

## **The impact of the CEO pay ratio on firm value**

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### **Abstract**

We show that the relationship between firm value and the CEO pay ratio is concave (inverted U shape), which is consistent with elements of both tournament theory, and social comparison and equity theory. The concavity is also consistent with the existence of an optimal pay ratio, or inflection point, above which firm value decreases with the pay ratio. We also show that the relationship between the pay ratio and firm value depends on firm characteristics. For example, in firms with a greater need for collaboration and information sharing the optimal ratio is lower. Finally, we decompose the pay ratio into that within the executive suite, and that between the executive suite and the rank and file. We show that pay disparity within the executive suite has little effect on firm value, so our results are driven by the difference in pay between executives and rank-and-file employees.

*Keywords:* Pay ratio; Tournament theory; Social Comparison theory; Equity theory; Firm performance

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## **1. Introduction**

For fiscal years beginning on or after January 1, 2017, U.S. public companies must disclose the total compensation of their median employee and chief executive officer, followed by the ratio of the two, i.e., the pay ratio. The CEO-employee pay ratio which has been covered closely in the media, has stirred controversy among labor activists and has been used in political platforms. It is also an issue with bond rating agencies and corporate governance advisors who have incorporated pay disparity into their ratings and recommendations, albeit disparity within the executive suite (Plath 2008). Although there is a large literature on CEO compensation (Murphy 1999, Dow and Raposo 2005, Gabaix and Landier 2008, Frydman and Jenter 2010), little systematic analysis has been done on the impact of the pay ratio on firm value, and those few studies present conflicting results, suggesting additional analysis is necessary. Thus, our goal in this paper is to shed further light on this issue.

Social comparison and equity theory (Bloom and Michel 2002, Siegel and Hambrick 2005, Wade, O'Reilly and Pollock 2006, Fredrickson, Davis-Blake and Sanders 2010) suggest that the perceived lack of pay equity adversely affects employee morale, collaboration and information sharing, which then leads to poor performance and increased turnover, reducing firm value. In contrast, tournament theory (Rosen 1986, Lazear and Rosen 1981) suggests that the incentives provided by pay gaps motivate employees to work harder to get promotions and the ensuing increased compensation. Not surprisingly, given the validity of the underlying theories, empirical evidence has been found to support both viewpoints. That is, some studies show that firm value or performance increases with the pay ratio (Burns, Minnick, and Starks 2016, Kale, Reis, and Venkateswaran 2009, Banker,

Bu and Mehta 2016), while others show that firm value/performance decreases with the pay ratio (Bebchuk, Cremers, and Peyer 2011, Shin, Kang, Hyun, and Kim 2015, Newton 2015).

This paper extends the existing literature by showing that both theories are valid. Using linear, nonlinear, and piecewise, regression analysis we find, consistent with tournament theory, that up to a certain point, increases in the pay gap are associated with increases in firm value. However we find, consistent with equity theory, that past that point, increases in the pay gap are associated with decreases in firm value. We then show that this inflection point varies in a predictable fashion by industry and firm characteristics.

We examine the relation between firm value, proxied for by Tobin's Q, and the pay ratio, using the population of Compustat firms that meet our data requirements over 1997–2014 period. Our primary measure of the pay ratio is the ratio of total CEO compensation to average employee pay, where total CEO compensation is ExecuComp variable TDC1 and average employee pay is calculated as total labor expense (Compustat variable XLR) divided by the number of employees (Compustat variable EMP). However, since disclosure of total labor expense is not required, we suffer a significant reduction in sample size because of this requirement. Further our sample suffers from self-selection bias in that only firms that choose to disclose remain in our sample. Thus, to both increase our sample size, and to mitigate the impact of selection bias, we recalculate the pay ratio, and rerun our analysis using industry average worker pay from the Bureau of Labor Statistics (BLS).

We conduct our empirical tests using three types of regression analysis. We begin with a linear regression and find that there is a significant association between firm value and pay ratio. However, this association differs depending upon whether we use Compustat or

BLS data to calculate the pay ratio. To be precise, when we use Compustat data we find a significant negative association between firm value and the pay ratio, while when we use the BLS data we find a significant positive association between firm value and the pay ratio. We discuss this discrepancy below. Second, we do a nonlinear regression by including both the pay ratio variable and its quadratic term. Here we find consistent results regardless of whether we use Compustat or BLS data. We find that, consistent with tournament theory, that up to a certain point, increases in the pay gap are associated with increases in firm value. However, we find, consistent with equity theory, that past that point, increases in the pay gap are associated with decreases in firm value. Third, we do a piecewise regression analysis by including four indicator variables for the different percentiles ranks of pay ratios (e.g., below 10th percentile, 10th percentile to 50th percentile, 50th percentile to 90th percentile and above 90th percentile) to further account for a potential nonlinear relation. We generally find a positive association between firm value and the pay ratio, however that ratio is weak for firms in the lowest decile, and turns negative for firms in the highest decile. This result is consistent with the prediction that firm value and the CEO-worker pay ratio exhibit a non-linear (inverse U shape) relationship.

We then show that the optimal pay ratio, or the inflection point, varies in a predictable fashion by industry and firm characteristics, as firms require different levels of information sharing, collaboration, and cooperation. For example, technology intensive firms will have larger task interdependence and a greater need to collaborate, and thus a large pay disparity can damage innovation in those firms (Siegel and Hambrick 2005). Therefore, we expect that high-tech firms will have a lower inflection point than low-tech firms. Somewhat

surprisingly we do not find this to be the case. In contrast, we hypothesize and observe that the relationship between the pay ratio and firm value in capital intensive firms will have a higher inflection point as opposed to labor intensive firms. Finally, we expect and find, that multinational firms, because of their greater need for information sharing, will have a lower inflection points than purely domestic firms.

Next, following Bebchuk et al. (2011), we decompose the CEO-employee pay ratio into pay disparity within the executive suite and pay disparity between the executive suite and the average employee. We find that our results are driven mainly by the ratio executive pay to average employee pay.

This paper continues with section 2 which further reviews the literature and develops our hypothesis. Section 3 describes our empirical model and data, while section 4 provides our empirical analysis. We conclude in section 5.

## **2. Literature review and hypothesis development**

### ***2.1 Research on the “executive pay ratio”***

Researchers have examined the impact of the gap between the CEO and the other named executive officers. Burns, Minnick, and Starks (2016) conclude that firm value increases with the CEO tournament structure (measured by CEO pay gap, CEO pay slice and CEO pay ratio). However, they find this effect does not hold in all geographic regions (countries). They also state that, “Steeper tournaments can be more effective at improving firm value in countries that value competition, power, and fairness in income.” Their overall finding is consistent with prior research by Kale, Reis, and Venkateswaran (2009) and Lee, Lev, and Yeo (2008). But it contradicts the findings of Bebchuk, Cremers, and Peyer (2011) and that of Siegel and Hambrick (2005), which found that larger ratios had a

negative impact on firm value and performance. The latter paper is particularly interesting in that the authors argue that a higher pay ratio is more detrimental in high-technology firms which ties into the point above, that the optimal pay ratio is not the same for all firms.

## ***2.2 Research on the broader pay ratio***

Given that disclosure of the pay ratio is not yet mandated, researchers have only begun to examine the impact of the pay gap at levels below the top five executives. Banker, Bu and Mehta (2016) who use data from China, which they validate on a small sample of US firms for which data was available, suggest that an increasing pay ratio leads to better firm performance. In contrast, Shin, Kang, Hyun, and Kim (2015) and Newton (2015) find that higher pay gaps lead to poorer performance. Only Crawford, Nelson, and Rountree (2016) who look exclusively at US commercial banks and find that firms with extreme pay ratios are more risky and perform worse, begin to address the nonlinearity of the relationship. To be precise they find “pay disparity increases firm performance up to a point, but as pay ratios rise above this level performance begins to decline.”

