Handelshøyskolen BI

GRA 19703 Master Thesis

Thesis Master of Science 100% - W

Predefinert informasjon

Startdato:	16-01-2022 09:00	**Termin:**	202210
Sluttdato:	01-07-2022 12:00	**Vurderingsform:**	Norsk 6-trinns skala (A-F)
Eksamensform:	T		
Flowkode:	202210||10936||IN00||W||T		
Intern sensor:	(Anonymisert)		

Deltaker

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Informasjon fra deltaker

Tittel *:	CEO gender and its impact on profitability, growth and volatility in Norwegian startups
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Inneholder besvarelsen konfidensielt materiale?:	Nei	**Kan besvarelsen offentliggjøres?:**	Ja

Gruppe

Gruppenavn:	(Anonymisert)
Gruppenummer:	16
Andre medlemmer i gruppen:	

Master Thesis

CEO gender and its impact on profitability, growth and volatility in Norwegian startups

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Master of Science in Business – Major in Finance

Abstract

There has been a lot of discussion on CEO gender and its impact on firm performance, growth and volatility. This paper examines whether Norwegian female-led startups financially underperform, grow slower and are less volatile than male-led. More specifically, this research analyses if there are differences between startups five years after foundation and whether differences in industries have an effect. The analysis is based on a cross-sectional regression including 2 267 Norwegian companies led by both genders from 2005 until 2019. We find evidence that female-led startups grow faster in total assets, even after adjusting for industry differences. Nevertheless, male-led startups outperform in terms of ROA only after adjusting for industries. Further, female CEOs prove to have no impact on all remaining profitability and growth measures, even after adjusting for industries. Finally, CEO gender proves to have no effect on the volatility in operating income, with results remaining equal after industry adjustments. These findings demonstrate that there does not appear to be much evidence for the standard perceptions of female-led startups growing slower or performing worse than male-led startups.

We express our profound thanks to our supervisor Professor Charlotte Østergaard from the Department of Finance at BI Norwegian Business School. We appreciate her giving valuable and encouraging ideas, advice, and comments during our thesis completion.

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1.0 Introduction

Statistics show that more Norwegian women are taking higher education in business and management than men (Bartsch, 2020; Jalovaara et al., 2019). In addition, Norway is the second most gender-equal country globally (Schwab et al., 2019), with women contributing to a more significant part of the workforce (Christensen, 2019). Despite this, the proportion of Norwegian female entrepreneurs is barely 30% (Grünfeld et al., 2019).

In 2018 2.3 billion euros of venture capital was invested in the Nordics, where 88% went to all-male founder teams and only 1% to all-female founder teams (Unconventional Ventures, 2019). Moreover, despite the funding gap, a Boston Consulting Group (BCG) study found that women generate 78 cents in profit for each dollar invested, while men only generate 31 cents (BCG, 2020). Therefore, due to conflicting findings in the previous literature, we question if this is the case for Norwegian female entrepreneurs.

Gender diversity is becoming more relevant within finance as studies show a difference between how female and male entrepreneurs' are treated. Research demonstrates that male entrepreneurs can be favourably recognized as they tend to have more entrepreneurial skills, knowledge, social network and experience (Koellinger et al., 2013). Additionally, females have different risk attitudes than men (Dohmen et al., 2011), whereas Jianakoplos & Bernasek (1998) showed that women are more risk-averse (Jianakoplos & Bernasek, 1998). Research also suggests that women concentrate more in retail and other services industries (Du Rietz & Henrekson, 2000). These industries tend to grow slower and have fewer expansion opportunities compared to more male-dominated industries such as technology and IT (Griffith & Harmgart, 2005).

As Norway is world-leading regarding equality and diversity (Teigen, 2021), it is interesting to study whether Norwegian female-led startups grow slower or perform worse than male-led startups. This is especially valuable as previous research finds strong evidence that gender equality can promote economic growth (Kabeer, 2012). Lastly, most studies focus explicitly on gender differences within the Board of Directors, indicating a need for further research on gender differences and CEOs.

Studies show that startups tend to lack focus on corporate governance and governance complexity (Pollman, 2019). Few studies focus on gender and financial performance in the startup industry. Therefore, in this thesis we use data collected through CCGR to investigate the effect of gender on Norwegian startups' financial performance, growth and volatility. We constructed several hypotheses with appropriate regression methods to consider how a startup's performance, growth and volatility are affected by the CEO's gender.

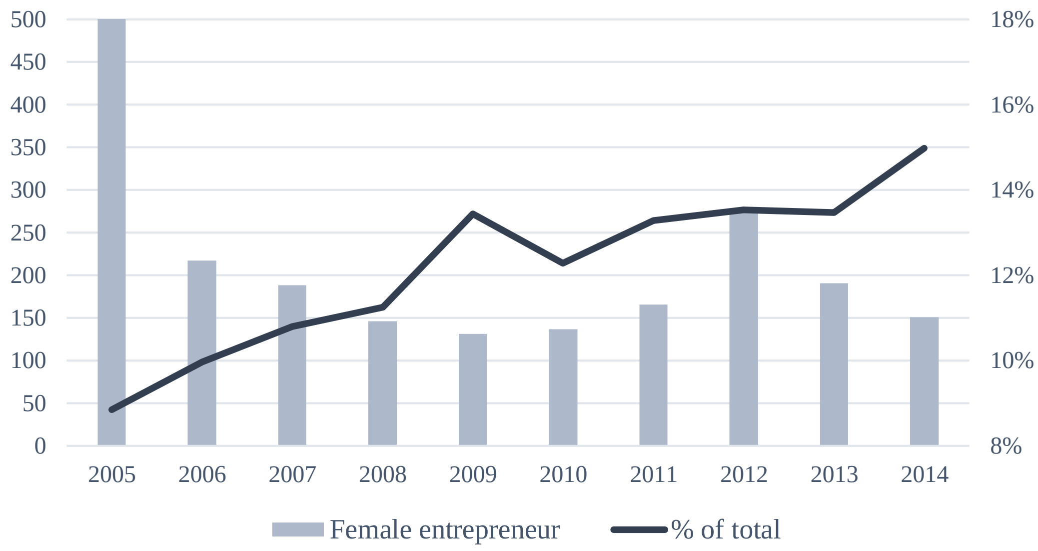
This paper studies whether Norwegian female-led startups are less profitable and volatile and grow slower than male-led startups and the potential reasons why. As the majority of previous international research indicates that female-led startups tend to underperform (Fairlie & Robb, 2009a; P. Rosa et al., 1996), our goal is to measure whether this is the case for Norwegian female-led startups.

This study is organized into five sections. First, we give insights into how previous research studies the gender effect on performance, growth and volatility. The next section presents our process of cleaning, preparing and gathering the data and an overview of the descriptive statistics. Further, we present the methodology used to estimate our models and analysis to perform our cross-sectional regressions. Lastly, we present our key findings and discussions before presenting a conclusion and recommendations for further research and limitations.

2.0 Background

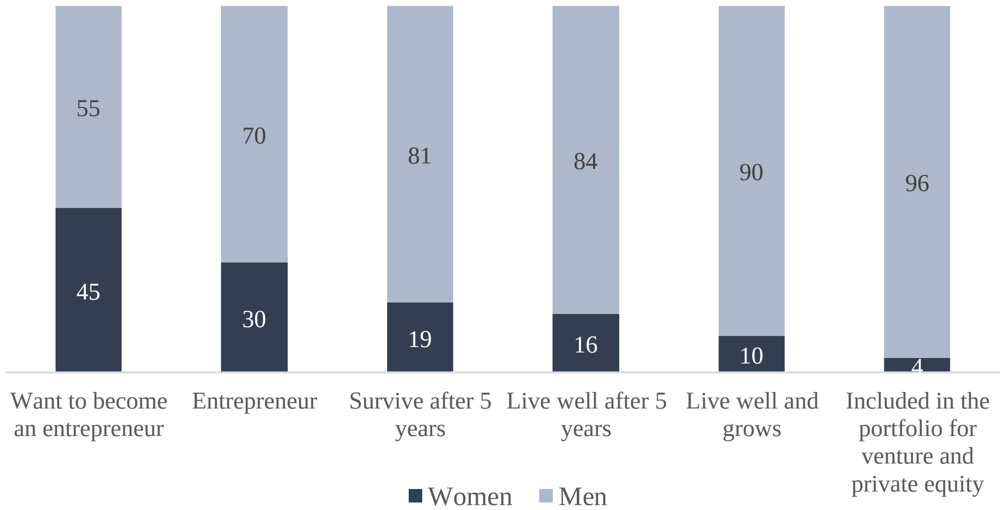
As illustrated in Figure 1, the proportion of female Norwegian entrepreneurs is low. Also, previous statistics find a decrease in female representation at the end of the startup cycle, as shown in Figure 2 (Grünfeld et al., 2019).

Figure 1: Development of female entrepreneurs (2005-2014)



Only 10% of all startups surviving with substantial growth are female-led after five years (Figure 2). In addition, barely 4% of all startups included in the venture capital and private equity portfolio are female entrepreneurs.

Figure 2: Proportion of women on the road to establishing a growth company



3.0 Literature Review

An increased number of studies investigate the impact of gender in leading positions on financial performance (M. González et al., 2020; J. M. Rosa & Sylla, 2018; Torchia et al., 2011). However, studies on CEO gender and startups seem to be limited. Gonzalez et al. (2020) argue that the link between gender diversity and financial performance is complex and inconsistent due to contradicting findings from theoretical and empirical aspects; hence more evidence is needed. In the following section, we review related literature in four parts and present how gender has an effect on profitability, growth and volatility, and differences across industries.

3.1 Gender and financial performance

The majority of existing research is concentrated on the BoD; however, some studies examine the impact of CEO gender. A study on Norwegian firms discovered a positive connection between female directors and innovation and a negative connection between innovation and male directors (Torchia et al., 2011). Furthermore, studies find that most female-owned companies have a lower profit per employee than the majority of male-owned (J. M. Rosa & Sylla, 2018). Other research papers focusing on sales and profits have discovered that female-owned firms perform worse than male-owned (Fairlie & Robb, 2009b; P. Rosa et al., 1996; Watson, 2002). Literature also suggests that female-led startups with less startup capital and experience are reasons for underperformance (Fairlie & Robb, 2009a). On the other hand, Demartini (2018) found that Italian female-led startups do not lag behind male-led in terms of dimension, company profitability, efficiency, and financial management (Demartini, 2018).

Previous research found that women and men have different motivations and expectations for owning a business. Females prefer personal fulfilment, flexibility, and a sense of having greater control, whereas males are more likely to be driven by firm growth and profits (Anna et al., 2000; N. Carter et al., 2003; Morris et al., 2006). Furthermore, Cliff (1998) and Orser & Hogarth-Scott (2002) prove that women keep their businesses small and manageable due to a desire for control and more risk aversion (Cliff, 1998; B. Orser & Hogarth-Scott, 2002). These characteristics can explain why female-led startups underperform compared to male-led startups, as proposed by Fairlie & Robb (2009) and Watson (2002).

Furthermore, Fielden et al. (2003) found that women tend to enter startups as it provides them with more independence, flexibility and control. However, female entrepreneurs do not have the same experience or skill base as their male counterparts (Fielden et al., 2003). Similarly, female entrepreneurs with less experience have limited venture capital access and grow slower than male-owned startups (Moore, 1999).

3.2 Gender and volatility

Several findings in financial literature indicate that risk and profitability are positively related (Ghysels et al., 2005). Faccio et al. (2016) discovered that companies with female CEOs have less volatile earnings and a higher chance of survival than similar firms led by male CEOs (Faccio et al., 2016). Jianakoplos & Bernasek (1998) suggest that females are more risk-averse in financial decision-making than men; this can explain why female-led startups have less volatile earnings. Kappal & Rastogi (2020) suggests that female entrepreneurs are more risk-averse due to their lack of knowledge and time to understand investments (Kappal & Rastogi, 2020).

