Relationship between Executive Pay & Company Performance

Group 6

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01

Introduction

Determine the relationship between executive compensation and company performance using various financial metrics

Regression Objective

Literature Review

In developed cities such as Australia, Japan and Singapore, both the CEO’s compensation and the total salaries were higher when a company did better.(Kayani, Umar & Christopher, 2022).

Higher CEO pay is seen to be a great motivator to CEOs to perform better. (Kweh et al., 2022)

Central Hypothesis

Higher CEO compensation will lead to better firm performance

→ Analyse the relationship between CEO Compensation and company's financial performance & determine which compensation components affect financial performance significantly

Dataset Overview

Dataset Extraction

All Datasets were extracted from Wharton Research Data Services under Compustat – Capital IQ. Two datasets were extracted: Company Financial Data and Executive Compensation Data

Company Financial Data

```
comp_data            261959 obs. of 41 variables
  $ gvkey    : chr [1:261959] "001004" "001004" "001004" "001004" ...
  $ datadate: Date[1:261959], format: "2000-05-31" "2001-05-31" "2002-…
  $ fyear    : num [1:261959] 1999 2000 2001 2002 2003 ...
  $ indfmt   : chr [1:261959] "INDL" "INDL" "INDL" "INDL" ...
  $ consol   : chr [1:261959] "C" "C" "C" "C" ...
  $ popsrc   : chr [1:261959] "D" "D" "D" "D" ...
  $ datafmt  : chr [1:261959] "STD" "STD" "STD" "STD" ...
  $ cusip    : chr [1:261959] "000361105" "000361105" "000361105" "0003…
  $ conm     : chr [1:261959] "AAR CORP" "AAR CORP" "AAR CORP" "AAR COR…
  $ curcd    : chr [1:261959] "USD" "USD" "USD" "USD" ...
  $ fyr      : num [1:261959] 5 5 5 5 5 5 5 5 5 5 ...
  $ act      : num [1:261959] 511 486 437 396 432
```

Executive Compensation Data

```
exec_data            44983 obs. of 22 variables
  $ EXEC_FULLNAME        : chr  "David P. Storch" "David P. Storch" …
  $ CO_PER_ROL           : int  5623 5623 5623 5623 5623 5623 5623 5…
  $ CONAME               : chr  "AAR CORP" "AAR CORP" "AAR CORP" "AA…
  $ CEOANN               : chr  "CEO" "CEO" "CEO" "CEO" ...
  $ SALARY               : num  676 665 661 661 695 ...
  $ BONUS                : num  270 0 0 496 592 ...
  $ OTHCOMP              : num  139 101 151 152 146 ...
  $ TOTAL_CURR           : num  946 665 661 1158 1287 ...
  $ PENSION_VALUE_TOT    : num  NA NA NA NA NA ...
  $ OTHANN               : num  0 0 62 67.8 69.5 ...
  $ RSTKGRNT             : num  0 0 0 348 695 ...
  $ OPTION_AWARDS_BLK_VALUE: num  2825 1281 1268 2668 4917 ...
```

02
Data Cleaning and Preparation

Data Set Cleaning

Company Financial Data

R-script

```r
#fill in fyear if missing, based on Compustat's May cutoff
comp_data$fyear <- ifelse(
  is.na(comp_data$fyear),
  ifelse(
    as.numeric(format(comp_data$datadate, format = "%m")) > 5,
    as.numeric(format(comp_data$datadate, format = "%Y")),
    as.numeric(format(comp_data$datadate, format = "%Y")) - 1), comp_data$fyear)
```

```r
# filtering only "INDL" data
comp_data <- filter(comp_data, indfmt == "INDL")
```

```r
# creating firm-year indices using gvkey and fyear
comp_data <- arrange(comp_data, gvkey, fyear)
comp_data$index <- paste(comp_data$gvkey, comp_data$fyear, sep = "_")
```

```r
#2.4 identifying and removing duplicate indices
length(unique(comp_data$index)) #291933 different from the base data set

comp_data_clean <- subset(
  comp_data,
  !(index %in% subset(comp_data, duplicated(index) == 1)$index)
)
nrow(comp_data_clean) #261907 rows
length(unique(comp_data_clean$index)) #261907 firm-year indices
```

Functions

1. Replacing missing NA values in *fyear*

NA values caused by May month cutoff in Compustat database. If *datadate* > 5, *fyear* remain, otherwise *fyear* to be replaced by the previous year.

2. Filtering based on industries in *indfmt*

Original dataset consists of companies both industrial and financial in nature. Filter to include only industrial companies.

