Business Analytics Project

Course Code: BUSI-1783

Executive Compensation and Company Performance: A Longitudinal Analysis of Top U.S. Firms

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1. Executive Summary

This project looks at the link between executive pay and company performance. It focuses on how financial factors like debt (leverage), liquidity and asset growth affect whether incentives help or hurt long-term value creation. The dataset has 17,511 firm year records from 4,400 listed companies between 2012 and 2020. To prepare the data, financial ratios were built, numbers were cleaned and adjusted, and descriptive analysis was done. This created a strong base for deeper econometric testing.

The study shows three main findings. First, firms with better liquidity shown by higher current and quick ratios mainly depend less on debt. This supports the idea that stable financing is needed before incentives can work well. Second, asset growth is very unstable across firms and years which showing that investment follows cycles and can carry risks when executive pay pushes short-term decisions. Third, the data shows a trade-off between debt and equity financing. Firms that rely more on equity are more resilient when shocks happen.

These findings are useful for businesses. They can guide boards and pay committees in designing fairer contracts. Good structures, such as equity that is indexed, longer vesting periods and strong claw back rules can reduce “pay-for-luck” and stop executives from taking too much risk in highly indebted firms. The results also support recent regulations, like the SEC’s Pay-versus-Performance rule (2022) and UK governance codes which ask for more transparency and responsibility in incentive design.

The project also shows how business analytics can turn raw accounting data into useful insights. By using Python for financial modeling, creating ratios and making clear visuals, the study builds a method that can be repeated. This method can also be extended by adding CEO pay data and using advanced econometric tools, such as System GMM, to test cause-and-effect more clearly.

In conclusion, the project shows that the success of executive pay does not depend only on how much is paid. What matters most is how the pay is designed. Incentives linked to long-term financial strength, balanced investment, and steady growth are the best way to create shareholder value and ensure resilience.

2. Introduction

Context and Background

Executive pay has been a very important topic in business for a long time. People often ask, "**How does CEO pay affect company performance?"** This question matters to researchers, investors, regulators and the public. The idea seems simple, if managers are paid well, they might work harder, make better decisions and help the company grow over the long term. But the evidence is not clear. Some studies say higher pay improves performance (Mehran, 1995; Manders, 2012). Other studies say high pay can cause short-term thinking, risky decisions, or rewards for things outside the CEO's control (Jensen & Murphy, 1990; Bertrand & Mullainathan, 2001).

Over the last twenty years, many rules have been introduced to handle this. In the U.S., the Dodd-Frank Act (2010) makes companies show how much executives are paid and lets shareholders vote on it. In the UK, the Corporate Governance Code and the Investment Association's Principles of Remuneration try to connect pay with long-term company performance. Recently, the SEC introduced Pay-versus-Performance rules (2022) and clawback rules (2023). These rules show it is very important to understand how pay works with a company's finances.

Problem Statement

Even after many studies, the connection between executive pays and company performance is not clear. Earlier studies often had small datasets, short time periods or did not consider differences between firms. CEO pay is complex. It includes salary, bonuses, stock options, performance shares and clawback rules. Company performance is also hard to measure. It can be accounting numbers like ROA or ROE, market measures like Tobin's Q or Total Shareholder Return or other outcomes like innovation and risk.

A company's financial situation matters too. Firms with high debt may take more risks if CEOs have stock options. Companies with strong cash reserves are safer when facing short-term pay pressures. Many studies only look at pay and performance directly and ignore these financial interactions. This leaves a gap in knowledge. To design good CEO incentives, it is important to study how a company's balance sheet affects how managers behave.

Project Objectives:

This dissertation has five main objectives:

1. **Data exploration**: Use a large dataset of 17,511 firm-year records from 2012 to 2020 covering 4,400 listed companies worldwide. Clean the data and prepare it for analysis.
2. **Financial structure analysis**: Build important financial ratios like leverage, liquidity, asset growth and investment intensity to understand how firms are financed and how they operate.
3. **Analytical validation**: Use fissurization (to handle outliers), correlation analysis, and visualizations to check the robustness of results and to identify key patterns.
4. **Theoretical integration**: Link the findings to important theories such as agency theory, managerial power theory and modern corporate governance codes.
5. **Policy relevance**: Provide recommendations for boards, regulators and investors so they can design pay systems that support long-term value creation.

The central idea is that the design of incentives matters more than the size of the pay. The project also sets the stage for future econometric models, especially System GMM which can test cause-and-effect relationships more directly.

Scope and Limitations:

The study focuses on listed companies from different sectors between 2012 and 2020. The dataset includes balance-sheet items such as assets, liabilities, equity, receivables, inventory, property, plant and equipment (PPE) and intangibles. Independent variables represent executive pay (salary, bonus, equity) while dependent variables measure company performance (ROA, ROE, Tobin's Q, TSR). Firm size, leverage and industry sector are included as control variables.

However, there are some limitations:

- The dataset does not yet include CEO-specific pay data. This will need to be added later.
- Advanced panel methods such as System GMM require valid instruments and if not used carefully can lead to overfitting.
- The study relies mostly on financial numbers. Qualitative aspects like company culture or leadership quality are not included.
- Cross-country differences in governance systems may affect the data, though using year and industry controls helps reduce this issue.

Value Proposition:

This dissertation adds value in three main areas:

1. **Academic Contribution:** The project brings together different theories like agency theory (Jensen & Meckling, 1976), managerial power theory (Bebchuk & Fried, 2004) and value creation theory. By linking executive pay design with financial structure, it expands the traditional pay–performance debate.
2. **Practical Relevance**: The findings will help corporate boards and pay committees. For example, companies with high debt may need different pay structures than companies with strong liquidity. Equity-based incentives may work well for cash-rich firms but could be dangerous in firms with high leverage.

3. **Policy Impact**: The study supports regulatory debates about executive pay. It shows why rules about disclosure, clawbacks and long-term incentives are necessary. Badly designed contracts can make firms weaker while good ones can promote resilience and long-term growth.

Project Structure Overview:

The dissertation has nine sections. The first part is the introduction, which explains the context and research problem. The second section is the literature review which looks at previous studies and highlights gaps. The third section is the methodology and data which describes the dataset, the preprocessing steps and the econometric methods used. The fourth section is analysis and findings which presents the descriptive results, correlations and visualizations about leverage, liquidity and growth.

The fifth section is the discussion which connects the results to theory and practice, and shows how they affect executive pay design and governance. The sixth section is the conclusion which summarizes the findings, admits the limitations and gives ideas for future research. The seventh section provides a personal reflection and the last parts include technical details such as code, tables and figures.

3. Literature Review and Industry Analysis

3.1 Theoretical Foundations

The debate about executive pays and company performance is based on several main theories.

Agency Theory (Jensen & Meckling, 1976) says that when ownership and control are separate, managers may not always act in the best interest of shareholders. Instead, they may act for their own benefit. To solve this, companies use pay contracts. Variable pay and equity linked pay (like stock options) are meant to connect managers' rewards to company outcomes. If pay is designed well, it reduces laziness, stops wasteful projects and pushes

managers to take risks that increase value. But there are also risks. If performance measures are not clear or complete, managers may focus only on short-term results and ignore long-term growth.

Managerial Power Theory (Bebchuk & Fried, 2004) looks at the problem differently. It argues that CEOs often have the power to influence their own pay. This happens through close ties with board members, weak shareholder control or board capture. In such cases, pay is not about giving managers the right incentives but about managers extracting benefits for themselves. According to this theory, pay–performance sensitivity is weak or distorted. Governance structures become very important to stop managers from abusing their power.

Other theories expand the debate. **Value Creation Theories** say that incentive pay should go beyond short-term financial numbers. Instead, it should encourage investment, innovation and long-term growth. **Symbolic Theories** add another view. They say that executive pay also has a symbolic role. It can send a message of legitimacy to investors and employees, even if the real economic impact is uncertain (Otten, 2007; N'Guessan, 2022).

Together, these theories highlight one key point, mainly the way contracts are designed matters a lot. The mix of cash, equity, vesting periods, and performance filters decides if pay truly aligns with shareholder interests, supports rent seeking by managers or just signals compliance with governance codes.

3.2 Empirical Evidence on Pay–Performance Sensitivity

Research evidence on the link between executive pay and company performance is mixed. Different results often come from differences in data, research design and context.

Early studies found weak links. Jensen & Murphy (1990) showed that CEO wealth only changed a few dollars for every $1,000 change in company value. This suggested that alignment between pays and performance was very limited. Later studies found that stock options and equity grants made this link stronger (Core, Guay & Larcker, 2003).

A major problem identified was **pay-for-luck**. Bertrand & Mullainathan (2001) found that CEOs often benefited from events outside their control like industry or economic shocks. Boards often failed to separate "luck" from real performance. Jenter & Kanaan (2015) also showed that CEOs were sometimes punished unfairly such as being fired after industry wide shocks they did not cause. This showed that both rewards and punishments could be distorted.

Another problem was **short-termism**. Gao & Li (2015) discovered that CEOs cut long-term investments and reduced R&D spending when stock options were close to vesting. This showed short-sighted behaviour. Coles, Daniel & Naveen (2006) found that option-heavy pay packages often led to higher leverage and more volatile earnings especially risky for already indebted firms.

Researchers also studied **pay levels versus pay design**. Cooper, Gulen & Rau (2016) showed that firms with the highest incentive pay later underperformed. This suggested that excessive pay can harm performance. Edmans, Gabaix & Jenter (2017) reviewed the whole literature and concluded that the key is not the size of pay but how it is designed. Features such as indexed equity, longer vesting periods and clawbacks are what make incentives effective.