Furthermore, John et al. (2008) prove that higher volatility in firm-level operating profits positively impacts long-term economic growth (John et al., 2008). Khan and Vieito (2013) examined the relationship between CEO gender, company risk, and firm performance in US companies from 1992 to 2004 (Khan & Vieito, 2013). The empirical findings showed that companies with a female CEO are associated with greater performance despite reduced company risk. Likewise, a German study found that risk aversion does not affect a company's growth potential (Grund & Sliwka, 2010).

3.3 Industry differences by gender

Female-led companies are overrepresented in Retail trade, Personal services and Professional services compared to male-dominated industries such as Construction. These female-dominated industries are highly competitive as they have low market power and few entry barriers, limiting growth and profitability opportunities (Brush, 1992; Du Rietz & Henrekson, 2000; Loscocco et al., 1991). Furthermore, only a small percentage of female-owned firms operate in rapid growth or high technology businesses (Menzies et al., 2004; Morris et al., 2006). This might explain why previous research indicates that female-led companies grow slower on average (Moore, 1999). In addition, Fairlie & Robb (2009) studied that industry differences are generally associated with less favourable outcomes for female-owned firms.

Watson (2003) found that Australian female-led startups have a significantly higher failure rate than male-led startups. However, by controlling for industry effects, the study found that the gender of the leader was not significant for the firm failure rate (Watson, 2003). This emphasizes the importance of controlling for industries while studying gender differences in companies having higher failure rates, such as startups. In contrast to Watson (2003), a study in the US confirmed no differences in performance measures such as Return on Assets, Sharpe Ratio and Closure Rates related to gender (Robb & Watson, 2012). The study used data from 4000 new ventures over five years and controlled for demographic differences such as industry, experience, and hours worked.

3.4 Additional research on gender differences within startups

Brush et al. (2004) points out that female entrepreneurs have different access to business and investment networks than male entrepreneurs. On the other hand, variations in business outcomes can be related to gender differences in motivation, type of business and preferences in work capacity (Brush et al., 2004). Additionally, literature found that women married to male entrepreneurs are more likely to enter self-employment. Further, they discovered that flexible schedules and other family-related reasons motivate women more than men to choose self-employment (Bruce, 1999; Lombard, 2001). Cromie (1987) and Carter & Cannon (1992) found that female entrepreneurs are less motivated to make profits (Cromie, 1987) (S. Carter & Cannon, 1992). This might explain why previous research has found that female entrepreneurs underperform and grow slower compared to male entrepreneurs (Moore, 1999; P. Rosa et al., 1996; Watson, 2002).

Compared to more well-established companies, startups face challenges such as complications with raising capital, gender diversity and growth (Salamzadeh & Kawamorita Kesim, 2015). Henderson et al. (2015) found that females with the same credit score as men obtained significantly less access to credit (Henderson et al., 2015). There is an interest in studying whether these differences are linked to female-led startups being treated differently by financiers (B. J. Orser et al., 2006), further affecting company growth and financial performance.

4.0 Data and descriptive statistics

Our data sample on Norwegian startups was obtained from the Centre of Corporate Governance Research (CCGR). The database provides data for Norwegian firms, including the period 1994 – 2020. The whole sample of data consisted of 5.8 million observations. The data includes high-quality and extensive financial information and a wide range of corporate governance variables (Østergaard, 2020). The data is limited to Norwegian historical financial statements from startups led by both genders. Our model in this study will consist of a combination of theory and cross-sectional regression analysis. Furthermore, the data sample has undergone a screening process to ensure a meaningful and coherent analysis; see Table 3 for each screening's effect on the sample size.

The data sample consisted of several observations for each individual company, sorted by accounting year. We removed several observations to make the data sample specifically applicable to our hypothesis. Firstly, we removed observations with missing values in CEO gender, as this observation was the key control variable for answering our hypotheses. To ensure all companies had the same gender throughout the regression period, all companies that did not have the same CEO gender throughout the regression period were removed. Further, we removed all inactive firms with missing values in total equity, negative values in total fixed assets and total current assets and revenue. Also, companies with zero total assets, average total assets, and equity within the regression period were removed. These observations were required to define meaningful dependent variables, such as return on assets and return on equity. In order to exclude inactive firms, all companies with missing values in employees were removed. Additionally, all companies with missing values or less than 20% in shares owned by the CEO were excluded to ensure the observations' credibility as startups led by entrepreneurs and not large corporations or institutions. Also, all companies with other firm types than AS and NOK as currency were excluded to avoid companies with conflicting and irrelevant values related to our thesis.

Further, we removed firms established before 2005, as we wanted the sample to include newly established companies with relevant accounting numbers for up to 15 years. Furthermore, companies that did not have observations in the foundation year, the year after, fifth and sixth accounting year were removed. The removal was done to avoid non-reporting companies within the relevant regression period, causing missing values when calculating our financial measures. Companies with missing industry codes were also removed, as this variable was used to control for industry differences in our regression model. Also, companies with multiple industries were removed to ensure all firms were operating within one sector throughout the whole regression period. Companies operating within the real estate, finance, and insurance industries were removed due to their specific accounting principles and capital requirements. Further, we excluded the sample outliers at the 1^{st} and 99^{th} percentile in our key financial variables, such as return on equity and return on assets. Finally, the variables in our regression were winsorized to assign less weight to outliers, so they were closer to the sample mean.

We divided the dataset into industry groups presented in Table 4 in the Appendix to control each industry's effect on our regressions dependent variables. Statistics Norway (SSB) has a public sector grouping based on the applied industry codes. These groupings varied throughout our data sample, as there were two different industry code groupings to consider from 2002 and 2007. To avoid conflicting interpretations of industry codes, we converted the earlier industry codes for each company to fit the newest grouping system as of 2007, utilizing SSB's available conversion overview.

The final data sample resulted in an unbalanced panel data set with 18 761 observations from Norwegian AS firms over 15 years, 2005 – 2019, with a total of 2 267 individual firms. After computing our relevant variables, we finalized and quality assured our dependent and independent variables. We believe the final number of observations and the total dataset are substantial and specific enough to answer our hypotheses over the chosen period.

4.1 Financial performance and growth variables

We created different financial measures using the available accounting variables in the CCGR database to examine profitability, growth and volatility. Return on assets and return on equity were both financial performance measures we chose to apply. In the business industry, performance indicators are frequently used as a benchmark. Studies have recently utilized a variety of ways to measure profitability, and the field is rather diverse (Kopecká, 2018).

Return on Equity (ROE) is one of the most frequently used financial performance indicators. It has been recognized as an important measure for investors to consider when making investment decisions (du Toit & Wet, 2007). *ROE* mainly emphasises an investment's equity component and demonstrates a company's ability to generate profits based on its share capital. *ROE* is defined as:

$$ROE_{i,t} = \frac{Net\ income_t}{\frac{Total\ Equity_{i,t} + Total\ Equity_{i,t-1}}{2}}$$

Furthermore, it is important to acknowledge that *ROE* is affected by a company's level of debt. Even if the company's total value is declining, a higher level of debt can improve the return on equity (du Toit & Wet, 2007). This emphasizes the need to use a variety of financial measures when assessing a startup's performance.

Return on assets (ROA), on the other hand, measures a company's ability to create future earnings by looking at its total assets. Along with *ROE*, *ROA* is one of the most frequent and valuable financial measures of profitability (Jewell & Mankin, 2011). *ROA* is defined as:

$$ROA_{i,t} = \frac{Net\ income_t}{\frac{Total\ assets_{i,t} + Total\ assets_{i,t-1}}{2}}$$

The observations in the sixth year of ROA and ROE were used in the analysis, as the first year of operation can be too early to measure performance. Therefore, the first year of *ROA* and *ROE* were not utilized in the regressions. However, these observations were needed to analyze the development in the performance measures.

To analyze how much each startup grows in its first five years of operating, we used the *Compound Annual Growth Rate (CAGR)* of *Total Assets* and *Operating Income*. We consequently calculated the *CAGR* for each company by using the above-mentioned measures from year 1 and 6. Thus, *CAGR* is defined as:

$$CAGR_{i,t} = \left(\frac{Ending\ value}{Starting\ value}\right)^{\frac{1}{n}} - 1$$

In order to measure the company's development in profitability, we used the *CAGR* of ROA and ROE. Furthermore, to measure volatility in earnings, we used the standard deviation of operating income, defined as *Operating Income Volatility*. We selected operating income rather than net income to properly assess the volatility of operations within startups as the latter includes several irrelevant components. As all firms in our data sample are privately held, we focus on the volatility of accounting returns rather than stock market returns.

4.2 Gender variable and industry

The main gender variable in the chosen regression is a gender dummy variable named *Female CEO*. The variable will take on the value of 1 when the CEO of a startup is female and 0 otherwise. In addition to the gender variables, we replace all variables in the model with industry-adjusted variables. The study by Watson (2003) found that industry specifics significantly affect startup performance. Hence, we control for industries by looking at which industry each company belongs to and convert all variables by subtracting out the average from each original variable.

4.3 Accounting and firm-specific variables

Variables relating to the company's fundamental characteristics are also included. According to financial literature (V. M. González, 2013), there is a negative relationship between leverage and corporate performance. Furthermore, according to Frank & Goyal (2007), CEOs' differences explain variation in leverage. In addition, (Faccio et al., 2016) discovered that companies led by female CEOs had lower leverage. In our regression, *Leverage* is determined by the natural logarithm of total liabilities divided by total assets. The variable is then lagged by one period to capture the effect on the dependent variables in the next period.

The volatility of returns is a standard proxy for risk in the financial economics literature (Faccio et al., 2016). Therefore, we consider *Operating Income Volatility* to capture the volatility of operations and some of the riskiness in the CEOs' investment decisions. *Operating Income Volatility* is calculated by the natural logarithm (ln) of the standard deviation of operating income. The measure includes year zero, one, five and six from the foundation (meaning startups founded in 2005, the standard deviation was calculated using the years 2005, 2006, 2010, and 2011). Lastly, we account for *Firm size*, as suggested by earlier research. The natural logarithm of total assets is used to determine the variable. Further, *Firm size* is lagged by one period to capture the effect on the dependent variables in the next period.

4.4 Explanatory variables of interest

4.4.1 Startups

This thesis defines startups as companies that have survived at least six years since their foundation. Therefore, companies that did not report the sixth year were excluded from the data sample. Furthermore, we set the minimum CEO ownership to 20% to guarantee that entrepreneurs established the startups rather than institutional corporations.

4.4.2 Female- or male-led startup

The CEO is defined as the leader of the company, as the startup's top management often includes only one or a few leaders. Moreover, to separate male- from female-led startups, we determined that every startup must have the same CEO gender throughout the regression period. This constraint ensures our results unbiasedness by excluding startups with several CEO genders throughout the regression period.

4.5 Descriptive statistics

We conducted a descriptive analysis of our data sample to have an insightful overview of the difference between genders. The final filtered data sample included firm-year data from 2005 to 2019, including 2 267 startups. The number of startups with female CEOs was 268, accounting for 12% of the total sample, while 88% of the sample had a male CEO. Tabel 1 summarises the basic descriptive statistics for the empirical variables in our research. The total sample size consists of 18 761 observations, but several variables have missing values and therefore have a lower number of observations.