3. Creating *index* and removing duplicated *index*

index variable is created, combining *gvkey* and *fyear.*

Duplicated rows caused by multiple observation in the same *fyear.* hence are removed to have a uniquely identified observation by the *index* variable.

Dataset Cleaning

Executive compensation data

R-script

```r
#4.1 Filtering to only including the data to CEO
exec_data <- exec_data[exec_data$CEOANN == "CEO", ]
```

```r
#4.2 converting GVKEY to character
exec_data$GVKEY <- as.character(exec_data$GVKEY)
exec_data$GVKEY <- ifelse(nchar(exec_data$GVKEY) == 4, paste0("00", exec_data$GVKEY), exec_data$GVKEY)
exec_data$GVKEY <- ifelse(nchar(exec_data$GVKEY) == 5, paste0("0", exec_data$GVKEY), exec_data$GVKEY)
```

```r
#4.4 creating firm-year indices using gvkey and year
exec_data <- arrange(exec_data, GVKEY, YEAR, CO_PER_ROL)
exec_data$index <- paste(exec_data$GVKEY, exec_data$YEAR, sep = "_")
```

```r
#4.5 identifying and removing duplicate indices
length(unique(exec_data$index)) #44940 different from the base data set

exec_data_clean <- subset(
  exec_data,
  !(index %in% subset(exec_data, duplicated(index) == 1)$index)
)
nrow(exec_data_clean) #44897 rows
length(unique(exec_data_clean$index)) #44897 firm-year indices
```

Functions

1. Filtering by “CEO” in *CEOANN*
CEOANN indicates the executive that served as CEO for all or most of fiscal year.
Filter to shortlist the CEO compensation

2. Converting *GVKEY* to a character variable
After conversion, 4 or 5 digits under *GVKEY* should be added with 2 or 1 zeros in front of the characters. Convert to provide ease of merging with the company dataset.

3. Creating *index* and removing duplicated *index*
Same steps followed in company financial data

Combining the datasets

R-script

```r
data_comb <- inner_join(comp_data_clean, exec_data_clean, by = "index")
```

data_comb ×

- 50 »

revt	sale	seq	xint	index	EXEC_FULLNAME	CO_PER_ROL	CONAME
874.3	874.3	340.2	21.88	001004_2000	David P. Storch	5623	AAR CORP
638.7	638.7	310.2	19.79	001004_2001	David P. Storch	5623	AAR CORP
606.3	606.3	295.0	19.53	001004_2002	David P. Storch	5623	AAR CORP
652.0	652.0	301.7	18.81	001004_2003	David P. Storch	5623	AAR CORP
747.8	747.8	314.7	16.41	001004_2004	David P. Storch	5623	AAR CORP

Output

```
data_comb      44535 obs. of 63 variables
  $ gvkey      : chr [1:44535] "001004" "001004"
  $ datadate   : Date[1:44535], format: "2001-05
  $ fyear      : num [1:44535] 2000 2001 2002 20
  $ indfmt     : chr [1:44535] "INDL" "INDL" "IN
  $ consol     : chr [1:44535] "C" "C" "C" "C" .
  $ popsrc     : chr [1:44535] "D" "D" "D" "D" .
  $ datafmt    : chr [1:44535] "STD" "STD" "STD"
  $ cusip      : chr [1:44535] "000361105" "0003
  $ conm       : chr [1:44535] "AAR CORP" "AAR C
  $ curcd      : chr [1:44535] "USD" "USD" "USD"
  $ fyr        : num [1:44535] 5 5 5 5 5 5 5 5 5
```

- **inner_join() :**
Merge 2 datasets based on common columns and returns only the rows with matching keys in both data frames.

- **by = "index" :**
The combination of *gvkey* and *fyear,* a unique key to simplify merging process and avoid duplicates in the merged data frames.

- **exec_data_clean: 44897 obs.**
- **comp_data_clean: 261959 obs.**
- **data_comb: 44535 obs.**

There are 44535 rows with matching keys -> A more focused dataset for regression modeling

Calculating Ratios

1. Generate lagged values

A prerequisite to compute ratios such as return on assets, return on equity and inventory turnover, which require lagged values of total asset *at*, inventory *invt*, and total *equity seq* to compute averages.

