constant	0.612***	0.587***	0.577***	0.547***
	[0.003]	[0.004]	[0.006]	[0.015]
Adj R-squared	0.43	0.44	0.45	0.54
Number of observations	153,164	148,931	45,222	20,850
Job titles		yes	yes	Yes
Tenure			yes	
Age				Yes

Table 2b: Salary share of TDC1

	Dependent Variable: Salary/TDC1			
Female	0.026***	0.011***	0.015**	0.026**
	[0.003]	[0.003]	[0.006]	[0.012]
Constant	0.334***	0.301***	0.267***	0.222***
	[0.003]	[0.003]	[0.005]	[0.018]
Adj R-squared	0.42	0.43	0.41	0.51
Number of observations	128555	126695	40805	18647
Job titles		yes	yes	Yes
Tenure			yes	
Age				Yes

Table 2e: Share of Gender Difference Explained by Incentive Pay

	TCC	TDC1	
	Incentive Pay: Bonus	Incentive Pay: Bonus+SO+SG	Incentive Pay: SO+SG
Incentive Pay_m – Incentive Pay_f	$91,998	$587,004	$417,9569
Total $Compensation_m$ –Total $Compensation_f$	$213,308	$817,229	$817,229
Percentage Explained	**43%**	**72%**	**51%**

Notes to Table 2a, 2b and 2e: Based on ExecuComp data from Compustat All regressions include time and firm effects. Robust standard errors, clustered at firm-year level, in brackets. TCC and TDC1 are ExecuComp variables: TCC=Salary + Bonus, TDC1= TCC+SO+ SG+ Long term incentive payouts + Other Annual + All Other Total, SO= Total value of stock options granted (using Black-Scholes) and SG=Total value of restricted stock granted. *Significance at the 10% level, ** significance at the 5% level, *** significance at the 1% level.

Table 2c: Gender Difference in Stock Options Granted (SO)

	Dependent Variable: SO			
Female	-430.013***	-146.002***	-96.12	-271.925*
	[42.441]	[40.892]	[83.201]	[145.325]
Constant	834.596***	1,763.669***	2,432.070***	2,654.845***
	[41.993]	[54.230]	[104.097]	[474.702]
Adj R-squared	0.14	0.16	0.23	0.18
Number of observations	128,677	126,811	40,830	18,668
Job titles		yes	yes	Yes
Tenure			yes	
Age				Yes

Notes to Table 2c: Based on ExecuComp data from Compustat All regressions include time and firm effects. Robust standard errors, clustered at firm-year level, in brackets. SO= Total value of stock options granted (using Black-Scholes) and SG=Total value of restricted stock granted. *Significance at the 10% level, ** significance at the 5% level, *** significance at the 1% level.

Table 2d: Gender Differences in Stock Options Granted: % of Total Compensation

	Dependent Variable: SO/TDC1			
Female	-0.014***	-0.005	-0.004	-0.016
	[0.003]	[0.003]	[0.007]	[0.013]
Constant	0.272***	0.284***	0.350***	0.438***
	[0.004]	[0.004]	[0.007]	[0.022]
Adj R-squared	0.38	0.39	0.39	0.49
Number of observations	128,555	126,695	40,805	18,647
Job titles		yes	yes	Yes
Tenure			yes	
Age				Yes

Notes to Table 2d: Based on ExecuComp data from Compustat. Robust standard errors, clustered at firm-year level, in brackets. TCC and TDC are based on ExecuComp variables: TCC=Salary + Bonus, TDC= TCC+SO+ SG, SO= Total value of stock options granted (using Black-Scholes) and SG=Total value of restricted stock granted. *Significance at the 10% level, ** significance at the 5% level, *** significance at the 1% level.