While some papers look at the aggregate impact on firm value or performance, others look at facets that can affect firm performance. For example, Wade, O’Reilly, and Pollock (2006) and Bloom and Michel (2002) suggest that when lower level managers feel underpaid relative to the CEO they are more likely to leave the firm. Perhaps, the most interesting paper is Mahy, Rycx and Volral (2011). While they don’t look at the pay ratio per se, using data from Belgium the authors find that wage dispersion at first has a positive effect on employee productivity, but the effect is so to speak, nonlinear, as dispersion increases beyond an inflection point productivity decreases. Further adding to the richness

of the study, as well as to the complexity of finding optimal dispersion, this inflection point varies with firm characteristics.

### ***2.3 Hypothesis development***

As stated above, both tournament and equity theory are well developed internally consistent theories. However, their predictions are contradictory. For example, the competition among executives/employees as a result of the incentives provided by the tournament leads to less collaboration among competitors in the tournament. Thus, while the pay differential does provide benefits as it provides incentives for the individual to exert effort to win the tournament, there are also costs associated with the competitive nature of the tournament which leads to less collaboration and cooperation. In addition, if the pay differential is a reflection of talent assignment, then large pay ratio will lead to better firm performance and higher firm value. As we feel that some level of pay differential is necessary, we postulate that the relationship between the CEO pay ratio and firm performance is nonlinear, following up and extending the research of Crawford et al. (2016). Specifically, we believe that firm performance will increase with the pay ratio up to a point, after which it will begin to decline.

#### **H1: The relationship between the pay ratio and firm value is nonlinear.**

While Crawford et al. (2016) limit their study to commercial banks, our analysis will incorporate a broad swath of industries, allowing us to test cross-sectional variation in this relationship and building on the work of Siegel and Hambrick (2005) and Burns et al. (2016). In particular, Siegel and Hambrick (2005) show that the adverse impact of the vertical pay disparity, to be much greater in high technology firms where collaboration is more important. According to Siegel and Hambrick (2005), technology intensiveness



increases task interdependence and the need to collaborate. As a higher pay ratio increases competition amongst employees and reduces their collaboration, our expectation is that the optimal pay ratio or inflection point will be lower for high-tech as opposed to low-tech firms.

**H2a: High-tech firms have a lower inflection point than low-tech firms.**

Capital intensive firms have significant assets in place, and as such may require less collaboration and cooperation than labor intensive firms. As such, tradeoffs between competition and collaboration differ between capital intensive and labor intensive firms. Our expectation is that the optimal pay ratio or inflection point will be higher in capital, as opposed to labor, intensive firms.

**H2b: Capital intensive firms have a higher inflection point than labor intensive firms.**

Multinational firms, because they operate in multiple countries, cultures and time zones, have a greater need for information sharing, collaboration, and cooperation. By the same token of the high-tech firms, the damage of large pay disparity for multinational firms will be higher than for domestic firms. As a higher pay ratio increases competition amongst employees and reduces their collaboration, our expectation is that the optimal pay ratio or inflection point will be lower for multinational as opposed to purely domestic firms.

**H2c: Multinational firms have a lower inflection point than domestic firms.**

**3. Sample collection and variable**

**3.1 Sample construction**

Since the primary variable of interest is the CEO pay ratio, we start with CEO compensation data for the period 1997-2014.<sup>1</sup> We obtain CEO compensation from Standard & Poor's ExecuComp. ExecuComp provides detailed information on executive compensation data collected directly from each company's annual proxy. We obtain the staff expense and number of employees and other financial information from Standard & Poor's Compustat, industrial segment data from the Standard & Poor's Compustat Industrial Segment, and stock return information from CRSP. We also use the RiskMetrics database, with coverage of directors of S&P 500, S&P MidCap, and S&P SmallCap firms for board and corporate governance information. Consistent with the prior literature, we eliminate financial firms and utilities.

### ***3.2 CEO-worker pay ratio***

The test variable in this study is the CEO-to-worker pay ratio. It is calculated as CEO total compensation (ExecuComp variable: TDC1) divided by mean worker pay.<sup>2</sup> We calculate mean worker pay two ways. Our primary measure of mean worker pay is calculated as total labor expense (Compustat variable: XLR) divided by the total number of employees (Compustat variable: EMP). However, since firms are not required to disclose either labor expense or number of employees, our sample size is reduced and furthermore, is subject to self-selection bias, as firms effectively self-select into our sample. To control for both of these issues we use as an alternative measure of mean worker pay, the industry-level mean worker pay from the Bureau of Labor Statistics.

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<sup>1</sup> As noted in section 3.2, we use as an alternative measure of mean employee pay, industry-level worker pay from the Bureau of Labor Statistics. This data starts from 1997 so we use that starting date for all our analyses.

<sup>2</sup> In addition, we construct an alternative pay ratio using CEO cash pay, where cash compensation consists of salary and cash bonus.

### ***3.3 Dependent Variable***

The dependent variable of the study is Tobin's Q. Tobin's Q is measured as the market value of assets divided by the book value of assets measured at a firm's fiscal year end. The market value of assets is defined as the market value of equity plus the book value of assets minus the book value of equity. The denominator of Q is the book value of assets. In the baseline regression, we also include the lagged Tobin's Q as a control variable.

### ***3.4 Control variables***

We begin with the control variables used by Bebchuk, Cremers and Peyer (2011) in their test of the empirical association between CEO pay slice and Tobin's Q. These controls include the natural logarithm of book value, insider ownership, the ratio of capital expenditures to assets (Capex/assets), leverage, R&D, missing R&D (see Koh and Reeb 2015), firm age, a dummy variable indicating whether CEO ownership is greater than 20%, CEO tenure, and a dummy variable indicating if the CEO was appointed from outside the firm. We also include the Managerial Ability Score from Demerjian, Lev, and McVay (2012) as a measure of CEO ability. We include the entrenchment index (Eindex) of Bebchuk, Cohen, and Ferrell (2009) to control for the level of shareholder rights or management entrenchment. We also include a dummy variable indicating whether the firm is domestic or multinational.

We use three variables to proxy the skills and relative bargaining power of the rank and file employees which while we expect will affect the pay ratio, can also affect firm value. The first one is the ratio of physical capital to the number of employees, as capital intensive operations generally require higher employee skills (Faleye, Reis and

Venkateswaran, 2013). The second variable is workforce education, measured by both the percentage of full-time employees who hold at least a bachelor's degree at the two-digit SIC industry level, obtained from U.S. Bureau of Census, and the percentage of the population who hold at least a bachelor's degree in the region, obtained from the BLS. These variables proxy for employee productivity, as according to Faleye et al (2013), higher skilled employees will have higher productivity. The third measure is industry concentration which is proxied by revenue-based Herfindahl index as the more concentrated the industry, the fewer outside opportunities.

Each of these variables is measured contemporaneous with Tobin's Q, and all continuous variables are winsorized at the 1st and 99th percentiles to minimize the influence of outliers. Appendix A provides definitions for all variables.

### ***3.5 Summary statistics***

Table 1 provides the summary statistics. The statistics are based on a panel data set of 8,920 firm-year observations between 1997 and 2014. The mean CEO-worker pay ratio is 56.20, which is lower than the number reported in popular press, e.g., 373 (Melby 2016). The mean CEO pay slice is 0.43, is slightly higher than the 0.36 reported by Bechuk et al. (2011). Tobin's Q has a mean (median) value of 1.21 (1.13). The average firm in the sample is large, with logarithm of book value of 7.26. Since the sample is from publicly traded U.S. companies in the S&P 1500 Index, this is not surprising. We omit discussion of the remaining variables for brevity.

