FLIRTING WITH THE INVESTOR?

A STUDY ON THE EFFECT OF FEMALE CEOS' SIGNALING VALUE ON IPO UNDERPRICING

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Abstract

This study investigates the potential signaling value a female CEO emits and its effect on IPO underpricing. By using a multiple variable regression model, 249 IPOs in Sweden from 2005 to the beginning of 2022 were analyzed. The results show a slight, but statistically insignificant, increase in underpricing when the firm had a female CEO. The analysis furthermore covers the variability of firms' initial returns, showing that a female CEO decreases this variability. However, these results are also insignificant. We can therefore not find evidence supporting that female CEOs emit either a positive or negative signal that affects IPO underpricing.

Keywords

IPO Underpricing, Initial Public Offerings, Female CEO, Signaling, Information Asymmetry

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1. Introduction

On the 16th of June 2021 Pernilla Nyrensten took her company RevolutionRace public on Nasdaq Stockholm Main Market. Although the Swedish stock market was founded in 1863, Nyrensten was the first female founder and CEO to take her company public in Sweden (Affärsvärlden 2021). How come it has taken Sweden almost 160 years for this to occur?

Women have continuously been marginalized and excluded from high-ranking positions in the modern business world (Bertrand 2018). Even though the value of diversity has been highlighted and its focus in corporations is increasing, the glass ceiling is still present. In 2021 twelve percent of all CEOs in Sweden were women and only one percent of venture capital went to firms with a female founder (Allbright 2021). The underlying reasons for the underrepresentation of women have been widely studied, however, the research field is scarce when studied in combination with firm valuation (Bertrand 2018, Field, Souther et al. 2020, Cook, Diamond et al. 2021, Espinosa, Ferreira 2022). One of the most complex times of valuing a firm is at its initial public offering, the IPO (Cohen, Dean 2005). One cannot rely on extensive reports on historical performance and few valuation multiples are available. The lack of information causes information asymmetry between actors involved in the issuing, which many researchers agree leads to a phenomenon called IPO underpricing (Baron 1982, Rock 1986, Welch 1989, Ljungqvist 2004). The absence of information forces investors to take other measures into account when valuing the firm, such as the different signals that the firm emits. Studies have shown that the top management team as well as gender can work as a signaling mechanism (Eagly, Karau 2002, Cohen, Dean 2005, Eddleston, Ladge et al. 2014). In this study, we investigate if the gender of the CEO has an impact on how financial markets value firms. More specifically, we study firm valuation at the time of their IPO and whether the female gender bears a positive or negative signal. This paper therefore aims to answer the following question: *Do female CEOs emit a signal that affects IPO underpricing?*

Scholars have noted that IPOs are, on average, underpriced (Ritter 1984, Rock 1986). The degree of underpricing varies between countries, industries, and individual

companies. There have been many attempts to understand the driving factors behind underpricing. One of the most prominent explanations is information asymmetry, where there is a systematic mismatch in information between the parties involved in the IPO. This causes uncertainty about the actual value of the firm. A higher amount of uncertainty regarding the firm's value has been linked to a higher amount of underpricing (Rock 1986).

Underpricing results in less equity going to the issuing firm. It is therefore of interest for firms to reduce the underpricing and thus the uncertainty surrounding the firm at the time of the IPO. One way for firms to reduce uncertainty, and thereby the underpricing, is by emitting signals that credibly reveal information about the firm's quality, a method called signaling. Several studies have analyzed different signals and their impact on firm valuation. However, only one previous study, to our knowledge, has studied the impact a female CEO have on the underpricing of an initial public offering. The potential signaling value a female CEO emits and its effect on IPO underpricing therefore serves as an interesting area to research. It not only adds to the existing research but is of personal interest as both authors of this thesis are women.

The study uses data from Swedish companies going public between the 1st of January 2005 to the 22nd of March 2022. Furthermore, we exclude companies within the financial industry, including SPACs and crypto currency, in line with previous research (Butler, Keefe et al. 2014).

The result from this study shows that female CEOs have a small positive effect on IPO underpricing. However, these results lack significance. Furthermore, we observe that firms led by a female CEO at the time of the IPO have a lower variability in their initial returns, though these results are also insignificant. Therefore, we cannot conclude that the gender of the CEO emits a signal that has an impact on IPO underpricing.

2. Previous Literature and Contribution

This paper aims to combine two academic subjects that separately have been researched extensively, information asymmetry in relation to IPO underpricing and the effect a female CEO has on a firm. The fundamental concept behind the possible correlation between these two areas is signaling theory, which will be developed in section 3.4.

To our knowledge, Mohan, Chen (2004) is the only paper that has combined the research on IPO underpricing and the effects of having a female CEO. The paper found that IPO underpricing is higher for firms with a female CEO. However, the difference was not statistically significant. While this provides validation for researching these two topics in combination, the article is not published in a prominent journal and its results can not directly be applied on the Swedish IPO market due to the difference in time, institutional environment, and gender equality[1]. Furthermore, there is no clear consensus within IPO research regarding the possible predictors that drive IPO underpricing and the theories published in prominent journals have been ambiguous.

The above reasoning led us to use a different model than Mohan and Chen. Our research method uses a combination of variables with a foundation from prominent journals that have shown significance. The articles "*The Long-Run Performance of Initial Public Offerings*" by Jay R. Ritter (1991), "*Initial Public Offerings and Underwriter Reputation*" by Richard Carter and Steven Manaster (1990), and *"IPO First-Day Returns, Offer Price Revisions, Volatility, and Form S-1 Language"* by Tim Loughran and Bill McDonald (2013) were used to define the control variables for firm characteristics. In addition, since this paper examines the effect of CEO gender, control variables regarding CEO characteristics and diversity were added. These variables have been taken from the articles "*Information asymmetry and investor valuation of IPOs: top management team legitimacy as a capital market signal*" by Boyd D. Cohen and Thomas J. Dean (2005) and *Women in the boardroom and their impact on governance and performance* by Renee Adams and Daniel Ferreira (2009).

[1] Sweden is ranked number three in the SDG Gender index score in comparison to the U.S which is ranked 28.

3. Theory and Hypothesis Development

3.1 Initial Public Offerings

An IPO occurs when a firm goes through the process of going from a private corporation to being listed on a public stock exchange. This allows the public to invest in the firm. There are different theories of why firms choose to do an IPO. Ritter and Welch state that the primary reason for firms to go public is to raise capital and enable shareholders to convert their shares to cash (Ritter, Welch 2002). Merton argued that taking a company public would increase visibility and investor recognition leading to a lowered cost of equity (Merton 1987). Other reasons for going public might be dispersion of ownership and attracting public market competition (Chemmaneur, Fulghieri 1999, Maksimovic, Pichler 2001). Furthermore, an IPO enables an easier sale of a firm. Zingales observed that potential investors find it easier to spot a potential target when it is public. Additionally, it is harder for acquirers to pressure outside investors on pricing concessions than it is to pressure the unlisted company (Zingales 1995). Another reason according to Black and Gilson is that entrepreneurs often regain control from the venture capitalists in venture capital backed firms when the IPO occurs (Black, Gilson 1998).