Table 3a Pay Performance Sensitivities

	Dependent Variable: delta_TCC			Dependent Variable: delta_TDC		
Delta_mktval	**0.008*****	**0.010*****	**0.008*****	**0.070*****	**0.104*****	**0.060*****
	[0.001]	[0.002]	[0.003]	[0.019]	[0.033]	[0.021]
Female *delta_mktval	**-0.003***	**-0.007*****	**-0.006***	**-0.042**	**-0.103****	**-0.071****
	[0.002]	[0.003]	[0.003]	[0.030]	[0.041]	[0.029]
delta_MKT	**-0.006*****	**-0.011*****	**0.007**	**0.044****	**0.038**	**0.112*****
	[0.002]	[0.003]	[0.005]	[0.017]	[0.041]	[0.032]
Female	10.812**	27.502**	9.012	6.753	82.405	204.584
	[5.277]	[11.270]	[14.982]	[50.022]	[101.614]	[144.937]
Constant	77.966***	121.376***	259.798***	34.834	0.163	820.609
	[9.583]	[12.808]	[83.054]	[77.497]	[124.124]	[642.355]
Job titles	yes	yes	yes	yes	yes	Yes
Tenure		yes			yes	
Age			yes			Yes
Real Sales	yes	yes	yes	yes	yes	Yes
Industry Dummies	yes	yes	yes	yes	yes	Yes
Observations	96,857	29,740	15,400	73,558	24,120	11,884
R-squared	0.01	0.03	0.04	0.01	0.01	0.01
Adj R-squared	0.01	0.02	0.02	0	-0.01	-0.02

Notes: Based on ExecuComp data from Compustat. Robust standard errors, clustered at firm-year level, in brackets. TCC and TDC are based on ExecuComp variables: TCC=Salary + Bonus, TDC= TCC+SO+ SG, SO= Total value of stock options granted (using Black-Scholes) and SG=Total value of restricted stock granted. *Significance at the 10% level, ** significance at the 5% level, *** significance at the 1% level.

Table 3b Pay Performance Sensitivities: *Positive* Changes in Firm Market Value

	Dependent Variable: delta_TDC					
Delta_mktval	**0.053*** [0.017]**	**0.072 [0.048]**	**0.029* [0.016]**	**0.054*****	**0.083***	**0.037****
				[0.016]	[0.046]	[0.017]
Female *delta_mktval	**-0.067****	**-0.085***	**-0.096****	**-0.069****	**-0.07**	**-0.056**
	[0.028]	[0.048]	[0.042]	[0.033]	[0.060]	[0.057]
delta_MKT	**0.054*****	**0.083***	**0.037****	**0.074*****	**0.131*****	**0.081****
	[0.016]	[0.046]	[0.017]	[0.017]	[0.042]	[0.034]
Female* delta_MKT				**-0.073**	**-0.119***	**-0.115**
				[0.058]	[0.068]	[0.113]
Female	91.884*	112.645	97.813	150.616***	232.068*	28.951
	[55.646]	[128.559]	[150.171]	[55.216]	[136.748]	[149.245]
Constant	313.515***	345.856**	1,356.905***	314.605***	403.518**	1,340.455***
	[74.762]	[156.716]	[498.903]	[78.057]	[158.047]	[466.137]
Job titles	yes	yes	yes	yes	yes	Yes
Tenure		yes			yes	
Age			yes			Yes
Real Sales	yes	yes	yes	yes	yes	Yes
Industry Dummies	yes	yes	yes	yes	yes	Yes
Observations	43,995	14,500	7,657	43,995	14,500	7,657
R-squared	0.01	0.01	0.05	0.01	0.01	0.05
Adj R-squared	0	-0.02	0.01	0	-0.02	0.01

Table 3c Pay Performance Sensitivities: *Negative* Changes in Firm Market Value

	Dependent Variable: delta_TDC					
Delta_mktval	**0.044**	**0.107**	**0.008**	**0.04**	**0.105**	**0.022**
	[0.039]	**[0.078]**	**[0.049]**	[0.042]	[0.074]	[0.054]
Female *delta_mktval	**-0.012**	**-0.129***	**-0.01**	**-0.017**	**-0.136****	**-0.042**
	[0.046]	[0.070]	[0.042]	[0.045]	[0.064]	[0.044]
delta_MKT	**0.065****	**0.009**	**0.153****	**0.027**	**0.001**	**0.135**
	[0.028]	[0.058]	[0.072]	[0.032]	[0.075]	[0.115]
Female* delta_MKT				**-0.028**	**0.012**	**-0.145**
				[0.043]	[0.092]	[0.120]
Female	-27.51	-106.331	145.699	21.178	-88.135	116.159
	[85.009]	[211.729]	[180.113]	[69.565]	[166.438]	[176.688]
Constant	-402.055**	-695.604***	170.186	-353.863**	-757.553***	-184.302
	[157.600]	[191.714]	[1,545.623]	[152.795]	[219.921]	[1,483.629]
Job titles	yes	yes	Yes	yes	yes	Yes
Tenure		yes			yes	
Age			Yes			Yes
Real Sales	yes	yes	Yes	yes	yes	Yes
Industry Dummies	yes	yes	Yes	yes	yes	Yes
Observations	29,608	9,620	4,292	29,608	9,620	4,292
R-squared	0.01	0.02	0.02	0.01	0.02	0.02
Adj R-squared	0	-0.02	-0.05	0	-0.02	-0.05