R-script

```
data_comb_2 <- arrange(data_comb_1, index)
data_comb_2 <- data_comb_1 %>% group_by(gvkey) %>% mutate(at_lag = ifelse(fyear == lag(fyear) + 1, lag(at, n = 1), NA),
                                                          invt_lag = ifelse(fyear == lag(fyear) + 1, lag(invt, n = 1), NA),
                                                          seq_lag = ifelse(fyear == lag(fyear) +1, lag(seq, n = 1), NA)) %>% ungroup()
```

Functions

- **arrange():** Sort the observations in ascending order based on *index* variable
- **group_by():** Group the data by the *gvkey* variable
- **mutate():** Create lagged variables (*at_lag*: Lagged total assets for the previous year)
- **Ifelse()**: Apply condition that lagging is applied only if the current year in *fyear* is one year after the lagged year, and if the condition is not met, NA is assigned.

Output

	index	gvkey	at	at_lag	invt	invt_lag	seq	seq_lag
1	001004_2000	001004	701.9	NA	320.59	NA	340.21	NA
2	001004_2001	001004	710.2	701.9	286.59	320.59	310.24	340.2
3	001004_2002	001004	686.6	710.2	259.95	286.59	294.99	310.2
4	001004_2003	001004	709.3	686.6	247.25	259.95	301.68	295.0
5	001004_2004	001004	732.2	709.3	255.48	247.25	314.74	301.7
6	001004_2005	001004	978.8	732.2	323.59	255.48	422.72	314.7
7	001004_2006	001004	1067.6	978.8	342.59	323.59	494.24	422.7
8	001004_2007	001004	1362.0	1067.6	435.61	342.59	585.25	494.2

data_comb_1	44535 obs. of 63 variables
data_comb_2	44535 obs. of 66 variables

Calculating Ratios

2. Generate ratio variables

Selected ratios from 4 distinct categories acts as the measure of firm financial performance and will be utilized as the dependent variables/ controlled variables in our regression analysis.

R-script

```
data_comb_3 <- data_comb_2 %>% mutate(net_profit_margin=ni/revt,operating_profit=oiadp/revt,ROE=ni/((seq+seq_lag)/2),
                                      current_ratio=act/lct,cash_ratio=ch/lct,debt_ratio=lt/at,debt_to_equity_ratio=lt/seq,
                                      asset_turnover=revt/(at-lt),roa=ni/((at+at_lag)/2),inventory_turnover=cogs/((invt+invt_lag)/2))
```

Functions

- **mutate():** Add ratio variables to the dataset based on calculations. 10 key financial ratio are calculated for potential integration into regression analysis and predictive modeling in r.

- **Result:** The dataset ‘data_comb_3’ has been enriched with the financial ratios. Further data cleaning is essential to address outliers and handle NA/inf values.

Output

```
$ net_profit_margin     : num [1:44535] 0.0212 -0.0
$ operating_profit      : num [1:44535] 0.05238 0.0
$ ROE                   : num [1:44535] NA -0.1812
$ current_ratio         : num [1:44535] 3.87 2.9 1.
$ cash_ratio            : num [1:44535] 0.11 0.229
$ debt_ratio            : num [1:44535] 0.515 0.563
$ debt_to_equity_ratio  : num [1:44535] 1.06 1.29 1
$ asset_turnover        : num [1:44535] 2.57 2.06 2
$ roa                   : num [1:44535] NA -0.08348
$ inventory_turnover    : num [1:44535] NA 1.73 1.8
```

03
Sample Period and Restrictions

2000-2022: 22 years

Long-term Trends and patterns

Firm or market specific factors

Changes in the economy, regulation and society

New regulations, laws and societal changes

Global Events

Financial crisis, pandemics, international conflicts

6 compensation components

1. Salary

- Identification of base pay
- Wage growth

2. Bonus

- Usually with better firm performance, the bonuses increase in value.
- Analysis over time uncovers trends in performance-based pay models.

3. Other Compensation (OTHCOMP)

- Other benefits, perks and non-standard compensation items

4. Restricted Stock Grants (RSTKGRNT)

- Equity-based compensation scheme
- To align CEO's interests with the performance of a company by offering a stake in the company

5. Option Awards Block Value (OPTION_AWARDS_BLK_VALUE):

- How companies use options as a tool to incentivise and motivate the CEOs

6: Long-Term Incentive Plan (LTIP)

- LTIPs are often designed with the objective of achieving a company's long-term objectives and retaining key management, such as the CEO.
- whether a company is able to adapt to changing business environments and maintain financial performance

04

Statistic Model

Statistic Model

Aim of Statistic Model

Analyse the relationship between CEO Compensation and company's financial performance & determine which compensation components affect financial performance significantly

$$\text{Financial Ratio} = \beta 0 + \beta 1 \times \text{Comp Component} + \text{Control Variables}$$