3.2 IPO Underpricing

The phenomenon of IPO underpricing is common in a majority of both developed and emerging markets. Initial return is defined as the percentage change between the offer price and the closing price at the end of the first trading day, where the IPO is underpriced if the initial return is positive (Ritter 1991). Several theories explain why IPOs are underpriced, such as lawsuit avoidance, ownership dispersion, behavioral explanations, and asymmetric information (Ljungqvist 2004).

Lawsuit avoidance theories are prominent for companies in the US. The theory states that companies sell their stock at a discount to avoid future lawsuits from disappointed investors. In Sweden, this explanation has been proven to be economically insignificant (Rydqvist, 1994).

When a firm actively underprices its offering, it will become more attractive and thus gain more investors which in turn enables ownership dispersion. On one hand, ownership dispersion can be desirable as it prevents allocating large stakes to a few investors who thereby regain a large amount of outside control (Brennan and Franks 1997). On the other hand, Zingales argues that the IPO is a first step in selling all the shares over several periods (Zingales 1995). From this perspective, ownership dispersion is preferred since it enables higher liquidity in the secondary market of the shares. However, this field of research within IPO underpricing is still relatively unexplored and needs more empirical evidence to determine its validity and importance when setting offer prices (Ljungqvist 2004).

Behavioral explanations have been used to explain IPO underpricing by researchers when lawsuit risks, firm control and asymmetric information are not enough to explain the abnormally high returns that in some cases have been observed. The behavioral explanations consist of information cascades, investor sentiment as well as prospect theory and mental accounting. Similar to ownership dispersion, behavioral explanations are a relatively immature research area with more empirical research necessary to determine its actual effects (Ljungqvist 2004).

One of the most prominent theories is that information asymmetry causes IPO underpricing (Stiglitz 2000, Cohen, Dean 2005, Rock 1986). Information asymmetry and its implications on IPO underpricing is elaborated further in the following section.

3.3 Information Asymmetry

Information asymmetry builds upon the assumption that one party in a transaction knows more than the other parties. (Sceral, Erkoyuncu et al. 2018). Within IPO underpricing, information asymmetry has been empirically proven to be prevalent between informed and uninformed investors, between investors and the issuing firm as well as between underwriters and the issuing firm (Baron 1982, Rock 1986, Welch 1989, Ljungqvist 2004).

3.3.1 Information Asymmetry Between Investors

Rock's model on the winner's curse links information asymmetry to IPO underpricing. The underlying assumption in his model is that information asymmetry exists between

informed investors and the other parties involved in the transaction (Rock 1986). The informed investors have superior information regarding the true value of a firm compared to other uninformed actors and will therefore invest in good issues while withdrawing from the market if the shares are overvalued. This would make the uninformed investors receive all the shares they demand in unattractive offerings while being crowded out by informed investors in attractive offerings, making uninformed investors become reluctant to invest in IPOs (Ljungqvist 2004). Uninformed investors are furthermore necessary for the primary market, as the informed investor demand cannot fulfil the subscription-need on the market even in attractive IPOs. To keep the uninformed investors on the market, the expected return needs to be non-negative, making underpricing of IPOs necessary. Thus, firms collectively benefit from underpricing as it ensures the participation of uninformed investors. However, when looking at the perspective of the individual firm, underpricing is clearly costly (Ljungqvist 2004).

3.3.2 Information Asymmetry Between the Firm and Investors

Other scholars have argued that information asymmetry also prevails between the investors and the listing firm. Public market investors have little and unclear information about the company, making it difficult to determine its potential value as well as behavioral patterns of the firm (Cohen, Dean 2005, Stiglitz 2000). Unlisted firms have no long-term track record that investors can use to value the company. Furthermore, firms are complex, and their behavior is not always clearly visible (Schultz, Mouritsen et al. 2001). The information emitted by the firm prior to an IPO is colored by insiders with the aim to highlight the positive aspects of the firm to investors (Cohen, Dean 2005). Investors therefore take several different measurements into account when valuing a firm.

3.3.3 Information Asymmetry Between Underwriters and the Issuing Firm

Theory about information asymmetry and the principal-agent problems stems from the assumption that underwriters have more information about the capital market and the potential market demand than the issuing firm. Underwriters are motivated to underprice an IPO in order to decrease distribution efforts and costs of marketing and thus increase their profits (Baron 1982). The information advantage and the limited

ability issuers must monitor the actions of the underwriter result in a principal-agent problem. However, because of the high competition between underwriters, and the risk of missing potential clients due to exaggerated underpricing of previous IPOs, this problem is reduced. In addition, underwriters are typically compensated proportionally to IPO proceeds, which would create further incentive for the underwriter to minimize underpricing (Ljungqvist 2004).

3.4 Signaling Theory

3.4.1 Signaling Theory and IPO Underpricing

When information asymmetry is present and the actors in the transaction have access to different information, signaling can be used to mitigate this asymmetry. The theory is built upon the hypothesis that one party can credibly mediate certain information to another party in a transaction. In the context of firm valuation, signals are emitted by a firm through several different channels, for example corporate actions, board composition and the top management team. The strength of a signal is dependent on the degree of correlation it has with the unobservable value of the firm. Signaling is therefore prominent within firms performing IPOs, since less information is available to the general public. Therefore, signaling can work as a valuable tool for investors when valuing a firm (Cohen, Dean 2005, Connelly, Certo et al. 2011).

Underpricing, in itself, can be a method that firms use as a signal of quality. Attractive firms may want to signal to investors that they are a promising investment through underpricing their offering. The underpricing works as a signal of being such an investment because only those firms will be able to redeem the loss, the money left on the table, after their listing through secondary offerings with a more favorable stock price. Bad firms would not be able to recoup the loss from the underpricing and can therefore not afford this signal (Allen, Faulhaber 1989, Welch 1989). From this perspective, a firm wants a small amount of underpricing to avoid a negative signal but minimize the losses of leaving money on the table. However, underpricing as a signal can be very costly in comparison to other methods of signaling. Moreover, because of the high frequency of underpricing, several finance researchers have defined it as an equilibrium phenomenon (Allen, Faulhaber 1989, Grinblatt, Hwang 1989, Carter, Manaster 1990). Thus, they argue that underpricing is not used as a signal but is rather

considered to be a result of the degree of information asymmetry. The amount of underpricing can therefore be used as an indicator to determine the degree signaling has affected investors in their process of valuing the firm (Cohen, Dean 2005).

3.4.2 Top Management and Gender as a Signaling Mechanism

The CEO and other top executives have a large impact on the firm. Therefore, the firm benefits from having a top management that signals high quality when going public (Ljungqvist, 2004). In this context, age, education, prior industry experience and prior top management experience has been proven to serve as valid signals of quality (Cohen, Dean 2005). Research has furthermore shown that gender can bear a signal. Depending on the gender of the sender, the receiver interprets their actions differently (Eagly, Karau 2002, Eddleston, Ladge et al. 2014).

Female leaders as a positive signal

IPO underpricing is reduced if uncertainty regarding the firm is reduced. Studies have shown that women are more risk averse than men (Byrnes et al. 1999, Khan and Vieito 2013, Farooq et al. 2020). While this is one of the main reasons for women not breaking through the glass ceiling, as this limits the opportunity to reach high-ranking positions, it is beneficial within IPO underpricing since a higher-risk firm often induces a higher amount of underpricing (Ritter 1984, Rock 1986, Bertrand 2018).