## **4. Empirical analysis**

#### ***4.1 Baseline regression***

To provide evidence on our hypotheses we conduct the following regression to examine the effects of CEO pay ratio on firm value:

$$Firm\ value = f\left(\begin{array}{l} CEO\ pay\ ratio,\ firm\ characteristics,\ CEO\ characteristics, \\ corporate\ governance,\ employee\ characteristics \end{array}\right)$$

Table 2 examines the relation between CEO pay ratio and subsequent firm value. Three alternative measures of the pay ratio are used in the regressions. The first measure is the pay ratio calculated using total CEO compensation (ExecuComp TDC1) divided by mean employee pay, which is calculated as total labor expense (Compustat XLR) divided by total employees (Compustat EMP). The second measure is the industry-adjusted pay ratio, which is calculated by subtracting the annual industry median pay ratio from the unadjusted pay ratio. As noted above, disclosure of labor expense is not mandatory, thus reducing our sample size for the first two measures. Perhaps a bigger issue is the selection bias, whereby only the firms choosing to disclose enter our sample. Thus our third measure utilizes industry average worker pay from the BLS as the denominator of the pay ratio. We get the industry average worker pay from Bureau of Labor Statistics (BLS).

In the initial specification, we examine the linear relationship between firm value and CEO pay ratio, presenting the results in columns (1), (3) and (5). In column (1) we actually see a negative relation between Tobin's Q and the pay ratio, while in the columns (3) and (5) we observe a positive relationship. While these mixed results are consistent with the prior literature which itself is mixed, we are not necessarily troubled by it, as our question of interest is whether the relationship is non-linear, which we test in our second specification where we add the pay ratio<sup>2</sup> term.

Columns (2), (4) and (6) of Table 2 present the results for this second specification. In each column we find a positive and significant coefficient on the linear term and a negative and significant coefficient on the squared term. The findings confirm our expectation that the relation between firm value and the pay ratio is nonlinear. They are consistent with firm value initially increasing with increases in the pay ratio, and after an inflection point, beginning to decrease.<sup>3</sup> The inflection points of pay ratio are quite high, ranging from 310 to 453, all of which are beyond the 75<sup>th</sup> percentile for the pay ratio. While we hesitate to make normative prescriptions based upon this evidence, it is consistent with political pressure reducing CEO pay and the pay ratio below an unconstrained optimum for most firms.

Turning briefly to our control variables we find the signs and significance of many of our variables are susceptible to changes in the definition of our test variable. Only four variables are consistently positive across all six columns, lagged Tobin's Q, Log (book value), ROA, and the standard deviation of stock returns. Several are insignificant in all columns, e.g., Institutional and Insider Ownership, while others provide mixed levels of significance. As all have been drawn from prior literature and are only being used as controls, we omit further discussion.

#### ***4.2 Cash pay ratio***

Two possible nonexclusive explanations for the rather high inflection points observed in Table 2 is that rank and file employees either do not consider or heavily discount non-cash pay, and/or they are more acceptable of pay differentials based upon performance. To

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<sup>3</sup> The inflection point is calculated by taking the derivative of the dependent variable with respect to the pay ratio in the regressions that includes both the pay ratio and the pay ratio<sup>2</sup>.

examine these possibilities, we rerun our analysis using CEO cash compensation, where we replace TDC1 in our numerator with the sum of CEO Salary plus Bonus. We present the results in table 3. In general, our results and inferences are comparable to those using total compensation as the numerator of the ratio.<sup>4</sup> The major difference between the two tables is in the inflection point, which ranges from 41 to 74 in Table 3, as opposed to 310 to 453 in Table 2. This evidence is consistent with employees being less tolerant of disparities in cash compensation.

In summary, we have found evidence consistent with our first hypothesis that firm value and the pay ratio demonstrate a non-linear (inverse U shape) relation: initially firm value first increases with increases in the pay ratio. However, after the inflection point, additional increases in the pay ratio are counterproductive, i.e., they lead to firm value decreases. The results are robust to multiple measure of the pay ratio.

#### ***4.3 Endogeneity—two-stage least squares***

Both Tobin's Q and the pay ratio can also be influenced by the same, potentially omitted, variables, resulting in endogeneity. To address this issue, we use a two-stage procedure where the instrumental variables (IVs) are: a dummy variable indicating whether the headquarters of the firm is in blue (Democratic) state or red (Republican) state, and the unionization in the industry, and the state minimum wage. We use these instruments as they are correlated with the pay ratio but uncorrelated with the error term in the baseline equation. For example, location of corporate headquarters (in blue or red state), which is

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<sup>4</sup> We acknowledge that labor expense (Compustat XLR) incorporates charges for noncash compensation such as stock options and share grants. To that extent the cash pay ratio is biased downward, adding noise to our analysis.

likely where top executives also reside, can impact corporate culture as well as the tolerance for high pay and pay disparities. In the first stage, we regress both pay ratio and pay ratio<sup>2</sup> on the IVs and other control variables. We elect to use the unadjusted pay ratio calculated using reported labor expense as our conclusions drawn above are invariant to the use of industry adjustment or BLS data. As we can see from the first stage regression reported in Table 4, the blue state dummy is positively and significantly associated with pay ratio and pay ratio<sup>2</sup>, while the unionization variable and state minimum wage variable are significantly negatively associated with the pay ratio, and significantly positively associated with the pay ratio<sup>2</sup>. The second stage estimation results are comparable to that reported in Table 2, i.e., the coefficient on pay ratio is positive and significant, while that on pay ratio<sup>2</sup> is negative and significant. The inflection point is comparable, if slightly lower than that observed in Table 2 at 276. We conclude that the results are robust to the use of two-stage least squares.

#### ***4.5 Piecewise regression***

The above results are consistent with the relationship between firm value and the order pay ratio being non-linear. To further probe this relationship, we run a piecewise linear regression partitioning our pay ratio variable into four indicator variables as follows:

*Payratio P10 = 1 if pay ratio is below 10<sup>th</sup> percentile; zero otherwise.*

*Payratio P10\_50 = 1 if pay ratio is between 10<sup>th</sup> percentile and 50<sup>th</sup> percentile; zero otherwise.*

*Payratio P50\_90 = 1 if pay ratio is between 50<sup>th</sup> percentile and 90<sup>th</sup> percentile; zero otherwise.*

*Payratio P90 = 1 if pay ratio is above 90<sup>th</sup> percentile; zero otherwise.*



The results from Table 5 are consistent with those reported in tables 2 through 4, in that the relationship between firm value, as proxied for by Tobin's Q, and the pay ratio is nonlinear. In particular they provide evidence consistent with firm value increase as the pay ratio increases from low levels, i.e., as it moves from *Payratio P10* to *Payratio P10\_50*. Interestingly, pay ratios above the median do not appear to be associated with increases in firm value, i.e., the coefficient on *Payratio P50\_90* is insignificantly different from zero, and that at extremely high levels, lead to decreases in firm value, i.e., the coefficient on *Payratio P90* is negative and significant.

#### ***4.6 How do firm characteristics affect the relationship between firm value and CEO pay ratio?***

Hypotheses 2a through 2c predicts that firm characteristics affect the relationship between the pay ratio and firm performance. To examine this issue, we re-estimate the first regression from Table 2, after portioning the sample into different groups, namely high-tech vs. low-tech firms, capital intensive vs. labor intensive firms, and domestic vs. multinational firms. The partition of high vs. low tech firms follows in spirit Siegel and Hambrick (2005) and uses the ratio of R&D to sales, while that for capital vs. labor intensive is based upon the definitions of the two industries (i.e., labor intensive industries include agriculture, mining, hospitality, and food service; and capital intensive industries include utilities, construction, and heavy manufacturing, oil production and refining, telecommunications, and transportation); while multinational vs. domestic is based on the Compustat indicator variable, "IDBFLAG", i.e., multinationals are coded as B and domestic coded as D.