Table 3d Pay Performance Sensitivities of CEOs by Sign of Change in Market Values
Dependent Variable: delta_TDC

	Positive Changes in Market Value		*Negative* Changes in Market Value	
Delta_mktval	**0.126****	**.0418**	**0.083**	**-0.033**
	[0.054]	[0.032]	[0.081]	[0.094]
Female *delta_mktval	**-0. 69***	**-.285*****	**.222****	**-0.040**
	[0.380]	[.046]	[.093]	[0.182]
delta_MKT	**0.051**	**.212*****	**.121***	**.257***
	[0.074]	[.068]	[.071]	[.139]
Female* delta_MKT	**-0.043**	**-.160**	**-.162**	**-0.098**
	[.459]	[.242]	[.252]	[.189]
Female	591.241	522.679*	-74.233	362.751
	[433.013]	[289.857]	[522.571]	[431.454]
Constant	189.128*	1196.677	-356.293	-153.429
	[100.884]	[769.650]	[180.201]	[1065.054]
Real Sales	yes	yes	Yes	Yes
Industry Dummies	yes	yes	Yes	Yes
Age		yes		Yes
Observations	12,641	3,719	8,557	2,073
R-squared	0.021	.059	0.025	0.037
Adj R-squared	-0.009	-0.016	-0.018	-.096

Notes to Table 3b to 3d: Based on ExecuComp data from Compustat. Robust standard errors, clustered at firm-year level, in brackets. TCC and TDC are based on ExecuComp variables: TCC=Salary + Bonus, TDC= TCC+SO+ SG, SO= Total value of stock options granted (using Black-Scholes) and SG=Total value of restricted stock granted. *Significance at the 10% level, ** significance at the 5% level, *** significance at the 1% level.

Table 4a: Average firm size by gender of executive

	Market Value (Million $)	Sales (Million $)
Females	5,369.874	3,674.475
	[71.459]	[29.131]
Males	5,811.577	4,166.427
	[77.993]	[25.895]
T-test Statistic	-2.16	-3.58
p-value	0.031	0.000

Note: Based on ExecuComp, Compustat Data. Standard errors in brackets.

Table 4b: Pay performance sensitivities by size

	Bottom 25th size			25th < size <75th			Top 25th size	
Dependent variable	**delta_tcc**	**delta_tdc1**		**delta_tcc**	**delta_tdc1**		**delta_tcc**	**delta_tdc1**
delta_mktval	**0.116*** **	**0.439** **		**0.050*** **	**0.314** **		**0.007*** **	**0.068*** **
	[0.027]	**[0.181]**		**[0.006]**	**[0.147]**		**[0.001]**	**[0.021]**
delta_valMKT	**-0.003** **	**0.009**		**-0.003*** **	**0.046** **		**-0.005**	**0.099**
	[0.001]	**[0.007]**		**[0.001]**	**[0.020]**		**[0.005]**	**[0.062]**
Job Title	**Yes**	**yes**		**yes**	**yes**		**Yes**	**yes**
Constant	11.818**	-61.933**		58.118***	53.455		144.248***	200.477
	[5.463]	[30.054]		[6.792]	[76.720]		[36.780]	[392.724]
Observations	21554	17477		48217	38738		26898	21016
R-squared	0.05	0.04		0.04	0.01		0.01	0.01
Adj R-squared	0.04	0.02		0.03	0		0	0

Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%
Size distribution based on market value.

Table 5: Firm performance and gender of executives

	All executives				CEOs			
	Tq	F_opinc	%Change Market Value	Change Market Value	Tq	F_opinc	%Change Market Value	Change Market Value
Female	0.021	0.138	0.001	-61.188	-0.315	0.279	0.034	319.16
	[0.017]	[0.121]	[0.005]	[82.870]	[0.295]	[0.262]	[0.030]	[476.411]
Constant	1.659***	3.625	0.058***	587.478***	1.614***	7.385	0.062***	709.925***
	[0.027]	[3.128]	[0.007]	[119.130]	[0.029]	[6.448]	[0.009]	[164.846]
Observations	136,927	137,011	117,269	117,269	30,926	30,622	28,022	28,022
R-squared	0.46	0.04	0.18	0.06	0.47	0.08	0.19	0.08
Adj R-squared	0.45	0.02	0.16	0.04	0.42	-0.01	0.11	-0.02

Notes: Based on ExecuComp data from Compustat All regressions include time and firm effects. Robust standard errors, clustered at firm-year level, in brackets. F_opinc=EBIT/Assets, Tq=MKTVAL/Assets *Significance at the 10% level, ** significance at the 5% level, *** significance at the 1% level.