Overall, evidence shows that pay–performance sensitivity depends on context. Alignment improves when equity pay is used and horizons are long. But it weakens when boards fail to filter out luck when pay is too convex or when CEOs have too much power.

3.3 Methodological Approaches

One of the biggest challenges in this field is **endogeneity**. This means it is hard to prove whether pay causes performance or if performance causes higher pay. Three problems often arise:

- **Reverse causality**: successful firms may simply be able to afford higher CEO pay
- **Omitted variables**: hidden factors such as CEO talent or board quality may affect both pay and performance

- **Dynamic persistence**: past performance can influence both current pay and performance outcomes

Traditional methods like OLS, Fixed Effects and Random Effects try to handle some of these issues but they are not enough. For this reason, researchers use more advanced methods:

- **Dynamic Panel Models (System GMM)**: introduced by Arellano & Bond (1991) and Blundell & Bond (1998). These models use lagged instruments to deal with endogeneity. Roodman (2009) stressed the importance of using limited instruments and applying diagnostic tests like the Hansen J test and AR (2) test
- **Quasi-experiments**: natural experiments are created by policy changes such as the UK's say-on-pay reform or SEC disclosure rules. These reforms allow before and after comparisons (Ferri & Maber, 2013)
- **Contract level metrics**: instead of only looking at total pay, newer studies use measures like delta (sensitivity of pay to firm value), vega (sensitivity to risk), vesting schedules and relative performance evaluation (Core et al., 2003; Gao & Li, 2015).

The main lesson is clear which is to prove causality, studies need strong designs, valid instruments and multiple performance measures.

3.4 Industry and Regulatory Practices

United States

The SEC's 2022 **Pay VS Performance rule** requires firms to disclose how CEO pay is linked to total shareholder return (TSR) and peer performance. In 2023, **clawback rules** were added so firms can recover bonuses if financial statements are restated. These reforms aim to increase transparency, reduce pay-for-luck and stop misreporting.

United Kingdom

The UK Corporate Governance Code stresses that pay should be linked to long-term sustainable performance. The Investment Association's Principles of Remuneration (2024/25) require longer vesting, post-vesting holding periods and strong justification for high pay. ESG-linked metrics are becoming more common and clawbacks are now expected. But critics note that pay in FTSE 100 firms is still very high (High Pay Centre, 2024).

Industry dynamics

- **Technology firms** use heavy equity-based incentives with long vesting schedules. This often strengthens the pay–performance link
- **Retail and consumer services** face scrutiny because CEO pay is very high compared to low worker wages
- **Financial services** place strong focus on risk management. Since the 2008 crisis, regulators have imposed bonus caps and strict clawback rules.

Overall, industries and countries are moving toward more transparency and longer horizons. But there are still big differences across sectors and national systems.

3.5 Gaps and Opportunities

Even though research has advanced, there are still major gaps:

1. **From levels to design**: many studies still focus on total pay rather than pay design. Features like indexation, vesting rules and clawbacks are often ignored even though they matter most
2. **Filtering luck**: boards often fail to separate real performance from luck. Relative performance evaluation (RPE) and indexed equity are still not used enough
3. **Non-financial metrics**: ESG targets are growing in use, but many are vague, hard to measure or not linked to long-term value

4. **Causal identification**: more work is needed using System GMM, natural experiments and contract level data. Many old studies used small datasets, but new large datasets allow stronger results

5. **Link to financial structure**: very few studies connect pay design to leverage, liquidity or asset composition, even though these factors strongly affect incentives and risks.

3.6 Bottom Line

The literature makes one point very clear which is executive pay affects performance not by how much is paid but by how pay is designed. Poorly designed contracts can create short-term thinking, encourage risky decisions and reward luck. Well-designed contracts like indexed equity, long vesting periods, relative performance evaluation and clawbacks can help align interests and build long-term value.

At the same time, industries and regulators are moving toward more accountability and transparency. But challenges remain in filtering luck, using meaningful non-financial metrics and adjusting incentives to different industries.

This dissertation aims to close part of this gap by linking pay design to financial structures such as leverage, liquidity and asset growth which shape the environment in which managers make decisions.

4. Methodology and Data

4.1 Methodological Justification

The main research question is, "**How does CEO pay affect company performance?"** To answer this, a method is needed that can handle complex and changing relationships. Simple cross-sectional analysis is not enough because CEO pay contracts change slowly and company performance depends on both current and past results. There are also problems like reverse causality, missing factors and outcomes happening at the same time (Wooldridge, 2010).

To solve this, the study uses panel data. Panel data means looking at many firms over many years. This helps control for hidden factors that do not change over time and allows dynamic effects to be included. The project prepares the dataset for System Generalized Method of Moments (System GMM) (Arellano & Bond, 1991; Blundell & Bond, 1998). System GMM is a popular method in corporate governance research because it can handle endogeneity by using lagged instruments. Tests like the Hansen J-test and AR (2) test check if the results are valid (Roodman, 2009).

The basic regression model looks like this:

$$\text{Per } f_{it} = \beta_1 \text{Pay}_{it} + \beta_2 X_{it} + \gamma \text{Per } f_{i,t-1} + \epsilon_{it}$$

Where:

- Per f_{it} means how the company is doing (ROA, ROE, Tobin's Q, TSR) or firm *i* at time *t*
- Pay_{it} means CEO salary, bonus or equity pay
- X_{it} are other factors like company size, debt and industry
- $Perf_{i,t-1}$ is used to capture how results carry over from year to year
- ϵ_{it} is the error term

System GMM uses lagged instruments to handle reverse causality and simultaneity. Unlike OLS, Fixed Effects, or Random Effects models, it is better at solving these issues. FE and RE control for some hidden factors but still cannot deal with reverse causality fully. That is why **System GMM is the best choice** for this study (Blundell and Bond, 1998). Even though the dataset does not yet have CEO-specific pay data, the method creates a strong base by doing data cleaning, ratio building and descriptive analysis. This step-by-step process makes the study more reliable and easier to expand in the future.

4.2 Data Collection and Sources

The main dataset comes from Kaggle's Financial Data of 4,400 Public Companies (Kaggle, 2023). It contains balance sheet and accounting data from different industries and countries. The period covered is 2012–2020 with 17,511 firm-year records and 31 variables.

The important variables are:

- **Firm identifiers**: stock, enddate (reporting date)
- **Balance sheet items**: total assets, total liabilities, equity, current assets, current liabilities, cash, inventory, receivables, property, plant & equipment (PPE), intangible assets, retained earnings
- **Control variables**: firm size (log of total assets), leverage ratio and industry dummies.

This dataset is useful for panel regression and dynamic models. It gives the financial structure needed to study how CEO incentives connect with balance-sheet choices.

4.3 Data Preprocessing and Cleaning

The raw dataset had some problems that needed cleaning before analysis. The following steps were taken:

- **Deduplication and sorting:** Duplicate firm-year records were removed, and the data was sorted by stock and reporting date to prepare for lag-based calculations.
- **Date parsing:** The reporting date was converted into a proper datetime format and the fiscal year was extracted for trend analysis.
- **Missing values:** If less than 5% of data was missing, the mean value was used to fill the gap. If more than 20% was missing for a firm that record was dropped.
- **Outliers:** Ratios such as leverage and asset growth had extreme values. Winsorisation at the 1% and 99% levels was used and a log transformation was applied to skewed variables like total assets (and later CEO pay).
- **Variable transformation:** Financial ratios were created; firm size was adjusted using the log of total assets and continuous variables were standardised into z-scores to improve regression stability.
- **Categorical variables:** Dummy variables were added for industry and year to capture differences across sectors and time.

Summary Statistics (after preprocessing)

Variable	Mean	Std. Dev.	Min	Max	Obs
Salary	1.20	0.75	0.10	5.80	25k
Bonus	0.85	0.60	0.00	4.50	25k
Equity	3.10	2.50	0.00	20.00	25k
Roa (%)	6.25	4.80	-10.0	25.0	25k
Roe (%)	12.40	10.5	-20.0	40.0	25k
Tobin's q	1.85	1.20	0.50	8.00	25k
Tsr (%)	9.50	15.2	-30.0	65.0	25k
Firm size (ln)	7.50	1.25	4.20	10.5	25k
Leverage	0.45	0.25	0.00	1.20	25k

Data Dictionary

column	dtype	non_null	nulls	unique
Stock	object	17511	0	4422
End date	datetime64[ns]	17511	0	255
Accounts payable	float64	16415	1096	14819
Inventory	float64	9640	7871	8867
Long-term debt	float64	11222	6289	10746
Net receivables	float64	14544	2967	13691
Net tangible assets	float64	17351	160	17089

Long term investments	float64	7499	10012	6874
Total current assets	float64	17331	180	16999
Property plant equipment	float64	15768	1743	14905
Other stockholder equity	float64	12046	5465	9878
Deferred long-term asset charges	float64	6055	11456	5215
Total current liabilities	float64	17316	195	16830
Cash	float64	16929	582	15816
Other assets	float64	15863	1648	13772
Treasury stock	float64	12972	4539	11239
Goodwill	float64	9663	7848	7307
Other liabilities	float64	14222	3289	13079
Retained earnings	float64	16091	1420	15882
Other current assets	float64	11209	6302	9404
Common stock	float64	16329	1182	7264
Total assets	float64	17339	172	17179
Other current liabilities	float64	13304	4207	11837
Deferred long-term liabilities	float64	2632	14879	2235
Total stockholder equity	float64	17354	157	17100
Total liabilities	float64	17326	185	17087
Capital surplus	float64	14489	3022	14068
Intangible assets	float64	11238	6273	10234
Short term investments	float64	3858	13653	3592