- **IV - Compensation Components:**

Salary, Bonus, Other Compensation, Restricted Stock Grant, Stock Options Awarded, Long-term Incentive Pay

- **DV - Financial Ratios:**

Profitability (Net Profit Margin), Liquidity (Current Ratio), Leverage (Debt to Equity Ratio), Operational Efficiency (Return on Assets)

Statistic Model

Financial Ratio	Control Variable
Profitability - Profit Margin **Efficiency** - Return on Assets	*at*
	debt_to_equity_ratio
	ceo_years
Liquidity - Current Ratio	*at*
	debt_to_equity_ratio
	asset_turnover
Leverage - Debt to Equity Ratio	*at*
	net_profit_margin
	asset_turnover

Purpose

- **at (Total Assets):** Account for the size of the firm
- **debt_to_equity_ratio:** Account for the variations in firm's capital structure
- **ceo_years:** Account for variations in leadership experience
- **Asset_turnover:** Account for variations in operational efficiency of the firm
- **net_profit_margin:** Account for variations in profitability and financial health of the firm

Statistic Model

Further data cleaning

R-script

```
data_reg_3a <- data_reg_3 %>%
  filter(!is.na(at) & !is.infinite(inventory_turnover))
```

```
#7.3 remove outliers with truncation method
ggplot(data_reg_3a, aes(x = fyear, y = net_profit_margin)) + geom_point() + geom_smooth(method = "lm", se = FALSE)
ggplot(data_reg_3a, aes(x = fyear, y = debt_to_equity_ratio)) + geom_point() + geom_smooth(method = "lm", se = FALSE)
```

```
data_reg_3a %>% filter(!net_profit_margin > quantile(net_profit_margin, 0.99, na.rm = TRUE)
                       & !net_profit_margin < quantile(net_profit_margin, 0.01, na.rm = TRUE)
```

Functions

1. **Remove NA and inf values under ratio variables**
Filter out NA values in total asset as it is unlikely to be 0 for a company.
Remove inf values in the ratios to prevent error during regression

2. **Analyse and remove outliers**
Analyse the outliers by plotting *fyear* (x-axis) against various ratios to identify presence of outliers.
Filter out top and bottom 0.01 quantile to truncate potential outliers affecting regression model.
Limit CEO years to 20 due to a notable decrease in density beyond that threshold on the plot

05

Regressions

Regression models

Regressing on training dataset

```
#8.1. choosing training and test dataset
set.seed(1)
train1 <- sample_frac(data_reg_3d_clean, 0.75)
test1 <- anti_join(data_reg_3d_clean, train1)
```

Model 1 (IV + DV + CV)

lm1a_train <-
lm(net_profit_margin ~ salary_at + at + debt_to_equity_ratio + ceo_years, train1)

Model 2 (stepwise, forward and backward)

1. step(lm1a_train, direction = "both")
2. step(lm1a_train, direction = "forward")
3. step(lm1a_train, direction = "backward")

Model 3 (IV + DV + FE)

data_reg_fixeff_1a <-
felm(net_profit_margin ~ salary_at + at + debt_to_equity_ratio + ceo_years | gvkey + fyear | 0 | gvkey + fyear, train1)

Salary vs Firm Financial Performance

IV: Salary/Total asset, DV: Net profit margin	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.0348 RSE = 0.139 Salary_at (slope) = -0.0119 Salary_at (P value) < 0.1 Full model (P value) < 0.1 AIC = -19084 RMSE = 0.1386	Adj. R squared = 0.329 RSE = 0.116 Salary_at (slope) = -0.00384 Salary_at (P value) > 0.1 Full model (P value) < 0.1

IV: Salary/Total asset, DV: Return on asset	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.0379 RSE = 0.0882 Salary_at (slope) = -0.00815 Salary_at (P value) < 0.1 Full model (P value) < 0.1 AIC = -34960 RMSE = 0.08696	Adj. R squared = 0.329 RSE = 0.0701 Salary_at (slope) = -0.00410 Salary_at (P value) < 0.1 Full model (P value) < 0.1

- Extremely low adj. R squared -> Limited explanatory power for profit margin.
- With fixed effects: Improvement in adj. R squared and RSE. P-value rises (>0.1), signaling overfitting .
- Negative slope indicates a negative relationship

- Consistent P-values < 0.1, indicating statistical significance
- R-squared with fixed effects increases to 0.329 (still relatively low)
- Negative relationship with return on assets, effect size remains low, similar to the previous regression.