4.5.1 Profitability

The main reason for *ROA*, *ROE*, *ROA*- and *ROE CAGR* having missing values is because the measures are calculated using the average of two respective years. The *CAGR* variables are computed using only the second and last accounting year. Hence, each company will only have one observation of *ROA CAGR* and *ROE CAGR*. Also, *ROA* and *ROE* show fewer observations due to missing values for companies not reporting on *ROA* and *ROE* frequently. The average *ROA* and *ROE* for female-led startups are -2.85% and 14.64%, as for male-led it is 2.55% and 16.98%. The median value of *ROA CAGR* and *ROE CAGR* for female CEOs is -0.08% and -13.8%, respectively, whereas they are -3.4% and -10.97% for male CEOs. This indicates that female-led startups tend to have a weaker financial performance but improve their *ROA* more over time than male-led startups.

Operating Income CAGR has some missing observations as some startups do not report any income during their first years of foundation. *Total Assets CAGR* have the same number of observations as the total number of firms for the same reason as *ROA CAGR* and *ROE CAGR*. Table 1 indicates that female-led startups have an *Operating Income CAGR* of -13.8% compared to their male counterparts, with an average of 8.1%. Lastly, female CEOs have an average *Total Assets CAGR* of 14.1% compared to their male counterparts having 13.8%, signifying that female-led startups tend to grow faster than male-led startups but struggle generating profits.

4.5.2 Accounting and Firm-Specific

Table 1 shows that the average *Firm size* for the whole sample size is 13.28, where 50% of the observations are almost identical to the mean or less. For female-led startups, the average is 12.81, and for male-led startups, it is 13.33, indicating a minor difference between genders in firm size. Therefore, we can argue that female-led startups tend to have a slightly smaller firm size than male-led.

Leverage provides information about the startup's capital decision and risk-taking. For the total sample, the average *Leverage* is 0.66. An interesting observation is that female-led startups tend to have a 15% higher *Leverage* than male-led, with a ratio of 0.76. The high *Leverage* ratio can be explained by outliers, even after winsorizing. This is because half of the observations have a value of 0.5 or less, indicating the difference is from the presence of outliers (Cain & McKeon, 2016). Further, our descriptive statistics show that female-led startups have 21% less *Operating Income Volatility* than male-led. This implies that *Leverage* and *Operating Income Volatility* are marginally negatively correlated within startups; also reflected in our correlation matrix (Table 2).

4.5.3 Gender and Governance

The sample size includes two ownership variables, *Ownership* consists of the total number of personal owners and *Female Ownership*, consisting of the total number of female owners. The average *Ownership* in the total sample is two, indicating that the sample is representative of startups with few owners. Further, it is interesting to look at the average *Female Ownership*. Female-led startups have an average of 1.04 female owners, while male-led have an average of 0.13. This indicates that female-led startups tend to have more female owners in addition to their female CEO. In addition, *CEO share* shows that the average percentage of shares held by the CEO in our total sample is 79.48%. Also, we can see that at least 50% of the sample has a 100% in *CEO share*. This may confirm that the companies in the sample are not owned by institutional investors. Further, we can see a slight difference in *CEO share* between genders, with a male-led average of 79.95% and a female-led of 75.77%.

Table 1: Descriptive statistics

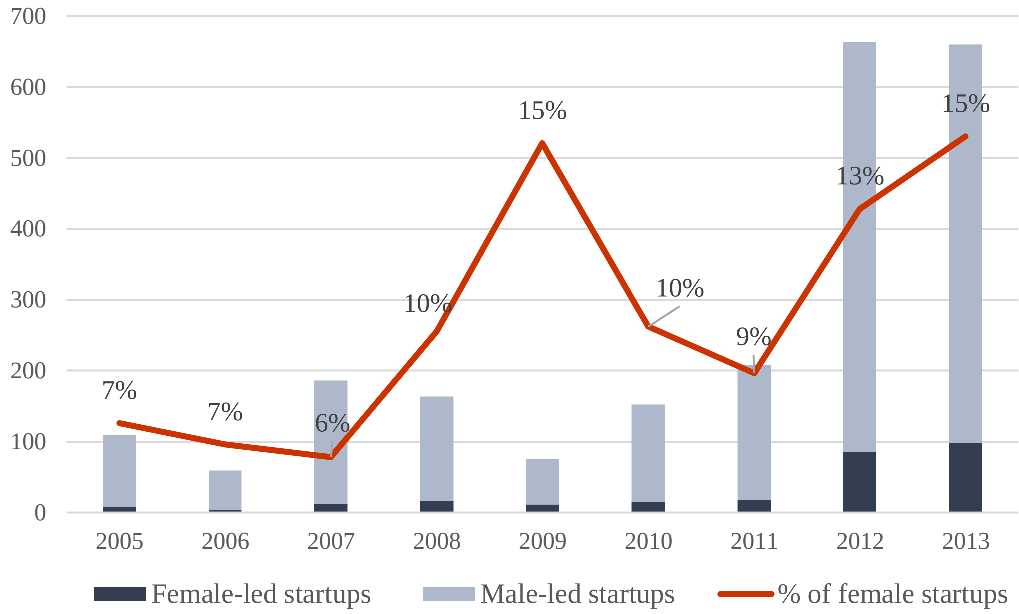
This table shows the descriptive statistics of the firm variables used in the analysis. The information in each section shows the number of observations (N), the estimated mean values (MEAN), the median value (MEDIAN), the standard deviation (STD. DEV.) and the minimum and maximum value (MIN and MAX). *ROA* is measured as the net income divided by average total assets. *ROE* is measured as net income divided by average total equity. *Operating Income CAGR* is the compounded annual growth rate of the firms' operating income. *ROE CAGR* and *ROA CAGR* are the compounded annual growth rates of the firms' *ROA* and *ROE*, respectively. *Operating Income Volatility* is the standard deviation of the firms' operating income, representing firm risk. *Total Assets CAGR* is the compounded annual growth rate of firms' *Total Assets.* The abovementioned variables have been calculated by using the natural logarithm (ln). Further, *Leverage* represents the firms leverage ratio, calculated by dividing the firms' total debt by its total assets. *CEO share* is the number of shares owned directly by the CEO, in percentage points. *Female Ownership* represent the number of female owners. Lastly, *Ownership* represent the number of external owners, excluding the CEO.

	All FIRMS (N =18 761)						**CEO MALE (N = 16 676)**						**CEO FEMALE (N = 2 085)**					
	N	MEAN	MEDIAN	STD.DEV	MIN	MAX	N	MEAN	MEDIAN	STD.DEV	MIN	MAX	N	MEAN	MEDIAN	STD.DEV	MIN	MAX
PROFITABILITY & GROWTH																		
ROA	2376	0.0192	0.0019	0.2872	-0.9300	0.8200	2100	0.0255	0.0030	0.2828	-0.9300	0.8200	276	-0.0285	0.0000	0.3146	-0.9300	0.8200
ROA CAGR	2267	0.0890	-0.0301	0.7346	-0.9951	0.9782	1999	0.0871	-0.0340	0.7316	-0.9951	0.9782	268	0.1033	-0.0079	0.7566	-0.9900	0.9782
ROE	2376	0.1671	0.0546	0.5424	-0.9500	1.8800	2100	0.1698	0.0570	0.7915	-0.9500	0.5379	276	0.1464	0.0405	0.5750	-0.9500	1.8800
ROE CAGR	2267	0.0267	-0.1109	0.7832	-0.9900	0.9900	1999	0.0290	-0.1097	0.7813	-0.9900	0.9900	268	0.0091	-0.1380	0.7968	-0.9900	0.9900
Total Assets CAGR	2267	0.1387	0.0756	0.3062	-0.4580	1.2762	1999	0.1384	0.0758	0.3049	-0.4580	1.2762	268	0.1410	0.0751	0.3160	-0.4580	1.2762
Operating Income CAGR	2252	0.0876	-0.0342	0.7036	-0.9900	0.9991	1985	0.0808	-0.0392	0.7001	-0.9900	0.9991	267	0.1380	0	0.7265	-0.9900	0.9976
ACCOUNTING & FIRM SPECIFIC																		
Firm size	18 682	13.28	13.36	1.86	6.91	20.24	16 613	13.33	13.42	1.84	6.91	20.24	2069	12.81	12.77	1.93	6.91	19.17
Operating Income Volatility	2267	122 038	39 313	283 690	0	6 060 618	1999	125 212	39 977	292 179	0	6 060 618	268	98 358	36 387	208 285	829	1 477 981
Leverage	18 646	0.6622	0.4622	0.9616	0	7	16 583	0.6496	0.4565	0.9370	0	7	2063	0.7636	0.5113	1.1354	0	7
GENDER & GOVERNANCE																		
Ownership	18 761	2	1	1	1	9	16 676	2	1	1	1	9	2085	2	1	1	1	6
Female Ownership	18 761	0.23	0	0.52	0	4	16 676	0.13	0	0.4	0	4	2085	1.04	1	0.59	0	4
CEO share	18 761	79.48	100	26.93	20	100	16 676	79.95	100	26.80	20	100	2085	75.77	100	27.71	20	100

4.5.4 The development of female CEOs over time

Figure 3 displays the number and percentage of female-led startups from 2005 until 2013, where we observe an upward trend. The highest percentage was found right after the financial crisis in 2009 and 2013.

Figure 3: The number and percentage of male and female led-startups (2005-2013)



4.5.5 Industry classifications and CEO Gender

Industry type has high importance in our research question, as existing research indicates that women concentrate more within the retail and other services industries (Du Rietz & Henrekson, 2000). These industries tend to have lower growth and expansion opportunities than the male-dominated technology and IT sectors (Griffith & Harmgart, 2005). As Figure 4 shows, industry F, G, and M have the highest number of observations in the sample. These industries represent *Construction*, *Wholesale and retail* and *Professional*, *scientific and technical activities*, respectively.

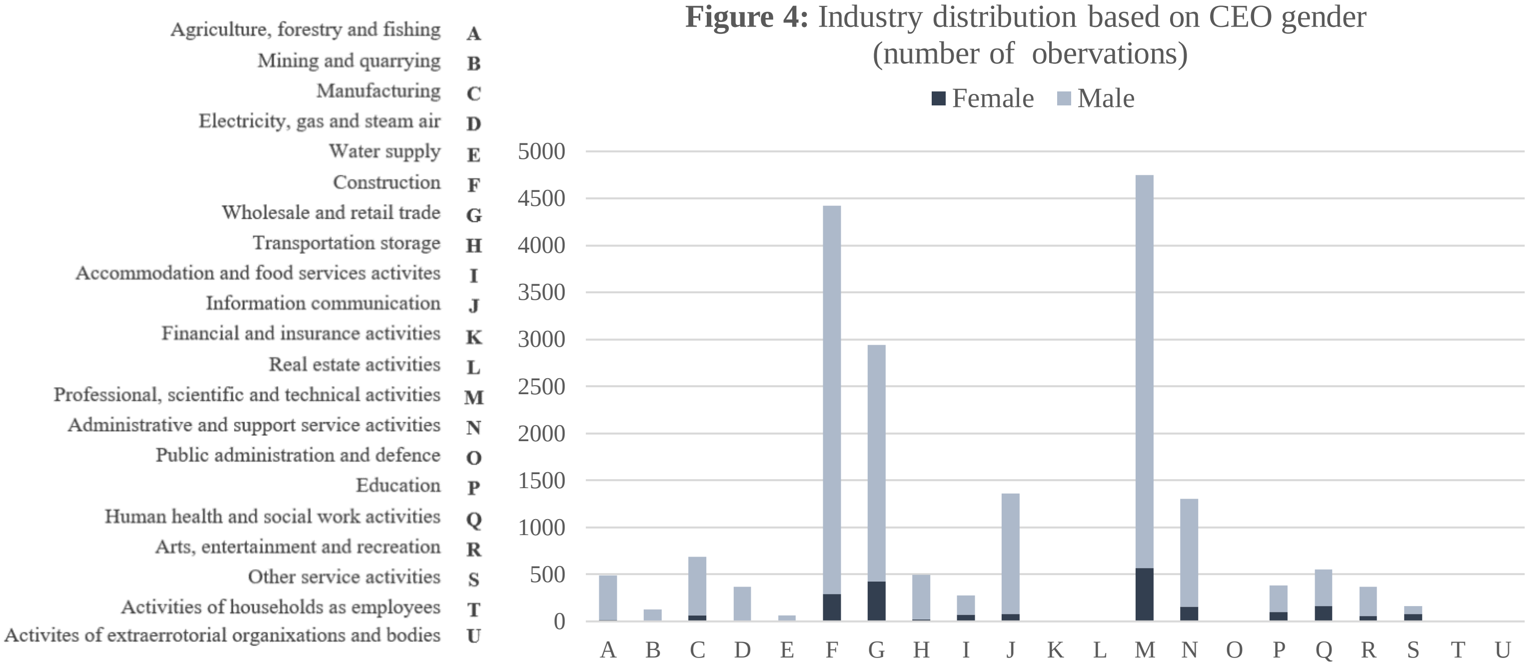


Figure 4: Industry distribution based on CEO gender (number of obervations)

Furthermore, Figure 5 displays the proportion of firms with female and male CEOs. Moreover, *Other services activities* are the only industry with nearly a 50% representation of female CEOs. Also, female CEOs have a 25% or higher representation in *Accommodation and food services activities*, *Education* and *Human health and social work activities*. The industries with no female representation are *Mining and quarrying*, *Water supply* and *Electricity, gas and steam air*.