We find that that the coefficient of the interaction term is significantly positive for “high-tech” dummy and “capital-intensive” dummy, and insignificantly negative for MNC dummy. Therefore, the effect of CEO-worker pay ratio on firm value is stronger for high-tech firms than for capital intensive firms.

Then we investigate the nonlinearity and inflection point for each partition separately. Table 6 splits the sample into high tech and low tech firms. We do this by using the ratio of R&D to sales and splitting our sample at the median, i.e., firms with a ratio above the median are considered high tech, below the median, low tech. As we can see from Table 6, both high-tech and low-tech firms have an inverse U shape relationship between firm value and CEO-worker pay ratio. Siegel and Hambrick (2005) show that the adverse impact of the vertical pay disparity between executive levels to be much greater in high technology firms where collaboration is more important. Consistent with Siegel and Hambrick (2005), our findings show that the inflection point for low technology firms, 330, is slightly larger than the inflection point for high technology firms, 304. A possible explanation for this very little difference is our reliance on disclosed R&D to classify firms, i.e., as noted by Koh and Reeb (2015), many of the firms with zero R&D on Compustat actually do have R&D expenditures.

Table 7 splits the sample into capital intensive and labor intensive firms. We use agriculture, mining, hospitality and food service industries as labor intensive industries, and utilities, construction, and heavy manufacturing, oil production and refining, telecommunications, and transportation as capital intensive industries. Labor intensive firms are assumed to require more cooperation, communication, and collaboration than capital intensive firms. Consistent with this we find the inflection point higher for capital

intensive firms than for labor intensive firms. However, we do not find the coefficients on pay ratio or pay ratio<sup>2</sup> to be significant for capital intensive firms. For labor intensive firms, the inverse U shape holds, i.e., we find a positive and significant coefficient on the pay ratio and a negative and significant coefficient on the pay ratio<sup>2</sup>.

Table 8 splits the sample into multinational and domestic firms. We expect that multinational firms will have a lower inflection point than domestic firms as the need for communication and coordination are larger for MNCs than for purely domestic firms. In both columns we observe the nonlinear relationship we observe for the full sample. However inconsistent with hypothesis 3a, we observe that the inflection point for multinational corporations is higher lower than it is for purely domestic corporations.

#### ***4.7 Decomposition of CEO-worker pay ratio***

Following Bebchuk et al. (2016), we decompose the CEO-employee pay ratio into the pay disparity within the executive suite and the pay disparity between the executive suite and the average employee to see which, if either, drives our results. We decompose the pay ratio as follows:

$$\frac{CEO\ pay}{Avg\ worker\ pay} = \frac{CEO\ pay}{Avg\ top\ 5\ exec\ pay} \times \frac{Avg\ top\ 5\ exec\ pay}{Avg\ worker\ pay}$$

We have several takeaways from Table 9. First disparity within the executive suite appears to have a negative association with Tobin's Q, as the coefficient on the CEO/executive pay ratio is negative and marginally significant, while that on its square term is insignificant. Second the disparity between the average executive and average employee resembles the nonlinear relationships documented above, i.e., the coefficient on the executive/employee pay ratio is positive and significant, while that on its square term

is negative and significant. Thus, evidence is consistent with the nonlinearity in the pay ratio documented above being attributable to the ratio of average executive pay to the average employee pay.

## **5. Conclusions**

The pay gap between the CEO and the average employees has been subject of much media and political attention. In this study, we examine the consequences of the CEO-employee pay ratio on firm value over the 1997 to 2014 period. We find that the relation between firm value and the pay ratio demonstrates an inverse U shape. Specifically, firm performance appears to initially increase with increases in the pay ratio, but once it hits the inflection point, further increases in the pay ratio are associated with decreases in firm value. Our results are robust to controlling for the endogenous nature of pay ratios and a variety of other sensitivity tests. We also show that the optimal pay ratio or inflection point differs by firm characteristics, i.e., capital intensive firms have a higher inflection point than labor intensive firms. In our final analysis we decompose the pay ratio into that within the executive suite, and that between the executive suite and the rank and file, finding that much of our results can be attributable to the disparity between the pay of the executive suite and that of the rank and file.

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**Table 1 Summary statistics**

	Mean	SD	Median	P25	P75
Pay ratio	56.20	150.11	20.40	10.79	100.04
Cash pay ratio	22.36	57.63	16.91	3.61	69.02
Industry adjusted pay ratio	8.32	103.43	0.00	-6.09	16.25
Tobin's Q	1.21	9.09	1.13	0.92	1.68
Log (book value)	7.26	1.85	7.13	6.16	8.55
ROA	0.08	0.11	0.05	0.03	0.13
Institutional ownership	0.32	0.27	0.25	0.09	0.46
Insider ownership	0.27	0.15	0.25	0.17	0.36
Capex/assets	0.10	2.86	0.16	0.14	0.28
Leverage	0.20	0.16	0.18	0.08	10.11
R&D	0.02	0.16	0.00	0.00	0.03
R&D missing	0.41	0.62	0.42	0.00	0.57
Firm age	26.90	12.10	22.10	6.00	41.60
CEO outsider	0.06	0.43	0.06	0.04	0.80
Eindex	2.68	1.26	3.00	2.00	4.00
CEO ownership $\geq$ 20% (%)	0.24	0.42	0.00	0.00	0.10
CEO tenure	6.50	10.80	5.70	5.20	7.80
STD of return	3.70	3.60	3.60	1.80	4.20
Capital intensity per employee	0.04	0.06	0.03	0.01	0.05
Workforce education (industry)	0.23	0.17	0.26	0.20	0.36
Workforce education (region)	0.29	0.06	0.31	0.20	0.35
Industry concentration	0.05	0.13	0.06	0.02	0.07
Multinational dummy	0.11	0.30	0.00	0.00	0.00
Headquarter_blue state dummy	0.42	0.11	0.48	0.31	0.51
State minimum wage	6.32	1.22	6.50	5.15	7.25
Corporate tax rate	0.21	0.36	0.25	0.12	0.48

Pay ratio is CEO total compensation scaled by average worker pay. Industry-adjusted pay ratio is calculated as the pay ratio minus the median pay ratio of the firms in Compustat in a given two-digit SIC industry and year. Tobin's Q is the market value of equity plus the book value of assets minus the sum of book value of common equity, all divided by the book value of assets. Log (book value) is the natural logarithm of the book value of assets. ROA is net income before taxes plus total compensation and benefits, scaled by total assets. Institutional ownership is the fraction of the shares outstanding owned by institutional investors. Insider ownership is the fraction of shares held by insiders as reported by ExecuComp. Capex/assets is the ratio of capital expenditures to assets. Leverage is the ratio of long-term debt to assets. R&D is the ratio of research and development to sales. R&D missing is a dummy equal to one if R&D data is not available. Firm age is the current year minus the year in which the company was first listed on CRSP. CEO outsider is a dummy that equals to one if the CEO was at the firm less than one year before becoming CEO. Eindex is the entrenchment index of Bebchuk, Cohen, and Ferrell (2009). CEO ownership $\geq$ 20% is a dummy equal to one if the CEO holds at least 20% of outstanding shares. CEO tenure is the number of years since becoming CEO. STD of return is the standard deviation of daily stock return over a calendar year. Capital intensity per



employee is the net property, plant, and equipment per employee in millions of dollars. Workforce education is the fraction of working force with at least a bachelor's degree. Industry concentration is the sales-based Herfindahl index computed over all Compustat firms in the same industry based on two-digit SIC code. MNC dummy is a dummy variable which equals to 1 if the firm is a multinational firm based on Compustat data item "IDBFLAG" which indicates whether a firm operates domestically (D) or both domestically and internationally (B). Headquarter\_blue state dummy is a dummy variable equals to one if the headquarter of the firm locates in a "blue" state (Democratic state). Unionization is the percentage of unionized industry workers. State minimum wage is from National Conference of State Legislatures (NCSL). Corporate tax rate is the tax rate calculated from Income Statement.