If the CEO is seen to be less risk averse, and both investors and underwriters take this into consideration when valuing the firm, the firm will consequently require less underpricing due to less uncertainty. This leads us to our first hypothesis:

H1: Female CEOs signal less uncertainty, requiring less underpricing.

Female leaders as a negative signal

The perceptions and prejudice regarding female leaders can affect their signaling value. The paper *'Role Congruity Theory of Prejudice Toward Female Leaders'* by Eagly and Karau (2002) describes the difficulties women face when being assigned the role of a leader due to the incongruity of socially perceived female attributes and the attributes of a leader. While women are perceived by the general public to have communal characteristics such as being helpful, kind and sympathetic, men are perceived to hold

agentic characteristics such as being confident and ambitious. Agentic characteristics are furthermore in line with the attributes a leader is perceived to have. Consequently, female leaders tend to be exposed to two types of prejudice. Firstly, they are seen as inferior leaders compared to men since they lack agentic characteristics. Secondly, if they are known to have agentic characteristics, these traits are still less desirable to bear as a woman, hence the female leader is less appreciated than a male leader that possess these traits since it goes against the fundamental norm (Eagly, Karau 2002).

Empirical evidence supports this theory, such as the meta-analysis of 61 Goldberg-paradigm experiments which concluded that devaluation of female leaders was greater relative to male leaders (Eagly, Makhijani et al. 1992). Other experiments have shown that the participants perceive women as less competent (Eagly, Makhijani et al. 1992, Foschi, Lai et al. 1994).

If underwriters think that investors hold these prejudices and take them into account when valuing a firm with a female CEO, they will set a lower IPO subscription price to compensate for the negative signal that the female CEO sends out. This leads us to our second hypothesis:

H2: If female CEOs send out a negative signal, the IPO underpricing will increase.

4. Data

4.1 Sample Collection

Our dataset originated from the Thomson Reuter Eikon database, where information on IPO listing date, company name, underwriters, listing market as well as the first day return was collected. Additional data on companies with a female CEO by the time of their IPO, not available in Eikon, was collected manually through *IPO-Guiden* provided by Affärsvärlden. Affärsvärlden is a Swedish journal founded in 1901, known for its stock market coverage and investigative journalism (NE 2019).

Data regarding CEO gender, board composition, firm age before the date of the IPO as well as missing data on revenue from the year prior to the IPO has been collected

manually through the firm's individual prospectuses. These have been found via the issuer's websites, underwriter websites, listing market websites as well as the Swedish Financial Supervisory Authority's prospectus register.

To determine the gender of the CEO and the members of the board we primarily looked at the pronoun used in the prospectus when describing the person in question. If there was no pronoun in the description, we looked at the pictures and names in the prospectus. If no picture was available in the prospectus or it was unclear whether the name was female or male, LinkedIn was used.

Furthermore, some of the data retrieved from Thomson Reuters Eikon has been manually corrected because of faulty reports in the database. One example of this is Nordic Iron Ore who performed a 1:10 reverse stock split in 2018. This happened after the announcement of the IPO but before the listing was finalized. This resulted in the underpricing of Nordic Iron Ore being reported ten times than the actual value.

4.2 Data Description

We started off with 699 companies who had an IPO in Sweden on Nasdaq Main Market, Nasdaq First North or Spotlight between 2005 to February 2022. Firstly, our sample was decreased to 307 firms because of missing data on first day return. Secondly, we excluded those firms without an available prospectus, limiting our sample to 290 firms. Lastly, we excluded firms within the finance industry, including those within cryptocurrency and SPACs, in accordance with previous literature (Butler, Keefe et al. 2014). Our final sample used in our regression consists of 249 firms. The sample collection and cleaning process is illustrated in Table 1.

Table 1: Sample Collection and Cleaning

Source		# of observations
Eikon		682
IPO Guiden		17
Total initial sample		**699**
Data cleaning criteria		**# of observations excluded**
i.	*missing data*	392
ii.	*no available prospectus*	17
iii.	*excluding the finance industry*	41
Total observations excluded		**450**
Final sample size		**249**

The table shows an overview of the sample collection and data cleaning process of the firms in the dataset.

A description of the collected data is shown in Table 2. The initial return varies between 24.92% underpricing to a negative return of -15.73%. A negative initial return is called overpricing. 34 out of 37 female CEOs in the dataset took their company public between the years 2017 to 2021. It can also be observed that 2021 was a record year for IPOs, with 73 out of 249 listings in our sample occurring this year, however, the average initial return was not abnormally high.

Table 2: IPOs, average initial return and number of female CEOs

Year	# IPOs	Average Initial Return	# Female CEOs
2022 (1 Jan - 22 Feb)	3	-15.73%	0
2021	73	7.52%	10
2020	19	10.88%	5
2019	9	13.55%	2
2018	20	-1.02%	6
2017	52	11.60%	11
2016	18	10.34%	0
2015	20	3.70%	1
2014	13	7.86%	0
2013	0	-	-
2012	1	2.92%	0
2011	2	-2.66%	0
2010	8	24.92%	2
2009	0	-	-
2008	1	2.14%	0
2007	4	-9.12%	0
2006	5	14.66%	0
2005	1	12.69%	0
Total	249	8.13%	37

The table shows the number of observations in our sample, the average initial return as well as the number of female CEOs at the time of the IPO each year.

5. Methodology

The main goal of this paper is to find if a causal relationship between IPO underpricing and female CEOs exists. However, identifying a causal relationship between a female CEO and IPO underpricing is challenging since firms that chose to have a female CEO might be fundamentally different from firms that don't. In an ideal experiment we would randomly assign female CEOs to firms and follow them over time to see the impact of having a female CEO on the under- or overpricing by the market of the IPO. The

second-best approach would be to create a synthetic match based on observables. However, this method would still not address the unobservable differences that might play a role in the choice of having a female CEO. Since it is difficult to create our own control group through matching, an Ordinary Least Squares (OLS regression) will be performed with several control variables used to control for other factors affecting IPO underpricing.

If the OLS regression would include control variables that represent all the factors that are of importance when determining IPO underpricing, with a large enough dataset, it would approach our ideal setting. Since there is no consensus in the literature about the relevant control variables we will, as previously mentioned, base our variables on "*The Long-Run Performance of Initial Public Offerings*" by Jay R. Ritter (1991) and "*Initial Public Offerings and Underwriter Reputation*" by Richard Carter and Steven Manaster (1990), and adding control variables regarding CEO characteristics and diversity from from the articles "*Information asymmetry and investor valuation of IPOs: top management team legitimacy as a capital market signal*" by Boyd D. Cohen and Thomas J. Dean (2005) and *Women in the boardroom and their impact on governance and performance* by Renee Adams and Daniel Ferreira (2009), realizing again that unobserved differences cannot be controlled for and hence potentially bias our results.

5.1 Regression

An OLS regression describes the relationship between the dependent variable and one or several independent variables. The method minimizes the sum of squares of the differences when comparing observed and predicted values of the linear function. An OLS regression assumes linearity, constant error variance, no autocorrelation, normality of errors, no multicollinearity and exogeneity (Burton 2021). Homoscedasticity is tested for with a Breusch-Pagan test. Autocorrelation is tested for with a Durbin-Watson test. Normal distribution is tested by plotting individual scatter plots for each variable. Multicollinearity is tested for with a Pearson correlation matrix as well as a VIF-test.