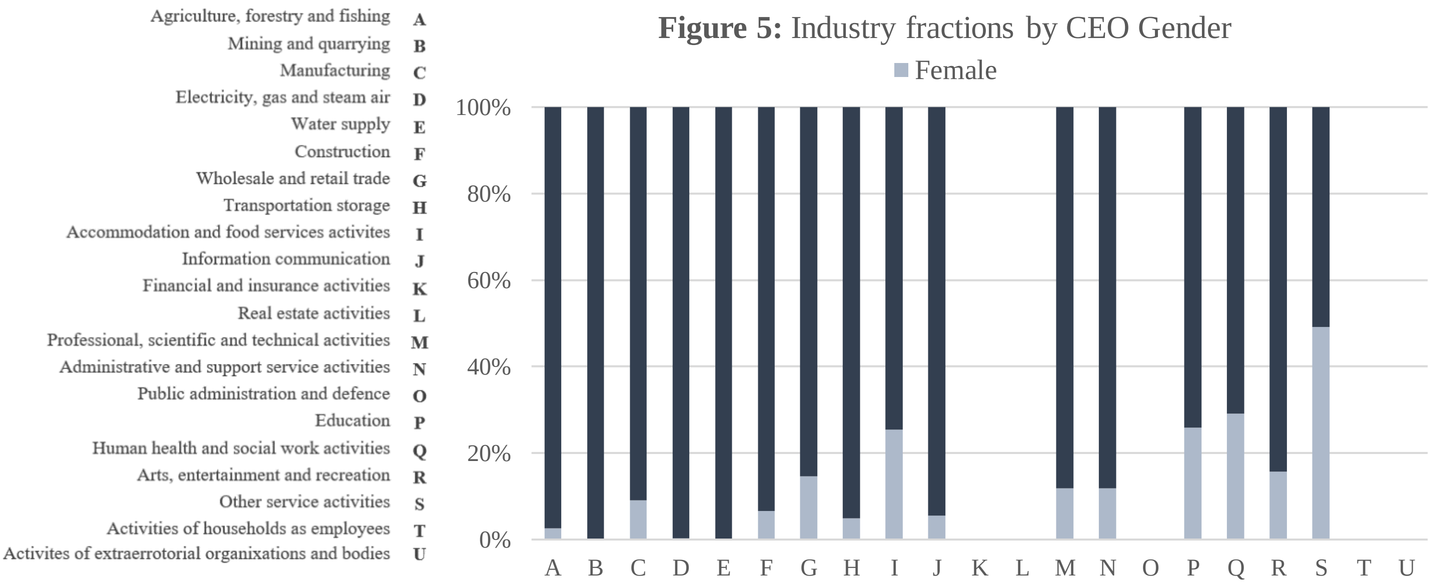


Figure 5: Industry fractions by CEO Gender

4.5.6 Industry variations in financial performance, growth and volatility

By allocating all firms into different industries, we identify variations across industries and separate highly male-dominated industries from more gender-equal industries. We discover several interesting outcomes by displaying our financial performance measures, volatility and growth, together with female CEO representation. All figures in this section sort female representation from highest to lowest, starting from the left. Firstly, in Figure 6.1, we notice a considerable difference across industries in ROA, where male-dominated industries tend to perform better than more gender-equal industries.

Figure 6.1: *Mean of ROA across industries*
The graph shows the distribution of ROA across industries with female CEO representation (secondary axis).

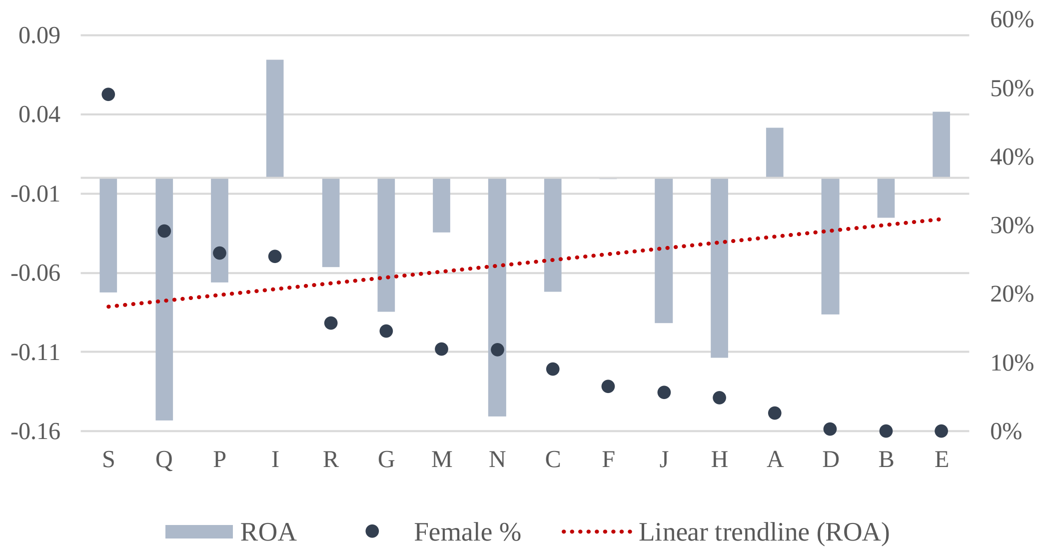
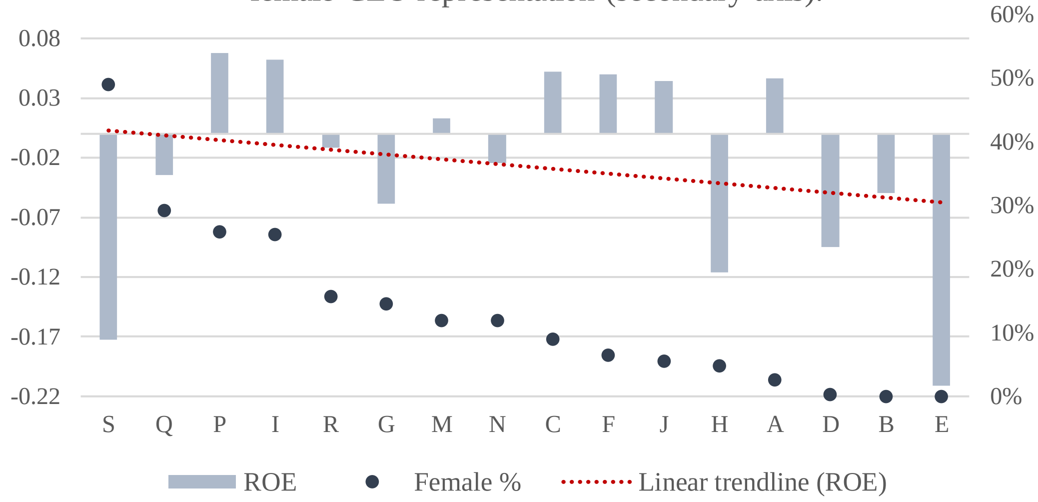


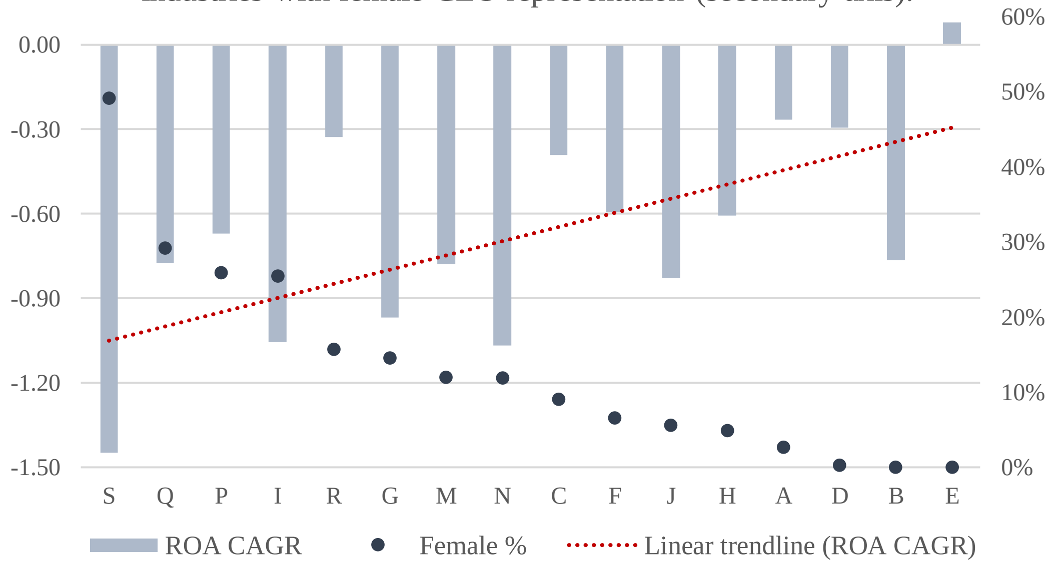
Figure 6.2 illustrates another perspective, where we observe a positive trend in *ROE* for industries with more female CEOs. This may imply that more gender-equal industries are better at generating profits in terms of equity but not in terms of assets. This is anticipated as higher leverage can improve *ROE,* and female-led startups operate with more leverage than male-led ones in our data sample. Also worth noticing is that the male-dominated industries have an average ROE of -12%, compared to -4% in the industries with the highest female representation.

Figure 6.2: Mean of ROE across industries
The graph shows the distribution of ROE across industries with female CEO representation (secondary axis).