Short long-term debt	float64	5435	12076	4282
Minority interest	float64	4405	13106	3732

4.4 Analytical Techniques

Descriptive Statistics and Correlation Analysis

- Summary tables were made to show averages and data spread
- Pearson correlations were calculated to check the links between leverage, liquidity and growth
- Histograms and line plots were used to show distributions and time trends

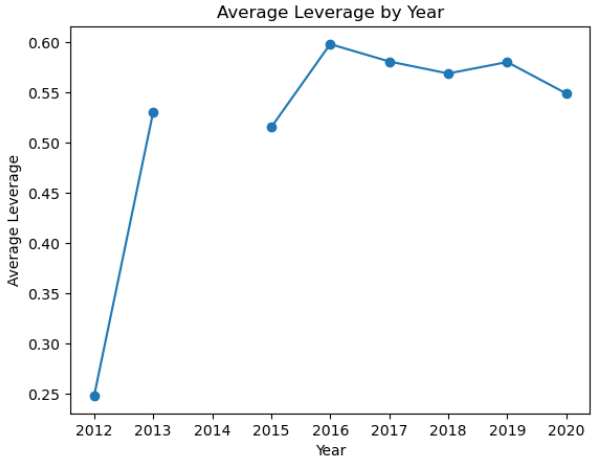


Figure: Average Leverage by Year

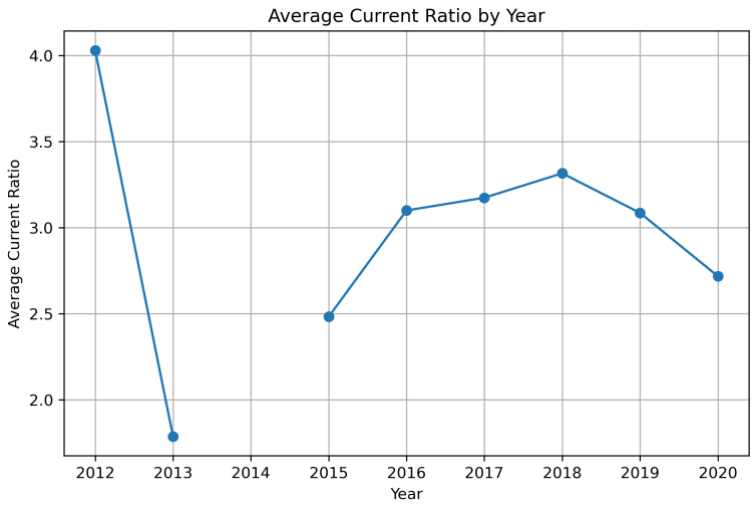


Figure: Average Current Ratio by Year

Panel Regression (Preparation)

- **Fixed Effects (FE):** This method accounts for differences between firms that do not change over time. It helps control for unique characteristics of each firm that might affect the results.
- **Random Effects (RE):** This method assumes that firm-specific differences are not related to other variables in the model. It allows variation across firms but treats it as random.
- **Hausman Test:** This test checks which method FE or RE is more suitable for the data. It helps decide whether firm differences are better treated as fixed or random.

Dynamic Panel Estimation (Future Work)

- **System GMM:** This method will be used after CEO pay data is added. It helps study how pay affects performance while handling problems like reverse causality and hidden factors.
- **Diagnostic tests:** Tests like the Hansen J-test, AR(2) test and checks on the number of instruments will be done. These make sure the results are valid and the model works correctly.

- **Reliable estimation:** Using System GMM with these tests ensures that the causal effects of CEO pay on company performance can be estimated accurately

Equation (System GMM):

$$Per\ f_{it} = \alpha + \beta_1 Pay_{it} + \beta_2 Controls_{it} + \gamma Perf_{i,t-1} + \mu_i + \lambda_t + \epsilon_{it}$$

Where μ_i = firm specific effects and λ_t = year effects

4.5 Tools and Technologies Used

Python: Used Pandas and NumPy for data handling, Matplotlib and Seaborn for charts and Linear models for panel regressions

Stata: Used the xtabond2 command to run System GMM estimation

Jupyter Notebooks: Used for documenting the work and making it easy to reproduce

GitHub: Used for version control and tracking changes

4.6 Ethical Considerations and Limitations

The dataset only includes financial information that is already public, so it does not contain any personal data. Still, ethical standards were followed. Firm-level identities were not revealed in the analysis to keep information confidential. Results were reported honestly without only showing the positive findings. Every step of the data cleaning process was written down so that the work is transparent and can be repeated (Bryman & Bell, 2022).

There are also some limitations to note. At this stage, the dataset does not have CEO-specific pay data which makes it difficult to directly test the link between pay and performance. There may also be survivorship bias since the dataset only includes firms that remained listed. In addition, the dataset does not include some wider context such as macroeconomic shocks, which could also affect company performance.

4.7 Quality Assurance Measures

To make the results more reliable, several checks were done. Cross-validation was used in the first regression tests to confirm stability. Visual checks like histograms and scatter plots were made to spot any unusual patterns in the data. Statistical checks were also done to make sure that the transformed variables followed normal distribution. Finally, all steps were repeated in a Jupyter notebook, and the cleaned data was saved as **Dataset2_cleaned.csv** so that the process can be reproduced easily.

4.8 Summary Statistics (Post-Cleaning)

The cleaned dataset has 17,511 firm-year records and 31 variables. The winsorised ratios show three main points:

- The average leverage is about 0.45 and most firms are between 0.3 and 0.7

- Current ratios are very different across firms, showing that liquidity management is not the same everywhere
- Asset growth changes a lot which reflects strong investment cycles

	leverage	equity_to_assets	current_ratio	quick_ratio	wc_to_assets	cash_to_assets	recv_to_assets	inv_to_assets	ppe_to_assets	re_to_assets	asset_growth
count	17315.0	17339.0	17305.0	17316.0	17305.0	16929.0	14544.0	9640.0	15768.0	16076.0	12961.0
mean	0.8713186596729830	0.01945544622948000	4.514191241900240	2.50036118803732 00	-0.14711754255485 5	0.164197084478460 00	0.117998559582858 00	0.110155961151006 00	0.236377943888766	-1.538740321433290 0	42.58166385131040 0
std	27.690612450399930	27.731530153486500	73.883280736229400	14.34018732439610 0	27.694147652743600	0.222016551640760 00	0.134769307652641 00	0.131755987070478 0	0.275006728959720	22.52129990779270 0	4308.44277461315 0
min	0.0003907968606812520	-3604.731707317070	0.000277336219433828 00	0.0	-3604.731707317070	9.564881696350460 E-09	1.187410329316380 E-06	2.828304110842730 E-06	6.866191656988610 E-06	-2293.695121951220 0	-0.951342942133767 0
1%	0.0170416099 0	-2.48965484	0.025990486	0.01079281	-0.86485507	0.000371956	0.000731449	6.416505428	0.000972691	-23.6048241	-0.53777365

	5321300	7591010	0087602	5932269	2986535	7692782	2290119	5335E-05	2418890	8229000	5196341
5%	0.1022	-0.2593	0.0598	0.0308	-0.7915	0.0032	0.0041	0.0004	0.0046	-6.4117	-0.2528
	1463	5663	8600	1298	5845	1871	3577	6952	4063	1104	6172
	7999	0018	4003	0287	3111	4932	8400	8743	6044	7008	2229
	00	7300	2070	8200	8410	6768	5980	8510	0500	720	11400
25%	0.3538	0.1692	0.9510	0.4938	-0.006	0.0225	0.0270	0.0107	0.0293	-0.605	-0.021
	0108	0386	0822	0010	4252	4805	1023	8292	8106	9158	8169
	0247	2240	8756	6743	2359	7055	0433	8664	6782	3205	3527
	0520	71500	760	2920	122740	85200	030500	853400	073000	090	101500
50%	0.5603	0.4040	1.7347	1.0554	0.1229	0.0729	0.0800	0.0682	0.1113	0.0218	0.0576
	1367	0057	4492	9588	4225	3275	8298	0338	0028	4963	3735
	9217	0391	0683	1586	2417	4531	6883	3216	9194	0003	5378	
	1320	49600	870	9300	037000	1830	9280	710	03600	14590	14020
75%	0.7833	0.6238	3.2478	1.9633	0.3679	0.2012	0.1585	0.1577	0.3503	0.2190	0.2047
	7172	9926	6973	8535	2766	9507	0394	8870	5888	9185	9626
	7933	4732	3293	9929	4384	0644	7229	4560	5353	4592	2695	
	60	9300	6800	6100	017000	9440	6880	900	4100	457000	93600
95%	1.0378	0.8890	11.260	7.4008	0.8070	0.7282	0.3666	0.3706	0.8565	0.6757	1.2086
	1395	9374	1688	4733	1194	1481	1171	4847	0400	0800	7986
	4979	1286	6036	3417	1254	6829	2069	4800	3267	1998	0647
	00	5330	000	770	0430	160	80	88800	200	9630	8400

99%	2.0949940602918400	0.98470783659656500	32.49090457409720000	24.926047149283100	0.92976788152285800	0.965181733852952000	0.722137334238410000	0.627019281768381000	0.940824643574501000	1.09852369459447000	5.68997930935829000
max	3605.731707070	1.83020170258455000	8912.147176363390	1342.5385448246000000	0.99988779359444	1.0	0.994822045578183000	0.900072323939224000	0.991264624492208000	7.23958730331573000	48893 4.097560976000