Figure 4: Percentage Female and Compensation by Firm Size

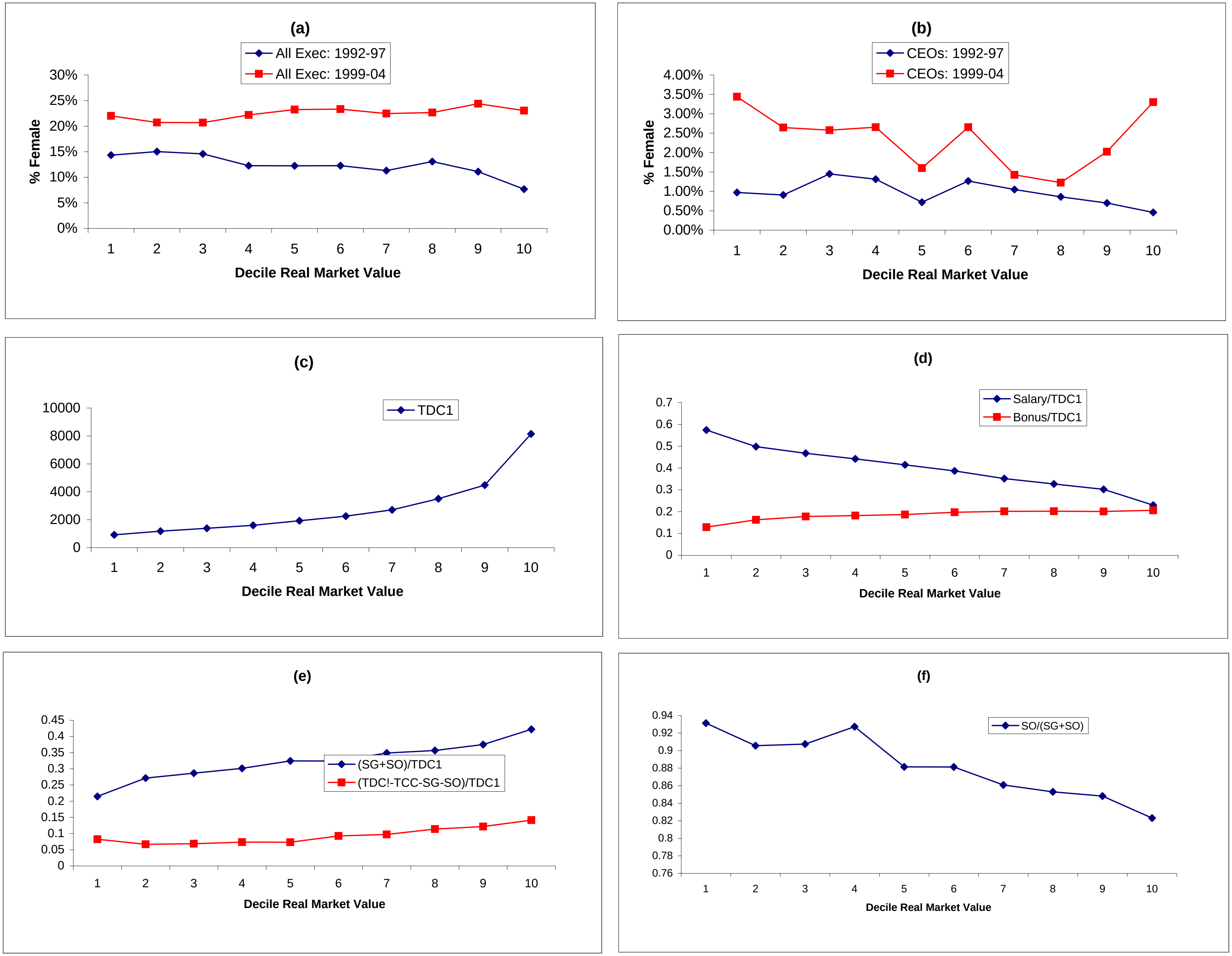

Table A1a
Summary Statistics

	FEMALES			MALES		
	Mean	Std Dev.	Obs	Mean	Std. Dev.	Obs
TCC	473	525.9	6560	659	1032.7	133120
TDC1	1456	3209.3	4993	2045	6270.1	112744
SALES	3497	8316.7	6542	4128	11566.6	132737
EMPLOYEES	17.4	49.0	6367	17.9	49.1	129423
MKTVAL	5055	15957	6378	5707.9	19753.5	130334
Salary/TCC	0.70	0.20	6555	0.68	0.22	132755
Salary/TDC1	0.41	0.25	4992	0.40	0.25	112631
AGE	49.5	7.2	574	52.2	7.9	16627
TENURE	7.4	8.1	1955	11.0	11.0	39266