The following regression is used to test the hypotheses:

$$\begin{aligned} \mathrm{IR_{LN}} = \ & \beta_0 + \beta_1 FCEO + \beta_2 FirmAge_{LN} + \beta_3 FirmSize_{LN} + \beta_4 HighTech \\ & + \beta_5 CEOage + \beta_6 CEOtenure_{LN} + \beta_7 UnderwriterRep \\ & + \beta_8 FBoard + \varepsilon \end{aligned}$$

5.1.1 Dependent Variable

Initial Return - $\mathrm{IR_{LN}}$

The dependent variable in our analysis is the first day return of the share, in line with previous research (Loughran, McDonald 2013, R. Ritter, 2022). This variable is often defined as the percentage change between the offer price and first day closing price. In our regression the variable is log transformed which allows us to achieve data closer to normal distribution and reduces the impact of extreme values. Since log-transformation does not allow negative numbers, we define our variable as the closing price divided by offer price.

First Day Return = ln(first day closing price/offer price)

5.1.2 Independent Variable

Female CEO - FCEO

To test our hypotheses, we create a dummy for our independent variable. The variable takes on the value 1 if the CEO of the company is female, and 0 if the CEO of the company is male. As written in our hypothesis, we expect the variable to have either a positive or negative relation with IPO underpricing.

5.1.3 Control Variables

Firm Age - $\mathrm{FirmAge_{LN}}$

Firm age is calculated by taking the natural logarithm of the years the firm has been active up until the IPO date, in line with previous literature (Carter, Manaster 1990, Ritter 1991, Carter et al. 1998). The value 1 is added to the firms that made their IPO in

the same year they were founded, in order to enable the use of natural logarithms (Carter, Manaster 1990). An older firm holds less risk since it generally has more information available to the market, such as previous performance, leading to less uncertainty among investors. Therefore, older firms are expected to require less underpricing, hence be negatively correlated with IPO underpricing (Ritter 1984, Rock 1986, Datta, Guthrie 1997).

Firm Size - $\text{FirmSize}_{\text{LN}}$

In line with previous scholars, firm size is calculated by taking the natural logarithm of the proxy firm revenue. The proxy is based on the firm's revenue the year prior to the IPO. The value 1 is added to the observations that did not have any revenue in the previous year, to enable the use of natural logarithms (Loughran, McDonald 2013, Butler, Keefe et al. 2014). Smaller firms are expected to be negatively associated with IPO underpricing since they are more difficult to value. Consequently, investors are subjected to a greater amount of adverse selection, leading issuers to provide a greater amount of underpricing as compensation (Ritter 1984, Rock 1986).

Females on the Board of Directors - FBoard

The variable *FBoard* is calculated by the number of female directors divided by the total number of directors. As will be further explained in section 5.3.3, the variable may be endogenous when it comes to firm performance. However, since females on board have shown to improve corporate governance and corporate governance in turn has been proven to decrease IPO underpricing, this variable is of importance (Adams, Ferreira 2009, Judge, Witt et al. 2015, Kahloul, Sbai et al. 2022). Furthermore, board diversity can work as a signal for investors regarding the possibilities for improved company reputation and firm performance (Bear, Rahman et al. 2010). This variable is therefore expected to be negatively correlated with IPO underpricing.

CEO Age – CEOage

This variable is attained by taking the CEO age at the time of the IPO. Age has previously been associated with greater conservatism and lower risk taking. Younger managers are more prominent to pursue more innovative and risky strategies while

older managers are more conservative (Hambrick, Mason 1984, Cohen, Dean 2005). Higher age is therefore expected to be negatively correlated with IPO underpricing.

CEO Tenure – $\mathrm{CEOtenure_{LN}}$

This variable is calculated as the time the CEO has been CEO at the company until the IPO date. For the variable to behave closer to normal distribution, the natural logarithm was used. Cohen and Dean argued that experience of the top management team is linked to the quality of the firm from an investor's perspective, which reduces IPO underpricing. The variable is therefore expected to be negatively correlated with the dependent variable (Cohen, Dean 2005).

Underwriter Reputation - UnderwriterRep

As Carter et al (1998) we have looked at underwriter reputation. However, since the list they used to determine underwriter reputation is only available for the US, we have used the method by Chen et al. (2013) where quality of underwriters is calculated as the current market share the underwriter had at the IPO. If an underwriter is in the top 25% in terms of market share of IPOs during the period, we define it as a 1, otherwise 0 (Chen et al. 2013). Renowned underwriters can work as a signal mechanism for higher quality of the listing firm (Booth, Smith 1986, Carter et al. 1998). Underwriters with extreme underpricing will lose potential issuers since it is costly for the issuer, and therefore lose market share (Beatty, Ritter 1986, Megginson, Weiss 1991). This variable is therefore expected to be negatively correlated with underpricing.

Industry - HighTech

To divide our dataset into the correct industries, the SIC classification system is used. We create a dummy variable to adjust for high tech industries, where a 1 is a high-tech industry and 0 a non high-tech industry (Lowry et al. 2010, Loughran, McDonald 2013). Evidence has shown that there is higher underpricing and more volatility in high tech companies, which may be due to the uncertainty of future growth within the sector. Furthermore, risk can be a reflection of technological uncertainty (Loughran, Ritter 2004, Lowry et al. 2010). This leads us to expect that high-tech industries are positively correlated with underpricing.

Year Fixed Effect

A variable often used when examining IPO underpricing is year fixed effects. This variable has been excluded in this study due to the few female CEOs present in the data set. However, a robustness test is performed looking at a smaller time span from 2017 and 2021, accounting for approximately 90% of female led IPOs in our data set.

Table 3 shows a summary of all above mentioned variables.

Table 3: Summary of variables

Dependent variable	**Variable name**	**Description**	
Initial Return	*LN_IR*	Natural logarithm of the first day closing price relative to the offer price	
Independent variable	**Variable name**	**Description**	**Exp. sign**
Female CEO	*FCEO*	Dummy variable coded 1 if the CEO is female and 0 if the CEO is male	+/-
Control Variables	**Variable name**	**Description**	**Exp. sign**
Firm Age	*LN_Age*	Natural logarithm of the number of years the firm has been active up until the IPO date	-
Underwriter	*UnderwriterRep*	Dummy variable coded 1 if the underwriter is in the top 25% in terms of market share of IPOs	-
Industry	*HighTech*	Dummy variable coded 1 if the company is in a high-tech industry, otherwise 0	+
CEO Age	*CEOAge*	Age of the CEO at the IPO date	-
CEO Tenure	*LN_CEOtenure*	The time the CEO has been CEO at the company until the IPO date	-
Firm Size	*LN_Rev*	Natural logarithm of the firms revenue one year prior to the IPO. The value 1 is added to the observations that did not have any revenue	-
Females on board	*Fboard*	Percentage calculated by dividing females on board with the total number of board members	-

This table includes the variables used in the regression, the variable name and a short description of each variable. The expected signaling of each outcome is also included.