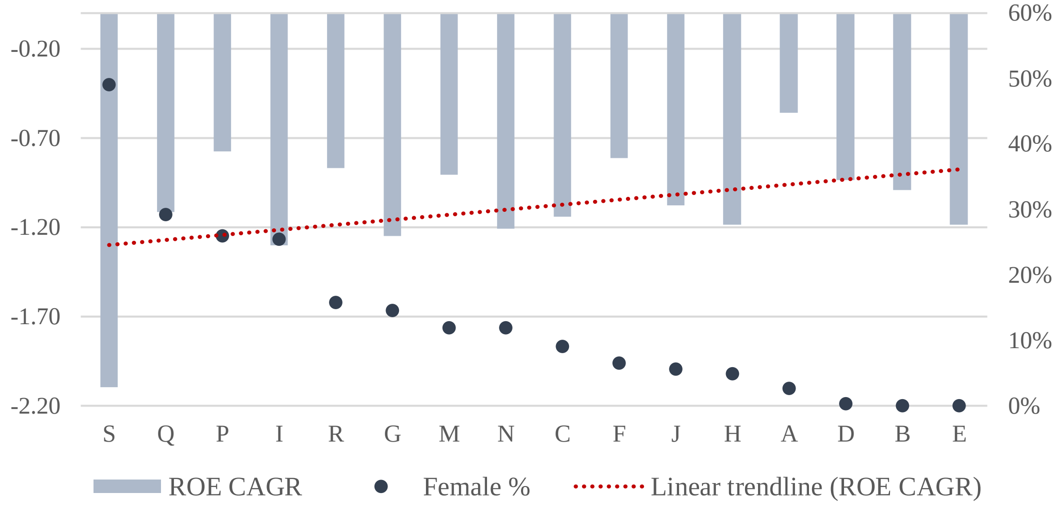
Further, as we find contradictory results in how more female-dominated industries perform financially, it is interesting to see if this is also the case for the development in profitability. In addition to male-dominated industries outperforming in terms of ROA, they also appear to improve their profits faster, as seen in Figure 6.3. This suggests that industries with higher female representation struggle to generate returns on their assets.

Figure 6.3: Mean of ROA CAGR across industries
The graph shows the distribution of ROA CAGR across industries with female CEO representation (secondary axis).



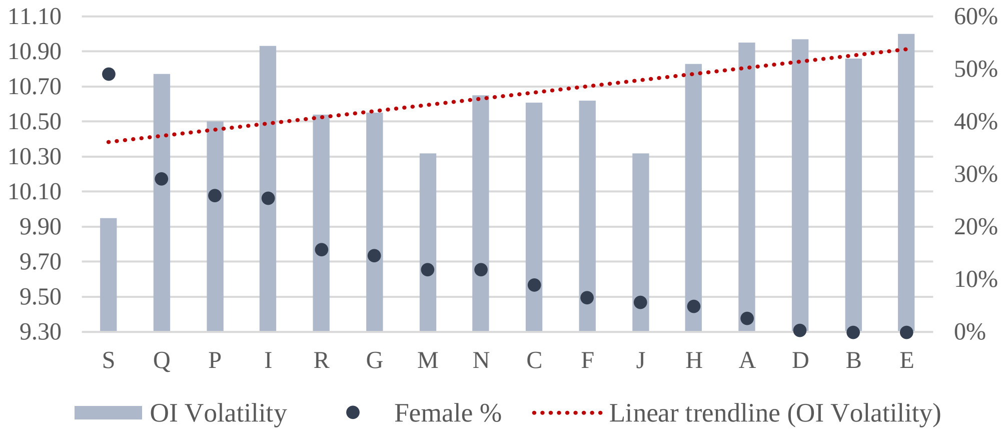
Moreover, the same pattern is observed in *ROE CAGR*; however, not as substantial as shown in Figure 6.4. The majority of industries struggle to improve profits in terms of ROA and ROE, whereas male-dominated industries seem to be better at generating revenues and managing their costs.

***Figure 6.4:** Mean of ROE CAGR across industries*
The graph shows the distribution of ROE CAGR across industries with female CEO representation (secondary axis).



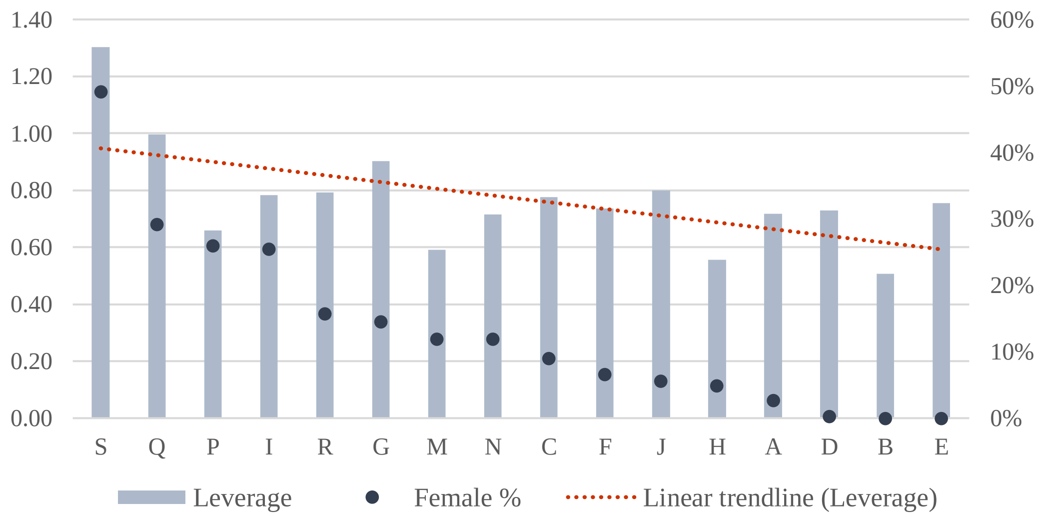
Furthermore, male-dominated industries tend to have more volatile income than more gender-equal industries, as illustrated in Figure 6.5. This may explain why male-dominated industries outperform in terms of profits, as these industries tend to be more volatile.

Figure 6.5: *Mean of Volatility across industries.*
The graph shows the distribution of Operating Income Volatility with female CEO representation (secondary axis).



Highly volatile industries usually operate with a low level of leverage, as high leverage increases the probability and cost of bankruptcy and the debt overhang problem. As a result, male-dominated industries with high volatility should be expected to have a lower level of leverage. As bankruptcy costs are especially damaging for companies in their early years of operating, it is anticipated that this should also be the case for startups. Figure 6.6 confirms our expectations, as we observe that male-dominated industries have a substantially lower leverage ratio.

Figure 6.6: *Mean of Leverage across industries*
The graph shows the distribution of Leverage across industries with female CEO representation (secondary axis).



4.5.7 Correlation matrix

When two or more independent variables are highly correlated, this is known as multicollinearity. This can increase the standard errors of regressors, making parameter estimation problematic and potentially leading to incorrect identification of relevant predictors in regression models (Dormann et al., 2013). Hill et al. (2018) indicated that we check for collinear correlations in our explanatory variables by examining their sample correlation coefficients. The sample correlation coefficients indicate whether or not the variables have strong linear correlations (Hill et al., 2018).

In the presented correlation matrix, the highest correlations between the dependent variables are *Ownership* and *CEO share* (-0.815). This result is expected as *Ownership* represents the number of owners besides the CEO, directly depending on each other. Due to multicollinearity, we therefore exclude *Ownership* as a dependent variable in our regression. Furthermore, the highest correlation between our independent variables is found between *ROE CAGR* and *ROA CAGR*. However, this will not impact our analysis as these are independent variables in separate regressions. The rest of the values for our independent variables in the correlation matrix are within acceptable limits, reducing the risk of parameter estimation difficulties in our regression models (Dormann et al., 2013).

Table 2: Correlation matrix

Table 2 shows the Pearson correlation coefficients for pairs of variables used in the empirical analysis. *ROA* is measured as the net income divided by average total assets. *ROE* is measured by taking the net income divided by average total equity. *OI CAGR* is the compounded annual growth rate of the firms' operating income. *ROE CAGR* and *ROA CAGR* are the compounded annual growth rates of the firms' ROA and ROE, respectively. Std. OI is the standard deviation of the firms' operating income, representing firm risk. *Total Assets*$_{t-1}$ is the firms' total assets lagged by one period, representing firm size. *Total Assets CAGR* is the compounded annual growth rate of firms' *Total Assets*. The abovementioned variables have been calculated by using the natural logarithm (ln). Further, *Leverage*$_{t-1}$ represents the firms leverage ratio lagged by one period, calculated by dividing the firms' debt by total assets. *CEO share* is the number of shares owned directly by the CEO, in percentage points. *Female CEO* is a dummy variable, taking the value 1 if the CEO is female and 0 if the CEO is male. Lastly, *Ownership* represent the number of external owners, excluding the CEO.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) *ROA*	1.000											
(2) *ROE*	0.256	1.000										
(3) *OI CAGR*	-0.002	0.043	1.000									
(4) *ROE CAGR*	0.007	-0.008	0.010	1.000								
(5) *ROA CAGR*	0.022	-0.029	0.029	0.650	1.000							
(6) *CEO share*	0.027	0.008	-0.035	0.008	-0.028	1.000						
(7) *Std. OI*	0.009	-0.014	0.018	-0.015	-0.008	0.012	1.000					
(8) *Leverage*$_{t-1}$	-0.306	0.000	0.027	-0.007	0.014	0.010	-0.007	1.000				
(9) *Total Assets*$_{t-1}$	0.334	0.101	-0.023	0.024	0.016	-0.008	-0.006	-0.305	1.000			
(10) *Total Assets CAGR*	0.028	0.005	-0.015	0.154	0.166	0.018	0.007	-0.020	-0.032	1.000		
(11) *Female CEO*	-0.009	0.004	-0.027	-0.049	-0.023	-0.049	0.028	0.033	-0.032	0.012	1.000	
(12) *Ownership*	-0.010	0.011	0.021	-0.012	0.019	-0.815	-0.026	-0.019	0.041	-0.022	0.020	1.000

5.0 Methodology

The methodology for this thesis is based on an OLS model analysis in STATA to estimate the effect CEO gender has on a company's financial performance, growth and volatility. The data set is an unbalanced panel data set, as it includes observations from multiple companies at various points in time with several variables. Although the data sample contains several observations for each company over time, we apply a cross-sectional analysis due to limitations in our performance measures, explained in detail in the previous section. The following section includes our research method and the selected regressions used in this study.

5.1 Main models and estimation methods

This thesis is a quantitative study as we used existing data from the CCGR database for our analysis. Our study takes a deductive approach, including an empirical analysis of the outcomes of several regressions. We intended to use archive data to compare our independent and dependent variables and form conclusions and findings based on the results.

Each model presented in this section has different dependent variables for measuring financial performance, growth, and volatility. In hypothesis 4, the regressions conducted include the same variables as in hypotheses 1-3. This was done to adjust for industry averages as a robustness test on our initial results. The hypotheses that were formally tested with their chosen OLS regressions are presented below.

Hypothesis 1: Female-led startups financially underperform male-led startups.

$$Dependent\ variable_{i,t} = \beta_0 + \beta_1 Female\ CEO_{i,t} + \beta_2 X_{i,t} + u_i + \epsilon_{i,t}$$

$Where$:

$Dependent\ varibles_{i,t}$ $ROA, ROE\ and\ CAGR\ (ROA\ and\ ROE)\ of\ firm\ i, in\ year\ t$

$Female\ CEO_i$ $Dummy\ variable\ taking\ value\ of\ 1\ if\ the\ CEO\ is\ female$

X_i $Vector\ of\ control\ variables\ (CEO\ share,\ firm\ size\ ln(assets), leverage)$

u_i $Unobserved\ random\ effects$

$\epsilon_{i,t}$ $Error\ term$

Hypothesis 2: Female-led startups grow slower than male-led startups.

$$Dependent\ variable_{i,t} = \beta_0 + \beta_1 Female\ CEO_{i,t} + \beta_2 X_{i,t} + u_i + \epsilon_{i,t}$$

$Where$:

$Dependent\ varibles_{i,t}$ $CAGR\ (\ Total\ Assets\ and\ Operating\ Income)\ of\ firm\ i, in\ year\ t$

$Female\ CEO_i$ $Dummy\ variable\ taking\ value\ of\ 1\ if\ the\ CEO\ is\ female$

X_i $Vector\ of\ control\ variables\ (CEO\ share, firm\ size\ ln(assets), leverage)$

u_i $Unobserved\ random\ effects$

$\epsilon_{i,t}$ $Error\ term$

Hypothesis 3: Female-led startups have less volatile earnings than male-led startups.

$$Dependent\ variable_{i,t} = \beta_0 + \beta_1 Female\ CEO_{i,t} + \beta_2 X_{i,t} + u_i + \epsilon_{i,t}$$

$Where$:

$Dependent\ varibles_{i,t}$ $\sigma(OI)\ of\ firm\ i, in\ year\ t$

$Female\ CEO_i$ $Dummy\ variable\ taking\ value\ of\ 1\ if\ the\ CEO\ is\ female$

X_i $Vector\ of\ control\ variables\ (CEO\ share, firm\ size\ ln(assets), leverage)$

u_i $Unobserved\ random\ effects$

$\epsilon_{i,t}$ $Error\ term$

Hypothesis 4: Hypotheses 1-3 still hold after controlling for industry differences.