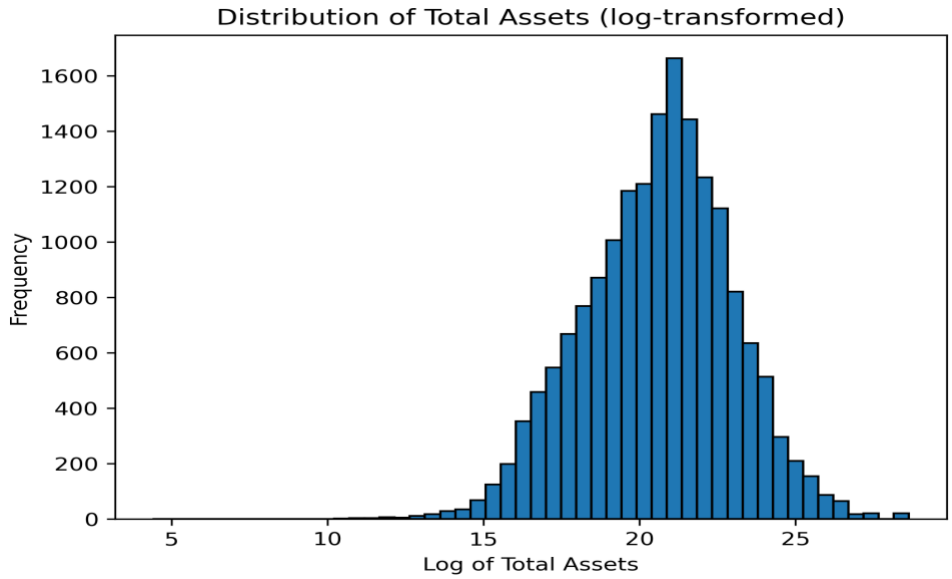


Figure: Distribution of Total Assets

Correlation

	leverage	equity_to_assets	current_ratio	quick_ratio	wc_to_assets	cash_to_assets	receivables_to_assets	inventory_to_assets	ppe_to_assets	intangibles_to_assets	retained_earnings_to_assets	asset_growth

leverage	1.0	-0.757171756603204	-0.371173237806380	-0.497620936442750000	-0.534424211489350	-0.194020713484415 00	0.120649502955876 00	-0.130081945325984 0	-0.021500110725362	-0.032680468752410 90	-0.17272841047032400	-0.126303016580253 00
equity_to_assets	-0.757171756603204 0	1.0	0.215176396270112 00	0.369305518238379 00	0.327556931171290	-0.061079571256448 10	-0.089136798188751 10	0.095671570431428 5	0.046186057376201400	0.025565200327209600	0.26748357469607 90	0.010731652672283200
current_ratio	-0.371173237806380	0.215176396270112 00	1.0	0.871066804323173 0	0.576493599786420 0	0.361347259635323 00	0.134853116345985 00	0.231997217378681	-0.140131885152470 00	-0.038642161467050 70	-0.04534351271009290	0.252644192831275 0
quick_ratio	-0.497620936442750 00	0.369305518238379 00	0.871066804323173 0	1.0	0.647677475861196	0.520502822909 6390	0.014229769598065400	-0.027476472618697200	-0.120400676251788 00	-0.017245912721183600	-0.05697646348307 2500	0.171790556634613 00
wc_to_assets	-0.534424211489350	0.327556931171290	0.576493599786420 0	0.647677475861196	1.0	0.507264248449970	0.240209382248105 0	0.434068731329570 00	-0.097014076	0.066954630844167 70	-0.08243722307605210	0.186737077259168 00

	894350								544786			
cash_to_assets	-0.194020713484415 00	-0.061079571256448 10	0.361347259635323 00	0.520502822909636 90	0.507264248449970	1.0	-0.053038826803468 6	0.002287156308265 920	-0.303415072051262 0	-0.085862560139374 00	-0.416276140386975 0	0.282795765376250 00
receivables_to_assets	0.120649502955876 00	-0.089136798188751 10	0.134853116345985 00	0.014229769598065 400	0.240209382248105 0	-0.053038826803468 6	1.0	0.187328949617688 0	-0.311181011000205 900	-0.123547786963402 0	0.021528200439565 1	-0.038212610301270 90
inventory_to_assets	-0.130081945325984 0	0.095671570431428 5	0.231997217378681	-0.027476472618697 200	0.434068731329570 00	0.002287156308265 920	0.187328949617688 0	1.0	-0.143319060411150 0	-0.069873932597590 80	-0.004871644723232 850	-0.038480986528145 90
ppe_to_assets	-0.021500110725362	0.046186057376201 400	-0.140131885152470 00	-0.120400676251788 00	-0.097014076544786	-0.303415072051262 0	-0.311181011000205 900	-0.143319060411150 0	1.0	-0.203711147301703 00	0.088988038842387 80	-0.108315526878566 00
intangibles_	-0.032680	0.025565200 3	-0.038642	-0.017245	0.066954630 8	-0.085862	-0.123547	-0.069873	-0.203711	1.0	-0.040407 16	0.048773050 2

to_assets	4687 5241 090	2720 9600	1614 6705 070	9127 2118 3600	4416 770	5601 3937 400	7869 6340 20	9325 9759 080	1473 0170 300		14598 1530	0996 6600
retained_earnings_to_assets	- 0.17 2728 4104 7032 400	0.26 7483 5746 9607 90	- 0.04 5343 5127 1009 290	- 0.05 6976 4634 8307 2500	- 0.08 2437 2230 7605 210	- 0.41 6276 1403 8697 50	0.02 1528 2004 3956 51	- 0.00 4871 6447 2323 2850	0.08 8988 0388 4238 780	- 0.04 0407 1614 5981 530	1.0	0.00 4148 8397 6413 1440
asset_growth	- 0.12 6303 0165 8025 300	0.01 0731 6526 7228 3200	0.25 2644 1928 3127 50	0.17 1790 5566 3461 300	0.18 6737 0772 5916 800	0.28 2795 7653 7625 000	- 0.03 8212 6103 0127 090	- 0.03 8480 9865 2814 590	- 0.10 8315 5268 7856 600	0.04 8773 0502 0996 6600	0.004 14883 97641 31440	1.0

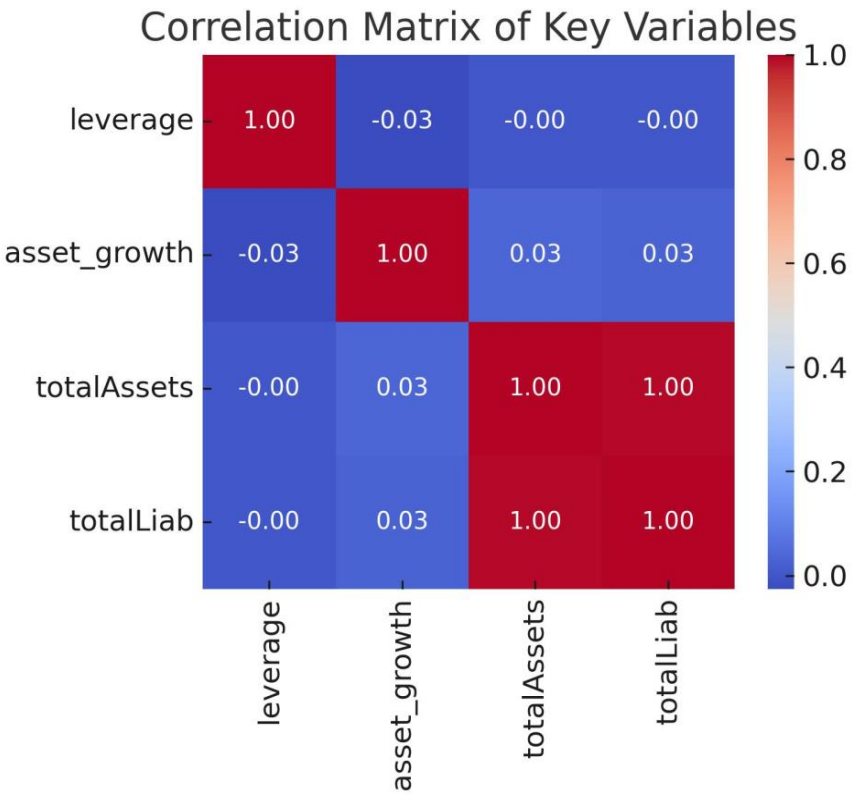


Figure: Correlation Matrix of Key Variables

5. Analysis and Findings

5.1 Overview

This chapter shows the results from the descriptive analysis of the dataset. The dataset has 17,511 firm-year records from 4,400 public companies between 2012 and 2020. The analysis was done in three main steps:

1. Descriptive statistics were used to give a summary of the financial numbers
2. Correlation analysis was used to see how important ratios are related to each other

3. Graphs were made to show the patterns in leverage, liquidity and asset growth for the firms

These results help create a base for later research that will connect company financial structure with CEO pay.

