Compensated Fairly? A Regression-Based Study of CEO Pay and Financial Outcomes

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Problem Statement

Executive compensation remains a polarizing topic in corporate governance, particularly as firms across different sectors experience growth, disruption, and increasing shareholder scrutiny. While proponents argue that high pay is necessary to attract and retain top talent, critics question whether such compensation reflects shareholder value creation.
This project examines the relationship between executive compensation and company performance among publicly traded U.S. companies from 2010 to 2024. Specifically, it asks: **Does higher executive compensation lead to better company outcomes, once firm size, executive rank, and company age are controlled for?** Using real-world data from WRDS (ExecuComp and Compustat), we investigate whether compensation levels are aligned with key firm success metrics, such as return on assets (ROA) and stock market performance. The goal is to identify patterns of overpayment or underpayment and assess whether executive rewards are justified by measurable performance.

Executive Summary

Executive pay practices continue to generate debate among investors, policymakers, and the public. This study investigates whether highly compensated executives deliver superior firm outcomes, utilizing panel data from publicly traded U.S. companies from 2010 to 2024. Data is sourced from the WRDS ExecuComp database (providing detailed compensation information) and merged with Compustat financial fundamentals to build a comprehensive firm-executive-year panel.
We employ multivariate regression models, controlling for key factors such as firm size (measured by log assets), company age (in years since founding), and executive role (e.g., CEO, CFO, President). Our modeling strategy includes two components:

- **Compensation Benchmarking (Model A):** Predicts expected executive pay based on firm characteristics to detect overpayment or underpayment relative to peers.
- **Performance Benchmarking (Model B):** Predicts expected firm performance based on size, industry, and age to identify outperformers and underperformers.

By combining these models, we analyze the alignment between pay and performance. Results are visualized through a Streamlit dashboard featuring scatter plots, time-series charts, heatmaps, and firm-level performance scorecards. This project provides data-driven insights into whether executive compensation practices are performance-justified or indicate governance inefficiencies.

Related Research

Prior research on executive compensation provides an essential context for this study.

- In "Pay Without Performance," **Bebchuk and Fried (2004)** argue that executive compensation often reflects managerial power dynamics rather than being tied to a firm's success. Their work suggests that weak governance structures can lead to excessive or misaligned pay.
- **Jensen and Murphy (1990)** examined the sensitivity of CEO wealth to firm performance, finding that despite theoretical expectations, the actual relationship was relatively weak. This raised early concerns about whether incentive structures motivate executives to maximize shareholder value.
- **Core, Guay, and Larcker (2003)** provided a more nuanced view, finding mixed evidence across various industries. In some sectors, executive pay and performance appeared moderately aligned, while in others, weak or no alignment was observed. This highlights the importance of sector-specific analysis, as exemplified by the technology focus of the present study.

Dataset Overview

We used historical dataset for all the companies listed on US stock exchange for the period of 2010-2024 from WRDS (Compustat and Execucomp).

1. Executive compensation [Source: ExecuComp (via WRDS)]

Field (WRDS Name)	**Description**
GVKEY	Company key to link with Compustat
EXEC_FULLNAME	Executive's full name
TICKER	Ticker symbol
CUSIP	CUSIP (used to link with industry)
YEAR	Fiscal year
TDC1	Total Summary Compensation
SALARY	Base salary
BONUS	Annual bonus
STOCK_AWARDS	Equity grants

OPTION_AWARDS	Stock options
TITLE	Job title (filter for CEO, CFO, etc.)
AGE	Executive's age
JOINED_CO	Executive's tenure (optional)

2. Financial data [Source: Compustat North America - Annual Fundamentals (FUNDA)]

Field (WRDS Name)	**Description**
GVKEY	Link to ExecuComp
CUSIP	CUSIP code
FYEAR	Fiscal year
AT	Total Assets (used to control for size)
REVT	Revenue
NI	Net Income
ROA	Return on Assets = NI / AT
EMP	Number of employees
MKVALT	Market value of equity
CEQ	Common equity
TIC	Ticker symbol
SIC	Industry classification code