5. Results

5.1 Descriptive Statistics

Table 4a and 4b shows the summary statistics for our variables. The dependent variable, initial return, shows a mean of 8.13% and a median of 4.75%. Furthermore, both positive and negative returns have been included in the dataset, with a maximum initial return of 161.29%, i.e., underpricing, and a minimum initial return of -86.07%, i.e., overpricing. When comparing the data on initial return with the papers used as foundation for firm characteristics, both show considerably larger means. Ritter (1991) has a sample with mean initial return of 14.1%, Carter and Manaster (1990) has a sample with mean initial return of 16.79% and Loughran and McDonald (2013) has a mean initial return of 34.8%.

The differences can be attributed to two factors. Firstly, Carter and Manaster (1990), Ritter (1991), and Loughran and McDonald (2013) studied the US IPO market. The difference in countries entails different market characteristics which may cause the difference in our results. For example, the sample data set used in this study contains years with negative initial returns, which may be a reason for the differences in the mean. Secondly, the time periods studied are vastly different. Carter and Manaster (1990) studied the period 1979 to 1983, Ritter (1991) has a sample taken from the year 1975 to 1984, and Loughran and McDonald (2013) studied the period 1997 to 2010. For example, the study by Loughran and McDonald has data that includes the internet bubble, which may be a cause for the high underpricing observed in their study.

The independent variable, Female CEO, has a mean of 15%, meaning that 15% of all firms included in the dataset had a female CEO at the time of their IPO. When compared to the only other paper written on the impact of female CEOs by Mohan and Chen (2004), 5% of firms in the dataset had a female CEO. This may, like the above arguments, be due to time and geography. Sweden is for example ranked higher than the US on the SDG Gender index and the importance of diversity in corporations has increased in recent years (SDG Gender Index Report 2021).

Table 4a: Summary Statistics

Variable	N	Mean	Median	Std. Dev	Min	Max
LN_IR	249	0.03	0.04	0.32	-1.97	0.96
FCEO	249	0.15	0.00	0.36	0.00	1.00
LN_Age	249	2.27	2.30	1.04	-0.69	4.93
UnderwriterRep	249	0.49	0.00	0.50	0.00	1.00
HighTech	249	0.46	0.00	0.50	0.00	1.00
CEOAge	249	48.06	48.5	8.433	23.00	70.00
LN_CEOTenure	249	1.13	1.10	0.97	0.00	3.14
LN_Rev	249	16.71	18.19	5.51	0.00	26.29
FBoard	249	0.21	0.20	0.17	0.00	1.00

The table shows the mean, median, standard deviation, minimum value and maximum value for each variable.

Table 4b: Non-Logarithmic Variables

Variable	N	Mean	Median	Std. Dev	Min	Max
IR	249	8.128%	4.752%	0.313	-86.072%	161.29%
Age	249	16.30	10.00	20.94	0.00	139.00
Rev	249	1 850 801 453.77	79 363 780	16 718 652 215.92	0.00	262 833 000 000
CEOTenure	249	4.688	3.00	4.909	0.00	23.00

The table shows the original values of the mean, median, standard deviation, minimum value and maximum value of the variables that have been log transformed.

5.1.1 Firm Differences

When comparing the characteristics of firms with a female CEO to a firm with a male CEO, several characteristics are similar. However, firm size differs substantially, with firms with a male CEO having an average revenue approximately ten times larger. In addition, renowned underwriters are employed 53% of the time for male-led IPOs, while only 24% of the time for women-led IPOs. A potential explanation for the correlation between firm size and underwriter reputation is written in the next section.

Table 5: Comparison between female- & male-led firms

	Male CEO	Female CEO
Initial Return	8.93%	3.52%
Firm Size (MSEK)	2 144.66	215.66
Firm Age	16.75	11.11
Underwriter Reputation	52.83%	24.32%
High Tech	43.87%	56.76%
CEO Age	48.2	47.5
CEO Tenure	4.99	2.95
Females on Board	22.41%	25.42%

This table shows a comparison of the average of each variable split up between firms with a female CEO and male CEO at the time of the IPO

5.2 Correlation Matrix:

In Table 6, a Pearson's correlation matrix is shown. The correlation matrix is performed in order to detect potential multicollinearity between any of the variables in the regression. Multicollinearity becomes especially problematic when the sample size is small, and the independent variable explains a small portion of the dependent variable. A correlation above 0.6 substantially increase the risk of multicollinearity and a correlation above 0.8 is in general intolerably high (Grewal, Cote et al. 2004). None of the variables in our regression have such high correlation, however, some variables have statistically significant correlation between each other.

The correlation between *CEOage* and *CEOtenure* could be explained by the following: The road to becoming CEO entails, in most cases, a long road of career steps before the position is reached. It is therefore more uncommon for young people to become CEO of a company. In 2020 the average age of a CEO in Sweden was 49 years old (SCB 2021). The higher the age of the CEO, the longer time he or she has had the possibility to be in that position. Thus, the correlation between *CEOage* and *CEOtenure* has a logical explanation.

The correlation between *FirmAge* and *FirmSize* can be explained by the fact that older firms have had the time to develop their business and become established firms, creating revenue, and thus increasing the size. Several more newly created firms in the dataset do not have any revenue prior to going public as they are in earlier stages of business growth. Furthermore, both *FirmAge* and *Firm Size* are positively correlated with *UnderwriterRep* as successful underwriters most likely target larger transactions.

The variables *FirmSize* and *FirmAge* are both negatively correlated with *HighTech*. Many high-tech companies in our dataset are classified as either start-ups or medtech companies. Start-up companies have not been established for a long period of time and medtech companies usually take a long time before their products generate revenue because of the long R&D process. Furthermore, these companies need to go public early since the substantial risk of their operations makes it difficult to get capital through debt (Gao, Hou 2019).

FBoard and *UnderwriterRep* are positively correlated. This could be due to the societal developments that have put an emphasis on diversity. For example, Goldman Sachs announced in 2020 that they would not take a company public in the US or Western Europe without at least one diverse board member in terms of gender or background. In 2021 they increased the threshold to two diverse board members where one of them must be a woman (Goldman Sachs 2021).

Some other variables have significant correlation without any logical explanation, however, as the correlation is fairly low, none above 0.6, this causes no statistical problems.

In addition to the correlation matrix, a VIF test has been conducted to further ensure that no multicollinearity exists between our variables. A VIF value above 10 suggests high correlation (Dodge 2008). None of the values are above the threshold and should thus not be a cause for concern.

Table 6: Correlation Matrix

	Correlation Matrix									VIF
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	
(1) LN_IR	1									
(2) FCEO	-0.05	1								1.146452
(3) LN_Rev	0.26 **	-0.25 **	1							1.439536
(4) LN_Age	0.16 **	-0.09	0.32 **	1						1.200473
(5) HighTech	-0.02	0.09	-0.35 **	-0.17 **	1					1.169209
(6) UnderwriterRep	0.22 **	-0.20 **	0.42**	0.28 **	-0.26 **	1				1.326993
(7) Fboard	0.08	0.11	0.14 *	0.14 *	-0.10	0.16 *	1			1.070940
(8) CEOAge	-0.13 *	-0.03	0.08	0.16 *	-0.02	0.17 **	0.04	1		1.063526
(9) LN_CEOTenure	0.23 **	-0.22**	0.20**	0.22 **	-0.03	0.15 *	0.03	0.16 *	1	1.127255

This table lists all the variables in the regression and the potential correlation between them. If the correlation is 1 it implies perfect correlation and if the correlation is -1 it shows perfect negative correlation, A correlation above 0,8 between two or more variables may imply multicollineraty problems (Grewal et al,, 2004). The table also shows the results for the VIF-test, which shows that no multicolliniarity exists between the variables.