To test hypothesis 4, the regressions from hypotheses 1-3 were repeated, however, by subtracting the industry average from all variables in the regression.

$$Dependent\ variable_{i,t} = \beta_0 + \beta_1 Female\ CEO_{i,t} + \beta_2 X_{i,t} + u_i + \epsilon_{i,t}$$

$Where$:

$Dependent\ varibles_{i,t}$ $Industry\ adjusted\ [ROA\ and\ ROE, CAGR\ (ROA, ROE, Total\ Assets\ and\ Operating\ Income)\ and\ \sigma(OI)]\ of\ firm\ i, in\ year\ t$

$Female\ CEO_i$ $Dummy\ variable\ taking\ value\ of\ 1\ if\ the\ CEO\ is\ female$

X_i $Vector\ of\ industry\ adjusted\ control\ variables\ (CEO\ share, firm\ size\ ln(assets), leverage)$

u_i $Unobserved\ random\ effects$

$\epsilon_{i,t}$ $Error\ term$

Endogeneity is one of the biggest issues in empirical corporate finance and is an essential problem to assess when choosing a regression model. Endogeneity indicates that the error term is correlated with one or more of the independent variables, causing biased coefficient estimates. It affects the dependent variables by misrepresenting the results of the regression model, further causing reverse causality or omitted variable bias (Parsons & Titman, 2008).

As a first step in confronting the endogeneity issue, we chose several control variables working as proxies for our model's possible omitted exogenous parameters30/06/2022 10:21:00. Additionally, we lag two of our explanatory variables by one year in response to endogeneity concerns in the data (Bellemare et al., 2017). This is done due to financial decisions not materializing immediately after they are decided. Clustered standard errors are typically conducted with panel data to adjust for potential heteroscedasticity and standard errors being too small (Cameron & Trivedi, 2010). However, as our analysis is performed using only cross-sectional data, we do not see this necessary.

6.0 Results and discussion

The findings of our regressions are divided into four parts, each separated by one of our four hypotheses. All calculations were performed in STATA, where the regressions were conducted as presented in the methodology part.

6.1 Hypothesis 1: CEO gender and financial performance

Tables 3.1 – 3.4 present the main results from the OLS regression model to examine hypothesis 1, *"Female-led startups financially underperform male-led startups".*

Table 3.1: *The effect on Return on Assets*

The table displays the results of OLS regression with the natural logarithm of (1+ ROA) as the dependent variable. The independent variables are CEO gender (1 female, 0 men), percentage of shares owned by the CEO, leverage (total debt divided by total assets, lagged by one period) and company size (natural logarithm of total assets, lagged by one period). The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%.

	Coefficients	**t-Stat**
Intercept	-0.8923*** (0.0771)	-11.573
CEO gender (Dummy)	-0.0413 (0.0294)	-1.4006
CEO Share	0.0004 (0.0294)	1.1637
Leverage t-1	-0.0978*** (0.0089)	-10.948
Ln (Total Assets) t-1	0.0661*** (0.0051)	12.852

Number of observations: 2252, Root Mean Squared Error: 0.45, R-squared: 0.158,
Adjusted R-Squared: 0.157, F-statistic vs. constant model: 106, p-value = 0.000

As a result of the first model, shown in Table 3.1, a negative intercept indicates that the average startup has a significantly negative *ROA* of 60% converted from the natural logarithm. This might suggest that startups have difficulty generating returns on their assets in their early years of operation, in contrast to the positive average *ROA* presented in Table 1. Further, neither *CEO gender* nor *CEO share* significantly affects *ROA*. However, *Leverage* has a significantly negative impact on *ROA*. This may indicate that more levered firms have a lower *ROA* or that firms with low earnings borrow more. The insignificant result on *CEO gender* is somehow unexpected as female CEOs have higher leverage, as shown in the descriptive statistics (Table 1). Additionally, larger firms can generate profits from their assets better than smaller firms, statistically significant at the 1% level. At the same time, firm size can be expected to positively impact *ROA* as it directly impacts the measure, also illustrated in the correlation matrix (Table 2).

Table 3.2: *The effect on Return on Equity*

The table displays the results of OLS regression with the natural logarithm of (1+ ROE) as the dependent variable. The independent variables are CEO gender (1 female, 0 men), percentage of shares owned by the CEO, leverage (total debt divided by total assets, lagged by one period) and company size (natural logarithm of total assets, lagged by one period). The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%.

	Coefficients	**t-Stat**
Intercept	-0.5702***	-4.865
	(0.1172)	
CEO gender (Dummy)	-0.0499	-1.1137
	(0.0448)	
CEO Share	0.0006	1.097
	(0.0005)	
Leverage t-1	0.0226*	1.6623
	(0.0136)	
Ln (Total Assets) t-1	0.0384***	4.9208
	(0.0078)	

Number of observations: 2252, Root Mean Squared Error: 0.683, R-squared: 0.0123,

Adjusted R-Squared: 0.0106, F-statistic vs. constant model: 7, p-value = 0.0000

Furthermore, examining ROE, the average startup has a negative return on their equity of 43% converted from the natural logarithm, as shown in Table 3.2. This implies that the average startup struggles to generate returns from their equity in the early years of operating, similar to *ROA*. This again contradicts our findings in the presented descriptive statistics, where the average *ROE* is positive. Further, the results illustrate that neither *CEO gender* nor *CEO share* impacts *ROE*. However, *Leverage* and *Firm size* significantly impact *ROE*, proving that large and highly levered firms are better at generating profits from their equity.

Table 3.3: *The effect on Return on Assets CAGR*

The table displays the results of OLS regression with the natural logarithm of (1+ ROA CAGR) as the dependent variable. The independent variables are CEO gender (1 female, 0 men), percentage of shares owned by the CEO, leverage (total debt divided by total assets, lagged by one period) and company size (natural logarithm of total assets, lagged by one period). The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%.

	Coefficients	**t-Stat**
Intercept	-1.7574*** (0.3365)	-5.2232
CEO gender (Dummy)	-0.0262 (0.1285)	-0.2039
CEO Share	-0.0007 (0.0016)	-0.4590
Leverage t-1	0.0889** (0.0390)	2.2815
Ln (Total Assets) t-1	0.0752*** (0.0224)	3.3518

Number of observations: 2252, Root Mean Squared Error: 1.96, R-squared: 0.00594,

Adjusted R-Squared: 0.00417, F-statistic vs. constant model: 3.36, p-value = 0.0095

Table 3.3 demonstrates that the average development in ROA is significantly negative, with a value of 83%, converted from the natural logarithm. Startups have difficulties improving ROA throughout their first five years of operating. The results disprove our findings presented in the descriptive statistics, suggesting a positive average improvement in ROA. Furthermore, *CEO gender* and *CEO share* have no significant effect on improvements in ROA. In contrast to our findings in *ROA*, *Leverage* has a significant positive impact on improvements in ROA. However, firm size has a significantly positive effect on improvements in ROA, similar to our findings in *ROA*. This entails that larger firms are more capable of gaining returns on their assets and more likely to improve profits than smaller firms.

Table 3.4: *The effect on Return on Equity CAGR*

The table displays the results of OLS regression with the natural logarithm of (1+ ROE CAGR) as the dependent variable. The independent variables are CEO gender (1 female, 0 men), percentage of shares owned by the CEO, leverage (total debt divided by total assets, lagged by one period) and company size (natural logarithm of total assets, lagged by one period). The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%.

	Coefficients	**t-Stat**
Intercept	-1.9971***	-5.5053
	(0.3628)	
CEO gender (Dummy)	-0.0649	-0.4681
	(0.1386)	
CEO Share	0.0009	0.5643
	(0.0017)	
Leverage t-1	0.1106***	2.6334
	(0.0420)	
Ln (Total Assets) t-1	0.0636***	2.63
	(0.0242)	

Number of observations: 2252, Root Mean Squared Error: 2.11, R-squared: 0.00499,

Adjusted R-Squared: 0.00322, F-statistic vs. constant model: 2.82, p-value = 0.0239

Consistent with the results from the previous model, the development in ROE has a negative average value of 85% converted from the natural logarithm. This contradicts our positive findings for the variable in our descriptive statistics (Table

1). These results imply that startups have difficulties improving ROA and ROE in their first years of operating. Furthermore, the development in ROE has no significant relation to neither *CEO gender* nor *CEO share.* However, we find that both *Leverage* and *Firm size* have a significantly positive effect on the improvement in ROE. Equivalent to the results in *ROA CAGR*, both large firms and firms with a higher amount of leverage tend to improve profits more in terms of ROE.

The first hypothesis is rejected by all models presented above as all the regressions show that *CEO gender* has no significant impact on financial performance. As a result, the average startup struggles to generate returns regarding its assets and equity. These findings suggest that other factors affect *ROA* and *ROE* than *CEO gender*.

6.2 Hypothesis 2: CEO gender and growth

Table 4.1 – 4.2 presents the main results from the OLS regression model to examine hypothesis 2: *"Female-led startups grow slower than male-led startups"*.

Table 4.1: *The effect on Total Assets CAGR*

The table displays the results of OLS regression with the natural logarithm of (1+ TA CAGR) as the dependent variable. The independent variables are CEO gender (1 female, 0 men), percentage of shares owned by the CEO, leverage (total debt divided by total assets, lagged by one period) and company size (natural logarithm of total assets, lagged by one period). The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%.

	Coefficients	**t-Stat**
Intercept	-0.6752*** (0.0374)	-18.074
CEO gender (Dummy)	0.0420*** (0.0143)	2.9464
CEO Share	0.0006*** (0.0002)	3.7074
Leverage t-1	-0.0394*** (0.0043)	-9.0999
Ln (Total Assets) t-1	0.0560*** (0.0025)	22.472

Number of observations: 2252, Root Mean Squared Error: 0.218, R-squared: 0.264,

Adjusted R-Squared: 0.262, F-statistic vs. constant model: 201, p-value = 0.0000

As demonstrated in Table 4.1, the average growth in total assets is significantly negative, with a value of 49%, converted from the natural logarithm. Nevertheless, female CEOs positively impact growth in total assets, statistically significant at the 1% level. On average, female-led startups have a 4.2% higher growth in total assets than male-led startups. This is also consistent with the findings in our descriptive statistics (Table 1). Additionally, there is a significant positive impact of the CEO owning a larger amount of shares on growth in total assets. Increased personal wealth invested in the firm can strengthen the CEO's incentives to improve firm size and growth. Unlike *ROA CAGR* and *ROE CAGR*, *Leverage* in this model has a significantly negative impact. This finding suggests that startups operating with lower leverage grow faster in terms of total assets. Lastly, *Firm size* significantly positively impacts growth in total assets. This supports the argument that larger startups are more capable of growing faster compared to smaller startups.