Data Cleaning Steps

a. **Filter ExecuComp**:
   - Only `TITLE` containing "CEO"
   - Kept only `TDC1 > 0`
   - Filter by years: 2010–2024

b. **Filter Compustat**:
   - Retain observations matching selected SIC codes
   - Kept firms with non-missing `AT`, `NI`, `ROA`, `FYEAR`

c. **Merge**:

- Merged on `GVKEY` and `FYEAR` (aligns year of performance with pay)
- Dropped firms with missing `TDC1`, `AT`, `ROA`, etc.

d. **Creating Derived Variables**:
   - Log assets = `log(AT)` (proxy for size)
   - Years since founding (firm age; if `FYEAR - FIRSTYEAR`)
   - Binary: Is CEO based on `TITLE`
   - Industry dummy from `SIC` or Fama-French 12-sector mapping

Model Design

a. **Model A:** Compensation Benchmarking
Objective: Estimate the "fair market" compensation for an executive based on firm characteristics, then compare actual pay.

📈 **Model:**

$$\text{TDC1}_{it} = \beta_0 + \beta_1 \cdot \log(\text{Assets}_{it}) + \beta_2 \cdot \text{Revenue}_{it} + \beta_3 \cdot \text{IndustryDummies} + \beta_4 \cdot \text{ExecRank} + \beta_5 \cdot \text{FirmAge}_{it} + \varepsilon$$

Output:

- Predicted pay (Ŷ) = expected/fair compensation
- Actual pay vs. Predicted = Residual
  - Positive residual → Overpaid
  - Negative residual → Underpaid
- Visualize:
  - Scatter plot: Actual vs. Predicted
  - Bar chart: Top 10 Overpaid Execs (positive residuals)
  - Histogram of residuals

b. **Model B:** Company Performance Benchmarking
Objective: Determine whether the company is performing above or below expected levels, considering factors such as size, age, industry, and others.

📈 **Model:**

$$\text{ROA}_{it} = \beta_0 + \beta_1 \cdot \log(\text{Assets}_{it}) + \beta_2 \cdot \text{Revenue}_{it} + \beta_3 \cdot \text{IndustryDummies} + \beta_4 \cdot \text{FirmAge}_{it} + \varepsilon$$

Output:

- Predicted performance (Ŷ) = expected performance
- Actual vs. Predicted = Performance gap
  Positive → Outperformer

Negative → Underperformer

- Visualize:
  - Firm-level dashboard card (e.g., "You're in the 80th percentile of tech firms")
  - Industry averages + company highlight

Combine Both for Pay-Performance Alignment

Comp Residual	Perf Residual	Tag
High	Low	Overpaid & Underperforming
Low	High	Underpaid but Overperforming
Close to 0	Close to 0	In-Line
High	High	High Pay, High Performance

Streamlit Dashboard — Visual Outputs

a. Time Series Line Chart

- Plot CEO pay and firm performance over time
- Show change in alignment year over year

b. Scatter Plot with Trendline

- X: CEO Pay
- Y: ROA / Net Income / Revenue Growth
- Add a regression line
- Highlight “pay-for-no-performance” outliers

c. Heatmap

- Correlation between pay, tenure, firm size, ROA, etc.
- Can also compare across sectors

d. Interactive Filters

- Dropdowns: Industry, Year, Executive Title, Gender
- Sliders: Firm size, Pay range
- Real-time updates for visualizations

e. Bar Charts / Box Plots

- Compare average compensation by industry or firm size
- Box plots to show variance of comp vs. performance group

f. Summary Stats / KPI Tiles

- Avg CEO Pay
- Top 5 Paid Executives
- Avg ROA for top-paid firms
- Compensation-to-performance “scorecard”

Summary of Findings

This report presents a regression-based analysis of CEO compensation and firm performance in U.S. public companies over the period from 2010 to 2024. The objective was to assess the strength and structure of the pay-performance relationship, both overall and within specific industries. The findings suggest that executive compensation is only modestly correlated with firm-level financial outcomes, with widespread instances of misalignment and sectoral variation.