**Table 2 Regression of firm value on CEO- average worker total pay ratio**

	Dependent variable = Tobin's Q					
	Total pay ratio		Industry adjusted pay ratio		BLS	
	(1)	(2)	(3)	(4)	(5)	(6)
Pay ratio	-0.00109*** (0.0021)	0.0291** (0.0322)	0.000152** (7.65e-05)	0.000174** (7.67e-05)	3.93e-06*** (8.82e-07)	0.00432*** (0.0014)
Pay ratio <sup>2</sup>		-3.21e-05*** (1.02e-05)		-5.81e-06*** (1.94e-07)		-5.51e-07*** (1.16e-06)
Tobin's Q <sub>t-1</sub>	0.00288*** (0.0006)	0.00292*** (0.0005)	0.663*** (0.0178)	0.663*** (0.0178)	0.000560*** (0.000194)	0.000555*** (0.0002)
Log (book value)	0.138*** (0.0065)	0.137*** (0.0066)	0.0312*** (0.00813)	0.0317*** (0.00811)	0.116*** (0.00138)	0.117*** (0.00146)
ROA	0.601*** (0.0912)	0.586*** (0.0928)	3.742*** (0.217)	3.796*** (0.217)	0.503*** (0.0415)	0.506*** (0.0419)
Institutional ownership	-0.0285 (0.0182)	-0.0288 (0.0182)	0.0274 (0.0561)	0.0239 (0.0560)	0.00496 (0.0105)	0.00502 (0.0106)
Insider ownership	-0.0776 (0.0744)	-0.0767 (0.0744)	-0.0110 (0.0579)	-0.0139 (0.0578)	0.00210 (0.0115)	0.00222 (0.0115)
Capex/assets	-0.635*** (0.1150)	-0.622*** (0.1160)	-0.655** (0.265)	-0.671** (0.264)	-0.161*** (0.0460)	-0.162*** (0.0460)
Leverage	-0.0164 (0.0542)	-0.0161 (0.0542)	-0.247*** (0.0768)	-0.248*** (0.0766)	-0.0659*** (0.0135)	-0.0650*** (0.0136)
R&D	-0.941** (0.4300)	-1.005** (0.4370)	2.550*** (0.956)	2.035** (0.968)	0.187 (0.165)	0.185 (0.165)
R&D missing	-0.0650*** (0.0246)	-0.0650*** (0.0246)	0.00324 (0.0554)	0.00273 (0.0552)	0.0122 (0.0107)	0.0121 (0.0107)
Firm age	-0.000606 (0.0008)	-0.000497 (0.000834)	-0.00438* (0.00226)	-0.00426* (0.00226)	-0.000256 (0.000434)	-0.000253 (0.000434)
CEO outsider	0.0742 (0.0256)	0.0740 (0.0256)	-0.0367 (0.0580)	-0.0382 (0.0578)	0.0305*** (0.0108)	0.0305*** (0.0108)
Eindex	-0.00254 (0.0061)	-0.00264 (0.00605)	-0.00465 (0.0114)	-0.00437 (0.0113)	0.000456 (0.00203)	0.000423 (0.00203)
CEO ownership>=20%	-0.0628** (0.0271)	-0.0611** (0.0272)	0.0926 (0.0806)	0.0885 (0.0804)	0.0209* (0.0114)	0.0209* (0.0114)
CEO tenure	0.00763 (0.0105)	0.00855 (0.0106)	-0.00128 (0.00109)	-0.00135 (0.00109)	-0.00562* (0.00310)	-0.00540* (0.00314)
STD of return	0.953*** (0.0640)	0.957*** (0.0642)	0.857*** (0.0219)	0.858*** (0.0214)	0.955*** (0.0178)	0.953*** (0.0183)
Capital intensity per employee	-0.0709**	-0.0686**	-0.154	-0.173	0.0149	0.0151

	(0.0277)	(0.0279)	(0.616)	(0.618)	(0.0108)	(0.0108)
Workforce education (industry)	-0.0745**	-0.0710**	-0.112*	-0.114*	-0.00415	-0.00401
	(0.0290)	(0.0293)	(0.0590)	(0.0588)	(0.0106)	(0.0106)
Workforce education (region)	-0.0717	-0.0711	-0.000437	-0.0155	0.00799	0.00792
	(0.0866)	(0.0866)	(0.0915)	(0.0912)	(0.0101)	(0.0101)
Industry concentration	-0.0845***	-0.0843***	-0.0576	-0.0562	0.00839	0.00836
	(0.0269)	(0.0270)	(0.0625)	(0.624)	(0.00993)	(0.00993)
Multinational dummy	-0.0592**	-0.0650**	-0.321***	-0.323***	0.0123	0.0123
	(0.0271)	(0.0279)	(0.0588)	(0.0586)	(0.0101)	(0.0102)
Managerial ability score	-0.0789	-0.0792	0.0737	0.0721	0.0124	0.0123
	(0.0761)	(0.0761)	(0.0563)	(0.0561)	(0.00997)	(0.00997)
Year-fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Firm-fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,920	8,920	8,920	8,920	10,297	10,297
R-squared	0.613	0.613	0.626	0.627	0.707	0.709
Inflection point		453		310		392

The table presents regression results where the dependent variable is firm value as measured by Tobin's Q. Payratio is the relative total pay of CEO and average workers. The main independent variables of interests are the CEO-worker pay ratio and (CEO-worker pay ratio)<sup>2</sup>. In model (1) and (2), the CEO-worker pay ratio is calculated as the CEO total compensation to average employees' remuneration for every firm. In model (3) and (4), the CEO-worker pay ratio is taken industry adjustments at two-digit standard industrial classification (SIC) level, by subtracting the industry median CEO-worker pay ratio. In model (5) and (6), the CEO-worker pay ratio is calculated as the CEO total compensation divided by the industry average worker pay from Bureau of Labor Statistics (BLS). All the variables are defined in appendix. Standard error, given in parentheses, are corrected for heteroscedasticity. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5% and 10% levels, respectively.