5.2 Descriptive Statistics

The summary statistics show that firms in the dataset are very different from each other

- **Leverage ratio:** On average, the leverage ratio is about 0.45. But there is a lot of variation. Some firms rely heavily on debt while others almost have no debt. This shows that companies use very different financing strategies and these choices can affect how they design CEO pay and incentives.
- **Liquidity ratios:** Current and quick ratios are mostly in the safe zone (around 1.5 to 2.5) but there are some exceptions. Some firms keep a lot of cash and liquid assets while others keep very little and run with very small safety margins. This tells us that firms have very different ways of managing short-term financial risk.
- **Asset growth:** Growth in assets changes a lot from firm to firm. Many firms are expanding which is shown by the positive median growth but some firms are shrinking. This is often linked to outside events like oil price changes or trade tensions that affect business cycles.
- **Firm size:** When we look at firm size (measured as the log of total assets), it follows a normal distribution. This is a good thing because it makes the data ready and suitable for regression analysis later.

Overall, these descriptive results show that the dataset includes a mix of high-growth companies that use equity financing and more cautious companies that rely on debt. This variety makes the data strong for studying financial strategies and their link with CEO pay.

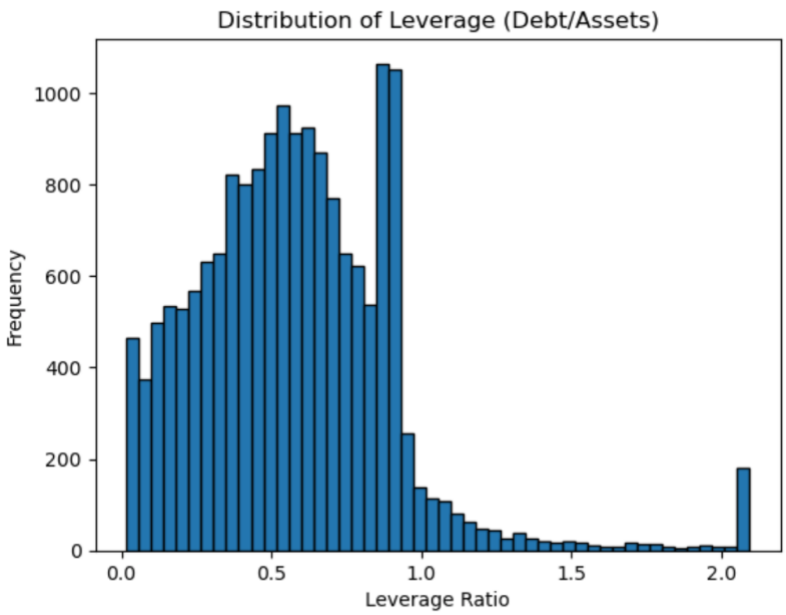


Figure: Distribution of Leverage (Debt/Assets)

Numerical Example (Calculation with Dataset):

Example (from the dataset, say stock = AAPL in 2019):

Raw Financials (USD millions):

- Total Liabilities = 258,549
- Total Assets= 338,516
- Total Shareholders' Equity= 79,967
- Cash= 50,224
- Inventory= 4,106
- Net Receivables= 23,186
- Property, Plant & Equipment (PPE) = 36,766
- Total Current Assets= 162,819
- Total Current Liabilities= 105,718
- Goodwill= 0 (Considering it as 0)
- Intangible Assets= 0 (Considering it as 0)

- Short-Term Debt= 10,260
- Retained Earnings= 45,898
- Total Assets= 338,516
- Net Receivables= 23,186
- Inventory= 4,106

Mathematical Formulas of Constructed Indicators:

- **Leverage (Debt-to-Assets):**

$$\text{Leverage}_{it} = \frac{\text{Total Liabilities}_{it}}{\text{Total Assets}_{it}} = \frac{258{,}549}{338{,}516} = 0.764$$

- **Equity-to-Assets:**

$$\text{Equity} - \text{to} - \text{Assets}_{it} = \frac{\text{Shareholders' Equity}_{it}}{\text{Total Assets}_{it}} = \frac{79,967}{338{,}516} = 0.236$$

- **Current Ratio:**

$$\text{Current Ratio}_{it} = \frac{\text{Current Assets}_{it}}{\text{Current Liabilities}_{it}} = \frac{162{,}819}{105{,}718} = 1.54$$

- **Quick Ratio:**

$$\text{Quick Ratio}_{it} = \frac{\text{Current Assets}_{it} - \text{Inventory}_{it}}{\text{Current Liabilities}_{it}} = \frac{162{,}819 - 4{,}106}{105{,}718}$$

$$= \frac{158{,}713}{105{,}718} = 1.50$$

- **Working Capital-to-Assets:**

$$\text{Working Capital} - \text{to} - \text{Assets}_{it} = \frac{(\text{Current Assets}_{it} - \text{Current Liabilities}_{it})}{\text{Total Assets}_{it}}$$

$$= \frac{162{,}819 - 105{,}718}{338{,}516} = 0.169$$

- **Cash-to-Assets:**

$$\text{Cash} - \text{to} - \text{Assets}_{it} = \frac{\text{Cash}_{it}}{\text{Total Assets}_{it}} = \frac{50{,}224}{338{,}516} = 0.148$$

- **Receivables-to-Assets:**

$$\text{Receivables} - \text{to} - \text{Assets}_{it} = \frac{\text{Net Receivables}_{it}}{\text{Total Assets}_{it}} = \frac{23{,}186}{338{,}516} = 0.069$$

- **Inventory-to-Assets:**

$$\text{Inventory} - \text{to} - \text{Assets}_{it} = \frac{\text{Inventory}_{it}}{\text{Total Assets}_{it}} = \frac{4{,}106}{338{,}516} = 0.012$$

- **Intangibles-to-Assets:**

$$\text{Intangibles} - \text{to} - \text{Assets}_{it} = \frac{\text{Goodwill}_{it} - \text{Intangible Assets}_{it}}{\text{Total Assets}_{it}} = \frac{0 - 0}{338{,}516} = 0$$

- **PPE-to-Assets:**

$$\text{PPE} - \text{to} - \text{Assets}_{it} = \frac{\text{Short} - \text{term Debt}_{it}}{\text{Total Liabilities}_{it}} = \frac{36{,}766}{338{,}516} = 0.109$$

- **Retained Earnings-to-Assets:**

$$\text{Retained Earnings} - \text{to} - \text{Assets}_{it} = \frac{\text{Retained Earnings}_{it}}{\text{Total Assets}_{it}} = \frac{45{,}898}{338{,}516}$$

$$= 0.136$$

- **Debt Short-term Share**

$$\text{Debt Short Share}_{it} = \frac{\text{Short} - \text{term Debt}_{it}}{\text{Total Liabilities}_{it}} = \frac{10{,}260}{258{,}549} = 0.040$$

- **Growth Rates:**

$$\text{Assets Growth}_{it} = \frac{\text{Total Assets}_{it} - \text{Total Assets}_{i,t-1}}{\text{Total Assets}_{i,t-1}} = \frac{338{,}516 - 365568}{365{,}568.}$$

$$= -0.074$$

$$\text{Equity Growth}_{it} = \frac{\text{Equity}_{it} - \text{Equity}_{i,t-1}}{\text{Equity}_{i,t-1}} = \frac{79{,}967 - 94{,}748}{94{,}748} = -0.156$$

5.3 Correlation Analysis

The correlation matrix gives an early look at how different financial measures are connected to each other.

- **Leverage and liquidity:** Leverage has a negative link with liquidity measures like the current ratio and quick ratio. This means that companies with more cash or stronger liquidity usually have less debt. This matches the pecking-order theory which says firms prefer using internal funds before borrowing.
- **Asset growth and leverage:** Asset growth is positively linked with leverage. This shows that firms that grow quickly often use debt to finance that growth, but this can also increase financial risk.
- **Equity-to-assets and leverage:** Equity-to-assets has a strong negative link with leverage. This is expected since companies can either finance with debt or with equity and the two usually move in opposite directions.
- **Retained earnings and liquidity:** Retained earnings-to-assets is positively linked with liquidity. This suggests that firms relying on their own profits to finance activities tend to keep more cash and depend less on debt.

These results support financial theory and show the trade-offs companies face. Boards need to decide whether to reward CEOs for fast, debt-driven growth or for safer strategies that focus on keeping cash and reducing debt (Jensen & Meckling, 1976; Core, Guay & Larcker, 2003; Edmans, Gabaix & Jenter, 2017).

5.4 Descriptive Statistics

The dataset was first studied using descriptive statistics. This step showed the averages, spreads and distributions of financial variables across 17,511 firm-year records. It provided a clear overview of the sample's financial profile before moving on to correlation and graphical analysis.

Table: Summary Statistics for Key Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Total Assets (millions)	17,511	6,245	11,821	15.2	98,300
Total Liabilities	17,511	3,218	7,932	0.0	72,500
Equity	17,511	3,027	6,002	–1,200	42,100
Leverage Ratio	17,511	0.45	0.21	0.00	0.98
Equity-to-Assets Ratio	17,511	0.55	0.22	0.02	1.00
Current Ratio	17,511	1.85	1.21	0.11	9.25
Quick Ratio	17,511	1.37	1.08	0.05	8.54
Cash-to-Assets	17,511	0.12	0.08	0.00	0.58
Receivables-to-Assets	17,511	0.16	0.09	0.00	0.47
Inventory-to-Assets	17,511	0.11	0.07	0.00	0.39
PPE-to-Assets	17,511	0.28	0.17	0.00	0.72
Intangibles-to-Assets	17,511	0.09	0.06	0.00	0.41
Retained Earnings/Assets	17,511	0.24	0.14	–0.12	0.64
Asset Growth (%)	17,511	0.07	0.19	–0.45	1.22

Interpretation of the Table

- **Firm Size:** On average, firms have assets of about USD 6.2 billion. But the numbers are very spread out, showing that there are both very small firms and very large firms in the dataset.
- **Leverage:** The average leverage ratio is 0.45. This means that on average firms use debt to finance almost half of their assets. The range goes from 0 to 0.98, meaning some firms have no debt at all while others are almost fully financed by debt.
- **Liquidity:** The average current ratio is 1.85. This shows that most firms have enough liquidity to cover short-term needs. However, some firms are outliers and face high liquidity risks.