5.3 Test of OLS Assumptions

5.3.1 Normal Distribution

One of the OLS assumptions is that the dataset is normally distributed. When examining our variables through individual scatter plots it was observed that this assumption was not fulfilled (see Figure 1 in Appendix). For the variables to behave more normally distributed, the natural logarithm was used on our dependent variable as well as some of the control variables (Burton 2021).

5.3.2 Heteroscedasticity

When testing for heteroscedasticity with a Breusch-Pagan test (see Table 8 in Appendix), the null hypothesis of homoscedasticity was rejected at a significance level of 1%, meaning that our dataset contains heteroscedasticity in the error term. Within the field of IPO underpricing researchers have shown that heteroscedasticity is a common complication since higher-risk firms have a greater variation of initial returns (Ritter 1984, Rock 1986). However, as homoscedasticity is an assumption for OLS, efforts have been made to mitigate heteroscedasticity. Firstly, the natural logarithm has been used for the dependent variable, initial return. Secondly, the regression has been performed both as a regular OLS regression as well as an OLS regression with robust standard errors. Lastly, in addition to the OLS regression and the OLS regression with robust standard errors, a WLS regression has been performed.

5.3.3 Endogeneity

To achieve valid regression results, endogeneity in the model needs to be avoided. In the research area of gender diversity's impact on a firm, this can be especially problematic as it is difficult to extinguish if a firm performs better *because* of the gender diversity or is a result of being a well performing firm and thus having organizational slack (Liu, Cheng et al. 2020).

What is diversity in a company defined as? When looking at gender equality index scores for corporations, the percentage of females on board is a common denominator to measure gender equality. Other variables being used are gender diversity policy, workforce diversity and women in leadership positions (Bloomberg 2022, MSCI 2022,

S&P500 2022). However, there is no isolating measurement for CEO gender. Thus, in the aspect of gender equality rankings, the gender of the CEO has a small impact. The problem of endogeneity is therefore not as prominent when trying to isolate the signaling value of female CEOs.

However, endogeneity might still be present if other confounding variables exist between CEO gender and firm performance. In the dataset used in this paper, firm size differs depending on the CEO gender as seen in Table 5, a claim that is also supported by Hoang et al.. Firm size has furthermore shown to be affecting IPO underpricing (Ritter 1984, Hoang et al. 2019). This is therefore a control variable of high importance to consider since it may be a confounding variable. There may be other confounding variables in our regression that have not been included, affecting our results. However, there is no current research examining this possibility.

5.4 Regressions

Column 1 in Table 7 shows the original OLS regression. Due to heteroscedasticity, these results are less reliable relative to the OLS regression with robust standard errors and the WLS regression, see column 2 and 3 respectively. To determine which regression to base our main analysis on, the two regression types are evaluated below.

5.4.1 Correcting for Heteroscedasticity Consistent (HC) Errors with a WLS Regression

When performing the WLS regression, the absolute values of the standard errors in the original model are regressed on the estimates from the original OLS model. This gives us a new function in which the square of the inverse is used as the WLS weight. This allows us to not assume which variable the heteroscedasticity is coming from. However, an assumption has still been made about the function of the weight. The assumption that the weight is the squared inverse of the created function is supported by the observation that uncertain firms have a higher variation of initial returns (Ritter 1984, Rock 1986). However, when plotting the heteroscedasticity in the baseline model, the plot does not show a clear pattern of this function (see Figure 2 in Appendix). Therefore, we cannot be sure that the assumption holds, and the results may become unreliable.

5.4.2 Correcting for Heteroscedasticity Consistent (HC) Errors with Robust Standard Errors

When using robust standard errors on the model, there is no assumption made about the presence of heteroscedasticity, nor any function of the variance, making it more suitable for our regression compared to the WLS regression. However, the robust standard error method may not take extreme outliers into account, assumes that there is no autocorrelation and requires a large sample to make correct conclusions about the standard errors. (Zeileis 2004). Autocorrelation was not found in our dataset. Extreme outliers are de-emphasized by using the natural logarithm. Furthermore, the estimator HC3 is used to minimize the risk of potential outliers skewing our results (since less weight is put on more influential observations) and cater to our relatively small sample size (MacKinnon, White 1985, Long, Ervin 2000). Based on the evaluation above, the results are based on the OLS regression with robust standard errors, using HC3 as an estimator.

5.5 Regression Results

The independent variable, *FCEO*, shows to have a small positive effect on our dependent variable, *LN_IR*. However, this result is not significant. We therefore fail to reject either of the hypotheses. The control variables *UnderwriterRep, CEOAge*, *LN_CEOTenure* and *LN_FirmSize* have significant impact. *UnderwriterRep* has a positive impact on *LN_IR* on a 1% significance level, *CEOAge* shows a negative impact with a significance level of 1%, *LN_CEOTenure* has a positive impact on *LN_IR* on a 0.1% significance level and *LN_FirmSize* show a positive impact on *LN_IR* on a 10% significance level. The control variables *LN_FirmAge*, *HighTech* and *FBoard* lack significance. The adjusted R^2 is 0.1462. This implies that 14.62% of first day return is explained by our model, meaning that other variables that are not included in our model have explanatory value.

Except for *CEOAge*, the other variables of significance have a positive correlation with initial return which goes against the previous literature this paper has referenced to (ex. Ritter 1984, Booth, Smith 1986, Rock 1986, Carter et al. 1998). However, Rock's model, which is strengthened by evidence from Ritter, implies that higher-risk firms' initial returns also have greater variation. From this perspective, proxies for lower risk

firms should be negatively correlated with IPO underpricing when looking at absolute values, which will be tested for in the Robustness test section.

Table 7: Regression Results

Variables	1	2	3
FCEO	0.058990	0.058990	0.031778
LN_Age	0.020640	0.020640	-0.025040
UnderwriterRep	0.101061 *	0.101061 **	0.064824
HighTech	0.068900 .	0.068900	0.172966 ***
CEOAge	-0.008234 ***	-0.008234 **	0.006455 ***
LN_CEOTenure	0.068797 **	0.068797 ***	0.002274
LN_Rev	0.012089 **	0.012089 .	0.008218
FBoard	0.045462	0.045462	-0.168486
N	249	249	249
Average Initial Return	8.12%	8.12%	8.12%
R^2	0.1719	0.1719	0.4142
Adjusted R^2	0.1443	0.1443	0.3946
F-statistics	6.229***	6.229***	21.21***

'***' p<0.001, '**' p<0.01, '*' p<0.05, '.' p<0.1

This table shows the results from the three regressions.
1: Ordinary Least Square Regression
2: Ordinary Least Square Regression with Robust Standard Errors
3: Weighted Least Square Regression

5.5.1 Robustness Test

Robustness tests are used to check the fragility of their model assumptions. Ideally, core coefficients in the regression should not change substantially when variables in the regression are changed (Lu, White 2014). Four different robustness tests have been executed to evaluate the strength of our regression. See Table 9 in appendix for full robustness regression result.