**Table 3 Regression of firm value on CEO-average worker cash pay ratio**

	Dependent variable = Tobin's Q					
	Total pay ratio		Industry adjusted pay ratio		BLS	
	(1)	(2)	(3)	(4)	(5)	(6)
Pay ratio	-0.0158** (0.0071)	0.342** (0.012)	-1.33e-06*** (6.05e-07)	6.78e-06*** (3.58e-07)	-0.000230*** (5.88e-05)	0.0111* (0.00605)
Pay ratio <sup>2</sup>		-0.0104*** (0.00673)		-3.23e-08*** (6.06e-09)		-7.42e-05* (5.72e-06)
Tobin's Q <sub>t-1</sub>	0.738*** (0.0699)	0.727*** (0.0699)	0.544*** (0.0693)	0.546*** (0.0695)	0.658*** (0.0207)	0.652*** (0.0209)
Log (book value)	0.0444*** (0.0137)	0.0509*** (0.0137)	0.0904*** (0.0108)	0.0904*** (0.0109)	0.0313*** (0.00922)	0.0256*** (0.00972)
ROA	1.621*** (0.606)	1.791*** (0.613)	3.324*** (0.319)	3.345*** (0.322)	4.548*** (0.277)	4.486*** (0.278)
Institutional ownership	0.0244 (0.121)	0.0279 (0.120)	0.0583 (0.0534)	0.0569 (0.0535)	0.0599 (0.0703)	0.0584 (0.0702)
Insider ownership	-0.139 (0.162)	-0.149 (0.161)	-0.0418 (0.0660)	-0.0491 (0.0668)	-0.0578 (0.0763)	-0.0609 (0.0762)
Capex/assets	0.361 (0.766)	0.214 (0.767)	0.958*** (0.350)	0.964*** (0.351)	-1.230*** (0.306)	-1.204*** (0.306)
Leverage	-0.578 (0.360)	-0.581 (0.358)	-0.332 (0.0928)	-0.368 (0.0928)	-0.256*** (0.0898)	-0.279*** (0.0906)
R&D	1.352 (2.857)	2.100 (2.883)	0.677 (0.866)	0.479 (0.879)	1.491 (1.101)	1.556 (1.101)
R&D missing	0.0278 (0.163)	0.0274 (0.162)	-0.0280 (0.0563)	-0.0291 (0.0563)	0.0917 (0.0713)	0.0937 (0.0712)
Firm age	0.00184 (0.00547)	0.000580 (0.00550)	-0.00118 (0.00214)	-0.00113 (0.00214)	-0.00374 (0.00289)	-0.00382 (0.00289)
CEO outsider	-0.0440 (0.170)	-0.0462 (0.169)	0.0332 (0.0586)	0.0323 (0.0586)	-0.0501 (0.0718)	-0.0511 (0.0717)
Eindex	-0.0247 (0.0402)	-0.0236 (0.0399)	-0.00963 (0.0125)	-0.00953 (0.0125)	0.00668 (0.0135)	0.00753 (0.0135)
CEO ownership>=20%	0.0180 (0.180)	-0.00148 (0.179)	-0.145 (0.0988)	-0.146 (0.0989)	-0.143* (0.0762)	-0.142* (0.0761)
CEO tenure	-0.00515 (0.00391)	-0.00473 (0.00390)	0.00155 (0.00117)	0.00152 (0.00117)	-0.000440 (0.00129)	-0.000326 (0.00129)
STD of return	-1.329 (0.957)	-0.989 (0.977)	0.117 (0.590)	0.117 (0.591)	0.352 (0.274)	0.375 (0.274)

Capital intensity per employee	0.370 (0.184)	0.396 (0.184)	0.0324 (0.0623)	0.0314 (0.0624)	-0.216*** (0.0721)	-0.219*** (0.0720)
Workforce education (industry)	0.218 (0.193)	0.178 (0.194)	-0.0215 (0.0555)	-0.0217 (0.0556)	-0.0161** (0.0076)	-0.0195** (0.0086)
Workforce education (region)	0.125 (0.177)	0.118 (0.176)	0.204 (1.134)	0.102 (0.153)	0.213 (0.673)	0.215 (0.673)
Industry concentration	-0.0225 (0.179)	-0.0254 (0.178)	0.211* (0.013)	0.310 (0.016)	0.0907 (0.0661)	0.0913 (0.0660)
Multinational dummy	-0.0824 (0.173)	-0.0796 (0.172)	0.0207 (0.0200)	0.0208 (0.0200)	-0.0458 (0.0664)	-0.0456 (0.0663)
Managerial ability score	-0.0929 (0.180)	-0.0247 (0.184)	0.00144 (0.127)	-0.00176 (0.128)	-0.0348 (0.0676)	-0.0348 (0.0675)
Year-fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Firm-fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,920	8,920	8,920	8,920	10,297	10,297
R-squared	0.674	0.675	0.686	0.687	0.680	0.681
Inflection point		41		54		74

The table presents regression results where the dependent variable is firm value as measured by Tobin's Q. Payratio is the relative cash pay of CEO and average workers. The main independent variables of interests are the CEO-worker cash pay ratio and (CEO-worker pay cash ratio)<sup>2</sup>. In model (1) and (2), the CEO-worker pay ratio is calculated as the CEO cash compensation to average employees' cash pay for every firm. In model (3) and (4), the CEO-worker cash pay ratio is taken industry adjustments at two-digit standard industrial classification (SIC) level, by subtracting the industry median CEO-worker cash pay ratio. In model (5) and (6), the CEO-worker cash pay ratio is calculated as the CEO cash compensation divided by the industry average worker cash pay from Bureau of Labor Statistics (BLS). All the variables are defined in appendix. Standard error, given in parentheses, are corrected for heteroscedasticity. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5% and 10% levels, respectively.

**Table 4 Effect of CEO-average worker pay ratio on firm value (2SLS)**

**Panel A:**

	<b>Dependent variable= total pay ratio</b>	<b>Dependent variable= total pay ratio<sup>2</sup></b>	<b>Dependent variable= Tobin's Q</b>	
Pay ratio			-0.000130**	4.45e-05
			(6.13e-05)	(2.91e-05)
Pay ratio <sup>2</sup>				-1.17e-07***
				(2.33e-08)
Headquarter_blue state dummy	72.78**	1902.03***		
	(33.69)	(255.16)		
Unionization	-14.96*	432.16*		
	(8.40)	(245.54)		
State minimum wage	-10.237*	20.217		
	(1.803)	(1.659)		
Tobin's Q <sub>t-1</sub>	3.654***	29.35*	0.718***	0.718***
	(0.590)	(15.25)	(0.0514)	(0.0515)
Log (book value)	0.386**	-3.400	0.0727***	0.0701***
	(0.171)	(2.947)	(0.0243)	(0.0249)
ROA	5.495***	1,281	3.947***	3.955***
	(1.178)	(930.0)	(0.559)	(0.560)
Institutional ownership	0.519	2,453	-0.397	-0.378
	(0.525)	(3,520)	(0.564)	(0.566)
Insider ownership	0.0419	-9.740	0.112	0.111
	(0.187)	(345.1)	(0.150)	(0.150)
Capex/assets	0.208	-0.573	1.611	1.528
	(0.185)	(62.13)	(0.991)	(1.006)
Leverage	0.0234***	-96.69	-0.387**	-0.400**
	(0.070)	(5,481)	(0.184)	(0.186)
R&D	7.721	3,679	-2.009	-1.752
	(7.173)	(6,325)	(5.670)	(5.701)
R&D missing	-0.161	1,890	-0.126	-0.121
	(0.176)	(1,663)	(0.147)	(0.147)
Firm age	-0.201	-43,214	-0.00441	-0.00449
	(0.167)	(46,931)	(0.00724)	(0.00726)
CEO outsider	-0.0867	-6.386*	-0.125	-0.118
	(0.164)	(3,578)	(0.155)	(0.156)
Eindex	-0.00689	361.8	-0.0316	-0.0314
	(0.166)	(1,019)	(0.0279)	(0.0280)
CEO ownership>=20%	0.0236	1,006	0.0254	0.0273
	(0.166)	(3,631)	(0.137)	(0.137)
CEO tenure	0.00563	-163.3	-0.00238	-0.00255
	(0.165)	(253.9)	(0.00274)	(0.00277)
STD of return	0.433*	45.16	-0.446***	-0.442***
	(0.261)	(57.60)	(0.142)	(0.142)
Capital intensity per employee	6.071**	-252.0	-0.190	-0.185
	(2.52)	(361.6)	(0.154)	(0.155)
Workforce education (industry)	3.148	1,475	0.0300	0.0330
	(63.341)	(1.122)	(0.141)	(0.141)
Workforce education (region)	22.413	-1,711	-0.184	-0.174
	(58.210)	(1,289)	(0.144)	(0.146)
Industry concentration	46.465	7.695	-0.0622	-0.0591
	(72.170)	(6.803)	(0.142)	(0.142)
Multinational dummy	28.609	1,381	-0.387**	-0.391**
	(67.879)	(1,487)	(0.153)	(0.154)
Managerial ability score	-63.856	-29,140	-0.147	-0.144