1. Correlation Between CEO Pay and Firm Performance

Across all U.S. companies studied, the correlation between CEO compensation and firm performance indicators such as net income and revenue was found to be 0.20. This indicates a low, positive relationship, meaning that while CEO pay tends to increase with better performance, it only explains approximately 20% of the variance in these financial metrics. Similarly, the correlation between CEO pay and return on assets (ROA) was even weaker, at just 0.03, suggesting an almost negligible relationship. Nonetheless, further regression analysis indicated that around 30% of the variance in ROA may be associated with CEO compensation, though this may be due to the influence of other variables within the model.

2. Pay-Performance Alignment Metrics

Our analysis of pay-performance alignment, defined as the percentage of companies where a CEO’s pay rank is within 25 percentage points of their performance rank, shows that 51.7% of companies exhibit alignment, while 48.3% demonstrate misalignment. This near-even split suggests a neutral trend across the sample—indicating that, on average, firms are equally likely to overcompensate or undercompensate their CEOs relative to company performance.

Additionally, we identified that 4.3% of firms in the top quartile of CEO pay fall into the bottom quartile for performance. These outliers are clear examples of “pay-for-no-performance” and represent a critical area of concern for stakeholders interested in governance and accountability.

3. Top-Paid Executives and Company Outcomes

An in-depth examination of the top five highest-paid executives revealed that while these individuals received generous compensation packages, their firms did not necessarily outperform peers. The average return on assets (ROA) for firms employing these executives

was approximately 5.12%—a positive figure, but not indicative of exceptional performance. Companies such as Palantir Technologies and DoorDash, which provided substantial executive pay, reported only moderate financial outcomes. This reinforces the idea that high compensation levels are not always matched by superior firm results in terms of net income or ROA.

4. Time Series Analysis: 2010 to 2024

From 2010 to 2024, CEO compensation across all industries demonstrated a consistent upward trend, with only minor interruptions. Even during the COVID-19 pandemic in 2020—when firm performance metrics, especially ROA, experienced significant declines—executive pay continued to rise. This temporal disconnect between compensation and firm-level financial performance raises questions about the responsiveness of pay structures to short-term performance fluctuations. Overall, while firm performance was volatile over the years, executive pay increased steadily, suggesting limited linkage between the two.

5. Outliers and Pay-for-No-Performance Cases

Scatter plot analysis further highlighted numerous outliers in the pay-performance relationship. Several executives who received exceptionally high compensation led firms that posted negative or near-zero ROA. These examples underscore the systemic issue of executive compensation not being closely tied to outcomes. The persistence of such outliers across industries, company sizes, and years illustrates that elevated pay often lacks corresponding justification in firm performance, making a strong case for reevaluating compensation design.

6. Industry-Specific Patterns in Pay-Performance Relationships

Sectoral analysis based on correlation heatmaps revealed notable variations in how executive pay aligns with firm performance:

- In the **Utility sector**, CEO pay showed strong correlations with firm size metrics such as revenue (0.68) and total assets (0.65), but an almost non-existent correlation with ROA (0.01). This suggests that compensation in this sector is driven more by scale than profitability.

- The **Communications sector** exhibited weak alignment overall, with correlations of 0.09 with ROA and 0.24 with net income, indicating a tenuous link between compensation and core performance outcomes.

- Conversely, the **Industrial Machinery sector** demonstrated stronger pay-performance alignment, with correlations of 0.51 for net income and 0.47 for revenue, suggesting more structured incentive systems.

These industry-specific results show that while misalignment is widespread, certain sectors maintain a clearer linkage between executive incentives and firm outcomes.

7. Comparative Compensation Trends Across Industries

CEO pay levels also varied significantly across industries. Communications executives received the highest average compensation, surpassing their counterparts in sectors such as Industrial Machinery, Electronics, and Primary Metals. This disparity suggests that industry context plays a major role in shaping executive pay, often independent of actual financial performance.

Over time, average CEO compensation increased steadily from 2010 to 2024, with a noticeable acceleration around the onset of the COVID-19 pandemic. This upward trajectory persisted across most industries despite economic challenges, indicating that executive pay has been largely resilient to broader performance volatility.