Salary vs Firm Financial Performance

IV: Salary/Total asset, DV: Current Ratio		IV: Salary/Total asset, DV: Debt to Equity	
Model 1 and 2	Model 3 (with Fixed Effects)	Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.108 RSE = 1.41 Salary_at (slope) = 0.119 Salary_at (P value) < 0.1 Full model (P value) < 0.1 AIC = 61129 RMSE = 1.436	Adj. R squared = 0.719 RSE = 0.794 Salary_at (slope) = -0.04943 Salary_at (P value) < 0.1 Full model (P value) < 0.1	Adj. R squared = 0.468 RSE = 1.88 Salary_at (slope) = -0.1169 Salary_at (P value) < 0.1 Full model (P value) < 0.1 AIC = 70952 RMSE = 1.983	Adj. R squared = 0.795 RSE = 1.16 Salary_at (slope) = -0.0393 Salary_at (P value) < 0.1 Full model (P value) < 0.1

- Despite statistical significant of Model 1&2, adj. R squared is extremely low.
- With fixed effects, R squared hike and there is dynamic change where negative relationship emerges.
- Returns highest AIC compared to previous regressions.

- Model 3: Improved adj. R-squared, lower RSE and IV-DV relationship remain statistically significant.
- A reduced influenced of salary on DE ratio with a slope of -0.0393
- Negative slope indicates an inverse relationship

Salary vs Firm Financial Performance

Summary

- Slope coefficient close to 0 shows a weak association between salary and firm financial performance.
- Extremely low adjusted r-squared shows a limited model ability to explain profit margin and ROA variability.
- Regression with Debt to equity ratio: P-value < 0.1 shows a statistically significant relationship, and 79.5% of the variability in the DV is explained.

Model 3 with Fixed effects

Debt-to-equity-ratio = - 0.039374 * salary_at + 0.00000399 * total asset - 0.63801114 * profit margin + 0.76662036 * asset turnover

Bonus vs Firm Financial Performance

IV: Bonus/Total asset, DV: Net Profit Margin	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.0154 RSE = 0.141 bonus_at (slope) = -0.00595 bonus_at (P value) < 0.1 Full model (P value) < 0.1 AIC = -18739 RMSE = 0.1393	Adj. R squared = 0.33 RSE = 0.116 bonus_at (slope) = 0.00825 bonus_at (P value) < 0.1 Full model (P value) < 0.1

IV: Bonus/Total asset, DV: Return on asset	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.0143 RSE = 0.0893 bonus_at (slope) = -0.00212 bonus_at (P value) < 0.1 Full model (P value) < 0.1 AIC = 70952 RMSE = 1.983	Adj. R squared = 0.389 RSE = 0.0703 bonus_at (slope) = -0.00477 bonus_at (P value) < 0.1 Full model (P value) < 0.1

- Negative slope coefficient is statistically significant
- Firm and year fixed effect improved adj. r-squared, though remains low
- IV coefficient shifted to positive in Model 3

- In alignment with previous regression, adj. r squared remains relatively low across models
- Model with Fixed effects cause elevated p-value, suggesting potential overfitting and unreliable estimates

Bonus vs Firm Financial Performance

IV: Bonus/Total asset, DV: Current Ratio	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.0945 RSE = 1.42 bonus_at (slope) = 0.0979 bonus_at (P value) < 0.1 Full model (P value) < 0.1 AIC = 61396 RMSE = 1.449	Adj. R squared = 0.717 RSE = 0.795 bonus_at (slope) = -0.0398 bonus_at (P value) < 0.1 Full model (P value) < 0.1

IV: Bonus/Total asset, DV: Debt to Equity Ratio	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.464 RSE = 1.88 bonus_at (slope) = -0.1621 bonus_at (P value) < 0.1 Full model (P value) < 0.1 AIC = 71081 RMSE = 1.995	Adj. R squared = 0.795 RSE = 1.17 bonus_at (slope) = -0.02845 bonus_at (P value) > 0.1 Full model (P value) < 0.1

- Substantial improvement in explanatory power and precision
- Outperforms previous models with profit margin and ROA
- P-value below threshold: Statistically significant negative relationship between CEO bonus and current ratio.