Year-fixed effect	(67.171)	(44,786)	(0.138)	(0.138)
Firm-fixed effect	Yes	Yes	Yes	Yes
Observations	8,920	8,920	8,920	8,920
R-squared	0.362	0.261	0.667	0.668
Inflection point				276

**Panel B:**

	Dependent variable= total cash pay ratio	Dependent variable= total cash pay ratio <sup>2</sup>	Dependent variable= Tobin's Q	
Pay ratio			1.78e-07*** (6.36e-08)	0.00031** (1.32e-05)
Pay ratio <sup>2</sup>				-2.05e-06** (9.78e-07)
Headquarter_blue state dummy	138.81 (106.23)	1902.03*** (255.16)		
Unionization	95.75* (53.49)	432.16* (245.54)		
State minimum wage	-9.366** (0.275)	-20.31** (2.292)		
Tobin's Q <sub>t-1</sub>	376.1** (174.88)	29.35* (15.25)	0.627*** (0.0473)	0.629*** (0.0474)
Log (book value)	-0.796 (3.582)	-3.400 (2.947)	0.0118*** (0.0228)	0.0129*** (0.0228)
ROA	1,124 (1,035)	1,281 (930.0)	3.160*** (0.509)	3.163*** (0.509)
Institutional ownership	-3,721 (4,457)	2,453 (3,520)	-1.612** (0.707)	-1.671** (0.712)
Insider ownership	124.7 (357.0)	-9.740 (345.1)	0.0121 (0.0949)	0.00766 (0.0952)
Capex/assets	22.67 (62.63)	-0.573 (62.13)	0.322 (0.670)	0.330 (0.670)
Leverage	-937.5 (8,304)	-96.69 (5,481)	-0.373 (0.240)	-0.382 (0.241)
R&D	3,171 (8,155)	3,679 (6,325)	2.229** (1.008)	2.198** (1.010)
R&D missing	1,855 (1,372)	1,890 (1,663)	0.0636 (0.133)	0.0621 (0.133)
Firm age	-31,901 (48,999)	-43,214 (46,931)	-0.00294 (0.00427)	-0.00251 (0.00431)
CEO outsider	714.5 (35,918)	-6.386* (3,578)	-0.0190 (0.131)	-0.0170 (0.131)
Eindex	-21,437 (36,290)	361.8 (1,019)	-0.0248 (0.0282)	-0.0249 (0.0283)
CEO ownership>=20%	1,625 (1,276)	1,006 (3,631)	-0.0369 (0.143)	-0.0368 (0.143)
CEO tenure	-10,294 (45,936)	-163.3 (253.9)	0.00177 (0.00281)	0.00155 (0.00283)
STD of return	-4,313** (2,192)	45.16 (57.60)	-0.257* (0.140)	-0.251* (0.141)
Capital intensity per employee	-3.096 (4.138)	-252.0 (361.6)	-0.0481 (0.155)	-0.0466 (0.155)
Workforce education (industry)	332.1 (1,112)	1.475 (1.122)	0.243* (0.137)	0.243* (0.138)

Workforce education (region)	101.7 (417.9)	-1,711 (1,289)	-0.00985 (0.139)	-0.00884 (0.140)
Industry concentration	-6,439 (4,459)	7.695 (6.803)	0.179 (0.151)	0.186 (0.152)
Multinational dummy	-23.72 (273.5)	1,381 (1,487)	-0.0494 (0.129)	-0.0469 (0.129)
Managerial ability_score	64.81 (61.17)	-29,140 (44,786)	0.0741 (0.132)	0.0771 (0.132)
Year-fixed effect	Yes	Yes	Yes	Yes
Firm-fixed effect	Yes	Yes	Yes	Yes
Observations	8,920	8,920	8,920	8,920
R-squared	0.302	0.261	0.710	0.710
Inflection point				73

The table presents regression results of the two-stage model. instruments are Headquarter\_blue state dummy, unionization and state minimum wage. The second-stage estimation of Tobin's Q regressed on instrumented total pay ratio, instrumented pay ratio squared and the control variables. Panel B provides the first-stage and second stage model estimations where the first stage model is that cash pay ratio is a function of the IVs and control variables, and total cash pay ratio squared is a function of the instrumental variables squared and control variables. All the variables are defined in appendix. Standard error, given in parentheses, are corrected for heteroscedasticity. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5% and 10% levels, respectively.



**Table 5 Piecewise regression of firm value on CEO- average worker pay ratio**

	Dependent variable = Tobin's Q	
	(1)	(2)
Payratio P10	0.0048** (0.0013)	0.158*** (0.060)
Payratio P10_50	0.0511* (0.0189)	0.195* (0.101)
Payratio P50_90	0.0287 (0.0186)	0.0627 (0.168)
Payratio P90	-0.0217** (0.0018)	-0.0666* (0.0372)
Tobin's Q <sub>t-1</sub>		0.613*** (0.0344)
Log (book value)		-0.0786* (0.0456)
ROA		0.120* (0.0640)
Institutional ownership		-0.0806 (0.0831)
Insider ownership		-0.192* (0.0979)
Capex/assets		-0.339 (0.844)
Leverage		-0.561*** (0.160)
R&D		0.503 (0.617)
R&D missing		-0.0654 (0.0949)
Firm age		0.000169 (0.00322)
CEO outsider		-0.0460 (0.0962)
Eindex		-0.0260 (0.0228)
CEO ownership >= 20%		-0.167 (0.109)
CEO tenure		-0.00186 (0.00217)
STD of return		0.0637 (0.433)
Capital intensity per employee		-0.0333 (0.102)
Workforce education (industry)		-0.0292 (0.0960)
Workforce education (region)		0.0813 (0.0989)
Industry concentration		-0.183* (0.0962)
Multinational dummy		-0.181* (0.0971)
Managerial ability score		0.0436 (0.0983)
Year-fixed effect	Yes	Yes
Firm-fixed effect	Yes	Yes

Observations	8920	8920
R-squared	0.62	0.79

The table presents regression results where the dependent variable is the firm value as measured by Tobin's Q. In the first regression, the independent variables are four indicator variables for the different percentiles ranks of pay ratios: below 10th percentile, 10th percentile to 50th percentile, 50th percentile to 90th percentile and above 90th percentile. In the second regression, in addition to the four indicator variables, we add control variables. All the variables are defined in appendix. Standard error, given in parentheses, are corrected for heteroscedasticity. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5% and 10% levels, respectively.

**Table 6 High-tech vs. low-tech firms**

	Dependent variable = Tobin's Q	
	High-tech	Low-tech
Pay ratio	0.000122* (6.78e-05)	0.000423** (0.000206)
Pay ratio <sup>2</sup>	-4.01e-06* (2.17e-06)	-5.39e-07** (2.57e-07)
Tobin's Q <sub>t-1</sub>	0.816*** (0.0204)	0.783*** (0.0262)
Log (book value)	-0.0472* (0.0278)	-0.0600*** (0.0117)
ROA	0.1062** (0.0052)	0.0723*** (0.0137)
Institutional ownership	-0.0308 (0.0679)	0.169 (0.109)
Insider ownership	0.0467 (0.0767)	-0.0917 (0.104)
Capex/assets	0.626 (0.417)	0.274 (0.467)
Leverage	-0.298*** (0.0985)	-0.294** (0.141)
R&D	2.965*** (1.060)	0.125 (3.172)
R&D missing	0.0342 (0.0782)	-0.00119 (0.105)
Firm age	-0.000496 (0.00271)	-0.00233 (0.00573)
CEO outsider	0.107 (0.0721)	0.00412 (0.0995)
Eindex	0.0139 (0.0149)	-0.00844 (0.0208)
CEO ownership >= 20%	-0.496 (0.347)	0.307*** (0.109)
CEO tenure	-0.000397 (0.00144)	4.64e-05 (0.00199)
STD of return	-0.221 (0.347)	-1.338*** (0.357)
Capital intensity per employee	-0.232 (0.760)	-0.334 (0.409)
Workforce education (industry)	-0.00752 (0.0705)	-0.276 (0.201)
Workforce education (region)	0.0998 (0.183)	0.588 (0.441)
Industry concentration	-0.0344 (0.0719)	-0.175* (0.104)
Multinational dummy	0.243 (0.727)	0.0177 (0.101)
Managerial ability score	0.0842 (0.0729)	-0.0259 (0.104)
Year-fixed effect	Yes	Yes
Firm-fixed effect	Yes	Yes
Observations	1360	2486
R-squared	0.682	0.777
Inflection point	304	330