The overall findings of this regression-based study point to a weak alignment between CEO compensation and firm financial performance. While modest correlations exist with metrics like net income and revenue, the relationship with return on assets is particularly weak. A significant portion of high compensation appears disconnected from firm success, raising concerns about the efficacy of current pay structures. However, some industries—such as Industrial Machinery—demonstrate relatively better alignment, offering potential models for more accountable compensation design. As executive pay continues to rise, it becomes increasingly important for firms and stakeholders to reassess the frameworks that link incentives to performance outcomes.

Limitations

While this analysis provides valuable insights into executive compensation practices and their relationship with firm performance, several limitations should be acknowledged to contextualize the findings accurately.

1. The dataset spans from 2010 to 2024 and captures historical patterns, but it does not incorporate real-time developments or account for economic shifts that may have occurred after this period. This temporal limitation may affect the relevance of certain insights for current decision-making.
2. Although the analysis offers industry-level filtering through the dashboard, many of the reported findings are based on aggregate results across all industries. This aggregation can obscure meaningful sector-specific differences in compensation practices and performance dynamics. As a result, nuanced variations in executive pay alignment that exist within specific sectors may not be fully represented.
3. The model does not control for external macroeconomic factors—such as business cycles, regulatory changes, or global crises—that could significantly impact both compensation structures and firm outcomes. These unobserved variables may introduce bias or confound the interpretation of observed relationships.

4. The analysis does not incorporate qualitative influences such as public sentiment, media scrutiny, or reputational pressures, all of which can shape executive compensation but are difficult to quantify and were beyond the scope of this study.
5. The compensation data used in this analysis is aggregated, meaning specific elements of executive pay packages—such as long-term stock awards, vesting schedules, deferred compensation, and performance-based incentives—are not dissected or evaluated independently. These components may have unique effects on executive behavior and firm outcomes that this study does not capture.

Conclusion

This analysis concludes that executive compensation is only moderately aligned with firm performance across U.S. companies during the period from 2010 to 2024. While a subset of highly compensated executives did lead firms that demonstrated stronger financial outcomes, a substantial number of cases revealed instances of overcompensation, particularly when measured against profitability indicators such as return on assets (ROA) and net income.

Over the examined time frame, executive pay exhibited a steady upward trend, largely unaffected by economic volatility or declines in firm performance. This persistent rise, especially during periods of financial uncertainty such as the COVID-19 pandemic, suggests a structural disconnect between compensation and short-term performance.

Industry-specific comparisons provided additional nuance. Sectors such as Industrial Machinery and Utilities showed relatively stronger alignment between pay and performance, indicating that some industries maintain more performance-sensitive compensation structures. In contrast, the Communications sector displayed weaker alignment, highlighting inconsistencies in how executive incentives are tied to outcomes across industries.

Overall, while the findings offer valuable insights into trends and structural patterns in executive compensation, they must be interpreted with caution. The results are shaped by modeling choices, the limitations of historical data, and the exclusion of qualitative and external factors that may also influence compensation practices. Future work should aim to incorporate these dimensions to provide a more holistic understanding of the pay-performance relationship.

References

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2. “Compustat Executive Compensation - Annual Compensation.” *Wharton Research Data Services*, University of Pennsylvania, wrds-www.wharton.upenn.edu/pages/get-data/compustat-capital-iq-standard-poors/compustat/execucomp/annual-compensation/. Accessed 9 Apr. 2025.

Gen AI Statement

In this project, we leveraged generative AI tools to support various stages of our work. A detailed summary of their use is as follows:

- **Code Review and Debugging:** We utilized GPT-4 and Manus to enhance code efficiency, correct syntax errors, and add components to specific visualization scripts.
- **Idea Generation and Refinement:** Generative AI assisted us in brainstorming ideas, refining our approach to regression modeling, selecting variables from Compustat and ExecuComp, and strengthening the executive summary.
- **Proofreading and Grammar Checks:** We utilized Grammarly to improve the clarity, readability, and grammatical accuracy of our written content.

Throughout the project, our team upheld academic integrity standards by carefully reviewing and validating all AI-generated content to ensure its accuracy and appropriateness.