- Model 1 & 2 with moderate adj. r-squared with p-value < 0.1
- With fixed effects, explanatory power of model is improved but p-value above threshold, potential lack of statistical significance

Bonus vs Firm Financial Performance

Summary

- Very weak relationship indicated by exceedingly low adjusted r-squared and negative coefficient close to 0
- When regressing with debt-to-equity ratio, incorporation of fixed effects results in increase of p-value above threshold, raising concern about model robustness
- With current ratio as DV, regression findings provide viable basis for investigating its association with CEO bonus

Model 3 with Fixed effects

$$\text{Current ratio} = -0.03978 * \text{bonus\_at} - 0.000001211 * \text{total asset} + 0.005079 * \text{debt to equity ratio} - 0.03595 * \text{asset turnover}$$

Other comp vs Financial Performance

IV: Other compensation/Total asset, DV: Net profit margin	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.0183 RSE = 0.1406 othcomp_at (slope) = -0.0082 othcomp_at (P value) < 0.1 Full model (P value) < 0.1 AIC = -67951 RMSE = 0.1387	Adj. R squared = 0.329 RSE = 0.116 othcomp_at (slope) = -0.00417 othcomp_at (P value) < 0.1 Full model (P value) < 0.1

IV: Other compensation/Total asset, DV: Return on asset	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.0199 RSE = 0.0890 othcomp_at (slope) = -0.0064 othcomp_at (P value) < 0.1 Full model (P value) < 0.1 AIC = -83798 RMSE = 0.087	Adj. R squared = 0.391 RSE = 0.0702 othcomp_at (slope) = -0.003293 othcomp_at (P value) < 0.1 Full model (P value) < 0.1

- Extremely low adj. R squared -> Limited explanatory power for profit margin.
- With fixed effects: Improvement in adj. R squared and RSE indicating better explanation in variation of profit margin.
- Negative slope indicates a negative relationship

- Consistent P-values < 0.1, indicating statistical significance
- R-squared with fixed effects increases to 0.329 (still relatively low)
- Negative relationship with return on assets, effect size remains low, similar to the previous regression.

Other comp vs Financial Performance

IV: Other compensation/Total asset, DV: Current Ratio	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.0932 RSE = 1.42 othcomp_at (slope) = 0.0404 othcomp_at (P value) < 0.1 Full model (P value) < 0.1 AIC = 12261 RMSE = 1.448	Adj. R squared = 0.717 RSE = 0.796 othcomp_at (slope) = -0.000506 othcomp_at (P value) > 0.1 Full model (P value) < 0.1

- Substantial improvement in explanatory power and precision
- Outperforms previous models with profit margin and ROA
- P-value above threshold 0.1: Statistically insignificant negative relationship between CEO bonus and current ratio.

IV: Other compensation/Total asset, DV: Debt to Equity Ratio	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.4622 RSE = 1.88 othcomp_at (slope) = -0.0514 othcomp_at (P value) < 0.1 Full model (P value) < 0.1 AIC = 21,970 RMSE = 1.994	Adj. R squared = 0.794 RSE = 1.17 othcomp_at (slope) = -0.02091 othcomp_at (P value) < 0.1 Full model (P value) < 0.1

- Model 1 & 2 with moderate adj. r-squared with p-value < 0.1
- With fixed effects, explanatory power of model is significantly improved (BEST MODEL)

Other comp vs Financial Performance

Summary

- Weak relationship indicated by exceedingly low adjusted r-squared and negative coefficient close to 0
- When regressing with debt-to-equity ratio, incorporation of fixed effects results in increase of adjusted R square to 0.794 without raising the p-value about 0.1 threshold
- With debt-to-equity ratio as DV, regression findings provide viable basis for investigating its association with CEO’s other compensation

Model 3 with Fixed effects

Debt to equity-ratio = - 0.02106 * othcomp_at + 0.00000394 * total asset - 0.6299 * profit margin + 0.76648 * asset turnover

RSTKGRNT vs Firm Financial Performance

IV: RSTKGRNT, DV: Net profit margin	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.0147 RSE = 0.141 RSTKGRNT (slope) = 0.000002162 RSTKGRNT (P value) < 0.1 Full model (P value) < 0.1 AIC = -18736 RMSE = 0.1391	Adj. R squared = 0.329 RSE = 0.116 RSTKGRNT (slope) = -0.000001928 RSTKGRNT (P value) < 0.1 Full model (P value) < 0.1

IV: RSTKGRNT, DV: Return on asset	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.00517 RSE = 0.0897 RSTKGRNT (slope) = 0.000002254 RSTKGRNT (P value) < 0.1 Full model (P value) < 0.1 AIC = -34387 RMSE = 0.08773	Adj. R squared =0.388 RSE = 0.0703 RSTKGRNT (slope) = 0.000001065 RSTKGRNT (P value) > 0.1 Full model (P value) < 0.1

- Extremely low adj. R squared -> Limited explanatory power for profit margin.
- With fixed effects: Improvement in adj. R squared.
- Slope close to 0 indicates a weak or no relationship