Table A1b
Incidence of Job Titles by Gender
(percentage values, columns 1 and 2 add to 100)

	FEMALES	MALES	T-test Statistics	p-values
Chair/CEO	6.04	23.18	-32.66	5.1E-23
Vice Chair	2.44	3.05	-2.82	0.0047
President	10.44	12.99	-6.01	1.8E-09
CFO	12.42	10.57	4.74	2.1E-06
COO	1.46	2.17	-3.87	0.0001
Other Chief	7.79	4.63	11.70	1.2E-31
Exec VP	16.63	13.34	7.62	2.6E-14
Senior VP	19.22	12.91	14.75	3.2E-49
Group VP	0.43	0.8	-3.36	0.0008
VP	17.45	12.21	12.56	3.6E-36
Other	2.12	1.42	4.64	3.4E-06
Missing	3.55	2.72	4.02	5.9E-05

Table A1c
Distribution of "Years-to-Payment": Long-Term Incentive Payout (LTIP) and Stock Options Granted

	Column (i): LTIP			Column (ii): Stock Options Granted	
Years	FEMALES	MALES	Years	FEMALES	MALES
1	1.31	2.3	0	0.36	0.2
2	6.75	8.26	1	0.39	0.29
3	77.86	72.17	2	0.26	0.24
4	9.38	10.25	3	0.46	0.42
5	3.38	5.4	4	0.72	1.01
6	0.94	0.85	5	4.43	4.82
7	0	0.18	6	1.64	1.61
8	0	0.08	7	3.38	3.12
9	0	0.01	8	1.08	1.13
10	0.19	0.49	9	9.31	10.22
11	0	0.01	10	74.45	73.42
14	0	0.01	11	2.98	2.75
			12	0.13	0.11
			13	0.03	0.03
			14	0.03	0.05
			15	0.2	0.27
			16	0.1	0.04
			>=17	0.8	0.76

Notes: Column (i): Distribution over years in the future the executive will receive the payout under the long-term incentive plan. Column (ii): Distribution over years until expiration of stock options granted to executive. Entries in the table are percentage values.

Table A1d
Key Words Used in Identifying "Job Titles"

TITLE	KEY WORDS
Chair/CEO	CHAIRMAN & CHAIR CHMN CEO CHIEF EXECUTIVE OFFICER
Vice Chair	VICE CHAIR VICE-CHAIR V-CHAIR V-CHMN VCHMN VICE CHMN VICE-CHMN
President	PRESIDENT

	PRES. PRES& PRES
CFO	CFO CHIEF FINANCE OFFICER CHIEF FINANCIAL OFFICER
COO	COO CHIEF OPERATING OFFICER CHIEF OPERATION OFFICER CHIEF OPERATIONS OFFICER
Other Chief	CHIEF CHF
Exec VP	EXECUTIVE VP EXECUTIVE V-P EXEC V.P. EXEC V-P EXEC. V-P EXEC. V-P EXEC.V-P EXEC.VP EXEC VP EXEC. VP
Sr VP	SENIOR VP SENIOR V-P SR V-P SR. V-P SR.V-P SR.VP SR VP SR. VP
Group VP	GROUP VP GROUP V-P
VP	VP V-P
Other	All uncategorized titles (where TITLEANN is not missing) plus ASSISTANT TO CHAIRMAN ASSISTANT TO CHMN ASSISTANT TO THE CHAIRMAN OFFICE OF THE CHAIRMAN ASSISTANT TO CEO ASSISTANT TO THE CEO ASSISTANT TO PRES ASSISTANT TO THE PRES EXEC. CEO-ASSISTANT

Table A1e
Incidence of Departments by Gender
(percentage values, columns 1 and 2 add to 100)

	FEMALES	MALES	T-test Statistics	p-values
HR	5.88	0.93	36.62	3.87E-29
Marketing	2.76	1.75	6.00	1.93E-09
Admin	3.23	1.78	8.53	1.43E-17
Other	84.57	92.82	-24.69	2.52E-13
missing	3.56	2.72	4.02	5.9E-05