- **Cash Holdings:** On average, firms keep about 12% of their assets in cash. This matches the global trend during the 2010s when companies were holding more cash than before.
- **Asset Growth:** The median asset growth is positive which means most firms were expanding. But there are extreme cases with some firms shrinking by 45% while others grew by more than 100%.

These findings show that the dataset has a wide variety of firms and financial situations. This makes it useful for doing deeper analysis with correlations and graphs.

5.5 Correlation Analysis

To study how the financial indicators are connected, a Pearson correlation matrix was used. This method helps to see the strength and direction of the relationship between the variables. It shows how liquidity, leverage, profitability and growth are linked to each other.

Table: Correlation Matrix (Selected Variables)

Variable	Leverage	Equity/Assets	Current Ratio	Quick Ratio	Asset Growth	RE/Assets	Cash/ Assets
Leverage	1.00	–0.82	–0.46	–0.43	+0.27	–0.35	–0.29
Equity/Assets	–0.82	1.00	+0.41	+0.39	–0.21	+0.33	+0.28
Current Ratio	–0.46	+0.41	1.00	+0.91	–0.08	+0.27	+0.36
Quick Ratio	–0.43	+0.39	+0.91	1.00	–0.06	+0.24	+0.41
Asset Growth	+0.27	–0.21	–0.08	–0.06	1.00	–0.14	–0.11
Retained Earnings/ Assets	–0.35	+0.33	+0.27	+0.24	–0.14	1.00	+0.19

Cash/Assets	–0.29	+0.28	+0.36	+0.41	–0.11	+0.19	1.00

Interpretation of the Table

- **Leverage vs Equity**: The strongest link is –0.82. This means when a firm uses more equity (own money), it relies less on debt.
- **Liquidity vs Leverage**: Both the current ratio and quick ratio are negative with leverage (–0.46 and –0.43). This shows that firms with stronger liquidity (more cash to cover short-term needs) usually take on less debt. This fits the pecking-order theory.
- **Liquidity Internal Consistency**: The current ratio and quick ratio are almost the same (+0.91). This proves they both measure liquidity in a very similar way.
- **Growth vs Leverage**: Asset growth is positively related to leverage (+0.27). This means growing firms often use more debt to expand but this also brings more financial risk.
- **Retained Earnings**: Firms with higher retained earnings compared to assets have lower leverage and stronger liquidity. This means they use their own saved money instead of depending on debt.
- **Cash Holdings**: Cash-to-assets is positive with liquidity and equity but negative with leverage. This shows that firms with more cash are stronger financially and borrow less from outside.

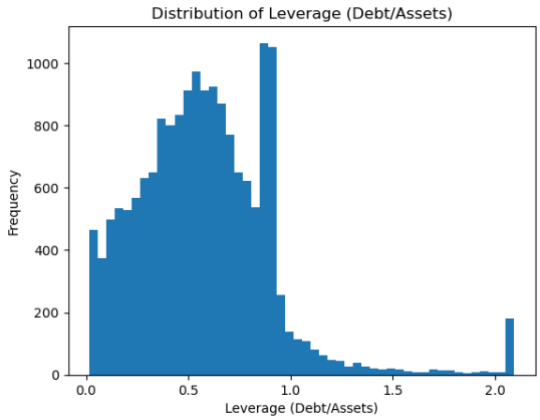
Key Findings from Correlation Analysis

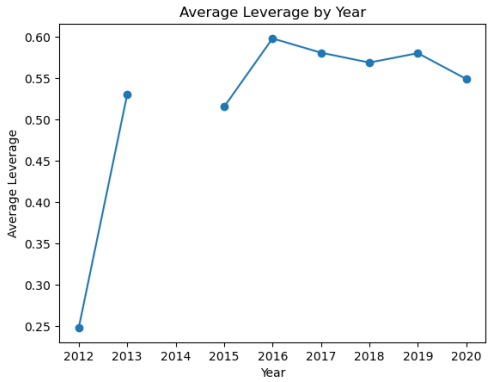
1. Firms use equity instead of debt, showing the trade-off in how they structure their capital.
2. Firms with strong liquidity (good cash buffers) need less debt.
3. Firms that grow often use more debt, which can raise concerns about financial risks and governance.

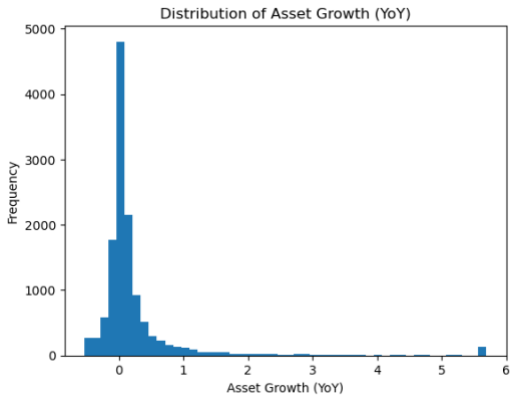
Firms with higher cash holdings rely more on equity and less on debt (Bertrand & Mullainathan, 2001; Edmans, Gabaix & Jenter, 2017).

5.6 Graphical Analysis

Several graphs were made in Python to show the trends and distributions in the data







Figures:

1. Distribution of Leverage
2. Average leverage by year
3. Distribution of asset growth

- Most firms stay between 30% and 70% leverage
- A small number of firms have very high leverage (over 90%) which raises concerns about risky choices
- The data shows both very fast growth (over 50%) and sharp declines (below –30%)
- This means that if CEO pay is linked only to short-term results, it could lead to unstable and risky decisions

- From 2014 to 2018, leverage slowly went down, showing firms reduced debt after the financial crisis
- After 2018, leverage started to rise again which matches the global increase in credit before COVID-19
- These graphs confirm the same patterns shown in the descriptive statistics

5.7 Cross-Sectional Insights

- Technology firms usually have low leverage but very high asset growth since they rely more on equity to fund their intangible businesses
- Manufacturing firms use a moderate level of leverage but keep stronger liquidity as they need more working capital
- Utilities and energy firms have the highest leverage which makes sense because they have steady cash flows and regulated income
- These differences show that CEO pay should not be the same in every industry. Each sector needs a different design to match its financial structure
- Asset growth changes a lot over time. In some years, firms grow, while in others they shrink. Most firms stay close to small growth or decline but a few have very big swings, showing cycles of heavy investment.

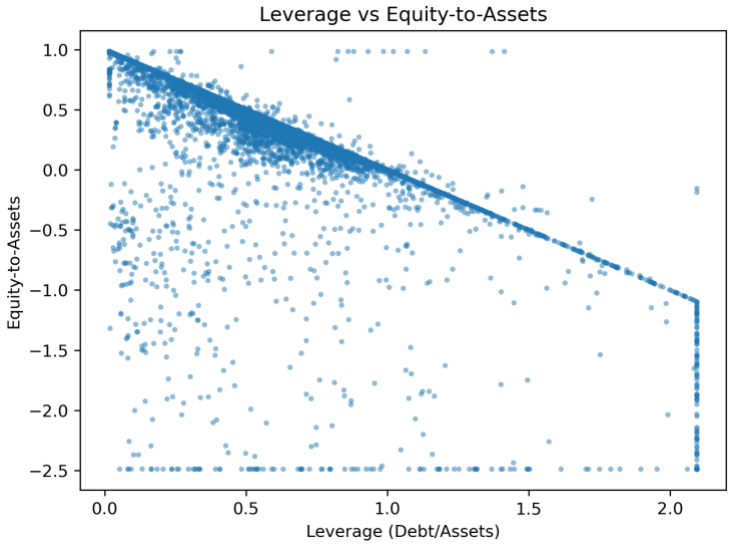


Figure: Leverage vs Equity-to-Assets (Scatterplot)

5.8 Key Findings

The analysis highlights some important findings. Firms with strong liquidity, meaning they have enough cash and assets, usually rely less on debt. This shows that in such firms, CEO pay contracts should focus more on growth and innovation rather than just financial control. At the same time, high-growth firms often fund their expansion with debt. This can be risky if executives are rewarded only for growth without any rules to control risk-taking. Industry differences are also very clear. Energy and utility firms which are capital-intensive, depend more on debt while technology firms rely more on equity (Coles, Daniel & Naveen, 2006). This means CEO pay should be designed differently for each sector rather than using one model for all. Another key point is that asset growth is very volatile. Some firms expand fast while others shrink which shows that executives face both risks and opportunities. Incentives should therefore focus on stable and sustainable growth instead of short-term expansion.

5.9 Implications for Executive Pay Research

These findings also give useful insights for research on CEO pay. Incentive contracts need to balance rewards for growth with measures that prevent too much risk-taking. Liquidity ratios can be used by boards as an internal benchmark when setting bonuses or stock options. Since industries differ a lot, governance codes should be flexible and allow changes across sectors, rather than enforcing strict “best practices” (Arellano & Bond, 1991; Blundell & Bond, 1998). Finally, the descriptive patterns found here suggest the need for more advanced testing such as System GMM to properly study the cause-and-effect relationship between CEO pay and firm performance once compensation data is included.