Table 4.2: *The effect on Operating Income CAGR*

The table displays the results of OLS regression with the natural logarithm of (1+ OI CAGR) as the dependent variable. The independent variables are CEO gender (1 female, 0 men), percentage of shares owned by the CEO, leverage (total debt divided by total assets, lagged by one period) and company size (natural logarithm of total assets, lagged by one period). The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%.

	Coefficients	**t-Stat**
Intercept	-1.8012*** (0.3168)	-5.6852
CEO gender (Dummy)	0.0643 (0.1210)	0.5314
CEO Share	-0.0017 (0.0015)	-1.1758
Leverage t-1	0.1283*** (0.0367)	3.498
Ln (Total Assets) t-1	0.0886*** (0.0211)	4.196

Number of observations: 2252, Root Mean Squared Error: 1.85, R-squared: 0.0109,

Adjusted R-Squared: 0.00914, F-statistic vs. constant model: 6.19, p-value = 0.0000

In the final model investigating growth, the average startup has a significantly negative growth in operating income of 83%, significant on the 1% level. Unlike the previous growth model, *CEO gender* and *CEO share* have no significant impact on growth in operating income. Moreover, *Leverage* and *Firm size* significantly positively impact growth in operating income, indicating that larger and more levered firms grow faster in terms of operating income.

Consequently, the second hypothesis is not rejected regarding growth in total assets, proving that females-led startups tend to significantly grow more than male-led startups. However, the other model predicts that *CEO gender* has no significant impact on growth. On average, both presented models indicate that startups have negative growth in their first years of operating. Finally, the model on growth in operating income suggests that larger and more levered startups tend to grow faster.

6.3 Hypothesis 3: CEO gender and volatility

Table 5.1 presents the main results from the OLS regression model to examine hypothesis 3: *"Female-led startups have less volatile earnings than male-led startups"*.

Table 5.1: *The effect on Operating Income Volatility*

The table displays the results of OLS regression with the natural logarithm of the standard deviation of OI as the dependent variable. The independent variables are CEO gender (1 female, 0 men), percentage of shares owned by the CEO, leverage (total debt divided by total assets, lagged by one period) and company size (natural logarithm of total assets, lagged by one period). The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%.

	Coefficients	**t-Stat**
Intercept	6.9752***	27.416
	(0.2544)	
CEO gender (Dummy)	-0.0467	-0.4808
	(0.0971)	
CEO Share	-0.0038***	-3.2734
	(0.0012)	
Leverage t-1	0.1712***	5.8149
	(0.0294)	
Ln (Total Assets) t-1	0.2817***	16.613
	(0.0170)	

Number of observations: 2250, Root Mean Squared Error: 1.85, R-squared: 0.0109,

Adjusted R-Squared: 0.091, F-statistic vs. constant model: 5.75, p-value = 0.0001

The table above shows that the average startup's operating income volatility significantly differs from zero. However, we find that *CEO gender* has no impact on volatility. These findings contradict the results in our descriptive statistics (Table 1), indicating that female-led startups have less volatile operating income. Further, *CEO share* has a significantly negative impact on volatility, suggesting that startups with CEOs owning additional shares are more risk-averse in their operating decisions. Lastly, *Firm size* and *Leverage* have a significantly positive impact on volatility. The positive leverage effect is anticipated as higher leverage results in increased firm risk, similar to a levered equity investment being riskier. After combining the results from growth, larger and more levered startups tend to grow faster, however, at the expense of higher volatility.

6.4 Hypothesis 4: Robustness check – CEO gender and industry differences

We check if the results from our previous hypotheses remain consistent after controlling for industries. Table 6.1 – 6.7 presents the OLS regression model's main results to examine hypothesis 4: "*Hypotheses 1-3 still hold after controlling for differences among industries.*"

Table 6.1: *The effect on ROA – industry adjusted*

The table displays the results of OLS regression with the natural logarithm of (1+ ROA) as the dependent variable. The independent variables are CEO gender (1 female, 0 men), percentage of shares owned by the CEO, leverage (total debt divided by total assets, lagged by one period) and company size (natural logarithm of total assets, lagged by one period). The control variable is industry (all variables are converted by subtracting out the average from each variable). The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%. To the right is the result from the non-industry adjusted regression from Hypothesis X.

	Industry adjusted		**Non-industry adjusted**	
	Coefficients	**t-Stat**	**Coefficients**	**t-Stat**
Intercept	0.0008 (0.0100)	0.0823	-0.8923*** (0.0771)	-11.573
CEO gender (Dummy)	-0.0513* (0.0293)	-1.7512	-0.0413 (0.0294)	-1.4006
CEO Share	0.0003 (0.0004)	0.9481	0.0004 (0.0294)	1.1637
Leverage t-1	-0.0984*** (0.009)	-10.99	-0.0978*** (0.0089)	-10.948
Ln (Total Assets) t-1	0.0671*** (0.0053)	12.608	0.0661*** (0.0051)	12.852

Number of observations: 2252, Root Mean Squared Error: 0.448, R-squared: 0.155,
Adjusted R-Squared: 0.154, F-statistic vs. constant model: 103, p-value = 0.0000

Examining the first industry-adjusted regression, we observe two changes from previous results, as shown in Table 6.1. Firstly, the intercept is insignificant after controlling for industries, meaning the average startup cannot generate profits from its assets after adjusting for industries. Secondly, we discover that female-led startups significantly underperform male-led startups in *ROA* by 5% on average.

This is consistent with the findings in the descriptive statistics (Figure 6.1), where more gender-equal industries tend to underperform male-dominated industries. Furthermore, *Leverage* and *Firm size* results remain consistent, as both coefficients are approximately identical and statistically significant at the 1% level. A significant negative *CEO gender* dummy is unexpected as we in this model adjust for industry differences in *Leverage*. Instead, we expected female-led startups to perform better or remain insignificant in *ROA* compared to male-led. However, this result might be explained by male-led startups being larger on average, as seen in our descriptive statistics (Table 1).

Table 6.2: *The effect on ROE – industry adjusted*

The table displays the results of OLS regression with the natural logarithm of (1+ ROE) as the dependent variable. The independent variables are CEO gender (1 female, 0 men), percentage of shares owned by the CEO, leverage (total debt divided by total assets, lagged by one period) and company size (natural logarithm of total assets, lagged by one period). The control variable is industry (all variables are converted by subtracting out the average from each variable). The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%. To the right is the result from the non-industry adjusted regression from Hypothesis X.

	Industry adjusted		**Non-industry adjusted**	
	Coefficients	**tStat**	**Coefficients**	**tStat**
Intercept	0.0013	0.0881	-0.5702***	-4.865
	(0.0153)		(0.1172)	
CEO gender (Dummy)	-0.0481	-1.0806	-0.0499	-1.1137
	(0.0445)		(0.0448)	
CEO Share	0.0005	0.8997	0.0006	1.097
	(0.0006)		(0.0005)	
Leverage t-1	0.0248*	1.821	0.0226*	1.6623
	(0.0136)		(0.0136)	
Ln (Total Assets) t-1	0.0397***	4.9134	0.0384***	4.9208
	(0.008)		(0.0078)	

Number of observations: 2252, Root Mean Squared Error: 0.681, R-squared: 0.012, Adjusted R-Squared: 0.0103, F-statistic vs. constant model: 6.84, p-value = 0.0000

Table 6.2 demonstrates certain changes in the industry-adjusted regression for *ROE*. The intercept changes from being significant at the 1% level to insignificant, indicating that the average startup cannot generate profits from its equity. Additionally, industry differences appear not to affect the influence of gender, as it remains insignificant after the adjustment. Further, we find that both *Leverage* and *Firm* size remain significant with similar coefficients.

Table 6.3: *The effect on ROA CAGR – industry adjusted*

The table displays the results of OLS regression with the natural logarithm of (1+ ROA CAGR) as the dependent variable. The independent variables are CEO gender (1 female, 0 men), percentage of shares owned by the CEO, leverage (total debt divided by total assets, lagged by one period) and company size (natural logarithm of total assets, lagged by one period). The control variable is industry (all variables are converted by subtracting out the average from each variable). The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%. To the right is the result from the non-industry adjusted regression from Hypothesis X.

	Industry adjusted		**Non-industry adjusted**	
	Coefficients	**tStat**	**Coefficients**	**tStat**
Intercept	-0.0094 (0.0438)	-0.2157	-1.7574*** (0.3365)	-5.2232
CEO gender (Dummy)	0.0327 (0.1277)	0.2561	-0.0262 (0.1285)	-0.2039
CEO Share	-9.6319e-0 (0.0016)	-0.0605	-0.0007 (0.0016)	-0.4590
Leverage t-1	0.0932** (0.0390)	2.3887	0.0889** (0.0390)	2.2815
Ln (Total Assets) t-1	0.0677*** (0.0231)	2.9208	0.0752*** (0.0224)	3.3518

Number of observations: 2252, Root Mean Squared Error: 1.95, R-squared: 0.0049,
Adjusted R-Squared: 0.00312, F-statistic vs. constant model: 2.76, p-value = 0.0262

Table 6.3 reveals that one of our primary findings changes when analyzing the industry-adjusted regression of *ROA CAGR*. The intercept is no longer significant, indicating no improvement in ROA after adjusting for industry differences. Nor in this model is the dummy significant, meaning *CEO gender* has no impact on *ROA*

CAGR. The insignificant dummy is unexpected as male-dominated industries tend to improve their profits faster, as shown in Figure 6.3 (descriptive statistics). Lastly, the results on *Leverage* and *Firm size* remain consistent, as both coefficients are approximately the same and statistically significant.

Table 6.4: *The effect on ROE CAGR – industry adjusted*

The table displays the results of OLS regression with the natural logarithm of (1+ ROE CAGR) as the dependent variable. The independent variables are CEO gender (1 female, 0 men), percentage of shares owned by the CEO, leverage (total debt divided by total assets, lagged by one period) and company size (natural logarithm of total assets, lagged by one period). The control variable is industry (all variables are converted by subtracting out the average from each variable). The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%. To the right is the result from the non-industry adjusted regression from Hypothesis X.

	Industry adjusted		**Non-industry adjusted**	
	Coefficients	**tStat**	**Coefficients**	**tStat**
Intercept	0.0025 (0.0472)	0.0522	-1.9971*** (0.3628)	-5.5053
CEO gender (Dummy)	-0.0057 (0.1376)	-0.0411	-0.0649 (0.1386)	-0.4681
CEO Share	0.0008 (0.0017)	0.47556	0.0009 (0.0017)	0.5643
Leverage t-1	0.1213*** (0.0421)	2.8827	0.1106*** (0.0420)	2.6334
Ln (Total Assets) t-1	0.0549** (0.0250)	2.1951	0.0636*** (0.0242)	2.63

Number of observations: 2252, Root Mean Squared Error: 2.1, R-squared: 0.00464,
Adjusted R-Squared: 0.00287, F-statistic vs. constant model: 2.62, p-value = 0.0335

Similar to *ROA CAGR*, Table 6.4 reveals that the intercept for the development in ROE becomes insignificant after adjusting for industry, illustrating that the average startup has no improvement in ROE. This result is consistent with the industry-adjusted model analyzing the financial performance in *ROE*. Likewise, *CEO gender* remains insignificant. Finally, the adjusted *Leverage* and *Firm size* variables are still significant with similar coefficients.

As a result, the models presented above reject the first part of hypothesis 4. Except for *ROA*, all other models prove that *CEO gender* has no significant impact on financial performance after adjusting for industries. Consequently, the average startup generates no returns in terms of assets or equity and does not improve over time. Finally, after adjusting for industry, all models still prove that *Firm size* has a significant positive impact on financial performance.