Table A3b Pay Performance Sensitivities
Dependent Variable: Delta_SO+SG

Female	-61.488	149.827	2.547
	[80.976]	[265.340]	[156.876]
delta_mktval	0.018	-0.013	0.054
	[0.026]	[0.023]	[0.041]
(female==1)*delta_mktval	0.054	0.033	-0.029
	[0.060]	[0.066]	[0.063]
delta_valIND	0.127***	0.128***	0.168***
	[0.029]	[0.033]	[0.061]
Constant	69.152	-724.754	-274.498
	[97.208]	[662.243]	[173.159]
Job titles	yes	yes	yes
Tenure		yes	
Age			yes
Real Sales	yes	yes	yes
Industry Dummies	yes	yes	yes
Observations	61066	10417	20285
R-squared	0.01	0.03	0.04
Adj R-squared	0.01	0.02	0.02

Notes to Table A3b: Based on ExecuComp data from Compustat. Robust standard errors, clustered at firm-year level, in brackets. We use ExecuComp variables: SO= Total value of stock options granted (using Black-Scholes) and SG=Total value of restricted stock granted. *Significance at the 10% level, ** significance at the 5% level, *** significance at the 1% level.

Table A7: Summary Statistics for ATUS sample:
Men and women in top 5% of income distribution

	Sample	All	Top 5% of income							
			all	under 65						
				all	not married	married	married			
							no children	children	children	
									no children under 5	children under 5
Variable										
Number of observations	women	11,668	171	171	73	98	38	60	35	25
	men	9,052	496	487	93	394	104	290	168	122
Percent in category (by gender)	women	100.0%	1.5%	1.5%	0.6%	0.8%	0.3%	0.5%	0.3%	0.2%
	men	100.0%	5.5%	5.4%	1.0%	4.4%	1.1%	3.2%	1.9%	1.3%
Annual Income	women	29,262	124,490	124,490	117,807	129,392	126,212	132,127	131,711	132,695
		(23,984)	(21,066)	(21,066)	(19,926)	(20,618)	(21,057)	(20,047)	(21,814)	(17,768)
	men	42,156	124,540	124,704	119,273	125,846	125,739	125,910	127,319	123,946
		(31,590)	(20,365)	(20,383)	(19,322)	(20,438)	(20,287)	(20,578)	(21,054)	(19,814)
Age	women	44.4	42.3	42.3	39.9	44.0	48.9	39.7	42.1	36.5
		(18.3)	(9.5)	(9.5)	(9.7)	(9.0)	(9.4)	(5.9)	(4.9)	(5.7)
	men	42.8	44.3	43.8	40.2	44.6	49.6	41.6	45.1	36.7
		(17.6)	(9.3)	(8.7)	(9.7)	(8.3)	(8.0)	(6.9)	(5.7)	(5.5)
Black	women	12.5%	6.7%	6.7%	15.3%	0.5%	1.1%	0.0%	0.0%	0.0%
		(33.1%)	(25.2%)	(25.2%)	(36.2%)	(7.0%)	(10.4%)	(0.0%)	(0.0%)	(0.0%)
	men	10.6%	3.9%	3.8%	1.8%	4.2%	1.4%	5.8%	5.3%	6.6%
		(30.7%)	(19.4%)	(19.1%)	(13.5%)	(20.0%)	(11.9%)	(23.4%)	(22.4%)	(24.8%)
Years of schooling	women	12.6	15.9	15.9	15.9	15.8	15.8	15.9	15.8	16.0
		(2.8)	(1.6)	(1.6)	(1.6)	(1.6)	(1.6)	(1.7)	(1.7)	(1.7)
	men	12.7	15.7	15.7	15.2	15.8	16.0	15.7	15.7	15.7
		(2.9)	(1.9)	(1.9)	(2.8)	(1.6)	(1.5)	(1.7)	(1.7)	(1.6)
Number of children	women	0.8	0.6	0.6	0.2	0.9	0.0	1.8	1.6	2.0
		(1.2)	(0.9)	(0.9)	(0.6)	(1.0)	(0.0)	(0.8)	(0.7)	(0.9)
	men	0.8	1.1	1.1	0.2	1.3	0.0	2.0	1.9	2.2
		(1.1)	(1.2)	(1.2)	(0.7)	(1.2)	(0.0)	(0.9)	(0.8)	(0.9)
Standard deviations in parentheses.										