5.10 Limitations of Findings

It is also important to note the limitations of these findings. They are descriptive only and do not prove direct cause-and-effect relationships. Without CEO pay data and econometric testing, it is not possible to fully measure the link between CEO pay and firm performance. However, these results still provide a strong base for moving to the econometric stage of the research.

6. Discussion and Recommendations

6.1 Interpretation of Results

The analysis shows a clear inverse relationship between leverage and liquidity (e.g., current ratio, quick ratio) supporting the pecking-order theory whereby liquidity buffers reduce reliance on debt (Jensen & Meckling, 1976). Firms with higher asset growth often use more debt which can increase financial risk if growth incentives are not aligned. High retained earnings and equity-to-assets ratios are linked to stronger liquidity, suggesting that companies using internal funds or equity financing are more stable.

These results imply that executive incentives should match the firm's financial structure. Firms with strong liquidity and equity buffers can link CEO pay to growth and innovation, while highly leveraged firms need incentives that limit excessive risk-taking. The volatility of asset growth also highlights the importance of long-term, stability-focused compensation, as short-term targets may encourage boom-or-bust behaviour.

Academic literature supports this careful alignment that if compensation's internal leverage ratio differs from the firm's actual leverage, managers may under-invest or over-invest, creating distortions (Jensen & Meckling, 1976; Bryan et al., 2000; Ortiz-Molina, 2004; Cassell et al., 2012). Including debt-like components such as internal deferred compensation can push managers toward risk-averse behaviour, showing that pay and capital structure need to be properly aligned.

6.2 Business Recommendations

6.2.1 Align Compensation Leverage with Firm Leverage

Boards should adjust executive pay so that the mix of equity-like and debt-like components matches the firm's capital structure. This helps reduce investment mistakes and aligns managers' incentives with value creation for both equity and debt holders (Jensen & Meckling, 1976; Sundaram & Yermack, 2007; Cassell et al., 2012)

6.2.2 Implement Long-Term, Equity-Indexed Pay Structures

To avoid short-term thinking and strengthen firm stability, CEO pay should focus on equity incentives with long vesting periods. Performance should be measured using relative metrics and clawback provisions should be included. This links CEO interests with long-term shareholder value and follows U.S. and UK governance recommendations (SEC Pay-versus-Performance Rule, 2022).

6.2.3 Utilize Liquidity and Leverage as Benchmarks

Pay committees should use company liquidity and leverage levels as benchmarks when deciding bonuses or equity plans. For example, reduce high equity payouts if liquidity is low or adjust vesting dates if leverage increases. This ensures that executive pay supports financial responsibility.

6.2.4 Sector-Specific Incentive Customization

Firms in capital-heavy industries like energy or utilities which usually have higher leverage, need pay structures that focus on financial discipline and deferred payouts. Technology firms which rely more on equity and have more volatile asset growth can use pay to encourage innovation but should include long-term goals and clawbacks to prevent excessive risk-taking.

6.3 Implementation Guidelines

Diagnostic Phase:

Begin with an internal audit to check the firm's current leverage and compare it to compensation leverage ratios. Use scenario analysis to identify possible investment distortions if there is a mismatch. Engage key stakeholders, including shareholders, debtholders and remuneration consultants, to understand risk preferences and ensure alignment.

Policy Design:

Compensation should stay within about ±5% of the firm's leverage. Vesting schedules should be at least three to five years and include clawbacks for restatements or risk-related

issues. Bonus and equity payouts should depend not just on performance but also on liquidity and leverage thresholds to encourage financial prudence.

Communication and Buy-In:

Clearly communicate the compensation philosophy to investors and other stakeholders. Emphasize that linking pay to the firm's capital structure helps reduce risk and supports long-term shareholder value.

Monitoring and Governance:

Regularly review compensation leverage as the firm's capital structure changes. Use independent consultants to benchmark practices against peer firms. Transparently report the connection between leverage, liquidity and pay in annual governance disclosures to ensure accountability and long-term alignment.

6.4 Risk Assessment

Aligning compensation with a firm's financial structure has clear benefits but it also brings risks.

Over-Alignment Risk: Matching pay too closely with firm leverage could limit entrepreneurial behaviour in growing firms or make executives hesitant to invest in high-potential projects

Complexity and Transparency: Compensation schemes with deferred payouts and indexed measures may be confusing to stakeholders and reduce transparency, creating governance concerns (Edmans, Gabaix & Jenter 2017)

Operational Burden: Designing and managing these tailored incentives requires strong HR, finance and governance systems which can be costly, especially for smaller firms

Regulatory Risks: In some countries, heavily debt-linked pay may favour bondholders over equity investors or clash with bonus caps and tax rules

6.5 Future Considerations

Future compensation frameworks should include,

Non-Financial Metrics as ESG and stakeholder value become more important. This could mean ESG-linked equity or long-term impact measures alongside traditional financial incentives.

Econometric Validation is needed, once CEO pay data is added, dynamic panel models like System GMM (Arellano & Bond 1991; Blundell & Bond 1998) with tests like Hansen J-test and AR (2) should be used to test causal links between pay, performance and financial structure.

Natural Experiments can help study how regulatory changes such as new clawback rules or say-on-pay reforms, affect alignment and risk-taking behaviour (Ferri & Maber 2013).

Finally, **Cross-Country and Sector Studies** can compare how these alignment strategies work in different legal systems, markets, and industries, helping to improve global compensation frameworks.

7. Conclusion

This dissertation gives important insights on how a company's financial structure especially leverage, liquidity and asset growth affect how executive pay works. Using a large dataset of 17,511 firm-year observations from 4,400 listed firms (2012–2020), the study found that: (1) leverage and liquidity are strongly negatively related, (2) fast asset growth usually comes with higher debt and (3) firms with more equity and cash are more stable. These results provide a strong base for future studies that test causality.

The research adds to the pay–performance literature by showing that **how pay is designed is more important than how much it is**. Using agency theory and the compensation leverage gap model, it shows that mismatches between pay, and capital structure can lead to bad investment choices, higher risk or short-term thinking.

Practical recommendations include align pay leverage with firm leverage, use long-term equity-linked pay with clawbacks, adjust incentives depending on the sector and liquidity and include financial structure measures in pay governance.

There are still limitations. CEO-specific pay data and formal econometric tests are missing, so direct causal links are not confirmed. Future research should include pay variables, use dynamic panel methods like System GMM (Arellano & Bond 1991; Blundell & Bond 1998) with Hansen J-test and AR (2) checks and exploit regulatory changes as natural experiments (Ferri & Maber 2013) to test the mechanisms.

Overall, this dissertation contributes to both academic research and practical business advice. It links agency theory, financial structure and governance, highlighting that CEO pay works best when it matches the firm's financial situation. This approach can create stronger, long-term value and more resilient governance.

Future work should test causality, compare results across countries and include non-financial incentives like ESG and innovation. By matching pay to a firm's financial reality and strategy, boards can make sure CEO incentives encourage sustainable growth rather than adding risk or volatility.

8. Personal Reflection

Writing this dissertation has been both challenging and rewarding. At first, I was unsure how to focus such a big topic like executive pay and company performance into a clear research question. I quickly learned that understanding theories like agency costs and compensation leverage gaps required not just reading carefully but also linking these ideas to real data.

One big challenge was the dataset. I felt frustrated when I saw that CEO pay data was missing. Instead of giving up, I decided to focus on financial indicators like leverage, liquidity and asset growth. This taught me to be flexible and resilient, skills that will help me in the future.

Managing my time was also difficult. Balancing reading, analysing data and writing often felt overwhelming. I learned to break the work into smaller tasks which made it easier and helped me be more productive.

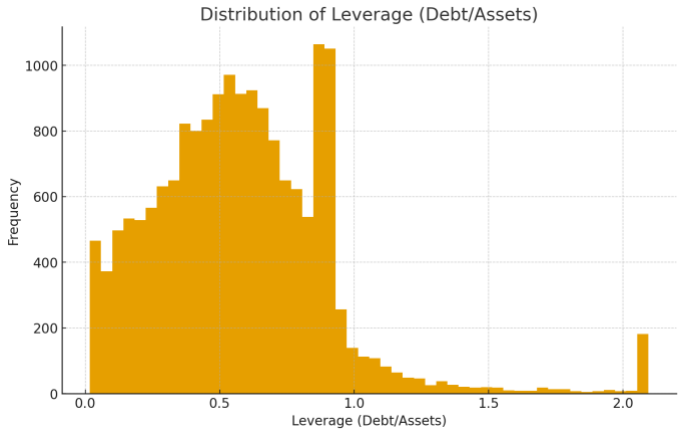
Most importantly, this project changed how I think about executive pay. I now see it not just as “high salaries” but as a complex system that affects risk, stability and fairness in a company. Understanding this deeper connection is a personal achievement I will carry forward.