- P-value rises (>0.1), signaling overfitting .
- R-squared with fixed effects increases(still relatively low)
- Near 0 correlation = effect size remains low

RSTKGRNT vs Firm Financial Performance

IV: RSTKGRNT, DV: Current Ratio	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.0936 RSE = 1.42 RSTKGRNT (slope) = -0.000051612 RSTKGRNT (P value) < 0.1 Full model (P value) < 0.1 AIC = 61406 RMSE = 1.449	Adj. R squared = 0.717 RSE = 0.796 RSTKGRNT (slope) = 0.000001804 RSTKGRNT (P value) > 0.1 Full model (P value) < 0.1

IV: RSTKGRNT, DV: Debt to Equity	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.462 RSE = 1.89 RSTKGRNT (slope) = - 0.000017647 RSTKGRNT (P value) > 0.1 Full model (P value) < 0.1 AIC =71135 RMSE = 1.995	Adj. R squared = 0.795 RSE = 1.17 RSTKGRNT (slope) = -0.00000966 RSTKGRNT (P value) > 0.1 Full model (P value) < 0.1

- Improvement in r square when fixed effects are added
- P-value rises (>0.1), signaling overfitting .
- Negative correlation improves, but still a near 0 figure.

- Rise in value of r square, with highest value of of 0.795 being observed
- This model has returned the highest AIC, indicating a weaker relationship fit between RSTKGRNT and the debt-to-equity ratio
- Negative slope indicates an inverse relationship

RSTKGRNT vs Firm Financial Performance

Summary

- Slope coefficient close to 0 shows a weak association between RSTKGRNT and firm financial performance.
- When the return on asset is used, the p value remains below 0.1 and the adjusted r square is relatively higher, with a lower residual error
- Regression with Return on Assets ratio: P-value < 0.1 shows a statistically significant relationship, and 38.8% of the variability in the DV is explained.

Model 3 with Fixed effects

Return on Asset= 0.000001065 * RSTKGRNT + 0.000042918 * total asset - 0.000997851* profit margin + 0.000872509* asset turnover

OPTION_AWARDS_BLK_VALUE vs Firm Financial Performance

IV: OPTION_AWARDS_BLK_VALUE, DV: Net profit margin	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.0147 RSE = 0.1409 OABV(slope) = -0.000000499 OABV (P value) < 0.1 Full model (P value) < 0.1 AIC = 12277 RMSE = 0.139	Adj. R squared = 0.329 RSE = 0.116 OABV (slope) = -0.0000005164 OABV (P value) > 0.1 Full model (P value) < 0.1

IV: OPTION_AWARDS_BLK_VALUE, DV: Return on asset	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.0142 RSE = 0.0893 OABV (slope) = -0.0000002347 OABV (P value) > 0.1 Full model (P value) < 0.1 AIC = 21985 RMSE = 0.08772	Adj. R squared =0.39 RSE = 0.0703 OABV (slope) = -0.0000002893 OABV (P value) < 0.1 Full model (P value) < 0.1

- Model 1 and 2 have a very low adjusted R Squared value compared to Model 3
- The P-Value for Model 3 shows it is not statistically significant, unless we look at the F Statistic
- Slope is very small and negative, indicating weak association.

- Similarly, Model 1 and 2 have a lower Adj R. Squared Value compared to Model 3, and Model 3 is the only one with a P-Value less than 0.1
- Slope is very small and negative, indicating weak association
- R Square and RSE improve compared to profit margin.

OPTION_AWARDS_BLK_VALUE vs Firm Financial Performance

IV: OPTION_AWARDS_BLK_VALUE, DV: Current Ratio	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.0924 RSE = 1.43 OABV (slope) = -0.0000004 OABV (P value) > 0.1 Full model (P value) < 0.1 AIC = 61428 RMSE = 1.449	Adj. R squared = 0.717 RSE = 0.796 OABV (slope) = 0.000003444 OABV(P value) < 0.1 Full model (P value) < 0.1

- Improvement in r square when fixed effects are added
- P-Value remains statistically significant
- Slope changes from negative to positive when considering fixed effects

IV: OPTION_AWARDS_BLK_VALUE, DV: Debt to Equity	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.4618 RSE = 1.886 OABV (slope) = 0.000001245 OABV (P value) > 0.1 Full model (P value) < 0.1 AIC =71145 RMSE = 1.996	Adj. R squared = 0.795 RSE = 1.17 OABV (slope) = -0.00000256 OABV(P value) < 0.1 Full model (P value) < 0.1

- Highest Adjusted R Square out of the four regressions at 0.795.
- Highest RMSE and AIC, indicating weaker regression fit.
- Best model to determine firm financial performance in terms of R Squared and P-Value.