Removing 2022

The dataset used for this paper includes data up until March 2022. However, the year 2022 demonstrates a large overpricing, a negative first day return, which may impact our regression and skew the results. To make sure that the year 2022 has not impacted our results significantly, this year is removed in a robustness test to see if results differ. It can be concluded from the robustness test that none of the variables show substantial changes compared to the original regression, thus strengthening the robustness of our variables.

Females on Board Dummy

The variable *FBoard* is measured as the number of female directors divided by the total number of directors, resulting in a percentage variable. However, gender diversity may also be defined as having at least one female on the board (Goldman Sachs 2021). The second robustness test performed is therefore conducted by making the variable *FBoard* a dummy. This turns the beta estimate negative of the tested variable, however, without significance. The other variable estimates do not change substantially.

Absolute Values

We observed that some of the control variables were connected to extreme values in the dependent variable, either being very underpriced or overpriced. To see if this observation holds, the initial return was transformed into absolute numbers. What can be observed is that firm age and high underwriter reputation proves to decrease the variance in the initial returns with a significance level of ten percent and five percent, respectively. High tech increases the variance with a significance level of one percent, implying that a high-tech company increases the probability of being either more under- or overpriced relative to non high-tech companies.

2017-2021

In our dataset it is observed that 34 of 37 female CEOs took their company public between 2017-2021. This may indicate that the perception of female leaders has changed over time, showing a different result if we look at another time span. It can be observed that the estimate of *FCEO* drops from a positive 0.058 to 0.012, strengthening this possibility. However, the result lacks significance.

5.5.2 Placebo Test

A placebo test has been conducted by randomizing our independent variable, *FCEO*, to make sure our results are not due to random noise. The results from the placebo test show a lower estimate for our independent variable (see Table 10 in Appendix) and a higher p-value, even though neither the actual regression nor the placebo test is significant. Furthermore, the control variables are not substantially affected. The placebo test therefore strengthens the findings from our original results.

6. Discussion

6.1 Analysis

When analyzing the possible fundamental differences between the companies that are led by a male or female, female CEOs taking a firm public are on average ten times smaller in firm size compared to male CEOs. A plausible reason may be that the 'glass ceiling' is more prominent when the firm is established. In the highest earning occupations, there is often a "winner takes all" or "winner takes most" attitude. Since women have been proven to be more risk averse this leads females to not aim for the highest roles in the more established firms (Gneezy et al. 2003, Bertrand 2018).

The findings from the regression show that female CEOs have a positive influence on IPO underpricing, supporting the hypothesis that investors and underwriters value female CEOs differently. However, the result lacks significance, meaning that our data does not show any credible evidence that a female CEO affects underpricing in an initial public offering. We therefore fail to reject either of our hypotheses. The lack of

significance in the results for our independent variable, female CEO, could be caused by two reasons. Firstly, the sample size could be too small. The few female CEOs that have taken their company public in Sweden may not be enough to prove causal inference. Secondly, the lack of significance may be because the signal caused by having either a male or female as CEO does not affect IPO underpricing. If this is the case, this is not an aspect firms need to consider when taking their company public.

Although we could not draw any conclusion from our independent variable, there are other aspects of our regressions that are of interest to analyze. Being a bigger firm, having longer CEO tenure and a renowned underwriter had a positive correlation with the initial return, the opposite of what was expected. However, the common denominator of these variables is that they decrease or increase information asymmetry. Therefore, these variables may not reduce underpricing, but rather the extreme amount of under- or overpricing, in line with the argument that higher-risk firms have a greater variation of initial returns (Ritter 1984, Rock 1986). If this statement is correct, the variables indicating less information asymmetry would make the first-day return be closer to zero, while the variables indicating more information asymmetry would do the opposite. This was tested for by running a regression with the absolute values of the first day returns as the dependent variable. The variables that gave significance in this regression were firm age, underwriter reputation and industry. Being an older firm and having a renowned underwriter reduced variance of the first day return, while being a high-tech firm increased the volatility, strengthening the proposed explanation. Having a female CEO also showed reduced variability, supporting the hypothesis that female CEOs are seen as more risk averse and hence reduce information asymmetry. However, the variable lacks significance.

Furthermore, 90% of all female CEOs took their company public between 2017-2021. This might indicate that the view of female leaders has changed over time, hence sending out a more positive signal when looking at a newer timespan. When performing this regression, it is seen that the estimate of having a female CEO drops from a positive 0.058 to 0.012, indicating that a lower underpricing is required compared to the whole time span. However, the result is still insignificant.

6.2 Limitations

The methodology used in this paper does not make it possible to fully isolate the signaling value of female CEOs due to potential unobserved differences that cannot be controlled for and hence bias our results. Control variables that previously have shown significance within the IPO underpricing research field were added to the OLS regression. However, the lack of a standard model for IPO underpricing research increases the uncertainty of which variables to include. This is thus an important limitation to keep in mind while interpreting our results.

Furthermore, since the study has been conducted over a long period, from 2005 to the beginning of 2022, there might have been a potential change in the difference or power of the signaling value. In addition, several important economic situations have occurred over the period. For example, the financial crisis in 2008 and the covid pandemic may have impacted the initial return and the perceived overall market risk. Regression results and their potential significance may therefore have been affected by these occurrences.

The sample also poses a limitation. The sample consists of 249 IPO firms, which is fairly small, and only 37 of these firms are female led. This is mostly due to the chosen market, Sweden. However, the lack of female CEOs is an occurrence in most countries, making it difficult to find a sufficient sample.

7. Concluding Remarks

7.1 Conclusion

To have a female CEO take a company public is a rarity. Even though the value of diversity has been highlighted and its focus in corporations is increasing, the glass ceiling is still present. The underrepresentation of women has been widely studied, however, the research field is scarce when studied in combination with firm valuation. This paper aims to broaden the research field of gender and firm valuation. More specifically, we contribute to the existing literature by examining if female CEOs carry a signaling value affecting IPO underpricing. The study was conducted from 2005 until

the beginning of 2022 on the Swedish stock market. The data set contained 249 companies, with 37 being female led.

The results show a slight, but statistically insignificant, increase in underpricing when the firm had a female CEO. When instead examining the variability of firms' initial returns, having a female CEO decreased it. However, this result also lacks significance. To conclude, we can therefore not find evidence supporting the hypotheses that female CEOs emit either a positive or negative signal when taking a firm public.

7.2 Future Research

This field of research remains fairly unexplored, with many aspects to further elaborate. This paper solely studies the first day initial return of initial public offerings. Interesting further research could therefore include studying long term performance of IPOs led by a female CEO. Furthermore, the results in our paper were insignificant, which may be due to the small sample size. Future research could therefore aim to study a larger sample size to see if any significant results can be found. Today, female CEOs are scarce in most countries. However, the number of female-led firms should most likely increase, facilitating the process of finding a sufficient sample. This will be an interesting area of research to follow in the future.