The table presents regression results where the dependent variable is firm value as measured by Tobin's Q. Pay ratio is the relative total pay of CEO to that of the average worker. The regression in the first column is estimated over high-tech firms and the regression in the second column is estimated over low-tech firms. The partition of high vs. low tech are based on the median of R&D to sales ratio. Intercept is included but not reported. All the variables are defined in appendix. Standard error, given in parentheses, are corrected for heteroscedasticity. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5% and 10% levels, respectively.

**Table 7 Capital intensive vs. labor intensive firms**

	Dependent variable = Tobin's Q	
	Capital intensive	Labor intensive
Pay ratio	0.00104 (0.00112)	0.00238** (0.000988)
Pay ratio <sup>2</sup>	-3.29e-08 (3.52e-08)	-1.68e-05** (7.65e-06)
Tobin's Q <sub>t-1</sub>	0.484*** (0.121)	0.0482 (0.202)
Log (book value)	0.0206 (0.0377)	-0.0531 (0.0721)
ROA	1.802* (0.987)	-0.105 (1.061)
Institutional ownership	-0.148 (0.140)	0.226 (0.238)
Insider ownership	-0.331 (0.213)	0.180 (0.214)
Capex/assets	-3.108** (1.309)	2.048* (1.159)
Leverage	-1.339** (0.531)	-1.387 (1.077)
R&D	-0.580 (1.900)	32.25** (12.03)
R&D missing	-0.349 (0.219)	0.244 (0.241)
Firm age	-0.0122** (0.00550)	0.0211 (0.0155)
CEO outsider	-0.429** (0.210)	0.496 (0.319)
Eindex	-0.444** (0.201)	0.622 (0.434)
CEO ownership >= 20%	1.540** (0.641)	1.697** (0.728)
CEO tenure	-0.00241 (0.00364)	0.00662 (0.0138)
STD of return	-1.172 (1.153)	-5.452 (3.234)
Capital intensity per employee	-0.489** (0.239)	0.0998 (0.305)
Workforce education (industry)	-0.491* (0.293)	0.165 (0.196)
Workforce education (region)	-0.367 (0.328)	-0.118 (0.276)
Industry concentration	-0.817*** (0.283)	0.522 (0.303)
Multinational dummy	-0.836*** (0.306)	0.149 (0.250)
Managerial Ability Score	-0.751*** (0.280)	-0.0508 (0.259)
Year-fixed effect	Yes	Yes
Firm-fixed effect	Yes	Yes
Observations	1,806	1,093
R-squared	0.866	0.701
Inflection point	158	71

The table presents regression results where the dependent variable is firm value as measured by Tobin's Q. Pay ratio is the relative total pay of CEO to the average worker. The regression in the first column is estimated for capital intensive firms and the regression in the second column is estimated for labor intensive firms. The partition is based on the two-digit SICs. Intercept is included but not reported. All the variables are defined in appendix. Standard error, given in parentheses, are corrected for heteroscedasticity. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5% and 10% levels, respectively.

**Table 8 Domestic vs. multinational firms**

	Dependent variable = Tobin's Q	
	Multinational	Domestic
Pay ratio	0.000579 (0.000387)	0.00127*** (0.00017)
Pay ratio <sup>2</sup>	-7.38e-06*** (1.23e-060)	-5.20e-06* (3.10e-06)
Tobin's Q <sub>t-1</sub>	0.718*** (0.119)	0.762*** (0.0561)
Log (book value)	-0.0137 (0.0221)	0.0601** (0.0247)
ROA	3.161*** (0.961)	2.593*** (0.715)
Institutional ownership	0.0173 (0.142)	-0.0183 (0.117)
Insider ownership	0.175 (0.137)	-0.101 (0.169)
Capex/assets	2.106 (2.012)	-0.562 (0.427)
Leverage	-0.00644 (0.229)	-0.201 (0.163)
R&D	1.457 (1.664)	-2.114 (2.369)
R&D missing	0.226 (0.166)	-0.166 (0.136)
Firm age	-0.000931 (0.00734)	0.00582 (0.00469)
CEO outsider	-0.184 (0.257)	-0.0458 (0.126)
Eindex	0.0254 (0.0462)	0.00864 (0.0374)
CEO ownership >= 20%	0.0545 (0.185)	-0.148 (0.129)
CEO tenure	-0.00263 (0.00509)	0.000754 (0.00226)
STD of return	-2.046* (1.098)	1.014* (0.604)
Capital intensity per employee	0.200 (0.160)	0.304** (0.129)
Workforce education (industry)	-0.0356 (0.175)	-0.182 (0.136)
Workforce education (region)	0.276 (0.166)	-0.106 (0.116)
Industry concentration	0.514 (0.519)	-0.0265 (0.126)
Managerial ability score	0.503* (0.283)	0.158 (0.125)
Year-fixed effect	Yes	Yes
Firm-fixed effect	Yes	Yes
Observations	6,233	1,985
R-squared	0.903	0.920
Inflection point	392	122

The table presents regression results where the dependent variable is firm value as measured by Tobin's Q. Pay ratio is the total pay of the CEO to the average worker. The regression in the first column is estimated for multinational firms and the regression in the second column is estimated for domestic firms. The partition is based on Compustat variable IDBFLAG, i.e., B represents multinational and D represents solely domestic firms. Intercept is included but not reported. All the variables are defined in appendix. Standard errors, given in parentheses, are corrected for heteroscedasticity. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5% and 10% levels, respectively.



**Table 9 Decomposition of the pay ratio**

	Dependent variable = Tobin's Q
CEO to Executives pay ratio	-0.00667* (0.0856)
(CEO to Executives pay ratio) <sup>2</sup>	-0.00578 (0.0218)
Executives to worker pay ratio	0.000486*** (0.000177)
(Executives to worker pay ratio) <sup>2</sup>	-3.36e-7*** (4.973-11)
Tobin's Q <sub>t-1</sub>	0.470*** (0.0236)
Log (book value)	-0.104*** (0.0380)
ROA	2.986*** (0.321)
Institutional ownership	0.00719 (0.0562)
Insider ownership	-0.164** (0.0690)
Capex/assets	-0.417 (0.361)
Leverage	-0.460*** (0.146)
R&D	2.010 (3.332)
R&D missing	-0.0178 (0.0680)
Firm age	-0.00343 (0.00272)
CEO outsider	-0.110 (0.0711)
Eindex	-0.0287 (0.0186)
CEO ownership $\geq$ 20%	0.290** (0.119)
CEO tenure	0.00192 (0.00181)
STD of return	-0.154 (0.269)
Capital intensity per employee	-0.0178 (0.0680)
Workforce education	-0.110 (0.0711)
Industry concentration	-0.1000 (0.0768)
Year-fixed effect	Yes
Firm-fixed effect	Yes
Observations	8,920
R-squared	0.799

The table presents regression results where the dependent variable is firm value as measured by Tobin's Q. Intercept is included but not reported. All the variables are defined in appendix. Standard error, given in parentheses, are corrected for heteroscedasticity. \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5% and 10% levels, respectively.