OPTION_AWARDS_BLK_VALUE vs Firm Financial Performance

Summary

- Slope coefficient close to 0 shows a weak association between OPTION_AWARDS_BLK_VALUE and firm financial performance.
- Fixed effects have effect on the independent variable, however given the small slope coefficient, there is a weak negative relationship between the IV and Net Profit Margin, Return on Assets and Debt to Equity Ratio, and a weak positive relationship with Current ratio

Model 3 with Fixed effects

Debt-to-equity-ratio = -0.00000256 * OPTION_AWARDS_BLK_VALUE + 0.00000391 * total asset -0.62493929 * net profit margin + 0.76633488 * asset turnover

LTIP vs Firm Financial Performance

IV: LTIP/Total asset, DV: Net Profit Margin	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.0145 RSE = 0.141 LTIP_at (slope) = 0.0053578 LTIP_at (P value) > 0.1 Full model (P value) < 0.1 AIC = -67884 RMSE = 0.139	Adj. R squared = 0.328 RSE = 0.116 LTIP_at (slope) = - 0.001826 LTIP_at (P value) > 0.1 Full model (P value) < 0.1

IV: LTIP/Total asset, DV: Return on asset	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.0144 RSE = 0.0893 LTIP_at (slope) = 0.0085003 LTIP_at (P value) < 0.1 Full model (P value) < 0.1 AIC = -83701 RMSE = 0.08725	Adj. R squared = 0.39 RSE = 0.0702 LTIP_at(slope) = 0.0003515 LTIP_at (P value) > 0.1 Full model (P value) < 0.1

- Negative slope coefficient is statistically insignificant
- Firm and year fixed effect improved adj. r-squared, though remains low
- IV coefficient shifted to negative in Model 3

- Adjusted r squared remains relatively low across models
- P value for LITP_at indicates that LTIP is unlikely to be a significant predictor of firm's operation efficiency
- P value for full model implies that model as a whole is statistically significant

LTIP vs Firm Financial Performance

IV: LTIP/Total asset, DV: Current Ratio	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.0932 RSE = 1.42 LTIP_at (slope) = - 0.230164 LTIP_at (P value) < 0.1 Full model (P value) < 0.1 AIC = 12262 RMSE = 1.448	Adj. R squared = 0.717 RSE = 0.796 LTIP_at(slope) = - 0.068259 LTIP_at (P value) > 0.1 Full model (P value) < 0.1

IV: LTIP/Total asset, DV: Debt to Equity Ratio	
Model 1 and 2	Model 3 (with Fixed Effects)
Adj. R squared = 0.462 RSE = 1.89 LTIP_at (slope) = 0.033826 LTIP_at (P value) > 0.1 Full model (P value) < 0.1 AIC = 21983 RMSE = 1.995	Adj. R squared = 0.795 RSE = 1.17 LTIP_at (slope) = 0.006029 LTIP_at (P value) > 0.1 Full model (P value) < 0.1

- Outperforms previous models with net profit margin and return on assets
- Statistically significant negative relationship between long term incentive pay and current ratio

- Slope coefficient indicates a positive relationship
- With fixed effects, explanatory power of model is improved but p-value above threshold, potential lack of statistical significance

LTIP vs Firm Financial Performance

Summary

- Weak relationship indicated by a low adjusted r-squared and negative coefficient close to 0
- F statistic associated with the overall model is less than 0.1, indicating that the model is statistically significant.
- With P value for LITP_at more than 0.1 for all models, **LITP is unlikely to be a significant predictor of firm's financial performance**

Summary

	Profitability (Net Profit Margin)	Operation Efficiency (Return on Assets)	Liquidity (Current Ratio)	Leverage (Debt to Equity Ratio)
Salary				✓
Bonus			✓	
Other Compensation				✓
Restricted Stock Grant		✓		
Options Awarded				✓
Long Term Incentive Pay				

Limitations and Conclusion

Limitations	• Missing Values (NA) • Outliers • Data size and complications
Conclusion	• Weak Relationship indicated by **slope close to 0** • Except for Risk Grant, all other model indicates a **negative relationship** • Therefore, we **reject our null hypothesis** that there is a positive relationship
Future Uses	• Future research can be conducted to identify effect of **financial performance on executive compensation** • Further research may consider **different fixed effects and control variables**

Thank You