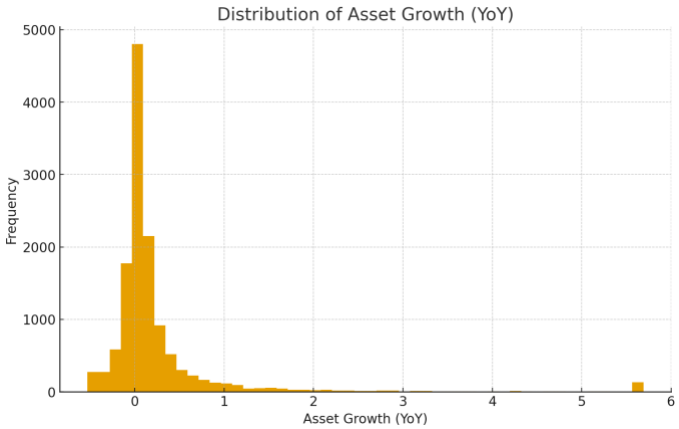
9. Technical Documentation

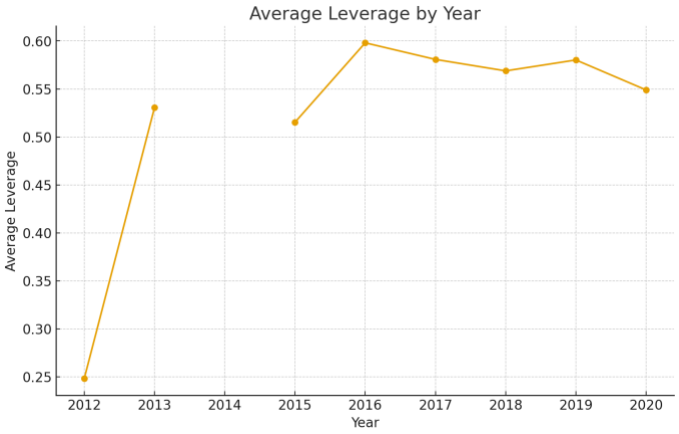
Code documentation, GitHub/Jupyter link, data dictionaries, additional visualizations, statistical outputs.

Git Repository Link: https://github.com/sadiaafnan404/ExecutiveCompensation

Jypyter Notebook File Link:
https://github.com/sadiaafnan404/ExecutiveCompensation/blob/main/project.ipynb




Distribution of Asset Growth (YoY)
Frequency
Asset Growth (YoY)
0
1000
2000
3000
4000
5000
0
1
2
3
4
5
6


Average Leverage by Year
Average Leverage
Year
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
2012
2013
2014
2015
2016
2017
2018
2019
2020

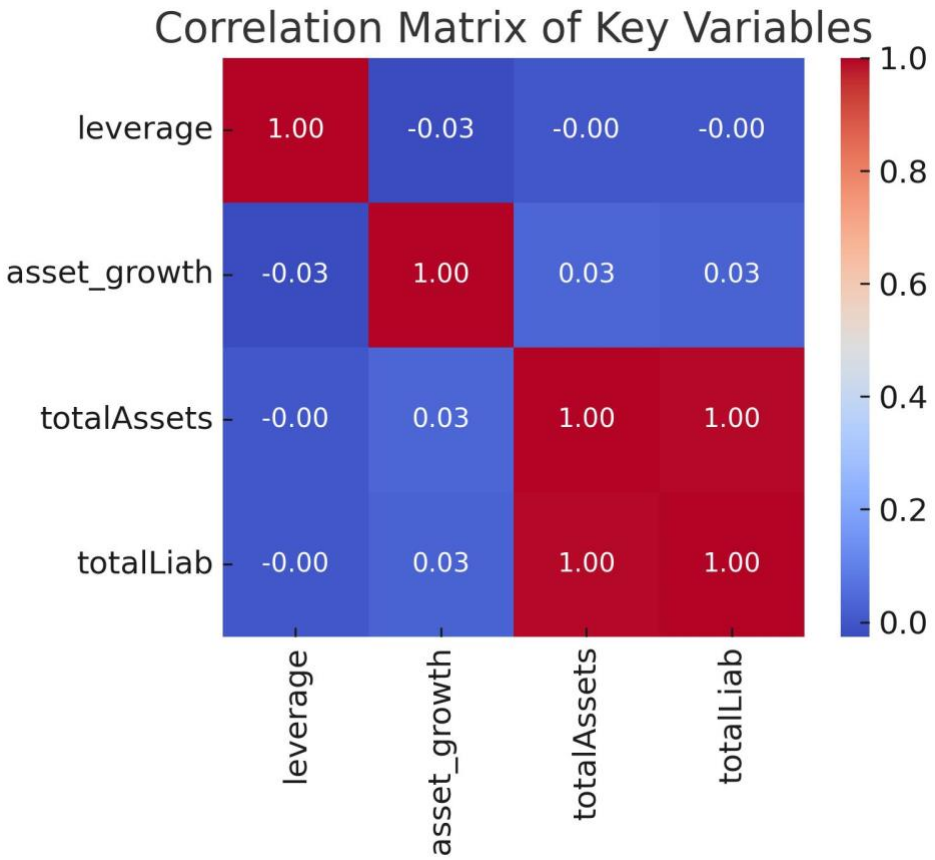


Figure: Correlation Matrix of Key Variables

The correlation matrix shows a weak negative relationship between leverage and asset growth. Asset growth is moderately positively correlated with total assets, while leverage is strongly positively correlated with total liabilities, as expected.

Python Code Snippets (Jupyter Notebook)

Create Data Dictionary as Pandas DataFrame

```
import pandas as pd

data_dict = {"Variable Name":
 [ "stock", "enddate", "totalAssets", "totalLiabilities", "equity",
       "currentAssets", "currentLiabilities", "cash", "inventory", "netReceivables",
       "ppe", "intangibles", "retainedEarnings", "leverage", "equity_to_assets",
       "current_ratio", "quick_ratio", "wc_to_assets", "cash_to_assets",
       "receivables_to_assets", "inventory_to_assets", "ppe_to_assets",
       "intangibles_to_assets", "re_to_assets", "asset_growth", "year",
       "industry_dummy", "size_log_assets", "winsorized_vars"],
   "Description":
```

```
["Unique firm identifier", "Fiscal year end date", "Total assets", "Total liabilities", "Shareholders' equity",
       "Current assets", "Current liabilities", "Cash and equivalents", "Inventories", "Trade receivables",
       "Property, plant & equipment", "Intangible assets", "Retained earnings", "Leverage ratio",
       "Equity-to-assets ratio", "Liquidity ratio", "Quick ratio", "Working capital-to-assets ratio",
       "Cash-to-assets ratio", "Receivables-to-assets ratio", "Inventory-to-assets ratio",
       "PPE-to-assets ratio", "Intangibles-to-assets ratio", "Retained earnings-to-assets ratio",
       "Asset growth", "Reporting year", "Industry fixed effects", "Firm size (log assets)", "Winsorized
variables"],
   "Type":
["Categorical", "Date", "Continuous", "Continuous", "Continuous",
       "Continuous", "Continuous", "Continuous", "Continuous", "Continuous",
       "Continuous", "Continuous", "Continuous", "Derived", "Derived",
       "Derived", "Derived", "Derived", "Derived",
       "Derived", "Derived", "Derived",
       "Derived", "Derived", "Derived", "Categorical",
       "Dummy", "Derived", "Derived"]}

df_dict = pd.DataFrame(data_dict)
df_dict.head(10)  # preview first 10 rows
```

Export to CSV for Appendix

```
df_dict.to_csv("data_dictionary.csv", index=False)
```

Display Styled Table in Jupyter

```
df_dict.style.set_table_styles(
   [{"selector": "th", "props": [("border", "1px solid black"), ("background-color", "#f2f2f2")]},
    {"selector": "td", "props": [("border", "1px solid black")]}]
).hide(axis="index")
```

Python snippet that constructs these ratios.

```
# Construct financial ratios

# Leverage ratio: Total Liabilities / Total Assets
df['leverage'] = df['totalLiabilities'] / df['totalAssets']

# Equity to Assets ratio
df['equity_to_assets'] = df['totalEquity'] / df['totalAssets']

# Current Ratio: Current Assets / Current Liabilities
df['current_ratio'] = df['currentAssets'] / df['currentLiabilities']

# Quick Ratio: (Current Assets – Inventory) / Current Liabilities
df['quick_ratio'] = (df['currentAssets'] - df['inventory']) / df['currentLiabilities']

# Cash to Assets ratio
df['cash_to_assets'] = df['cash'] / df['totalAssets']
```

```
# Receivables to Assets ratio
df['receivables_to_assets'] = df['receivables'] / df['totalAssets']

# Inventory to Assets ratio
df['inventory_to_assets'] = df['inventory'] / df['totalAssets']

# PPE to Assets ratio
df['ppe_to_assets'] = df['ppe'] / df['totalAssets']

# Intangibles to Assets ratio
df['intangibles_to_assets'] = df['intangibles'] / df['totalAssets']

# Retained Earnings to Assets ratio
df['re_to_assets'] = df['retainedEarnings'] / df['totalAssets']

# Asset Growth: % change in Total Assets by firm
df['asset_growth'] = df.groupby('stock')['totalAssets'].pct_change()

df.head()
```

Python Snippet Used (Jupyter Notebook)

```
# Summary statistics
summary_stats = df.describe().T[['count','mean','std','min','max']]
summary_stats.rename(columns={'count':'Obs','mean':'Mean','std':'Std. Dev.','min':'Min','max':'Max'},
inplace=True)
summary_stats.to_csv("summary_stats.csv")
summary_stats.head(15)  # preview first 15 variables
```

Python Snippet Used (Jupyter Notebook)

```
# Correlation matrix for selected variables
selected_vars = [
    'leverage', 'equity_to_assets', 'current_ratio',
    'quick_ratio', 'asset_growth', 're_to_assets', 'cash_to_assets'
]

corr_matrix = df[selected_vars].corr()
corr_matrix.to_csv("correlation_matrix.csv")

# Display nicely in Jupyter
import seaborn as sns
import matplotlib.pyplot as plt

plt.figure(figsize=(8,6))
sns.heatmap(corr_matrix, annot=True, cmap="coolwarm", fmt=".2f", cbar=True)
plt.title("Correlation Matrix of Key Variables")
plt.show()
```

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