Table 6.5: *The effect on Total Assets CAGR – industry adjusted*

The table displays the results of OLS regression with the natural logarithm of (1+ TA CAGR) as the dependent variable. The independent variables are CEO gender (1 female, 0 men), percentage of shares owned by the CEO, leverage (total debt divided by total assets, lagged by one period) and company size (natural logarithm of total assets, lagged by one period). The control variable is industry (all variables are converted by subtracting out the average from each variable). The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%. To the right is the result from the non-industry adjusted regression from Hypothesis X.

	Industry adjusted		**Non-industry adjusted**	
	Coefficients	**tStat**	**Coefficients**	**tStat**
Intercept	-0.0057 (0.0048)	-1.1786	-0.6752*** (0.0374)	-18.074
CEO gender (Dummy)	0.0301** (0.0141)	2.1429	0.0420*** (0.0143)	2.9464
CEO Share	0.0005*** (0.0002)	2.6823	0.0006*** (0.0002)	3.7074
Leverage t-1	-0.0377*** (0.0043)	-8.7688	-0.0394*** (0.0043)	-9.0999
Ln (Total Assets) t-1	0.0601*** (0.0026)	23.537	0.0560*** (0.0025)	22.472

Number of observations: 2252, Root Mean Squared Error: 0.215, R-squared: 0.274,
Adjusted R-Squared: 0.273, F-statistic vs. constant model: 213, p-value = 8.38e-1550

In contrast to the previous industry-adjusted models, all coefficients in this model are significant except for the intercept. The insignificant intercept illustrates that the average startup struggles to grow in terms of total assets. However, the results consistently prove that female-led startups grow substantially faster, with 3% more than male-led on average. Besides, we would expect the coefficient of the gender dummy to be higher after adjusting for industries. This is due to more gender-equal industries having more leverage, negatively affecting growth in total assets. However, the coefficient has decreased, possibly due to other factors beyond the chosen independent variables. In addition, *CEO Share* remains to positively affect growth in total assets, significant at the 1% level. This supports the effect that the CEO owning more shares encourages growth, as discussed in hypothesis 2. Finally, *Leverage* and *Firm size* remain equally significant, with similar coefficients.

Table 6.6: *The effect on Operating Income CAGR – industry adjusted*

The table displays the results of OLS regression with the natural logarithm of (1+ OI CAGR) as the dependent variable. The independent variables are CEO gender (1 female, 0 men), percentage of shares owned by the CEO, leverage (total debt divided by total assets, lagged by one period) and company size (natural logarithm of total assets, lagged by one period). The control variable is industry (all variables are converted by subtracting out the average from each variable). The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%. To the right is the result from the non-industry adjusted regression from Hypothesis X.

	Industry adjusted		**Non-industry adjusted**	
	Coefficients	**tStat**	**Coefficients**	**tStat**
Intercept	-0.0108 (0.0412)	-0.2628	-1.8012*** 0.3168	-5.6852
CEO gender (Dummy)	0.0663 (0.1202)	0.5517	0.0643 0.1210	0.5314
CEO Share	-0.0005 (0.0015)	-0.3643	-0.0017 0.0015	-1.1758
Leverage t-1	0.1180*** (0.0368)	3.2102	0.1283*** 0.0367	3.498
Ln (Total Assets) t-1	0.0825*** (0.0218)	3.7771	0.0886*** 0.0211	4.196

Number of observations: 2252, Root Mean Squared Error: 1.84, R-squared: 0.00851,
Adjusted R-Squared: 0.00674, F-statistic vs. constant model: 4.82, p-value = 0.0007

As the previous growth model discussed, the intercept becomes insignificant after adjusting for industry, resulting in the average startup not growing. Similarly, the *CEO gender* remained insignificant, confirming that gender has no impact on startup growth. This result demonstrates that growth in female-led startups does not appear to come at the expense of earnings. Lastly, *Leverage* and *Firm size* positively impact growth after adjusting for industry, statistically significant at the 1% level.

In conclusion, the industry-adjusted growth models indicate that the average startup has difficulty growing in both our chosen growth measures. We do not reject hypothesis 4 regarding growth in total assets. Nevertheless, since we reject the remaining, *CEO gender* seems to influence startups' growth. Lastly, female-led startups grow faster in terms of assets; however, there is little evidence that this comes at the expense of profits.

Table 6.7: *The effect on Operating Income Volatility – industry adjusted*

The table displays the results of OLS regression with the natural logarithm of the standard deviation of OI as the dependent variable. The independent variables are CEO gender (1 female, 0 men), percentage of shares owned by the CEO, leverage (total debt divided by total assets, lagged by one period) and company size (natural logarithm of total assets, lagged by one period). The control variable is industry (all variables are converted by subtracting out the average from each variable). The standard errors are displayed in light grey and parenthesis under the coefficients. The significance levels are indicated as follows: * = 10%, ** = 5% and *** = 1%. To the right is the result from the non-industry adjusted regression from Hypothesis X.

	Industry adjusted		**Non-industry adjusted**	
	Coefficients	**tStat**	**Coefficients**	**tStat**
Intercept	0.0023	0.0710	6.9752***	27.416
	(0.0331)		(0.2544)	
CEO gender (Dummy)	-0.0721	-0.7484	-0.0467	-0.4808
	(0.0963)		(0.0971)	
CEO Share	-0.0034***	-2.8017	-0.0038***	-3.2734
	(0.0012)		(0.0012)	
Leverage t-1	0.1709***	5.8029	0.1712***	5.8149
	(0.0295)		(0.0294)	
Ln(Total Assets) t-1	0.2928***	16.74	0.2817***	16.613
	(0.0175)		(0.0170)	

Number of observations: 2250, Root Mean Squared Error: 1.47, R-squared: 0.114,
Adjusted R-Squared: 0.112, F-statistic vs. constant model: 71.9, p-value = 0.0000

In the final industry-adjusted model, we only observe a change in the intercept. The insignificant intercept proves that the *Operating Income Volatility* of the average startup is close to the mean. Furthermore, the gender effect remains insignificant on *Operating Income Volatility*. Additionally, *CEO share*, *Leverage* and *Firm size* remain statistically significant at the 1% level and with similar coefficients. A positive *CEO Share* coefficient implies that owning a larger stake of shares can give incentives for taking less risky decisions, assuming volatile income leaves a larger downside in terms of share value.

7.0 Conclusion

The paper aimed to investigate whether female CEOs positively affect startups' financial performance, growth or volatility during their first five years. This was done by using different profitability and firm-specific measures. To examine startups' financial performance we utilized *ROA*, *ROE, ROA CAGR* and *ROE CAGR*. Also, we investigated growth by applying the compounded annual growth rate of Total Assets and Operating Income. In addition, we examined *Operating Income Volatility* by using the standard deviation. The study was conducted with a large data sample gathered from the CCGR database as of 2005 to 2019.

Several regressions were performed using OLS to examine the possible effect of CEO gender on startups'. The results disprove our first hypothesis that female-led startups perform better financially and remain robust after adjusting for industry differences. This supports little difference in female- and male-led startups' financial performance. Likewise, our second hypothesis finds that CEO gender does not affect startups' growth in Operating Income. However, our model on growth in Total Assets confirms our second hypothesis, even after adjusting for industries. This indicates that female CEOs positively affect growth in Total Assets.

Nevertheless, our third hypothesis shows that CEO gender does not affect a startup's volatility in operating income after adjusting for industries. This may indicate that female and male CEOs are equally risk-taking, contradicting existing literature suggesting that females are more risk-averse than men.

In conclusion, the findings in our research suggest that startups' profitability, growth and volatility are affected by several factors. Previous research has focused on gender effects on firms outside of Norway. Mainly, literature on Norwegian firms has concentrated on the gender effect on the board of directors. Also, previous studies on gender effects adjusted for industry differences have not explicitly focused on startups. Hence, research concerning Norwegian startups and how CEO gender affects financial performance, growth and volatility appears to be lacking. Thus, our study seems to be the only research examining the CEO gender effect in Norwegian startups and how this impacts various measures and adjusting for industry differences. Consequently, we identify this thesis as adding to the current literature, and future studies are proposed a similar approach.

However, this study also has limitations as we cannot include all influential variables, such as startup culture and CEO education. This is primarily because the master thesis procedure is limited considering time and theoretical depth. In addition, our findings could be affected by the financial crisis as we have examined startups established from 2005 until 2013. Therefore, expanding the data sample to a more extended period could have strengthened our findings. Also, our results could have been different if we chose to apply other definitions to our variables. However, as supported by previous literature, we concluded the chosen variables to be the most appropriate.

Finally, additional literature is needed on the topic, as there might be other explanations as to why female-led startups tend to underperform. This can be due to differences in access to capital or investor preferences. Moreover, our findings may not be directly transferable to other countries due to unique domestic contingencies. Therefore, future studies, including data from other countries, could further validate our findings and bring new empirical insights.

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APPENDIX

Table 3: Data Filtering

Table 3 presents the applied filters on the original data set to achieve a meaningful interpretation. Column one presents the different filter numbers, 15 in total. Column two presents the filter explanation. Columns three and four display the total number of remained observations and the number of excluded observations from the data sample after applying a specific filter.

Original Panel Data set			**5 819 873**
Filter Number	**Filter Explanation**	**All Observations**	**Excluded Observations**
1	Exclude firms with missing values in CEO gender variable.	4 270 675	1 549 198
2	Exclude firms with missing values in total equity	4 270 674	1
3	Exclude firms with missing values in the number of employees.	2 760 030	1 510 644
4	Exclude firms with missing values in the foundation year.	2 197 463	562 567
5	Exclude firms with negative total fixed assets and total current assets.	2 191 175	6 288
6	Exclude firms with negative revenues.	2 188 177	2 998
7	Exclude companies with missing values or less than 20% in CEO share.	1 134 956	995 957
8	Include firms with foundation year in 2005 or later	502 199	632 757
9	Exclude firms with missing industry code	441 286	60 913
10	Exclude firms that do not report in the first, second, fifth and sixth year—identical gender throughout first six years.	173 089	268 197
11	Exclude firms with missing values in industry codes, multiple industries, and included in the real estate industry.	31 630	141 459
12	Include firms only reporting in NOK and organization type AS.	30 293	1 337
13	Exclude firms with zero total assets in the second and sixth year and zero in average total assets and equity.	28 982	1 311
14	Exclude firms within the financial and insurance sector	20 147	8 835
15	Exclude firms within 1% of the upper and lower quantile of ROE and ROA.	18 761	1 386

TABLE 4: Summary statistics over industries

Table 4 shows how the observations in our dataset are distributed in different industries. All industries are coded according to public industry definitions from Statistics Norway. As definitions changed between different periods, earlier codes were decoded to fit the current standards.

	Percentage of the total number of companies	Observations
Agriculture, forestry and fishing	2.6%	489
Mining and quarrying	0.7%	129
Manufacturing	3.7%	688
Electricity, gas and steam air	2.0%	371
Water supply	0.3%	62
Construction	23.6%	4422
Wholesale and retail trade	15.7%	2942
Transportation storage	2.6%	496
Accommodation and food services activities	1.5%	279
Information communication	7.2%	1359
Financial and insurance activities	0.0%	0
Real estate activities	0.0%	0
Professional, scientific and technical activities	25.3%	4749
Administrative and support service activities	6.9%	1302
Public administration and defence	0.0%	0
Education	2.1%	386
Human health and social work activities	3.0%	555
Arts, entertainment and recreation	2.0%	369
Other service activities	0.9%	163
Activities of households as employees	0.0%	0
Activites of extraerrotorial organixations and bodies	0.0%	0
SUM		**18 761**