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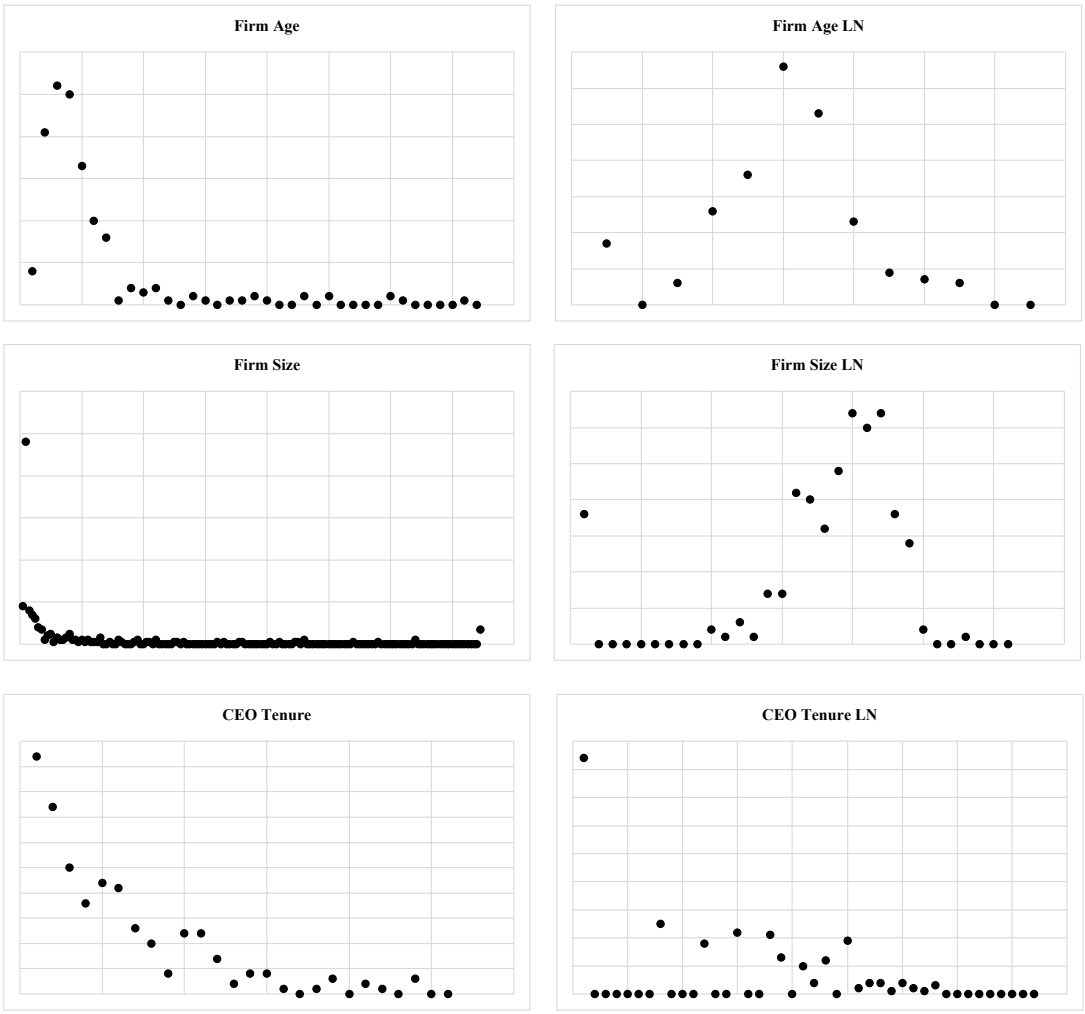
Appendix

Figure 1: Scatter plots of control variables that have been log-transformed



The figure show scatter plots for the control variables that have been log-transformed

Table 8: Breusch-Pagan Test

Breusch-Pagan Test		
Data: OLS with Robust Standard Errors		
BP	**df**	**p-value**
45.548	8	2.897e-07

The table shows the Breusch-Pagan Test, showing that the baseline model has heteroskedasticity in the residuals

Figure 2: Heteroskedasticity Pattern for the Baseline Model

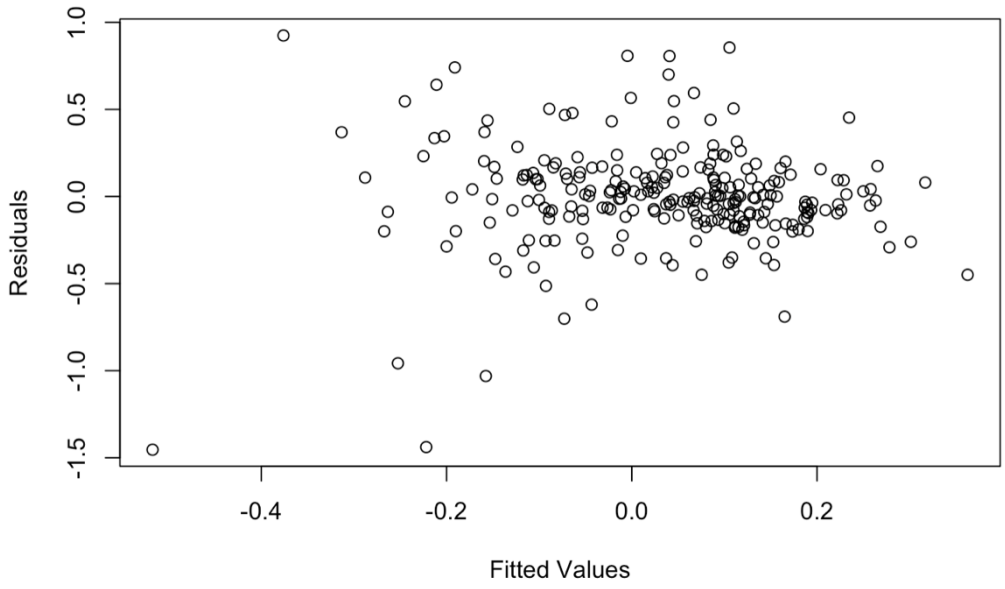


Table 9: Robustness Test Results

Robustness Test Results				
Variables	**1**	**2**	**3**	**4**
FCEO	0.0553344	0.0639758	-0.021638	0.0122192
LN_Age	0.0187913	0.0216335	-0.026018 .	0.0162320
UnderwriterRep	0.0964511 *	0.1044544 **	-0.075113 *	0.0760665 .
HighTech	0.0641804	0.0683299	0.101800 **	0.0308744
CEOAge	-0.0085154 **	-0.0082245 **	0.000832	-0.0056026 .
LN_CEOTenure	0.0683091 ***	0.0687446 ***	0.015766	0.0527413 *
LN_Rev	0.0122402 .	0.0122890 .	-0.000093	0.0097092
Fboard	0.0502505	- 0.0098903	-0.103580	0.0311158

'***' p<0.001, '**' p<0.01, '*' p<0.05, '.' p<0.1

This table shows the results from the four robustness tests.
1: Removing the year 2022
2: Females on Board as a dummy variable
3: Absolute values on dependent variable, initial reuturn
4: Shortened time span, 2017 - 2021

Table 10: Placebo Test

Placebo Test	
Variables	**Results**
FCEO	0.0350507
LN_Age	0.0215880
UnderwriterRep	0.0974546 **
HighTech	0.0683616
CEOAge	-0.0083778 **
LN_CEOTenure	0.0658886 ***
LN_Rev	0.0111068 .
Fboard	0.0704024

***' p<0.001, '**' p<0.01, '*' p<0.05, '.' p<0.1

The table shows the results of the placebo test on the independent variable *FCEO*